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United States Nuclear Regulatory Commission

Protecting People and the Environment

NUREG-1910
Supplement 1

Environmental Impact Statement for the Moore Ranch ISR Project in Campbell County, Wyoming

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

Draft Report for Comment

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

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Manuscript Completed: November 2009
Date Published: December 2009

Prepared by:

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

COMMENTS ON DRAFT REPORT

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

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Electronic comments may be submitted to the NRC by e-mail at MooreRanchISRSEIS@nrc.gov.

For any questions about the material in this report, please contact:

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ABSTRACT

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

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

By letter dated October 2, 2007, Energy Metals Corporation, a wholly-owned subsidiary of Uranium One, submitted a license application to NRC for a new source material license for the Moore Ranch Project, to be located in Campbell County, Wyoming, which is in the Wyoming East Uranium Milling Region identified in the GEIS. The NRC staff prepared this SEIS to evaluate the potential environmental impacts from Uranium One's proposal to construct, operate, conduct aquifer restoration, and decommission an ISR facility at the proposed Moore Ranch Project. This SEIS also describes the environment potentially affected by Uranium One's proposed site activities, presents the potential environmental impacts resulting from reasonable alternatives to the proposed action, and describes Uranium One's environmental monitoring program and proposed mitigation measures. In conducting its analysis in this SEIS, the NRC staff evaluated site-specific data and information to determine whether the applicant's proposed activities and site characteristics were consistent with those evaluated in the GEIS. NRC staff then determined relevant sections, findings and conclusions in the GEIS that could be incorporated by reference in this SEIS, and areas that needed additional analysis. Based on its environmental review, the NRC staff recommends that, unless safety issues mandate otherwise, environmental impacts of the proposed action (issuance of a source material license for the proposed Moore Ranch Project) are not so great as to make issuance of a source material license an unreasonable licensing decision.

Paperwork Reduction Act Statement

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

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BACKGROUND

By letter dated October 2, 2007, Energy Metals Corporation, a wholly-owned subsidiary of Uranium One (referred to herein as Uranium One), submitted an application to the U.S. Nuclear Regulatory Commission (NRC) for a new source material license for the Moore Ranch Uranium Project (Moore Ranch Project), located in Campbell County, Wyoming. Uranium One is proposing to recover uranium using the in-situ leach (ISL) recovery process (also known as the in-situ recovery (ISR) process). The proposed Moore Ranch Project includes a central processing plant, two well fields, two deep disposal wells for liquid effluent wastes, and the attendant infrastructure (e.g., pipelines).

The Atomic Energy Act of 1954, as amended by the Uranium Mill Tailings Radiation Control Act of 1978, authorize the NRC to issue licenses for the possession and use of source material and byproduct material. The NRC must license facilities, including ISR operations, in accordance with NRC regulatory requirements 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), that implement the National Environmental Policy Act of 1969 (NEPA), preparation of an environmental impact statement (EIS) or supplement to an EIS is required for issuance of a license to possess and use source material for uranium milling (see 10 CFR 51.20(b)(8)).

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

This SEIS includes the NRC staff's preliminary analysis that considers and weighs the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures for reducing or avoiding adverse effects. It also includes the Staff's recommendation regarding the proposed action.

PURPOSE AND NEED OF THE PROPOSED ACTION

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

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

THE PROJECT AREA

The Moore Ranch Project is located in southwest Campbell County, in south-central Wyoming, about half between the Towns of Wright located 40 kilometers (km) (25 miles [mi]) to the northeast and Midwest-Edgerton located 39 km (24 mi) to the southwest with populations of 1,604 and 439 people, respectively. The City of Gillette is located approximately 85 km (53 mi) to the northwest; the City of Casper is located approximately 85 km (53 mi) to the southwest. Planned facilities associated with the proposed project include a central plant with processing capabilities; two well fields with injection, production, and monitor wells, header houses, pipeline to connect the well fields with the central plant, and an access road network.

The proposed license area consists of approximately 2,879 hectares (ha) (7,110 acres [ac]) and is remotely located on private land with about 14 percent of the surface rights being administered by the State of Wyoming. The U.S. Department of the Interior, Bureau of Land Management does not administer surface rights within the proposed Moore Ranch license area.

IN-SITU RECOVERY PROCESS

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

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

ALTERNATIVES

The NRC's environmental review regulations in 10 CFR Part 51 that implement NEPA, require NRC to consider reasonable alternatives, including the No-Action alternative, to a proposed action before acting on a proposal. The NRC staff considered a range of alternatives that could fulfill the underlying purpose and need for the proposed action. Based on this screening 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 the proposed action and the No-Action alternative. Under the No-Action alternative, Uranium One would not be issued a license to construct and operate ISR facilities at the proposed site. Alternatives considered but eliminated from detailed analysis include conventional mining and milling at the Moore Ranch site, conventional mining and heap leach processing at the Moore Ranch site, alternate site location, alternate lixiviants, and alternate waste disposal methods.

SUMMARY OF THE ENVIRONMENTAL IMPACTS

This draft SEIS includes the NRC staff's analysis that considers and weighs the environmental impacts resulting from the proposed construction, operation, aquifer restoration, and decommissioning of an ISR facility at the Moore Ranch Project site and the No-Action alternative. The draft SEIS also provides mitigation measures for the reduction or avoidance of potential adverse impacts from the proposed action. The draft SEIS uses the assessments and conclusions reached in the GEIS in combination with site-specific information to assess and categorize impacts.

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

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

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

Impacts by ISR Facility Phase and Significance Level

Construction

SMALL impacts:	Land Use; Transportation; Geology and Soils; Surface Water and Wetlands; Ecological Resources; Groundwater; Air Quality; Noise; Historic and Cultural Resources; Visual and Scenic Resources; Socioeconomics (Demography, Income, Housing, Employment Rate, Local Finance, Education,Health and Social Services); Public and Occupational Health and Safety; Waste Management

MODERATE impacts: NONE

LARGE impacts: NONE

Operation

SMALL impacts: Land Use; Transportation; Geology and Soils; Surface Water and Wetlands; Groundwater; Ecological Resources; Air Quality; Noise; Historic and Cultural Resources; Visual and Scenic Resources; Socioeconomics (Income, Education); Public and Occupational Health and Safety; Waste Management

MODERATE impacts: Socioeconomics (Demography, Housing, Employment Rate, Local Finance, Health and Social Services);

LARGE impacts: NONE

Aquifer Restoration

SMALL impacts: Land Use; Transportation; Geology and Soils; Surface Water and Wetlands; Groundwater; Ecological Resources; Air Quality; Noise; Historic and Cultural Resources; Visual and Scenic Resources; Socioeconomics (Demography, Income, Housing, Employment, Local Finance, Education, Health and Social Services); Public and Occupational Health and Safety; Waste Management

MODERATE impacts: NONE

LARGE impacts: NONE

Decommissioning

SMALL impacts: Land Use; Transportation; Geology and Soils; Surface Water and Wetlands; Groundwater; Ecological Resources; Air Quality; Noise; Historic and Cultural Resources; Visual and Scenic Resources; Socioeconomics (Demography, Income, Housing, Employment, Local Finance, Education, Health and Social Services); Public and Occupational Health and Safety; Waste Management

MODERATE impacts: NONE

LARGE impacts: NONE

Impacts by Resource Area and ISR Facility Phase

Land Use

Construction: Impacts would be SMALL. Approximately 60 ha (150 ac) of the 2,879 ha (7110 ac) or 2 percent of the proposed license area would be disturbed by the construction phase of the proposed Moore Ranch Project. No historic or cultural resources would be affected. Topsoil would be stripped and stockpiled to build the central plant, develop two well fields and the attendant infrastructure, and to construct access roads. The construction phase would be of short duration (approximately nine months). Livestock grazing and natural resources extraction (e.g., coal-bed methane development) would be excluded from the fenced areas surrounding the well fields and the central plant during the life of the project.

Operation: Impacts would be SMALL. Livestock grazing and natural resources extraction would be limited from the well fields and the central plant during the ISR lifecycle limiting access to approximately 2 percent of the proposed license area for the life (approximately 12 years) of the project. Development of the well fields would be sequential moving from one well field area to the next. The direct impacts to land from earthmoving activities would be less than that during the construction phase.

Aquifer Restoration: Impacts would be SMALL. The impact to land use would either be similar to, or less than that described for the operations phase. Wellfields would be restricted from other uses as described for the operations phase. The potential impact to land use would diminish as restoration activities were completed and the use of well field header houses was complete.

Decommissioning: Impacts would be SMALL. The impact on land use from decontaminating and decommissioning the proposed Moore Ranch Project would be similar to that experienced during the construction phase. Decommissioning the buildings, well fields, access roads, and removing potentially contaminated soil would result in a temporary increase in land-disturbing activities. Upon completion of the plugging and abandonment of wells, soil would be reseeded and reclaimed in areas where it had been removed. As decommissioning and reclamation progressed, less disturbed land area would remain.

Transportation

Construction: Impacts would be SMALL. Truck traffic during construction activities would result in about a nine percent increase in local traffic. Localized fugitive dust emissions, noise from more traffic, and incidental wildlife or livestock kills could potentially occur. To further minimize the risk of an accident, onsite speed limits would be posted.

Operation: Impacts would be SMALL. Transportation impacts would be less than those during the construction phase since fewer trucks would be on the road. The probability of an accident was determined to be low and to minimize the risk of an accident materials would be shipped in accordance with NRC and USDOT regulations.

Aquifer Restoration: Impacts would be SMALL. Transportation impacts would be less than those during the construction phase and comparable to that during the operations phase. The need to transport hazardous materials and uranium-loaded resins would decrease as aquifer restoration proceeded; therefore, the potential for accidents resulting in spills or leaks would also decrease.

Decommissioning: Impacts would be SMALL. Transportation impacts would be less than those during the construction and operations phases. Transport of hazardous materials would cease during decommissioning, and access roads would either be reclaimed or left in place for future use.

Geology and Soils

Construction: Impacts would be SMALL. Earthmoving activities associated with construction of the central plant and chemical storage facilities, access roads, well fields, and pipelines would include the removal of top soil covering about 61 ha (150 ac). Furthermore, the drilling of wells and installation of pipeline would also disturb soil. Implementation of best management practices, the short duration of the construction phase, and mitigative measures to minimize soil impacts such as reestablishing temporary native vegetation as soon as possible after implementation would help to further minimize the potential impact.

Operation: Impacts would be SMALL. Removal of uranium from the target sandstones during ISR operations would result in a permanent change to the composition of uranium-bearing rock formations; however, since the rock matrix and structure would remain, no significant matrix compression or ground subsidence would be expected to occur. The potential for spills during transfer of uranium-bearing lixiviant to and from the central plant would be further mitigated by implementing onsite standard operating procedures and the need to comply with NRC and WDEQ requirements for spill response and reporting of surface releases.

Aquifer Restoration: Impacts would be SMALL. During aquifer restoration, the process of groundwater transfer and groundwater sweep would not remove rock matrix or structure. The formation pressure would be decreased during restoration to ensure that the direction of groundwater flow was into well fields to reduce the potential for lateral migration of constituents; however, the change in pressure would not result in collapse of overlying rock strata into the mining zone of the aquifer. The potential for and handling of a surface release would be comparable to that described for the operations phase.

Decommissioning: Impacts would be SMALL. Disruption and/or displacement of soils would occur during dismantling of the facilities and reclamation of the land; however, the disturbed lands would be restored to their pre-mining land use. Topsoil would be reclaimed and regraded to the original topography.

Surface Waters and Wetlands

Construction: Impacts would be SMALL. The occurrence of surface water at the Moore Ranch Project is limited and surface water flow in channels is intermittent. Although the proposed construction activities such as laying pipeline and drilling wells could generate surface water runoff; the implementation of best management practices and mitigative measures such as only doing work in channels when they were dry would help to further minimize potential impacts. Well construction would avoid channels whenever possible. Temporary disturbances to the soil from traffic during construction could result in surface water runoff and sediment transport during periods of surface flow. Wetland areas would be avoided.

Operation: Impacts would be SMALL. The central plant and support facilities would be constructed landward of intermittent channels and above peak flood elevations. Furthermore, the central plant and chemical and fuel tank storage tanks would also have secondary containment. Spills and leaks could potentially impact surface waters, but the implementation of best management practices would minimize the potential impact. A storm water management plan would detain or treat runoff. Routine maintenance of Wellfield 2 would require vehicular crossing of an intermittent channel; however, sedimentation and erosion control measures would be implemented to further minimize surface water runoff from such temporary disturbances.

Aquifer Restoration: Impacts would be SMALL. There would be no impact to surface water during aquifer restoration because waste water generated during this ISR phase would be disposed of via deep well injection. Automated sensors would monitor the injection pressure of the deep disposal wells to detect potential leaks or pipeline/well ruptures that could result in a discharge. 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. The impact from decommissioning would be similar to that during the construction phase. Recontouring of the land would restore areas to their pre-construction condition to minimize the long term impact to intermittent streams that were traversed during well maintenance.

Groundwater

Construction: Impacts would be SMALL. The primary impact to groundwater during the construction phase of the proposed Moore Ranch Project would be from the consumptive use of groundwater, injection of drilling fluids and muds during well installation in the well fields, and from surface spills that could potentially migrate to groundwater. Groundwater for consumptive use would be from an aquifer located deeper than the proposed mining zone and the volume would be small and temporary relative to the water supply in the affected aquifer. The introduction of drilling or production fluid into a wellbore could impact the groundwater quality in the aquifers that would be penetrated; however, the use of drilling muds designed to seal the wellbore to set the casing would mitigate this impact. The use of best management practices during facility construction and well field installation including the implementation of a spill prevention and cleanup program to prevent soil contamination that required an immediate cleanup response would prevent soil contamination or infiltration to groundwater.

Operation: Impacts on water levels in local wells and on groundwater quality would be SMALL. The operations phase of the proposed Moore Ranch Project has the potential to impact shallow (near-surface) aquifers, the aquifer being mined and surrounding aquifers, and deep aquifers below the ore production zone that are used for the disposal of liquid effluent. The potential impact to surficial aquifers would be SMALL since no wells for domestic, agricultural or livestock use are located within the proposed license area and the shallow aquifer is not hydraulically connected to other locally or regionally important aquifers over the majority of the proposed license area. The potential impact to groundwater supplies in the ore production zone and surrounding aquifers is related to the consumptive use of groundwater and groundwater quality. Groundwater modeling, performed by the applicant and verified by NRC Staff, of the ore production zone predicted that the potential drawdown in private wells located with 3.2 km (2 mi) radius surrounding the proposed license area would experience a nominal drawdown in their private wells, but it would not impact the well yields. The ISR operations would degrade groundwater quality in the ore production zone. However, the establishment of an inward hydraulic gradient as well as the installation of a groundwater monitoring network to detect potential vertical and horizontal excursions would limit the potential for undetected groundwater excursions that could degrade groundwater quality. Because the ore production zone is overlain and underlain by impermeable shale layers this further ensures hydraulic isolation of the ore production zone to minimize potential groundwater contamination above and below the production zone.

Liquid effluent generated from operation of the proposed Moore Ranch Project would be disposed of via deep well injection into a Class I disposal permitted by the Wyoming Department of Environmental Quality (WDEQ). The groundwater in the formations being considered for deep well disposal must not be a potential underground source of drinking water meaning that the total dissolved solids must exceed 3,000 parts per million and the ore production zone is in an aquifer exempted as a drinking water aquifer by the EPA. In addition, the WDEQ must determine that there is no pathway to human coriumption. The geologic formations being considered as an injection zone for deep well disposal at the Moore Ranch site are located thousands of feet deeper than the ore production zone.

Aquifer Restoration: Impacts would be SMALL. Groundwater restoration activities take place when a well field is no longer used to produce uranium. During aquifer restoration, there are potential impacts to groundwater quality and water levels. Groundwater modeling was performed to estimate groundwater drawdown in the ore production zone in Wellfields 1 and 2. The results of this modeling showed that the potential drawdown at the boundary of the proposed license area could range from one to nine feet and from one to six feet at Wellfields 1 and 2, respectively, from aquifer restoration activities. A drawdown contour of one foot extended from one to four miles from the proposed license area to the north, northwest, west and southwest. Only one private well was identified that could potentially be affected by the drawdown; however, the predicted drawdown would have a negligible impact on well yield.

Because the ore production zone coalesces with an underlying aquifer in a portion of Wellfield 2, groundwater modeling was performed to estimate the impact of aquifer restoration activities on water levels in the underlying aquifer and to surrounding users. The results of this analysis showed that private wells within a 3.2 km (2 mi) radius surrounding the proposed license area would experience a nominal (0.04 to 1.2) foot drawdown which would not be expected to impact well yields. Therefore, the impact on groundwater levels would be SMALL.

Impacts on groundwater quality would be SMALL. Post-restoration groundwater quality would be protective of the public and the environment. The goal of aquifer restoration is to restore groundwater quality in the ore production zone to pre-mining baseline conditions. If the aquifer cannot be restored to baseline conditions, then NRC requires that either the production zone be returned to maximum contaminant levels in Table 5C of 10 CFR Part 40, Appendix A or to alternate concentration limits approved by NRC.

Decommissioning: Impacts would be SMALL. The potential impact to groundwater quality during decommissioning and reclamation would be comparable to that described above for the construction phase of the proposed Moore Ranch Project.

Ecological Resources

Construction: Impacts would be SMALL. However, the impact would be reduced to SMALL from implementing the mitigative measures discussed in Section 4.6 of this draft SEIS. Approximately 61 ha (150 ac) of land would be disturbed during construction activities to build the central plant, develop well fields, lay pipeline and develop the well fields which would result in some habitat loss or alteration, displacement of wildlife, and injury or mortality from encounters with vehicles or heavy equipment, although wildlife species would generally be expected to disperse from the area once construction activities begin. Wyoming Fish and Game Department (WFGD) guidelines regarding noise, vehicular traffic, and human proximity would be observed during the construction phase. No threatened or endangered species are known to occur in within the proposed license area.

Operation: Impacts would be SMALL . However, the impact could be reduced to SMALL from implementing the mitigative measures discussed in Section 4.6 of this draft SEIS. Impacts would be similar but less than those experienced during the construction phase since less earthmoving activities would occur. Disturbed areas would be reseeded with WDEQ-approved seed mixtures.

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 could displace vegetation and wildlife species that recolonized the proposed license area since the construction phase. Revegetation and recontouring would restore habitat previously altered during construction and operations.

Meteorology, Climatology, and Air Quality

Construction: Impacts would be SMALL. Fugitive dust, vehicle combustion and diesel equipment used during construction would generate air emissions. The air quality within the proposed Moore Ranch Project would not be substantially affected by project construction because of the short-term (nine month) duration of the activity, the limited footprint of the construction area, the relatively low traffic volume and low heavy equipment usage compared to conventional mining, the low background concentrations of pollutants in this region, and the distance to the nearest resident who is located miles beyond 304 m (1,000 ft).

Operation: Impacts would be SMALL. Impacts would be less than those experienced during the construction phase and below the National Ambient Air Quality Standards. Operating ISR facilities are neither major point source emitters nor classified as a major source under the operation (Title V) Clean Air Act (CAA) permitting program.

Aquifer Restoration: Impacts would be SMALL. Less vehicular traffic would be required during the aquifer restoration phase than during operations because there would be fewer yellowcake shipments than during operations. The use of existing infrastructure and reduced traffic volume would reduce fugitive dust and exhaust emissions.

Decommissioning: Impacts would be SMALL. Impacts to air quality would be similar to that experienced during construction since the same type of activities would occur (e.g., earthmoving activities that generate fugitive dust emissions). The emissions would decrease as decommissioning progressed.

Noise

Construction: Impacts would be SMALL. Increased traffic and the use of drill rigs, heavy trucks, bulldozers, and other heavy equipment to construct and operate the well fields, drill wells, construct access roads, and build the central plant would generate noise audible above the undisturbed background levels. The sound from construction activities would return to pre-construction conditions at a distance of approximately 300 m (1000 ft). Therefore, there would be no audible noise at the location of the nearest resident approximately 4.5 km (2.8 mi) east of the proposed Moore Ranch licensed area boundary.

Operation: Impacts would be SMALL. Traffic would be the primary noise-generating activity that could be heard offsite. The central plant and other processing activities would generate indoor noise audible to workers. The nearest resident would not notice a change in noise at their location approximately 4.5 km (2.8 mi) east of the site.

Aquifer Restoration: Impacts would be SMALL. Noise impacts would be similar to, or less than, those experienced during the operations phase. Pumps and other well field equipment contained in building would reduce the potential sound impact to an offsite individual. As the location of the nearest resident 4.5 km (2.8 mi) east of the project boundary there would be no change in background noise.

Decommissioning: Impacts would be SMALL. Noise impacts would either be similar to, or less than, those experienced during the construction phase. Noise during this phase would be temporary, and once decommissioning and reclamation activities were complete, the noise level would return to baseline, with occasional vehicular traffic for long-term monitoring activities. At the location of the nearest residential 4.5 km (2.8 mi) east of the proposed project boundary there would be not change in background noise.

Historic and Cultural Resources

Construction: Impacts would be SMALL. Construction during implementation of the proposed action would not have a direct impact on specific archaeological sites determined to be eligible for listing on the National Register of Historic Places. The identified eligible sites would be avoided and, therefore, there would be no impact. If any identified historic or cultural resources were encountered during the construction phase of the proposed Moore Ranch Project they would be evaluated following procedures in an Unidentified Discovery Plan that would be developed prior to initiation of construction.

Operation: Impacts would be SMALL. There would be no impacts to historical and cultural resources recommended eligible to the National Register of Historic Places because these resources are not located in areas that would be affected by operations. As noted above, if any identified historic or cultural resources were encountered during the operations phase of the proposed Moore Ranch Project they would be evaluated following procedures in an Unidentified Discovery Plan that would be developed prior to initiation of construction.

Aquifer Restoration: Impacts would be SMALL. The impact to historic and cultural resources during the aquifer restoration phase would be similar to that described for operations above.

Decommissioning: Impacts would be SMALL. There would be no impact to historic and cultural resources during the decommissioning phase since no specific archaeological sites determined to be eligible for listing on the National Register of Historic Places would be affected by the proposed action. If any identified historic or cultural resources were encountered during the decommissioning phase of the proposed Moore Ranch Project they would be evaluated following procedures in an Unidentified Discovery Plan that would be developed prior to initiation of construction.

Visual and Scenic Resources

Construction: Impacts would be SMALL. The existing land use surrounding the proposed Moore Ranch Project has pipelines, well fields for CBM production, and utility lines that disturb the landscape, implementing the proposed action would not change the character of the landscape. Temporary and short-term visual impacts during the construction period in each well field would result from header house construction, well drilling, and construction of access roads and electric distribution lines. Best management practices such as dust suppression and coloration of well covers would be used to further mitigate the potential impact.

Operation: Impacts would be SMALL. The well fields would operate for approximately 3.25 years and they would be similar in visual impact to the CBM installations which occur in the area. The central plant would remain operational for approximately 12 years. The proposed operations are consistent with the BLM visual classification for this area.

Aquifer Restoration: Impacts would be SMALL. The visual impact would be the same as described for the operations phase. No modifications to either scenery or topography would occur during aquifer restoration which is estimated to last from 3.5 to 5 years. There would also be less vehicular traffic during aquifer restoration creating less of a visual impact.

Decommissioning: Impacts would be SMALL. Temporary impacts to the visual landscape would be comparable to those during the construction phase. Reclamation would return the visual landscape to baseline contours and would reduce the visual impact by removing buildings and the associated infrastructure.

Socioeconomics

Construction: Impacts would be SMALL. The potential temporary relocation of workers in nearby towns would have a SMALL impact on demographics. Workers would be paid the regional rates typical of the area; therefore impacts to income would be SMALL. Most of the construction work force is expected to be found within the existing workforce, so impacts on housing demand would be SMALL. Local employees and contractors would be employed whenever possible, which would have a slightly positive, but SMALL impact on employment rates. The local economy would experience a positive, but SMALL impact from the purchasing of local goods and services and taxes derived from construction equipment and other construction-related activities. An increased demand for local infrastructure, schools, and public services would have a SMALL impact on education and health and social services.

Operation: Impacts would range from SMALL to MODERATE. Relocation of workers and their families in nearby towns for an extended period of time (approximately 12 years) would have a MODERATE impact on 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 Moore Ranch Project would create new jobs, but would not contribute to the economic diversity of the area resulting in a MODERATE impact on employment. The local economy would experience a 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 SMALL impact on education because the current school system is not at full capacity. Increased demand for health and social services would have a MODERATE impact. However, since the local area has previously experienced cyclic periods of employment vs. unemployment it has developed the capability to manage change.

Aquifer Restoration: Impacts would be SMALL. Impacts would be similar to, but less than, those during the operation phase. Fewer workers would be required, thus reducing the potential 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 minority or low-income populations were identified in the vicinity of the Moore Ranch Project. Therefore, there would be no disproportionately high and adverse impacts to either minority or low-income populations from the proposed Moore Ranch Project

Public and Occupational Health and Safety

Construction: Impacts would be SMALL. Construction activities, including the use of construction equipment and vehicles could disturb the topsoil and create fugitive dust emissions. Radiological environmental monitoring data indicate that radioactivity levels in the topsoil at the proposed Moore Ranch Project are at background levels. Therefore, the inhalation of these concentrations of residual radioactivity would pose a radiological dose comparable to that from natural background exposure.

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

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

Decommissioning: Impacts would be SMALL. Impacts would be similar to, but less than, those experienced during construction. Soil and facility structures are decontaminated and lands are restored to pre-operational conditions.

Waste Management

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

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 permitted by the WDEQ and reviewed by the NRC would be drilled on site for disposal of liquid effluent wastes. Solids classified as Atomic Energy Act section 11e.(2) byproduct wastes would be sent to a licensed disposal facility. 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. All process or potentially contaminated equipment and materials including tanks, filters, pumps, piping would be inventoried and designated for removal to a new location for future use, removal to another licensed facility, or decontaminated to meet unrestricted release criteria. The process building would be decontaminated, dismantled, and released for use at another location. Safe handling, storage, and disposal of decommissioning wastes would be addressed in a required NRC decommissioning plan prior to initiating 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

The cumulative impact on the environment that results from the incremental impact of the proposed licensing action when added to other past, present, and reasonably foreseeable future actions was also considered, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. The NRC staff determined that the SMALL to MODERATE impacts from the proposed Moore Ranch Project are not expected to contribute perceptible increases to the MODERATE cumulative impacts, due primarily to; concurrent coal-bed methane (CBM) activities at the proposed Moore Ranch Project in conjunction with other oil and gas exploration and mining activities occurring throughout the Powder River Basin.

SUMMARY OF THE COSTS AND BENEFITS OF THE PROPOSED ACTION

The implementation of the proposed action would generate primarily regional and local costs and benefits. The regional benefits of building the proposed project would be increased employment, economic activity, and tax revenues in the region around the proposed site. Costs associated with the proposed Moore Ranch ISR Project are, for the most part, limited to the area surrounding the site.

COMPARISON OF ALTERNATIVES

Under the No-Action alternative, NRC would not issue a license to Uranium One to construct, operate, restore the aquifer, or decommission the proposed Moore Ranch Project. The land would be available for other uses; there would be no incremental increase in traffic on local roads attributable to the proposed action. No land disturbance from earthmoving activities that could disrupt vegetation or current grazing patterns would occur nor would increased surface water runoff result from such activities. Coal-bed methane operations in the area would continue resulting in surface water discharges to the local intermittent drainages. There would neither be an impact on groundwater quality nor on the water levels in surrounding private wells from operating the ISR facility. There would be no noise generating activity nor increased fugitive dust or exhaust emissions from either earthmoving activities or increased commuter traffic to the site. If the No-Action alternative were implemented, no new jobs would be created from the proposed action nor would additional tax revenue accrue to the local economy. There would be no affect on housing availability, the education system, or public services. There would be no disproportionate high and adverse impacts to minority or low-income populations under the No-Action alternative nor would there be any 11e.(2) byproduct material waste generated requiring disposition.

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 finds that, unless safety issues mandate otherwise, environmental impacts of the proposed action (issuing a source material license for the proposed Moore Ranch Project) are not so great as to make issuance of a source material license an unreasonable licensing decision.

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

- Potential impacts to nearly all environmental resource areas are expected to be SMALL, with the exception of:socioeconomics (specifically, demography, housing, employment rate, local finance, health and human services) during operations, where such impacts would be MODERATE.
- ISR operations would take place in ore zone aquifers exempted by the U.S. Environmental Protection Agency as a potential public drinking water source. Additionally, the applicant would be required to monitor for excursions of lixiviant from the production zones and to take corrective actions in the event of an excursion. Finally, the applicant would be required to restore groundwater parameters affected by ISR operations to levels that are protective of public health and safety.
- The regional benefits of building the proposed project would be increased employment, economic activity, and tax revenues in the region.
- The costs associated with the proposed project are, for the most part, limited to the area surrounding the site.

ABBREVIATIONS/ACRONYMS

AADT	annual average daily traffic count
ADAMS	Agency Wide Documents Access and Management System
ACL	Alternate Concentration Limit
AEA	Atomic Energy Act
ALARA	as low as reasonably achievable
AMSL	above mean sea level
APE	area of potential effect
APLIC	Avian Power Line Interaction Committee
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
B.P.	before present
CAA	Clean Air Act
CBM	coal bed methane
CCESC	Campbell County Educational Services Center
CDNR	Colorado Department of Natural Resources
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESQG	Conditionally Exempt Small Quantity Generator
CFR	Code of Federal Regulations
CO	carbon monoxide
CWA	Clean Water Act
dBA	decibels
DOC	U.S. Department of Commerce
DOE	U.S. Department of Energy
EA	Environmental Assessment
EIS	Environmental Impact Statement
ENSR	ENSR Corporation
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
FR	Federal Register
FSME	Office of Federal and State Materials and Environmental Management Programs

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

PVC	plastic polyvinyl chloride
RAI	Request for Additional Information
RCRA	Resource Conservation and Recovery Act
RFFA	reasonably feasible future action
ROD	Record of Decision
ROI	region of influence
RQ	Reportable Quantity
RTV	Restoration Target Value
SDWA	Safe Drinking Water Act
SEIS	Supplemental Environmental Impact Statement
SER	Safety Evaluation Report
SHPO	State Historic Preservation Office
SR	State Route
T&E	Threatened and Endangered
TCP	Traditional Cultural Property
TEDE	Total Effective Dose Equivalent
TDS	total dissolved solids
THPO	Tribal Historic Preservation Office
TNM	Traffic Noise Model Version 2.5
TPQ	Threshold Planning Quantity
TQ	Threshold Quantity
TR	Technical Report
TSCA	Toxic Substances Control Act
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
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USFS	U.S. Forest Service
USC	United States Code
USCB	U.S. Census Bureau
USGS	U.S. Geological Survey
VRM	Visual Resource Management
WBC	Wyoming Business Council
WDE	Wyoming Department of Education
WDEQ	Wyoming Department of Environmental Quality
WDOE	Wyoming Department of Employment, Research, and Planning
WDOR	Wyoming Department of Revenue
WGFD	Wyoming Game and Fish Department
WLS	Western Land Services
WNDD	Wyoming Natural Diversity Database
WQD	Water Quality Division

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

SI* (MODERN METRIC) CONVERSION FACTORS

Approximate Conversions From SI Units				
Symbol	**When You Know**	**Multiply By**	**To Find**	**Symbol**
Length				
cm	centimeters	0.39	inches	In
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
Area				
mm2	square millimeters	0.0016	square inches	in2
m2	square meters	10.764	square feet	ft2
m2	square meters	1.195	square yards	yd2
ha	hectares	2.47	acres	ac
km2	square kilometers	0.386	square miles	mi2
Volume				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m3	cubic meters	35.314	cubic feet	ft3
m3	cubic meters	1.307	cubic yards	yd3
m3	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 Energy Metals Corporation (EMC) on October 2, 2007, to develop and operate the Moore Ranch Uranium Project (referred to herein as the proposed Moore Ranch Project), located in Campbell County, Wyoming, by in-situ leach (ISL) (also known as in-situ recovery (ISR)) methods (EMC, 2007) (Figure 1-1). EMC is a wholly owned subsidiary of Uranium One, Inc. 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, 2009a) and as detailed in Section 1.4.1 of this chapter. The NRC's Office of Federal and State Materials and Environmental Management Programs prepared this SEIS as required by Title 10, "Energy," of the *U.S. Code of Federal Regulations* (10 CFR) Part 51. These regulations implement the requirements of the *National Environmental Policy Act of 1969 (*NEPA*)*, as amended (Public Law 91-190) which requires the Federal Government to assess the potential environmental impacts of major federal actions that may significantly affect the human environment.

1.2 Proposed Action

On October 2, 2007, EMC initiated the proposed federal action by submitting an application for an NRC source material license to construct and operate an ISR facility at the proposed Moore Ranch Project, and to conduct the consequent aquifer restoration and site decommissioning and reclamation activities. Based on the application, the NRC's federal action is the decision whether to issue the license to Uranium One. Uranium One's proposal is discussed in detail in Section 2.1.1 of the SEIS.

1.3 Purpose of and Need for the Proposed Action

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

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

1.4 Scope of the Supplemental Environmental Analysis

The NRC prepared this SEIS to analyze the potential environmental impact (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, 2009a). 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 Moore Ranch Project is located in one such region, the Wyoming East Uranium Milling Region. Table 1-1 summarizes the expected environmental impacts by resource area in the Wyoming East Uranium Milling Region based on the GEIS analyses.

The NRC staff considers the scope of the GEIS to be sufficient for the purposes of defining the scope of this SEIS. NRC accepted public comments on the scope of the GEIS from July 24 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, 2009a).

The SEIS 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, 2009a). The GEIS provides a starting point for NRC's NEPA analyses for site-specific license applications for new ISR facilities, as well as for applications to amend or renew existing ISR licenses. This SEIS tiers from the GEIS by incorporating by reference relevant information, findings and conclusions concerning potential environmental impacts. The extent to which NRC incorporates GEIS impact conclusions depends on the consistency between Uranium One's proposed facility and activities and conditions at the proposed Moore Ranch Project and the reference facility description and activities and information or conclusions in the GEIS. NRC's determinations regarding potential environmental impacts and the extent to which GEIS impact conclusions were incorporated by reference are discussed in Chapter 4 of this SEIS. Section 1.8.3 of the GEIS describes in more detail the relationship between the GEIS and the conduct of site-specific reviews as documented in this SEIS.

1.4.2 Public Participation Activities

As part of the preparation of this SEIS, NRC staff met with federal, state, and local agencies and authorities during the course of an expanded visit to the proposed Moore Ranch Project and site 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 January 25, 2008 related to the Moore Ranch license application (NRC, 2008a). NRC also published a Notice of Intent to prepare this SEIS on August 21, 2009 (NRC, 2009b).

1.4.3 Issues Studied in Detail

To meet its NEPA obligations related to its review of the Moore Ranch license application, the NRC staff has conducted an independent, detailed, comprehensive evaluation of the potential

Table 1-1. Range 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	S to M	S
Terrestrial Ecology	S to M	S	S	S
Aquatic Ecology	S	S	S	S
Threatened and Endangered Species	S to L	S	S	S
Air Quality	S	S	S	S
Noise	S to M	S to M	S to M	S to M
Historical and Cultural Resources	S to L	S	S	S
Visual and Scenic Resources	S	S	S	S
Socioeconomics	S to M	S to M	S	S to M
Public Health and Safety	S	S to M	S	S
Waste Management	S	S	S	S

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

environmental impacts from construction, operation, aquifer restoration, and decommissioning of an ISR facility at the proposed Moore Ranch Project. As discussed in Section 1.8.3 of the GEIS, the GEIS (1) evaluated 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 a range in potential impacts (e.g., SMALL to MODERATE, SMALL to LARGE) depending upon site-specific conditions (see Table 1-1). Based on the results of the GEIS analyses, this SEIS provides a more detailed analysis of the following resource areas:

- 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) were considered in this SEIS.

1.4.4 Issues Outside the Scope of the SEIS

Some issues and concerns raised during the scoping process on the GEIS (NRC, 2009a; Appendix A) were determined to be outside the scope of the GEIS. These issues and concerns, (e.g., general support or opposition for uranium milling, 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) were also determined to be outside the scope of this SEIS.

1.4.5 Related NEPA Reviews and Other Related Documents

The following NEPA and other related 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, 2009a). 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 (BLM) prepared this EIS for the West Antelope Coal Lease Application WYW163340, located approximately 24.6 km (15 mi) east of the Moore Ranch Project. The document evaluates the environmental impacts of leasing and mining coal on approximately 1,664 ha (4,109 ac).

NRC's Safety Evaluation Report. The NRC staff is preparing an SER for the Moore Ranch license application. In the SER, the NRC staff evaluates whether the licensee's proposed action can be accomplished in accordance with the applicable provisions of 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 applicable requirements in 10 CFR Part 20 and 10 CFR Part 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.

Final Environmental Impact Statement and Proposed Amendment of the Powder River Basin Oil and Gas Project, WY-070-02-065 (BLM, 2003). The BLM prepared this EIS to evaluate the potential effect from drilling, completing, operating and reclaiming 39,400 new natural gas wells and their associated infrastructure (roads, pipelines for gathering gas and produced water, electrical utilities, and compressors). This EIS evaluated potential effects to subwatersheds within the proposed Moore Ranch Project as well as to the aquifer that would be mined as part of the proposed action being considered in this SEIS.

NUREG-0889, Draft Environmental Statement related to the operation of Sand Rock Mill Project, Docket No. 40-8743, Conoco, Inc. (NRC, 1982). NRC evaluated the potential environmental impact from issuing a license to Conoco, Inc. to construct and operate a uranium mill, associated with an open-pit mine in the same geographic area now being considered for in-situ recovery of uranium. This environmental statement evaluated alternatives for tailings management including the use of evaporation ponds, which were considered but eliminated from detailed analysis in this SEIS.

NRC's Environmental Review for the Nichols Ranch ISR Project. The NRC is reviewing a license application from Uranerz Energy Corporation for an ISR project located on about 1,365 ha (3,371 ac) about 32 km (20 mi) northwest of the proposed Moore Ranch Project.

NRC's Environmental Review for the Irigaray and Christensen Ranch ISR Project License Renewal. The NRC is reviewing a license application from COGEMA Mining, Inc. for the renewal of Source Material License SUA-1341, which is located in Campbell and Johnson Counties about 30 km (19 mi) north-northwest of the proposed Moore Ranch Project. The Irigaray project was commercially licensed for ISR operations in 1978. The license was amended in 1987 to include the Christensen Ranch satellite facility. In June 2000, production ended and the site has been undergoing well field restoration and site decommissioning.

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.

1.6 Licensing and Permitting

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

This section of the SEIS summarizes the status of the NRC licensing process at the proposed Moore Ranch Project site and the status of Uranium One's permitting with respect to other applicable Federal, tribal, and state requirements.

1.6.1 NRC Licensing Process

By letter dated October 2, 2007, Uranium One submitted a final license application to NRC for the Moore Ranch Project (EMC, 2007). 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 Moore Ranch license application for detailed technical review by letter dated December 20, 2007 (NRC, 2007).

The NRC's detailed technical review of the Moore Ranch 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, 10 CFR Part 40, 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 proposed 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 Moore Ranch 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 Moore Ranch Project, Uranium One 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 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 permit status for Uranium One's proposed Moore Ranch Project.

Table 1-2. Environmental Approvals for the Moore Ranch Uranium 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 for EPA review; anticipated WDEQ review complete 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
	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
	Underground Injection Control Class V (WDEQ Title 35-11)	The Class V UIC permit will be applied for following installation of an approved site septic system during facility construction
	Air Quality Permit	Not needed
U.S. Nuclear Regulatory Commission Washington, DC 20555	Source Materials License (10 CFR Part 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

(from Griffin, 2009)

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 proposed Moore

Ranch 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 April 9, 2008, NRC staff initiated consultation with the USFWS, requesting information on endangered or threatened species or critical habitat on the Moore Ranch Project area (NRC, 2008b). NRC received a response from the Ecological Services Wyoming Field Office of the USFWS, dated May 7, 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 (FWS, 2008).

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 (NRC, 2009c).

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 April 9, 2008 (NRC 2008c), 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 June 5, 2008 (Wyoming SHPO, 2008), indicated that a cultural resource survey had not been conducted for the entire "area of potential effect". The response also provided guidance and recommendations for identifying historic properties. A followup letter to complete the consultation process was sent on October 23, 2009 (NRC 2009d).

NRC staff also met with a member of the SHPO's office on January 12, 2009 (NRC 2009c), to discuss site-specific issues, including Wyoming SHPO's review process, cumulative impacts to historic sites, and best management practices. 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 Moore Ranch 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 Bureau of Land Management*

The U.S. Department of the Interior, Bureau of Land Management (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 if BLM surface ownership exceeds 2 ha (5 ac) and obtain BLM approval before beginning operations beyond those for casual use. The BLM does not administer surface ownership at the proposed Moore Ranch Project. The NRC and the BLM are finalizing a Memorandum of Understanding (MOU) between the two agencies such that the BLM and NRC would offer each other cooperating agency status on future ISR projects that involve BLM-managed lands. Although the MOU has not yet been signed, the NRC staff has coordinated with the BLM during preparation of this Draft SEIS. The BLM has provided valuable information and guidance on energy-related activities in the region, such as CBM production, coal leases, oil and gas leases, wind energy, and uranium extraction. The BLM prepared an EIS that evaluated many of these activities as described in Section 1.4.5 and has prepared resource management plans for BLM-administered lands. The BLM also has a Cooperating Agency agreement with the WDEQ.

The NRC staff met with the staff of several BLM offices in January 2009 (NRC 2009c), 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.

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

1.7.3.2 *Coordination with the Bureau of Indian Affairs*

The U.S. Department of the Interior, Bureau of Indian Affairs' (BIA) 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 (NRC 2009c). The NRC staff briefed the BIA on proposed ISR facilities in Wyoming, and the involvement of BIA and Indian tribes in the environmental review process was discussed. 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 the 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 February 23, 2009 (NRC 2009e), 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

To date, no 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 (NRC 2009c) to discuss the WDEQ's role in NRC's environmental review process for the Moore Ranch project. Issues that were brought up during the meeting included the WDEQ storm water program, air quality review and permitting, and noise quality. The WDEQ also clarified the injection well classification system. The WDEQ expressed concern related to reclamation and restoration, and noted that groundwater quality should be returned to baseline conditions. As a license condition, the ISR operator would be required to return the aquifer to baseline conditions or to the maximum contaminant levels provided in Table 5C of 10 CFR Part 40, Appendix A or to alternate concentration limits approved by NRC. The WDEQ requested early involvement in the NRC's review of applications for proposed ISR projects in the State and emphasized coordination with the BLM when ISR projects are located on BLM lands. NRC staff met with the WDEQ in both June and September 2009 to coordinate review of this SEIS and to ensure that NRC's assessment included issues of interest to the WDEQ.

NRC staff also met with the WDEQ-LQD on January 14, 2009 (NRC 2009c). The WDEQ-LQD explained the UIC Class III well application process, and noted that the WDEQ would require well field packages and groundwater restoration standards for future ISR operations. They expressed concern about potential excursions and unconfined aquifers. WDEQ-LQD staff also stated that groundwater parameters 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. NRC has communicated with the WDEQ via teleconference and periodic meetings to discuss regulatory jurisdiction, the Wyoming permitting process, and the status of various issues.

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 proposed license area includes habitat for a variety of big game animals, raptors, migratory birds, and small mammals that may be affected by the proposed project. The WGFD has an interest in potential impacts to migratory behavior patterns, long-term population sustainability, and the effects of local hunting on big game; impacts to nesting raptors; and the loss of nesting habitat for the greater sage-grouse.

Based on a USFWS recommendation, NRC staff sought information form the WGFD regarding sage grouse habitat within the proposed license area and appropriate mitigative measures to minimize potential impacts to the sage grouse. WGFD responded that there was no known sage grouse habitat on the proposed Moore Ranch site (WGFD, 2009). Discussions via conference calls have also been held to pinpoint specific project-related concerns regarding impacts to other fish and wildlife populations. Those concerns have been noted and addressed in project planning.

The WGFD also provided input on several terrestrial and aquatic habitats which have been considered in the discussion of the affected environment (Chapter 3) and in the impacts analysis (Chapter 4) of this draft SEIS. NRC staff has also informally consulted with WGFD.

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 (NRC 2009c) 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 (NRC 2009c) 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 (NRC 2009c) 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 proposed license area which has included teleconferences and face-to-face meetings. NRC met with several local county and city entities on January 13 and 15, 2009 (NRC 2009c) to discuss site-specific issues for the proposed Moore Ranch Project. Meetings were held with the following local entities: Douglas and Converse County Office, City of Casper Planning Office, City of Gillette and Campbell County Office, Converse Area New Development Organization, and the Town of Wright. Meetings with the local county and city entities focused on local economies, housing availability, and community services.

1.8 Structure of the SEIS

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

Chapter 2 of this SEIS describes the proposed action and reasonable alternatives considered for the proposed Moore Ranch Project, Chapter 3 describes the affected environment for the Moore Ranch site, and Chapter 4 evaluates the environmental impacts from implementing the proposed action and alternatives. Cumulative impacts are discussed in Chapter 5; Chapter 6 describes the environmental measurement and monitoring programs proposed for the Moore Ranch Project. A cost-benefit analysis is provided in Chapter 7, and a summary of environmental consequences from the proposed action and No-Action alternative is summarized 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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BLM, 2003. "Final Environmental Impact Statement and Proposed Amendment for the Powder River Basin Oil and Gas Project (WY-070-02-065)," January 2003.

Energy Metals Corporation (EMC), 2007a. U.S. "Application for USNRC Source Material License, Moore Ranch Uranium Project, Campbell County, Wyoming, Environmental Report." Casper, Wyoming: Uranium 1 Americas Corporation. ADAMS Accession Nos. ML072851222, ML072851229, ML072851239, ML07285249, ML07285253, ML07285255. October 2, 2007.

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NRC, 2009c. Memo to A. Kock, Branch Chief, from I. Yu, B. Shroff, and A. Bjornsen, Project Managers, Office of Federal and State Materials and Environmental Management Programs. Subject: Informal Meetings with Local, State, and Federal Agencies in Wyoming Regarding the Environmental Reviews Being Conducted on the Moore Ranch, Nichols Ranch, and Lost Creek In-Situ Leach Applications for Source Material Licenses (Docket Nos. 040-09073, 040-09067, 040-09068, Respectively). ADAMS Accession No. ML090500544. March 2, 2009. .

NRC, 2009d. Letter to Richard Currit, Wyoming State Historic Preservation Office, Uranium One Inc. Moore Ranch In-Situ Uranium Recovery Project—Section 106 Consultation. ADAMS Accession No. ML092790445. October 23, 2009.

NRC, 2009e. Request for Information Regarding Tribal Historic and Cultural Resources Potentially Affected by the Proposed License Application for Uranium One Inc.'s Moore Ranch Uranium Recovery Project in Campbell County, Wyoming. ADAMS Accession No. ML090440139. February 23, 2009.

NRC, 2008a. "Notice of License Application Request of Energy Metals Corporation, WY and Opportunity to Request a Hearing." *Federal Register*. Volume 73, Number 17, pp. 4642-4646. January 25, 2008.

NRC, 2008b. Letter to Brian Kelly, U.S. Fish and Wildlife Service. Request for Information Regarding Endangered or Threatened Species and Critical Habitat for the Proposed License Application for Energy Metals Corporation's Moore Ranch Uranium Recovery Project. ADAMS Accession No. ML080950201. April 9, 2008.

NRC, 2008c. Letter to Mary Hopkins, Wyoming State Historic Preservation Office, Initiation of Section 106 Process for Energy Metals Corporation's Moore Ranch Uranium Recovery Project License Request. ADAMS Accession No. ML080950161. April 9, 2008.

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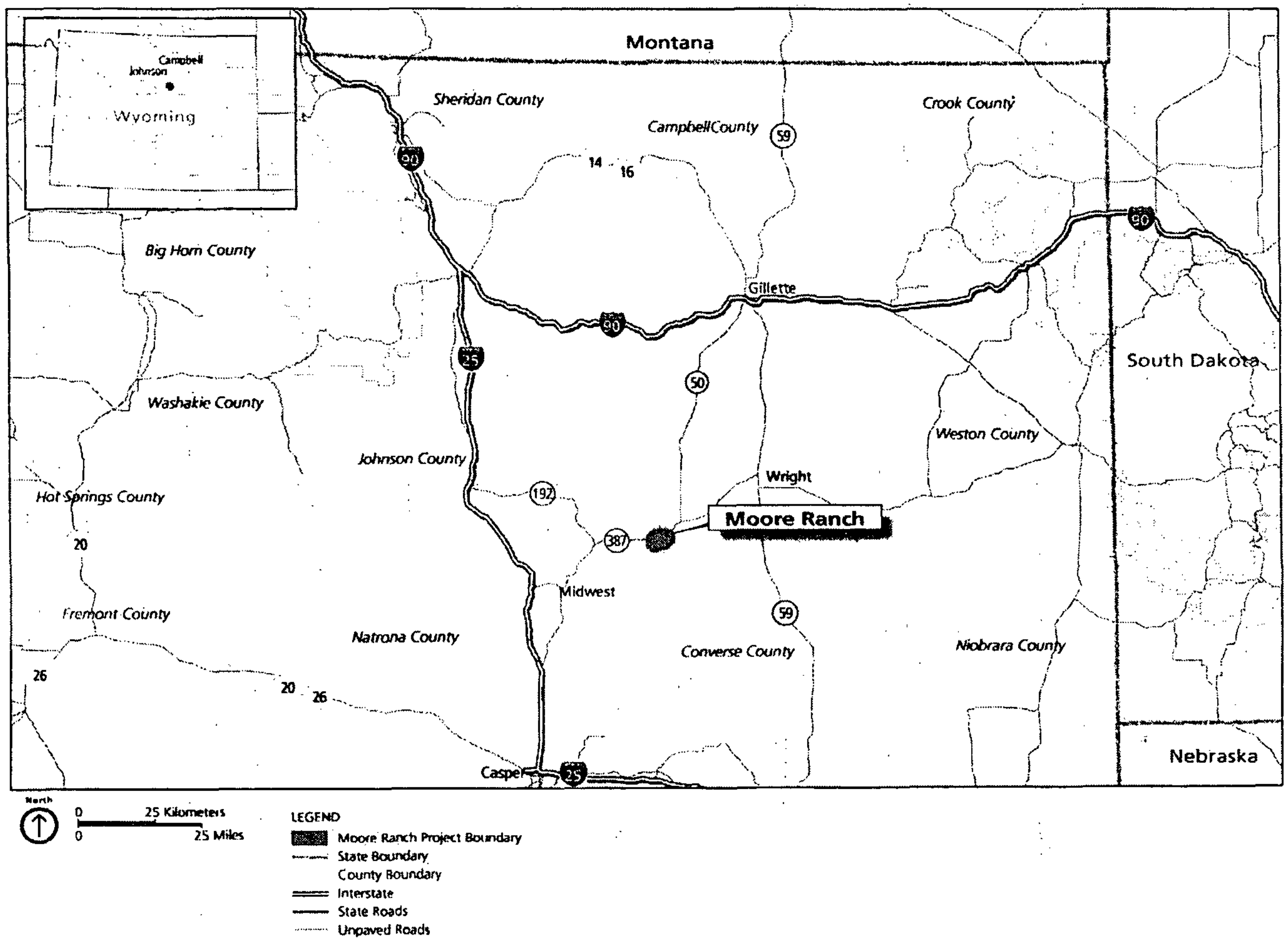

Figure 1-1. Location of the Proposed Moore Ranch Project

2 IN-SITU URANIUM RECOVERY AND ALTERNATIVES

Chapter 2 of the GEIS provided information on uranium recovery using the in-situ leach (ISL) process (NRC, 2009). This chapter describes the application of those processes and the alternatives considered for the issuance of a U.S. Nuclear Regulatory Commission (NRC) license to Uranium One for the construction, operation, aquifer restoration, and decommissioning of the Moore Ranch Project. This chapter describes the proposed action and alternatives which include a consideration of the No-Action alternative as required by the National Environmental Policy Act (NEPA). Under the No-Action alternative, Uranium One would not construct, operate, restore the aquifer, or decommission the Moore Ranch Project. The No-Action alternative is included to provide a basis for comparing and evaluating the potential impact of the proposed action.

Section 2.1 describes the alternatives considered for detailed analysis in this SEIS, including the proposed action. Section 2.2 describes those alternatives that were considered but eliminated from detailed analysis. Section 2.3 compares the predicted environmental impacts of the proposed action and the alternatives considered for detailed analysis. Section 2.4 provides a preliminary recommendation, and Section 2.5 provides the references cited for this chapter.

2.1 Alternatives Considered for Detailed Analysis

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

2.1.1 The Proposed Action (Alternative 1)

2.1.1.1 *Site Description*

The proposed license area for the Moore Ranch Uranium Project (Moore Ranch Project) is comprised of about 2879 ha (7,110 ac) in the Powder River Basin in Campbell County, Wyoming. The actual surface area that would be affected by the proposed ISL operation would be less than 61 ha (150 ac) and would consist of the main processing area, the well fields (and their associated infrastructure including pipeline and trunklines), mining support facilities such as warehouses and chemical storage areas, and access roads. The location of the proposed license area is comprised of either the following or portions of the following townships: Township 42 North, Range 74 West, Sections 25, 26, 27, 28, 33, 34, 35, 36; Township 41 North, Range 75 West, Sections 1, 2, 3, and 4, and Township 42 North, Range 74 West, Section 31. The proposed main processing area (referred to herein as the central plant) would be in the northeast quarter of Section 34 of Township 42 North, Range 74 West (Figure 2-1). The project site is located between the towns of Wright and Edgerton which are approximately 40 km (25 mi) northeast and 39 km (24 mi) southwest, respectively, from the Moore Ranch Project. No occupied housing units exist in the proposed license area; it is primarily used for grazing. Numerous wells used for coal bed methane (CBM) production also exist in the proposed license area as described in Section 3.2.1.3 of this SEIS.

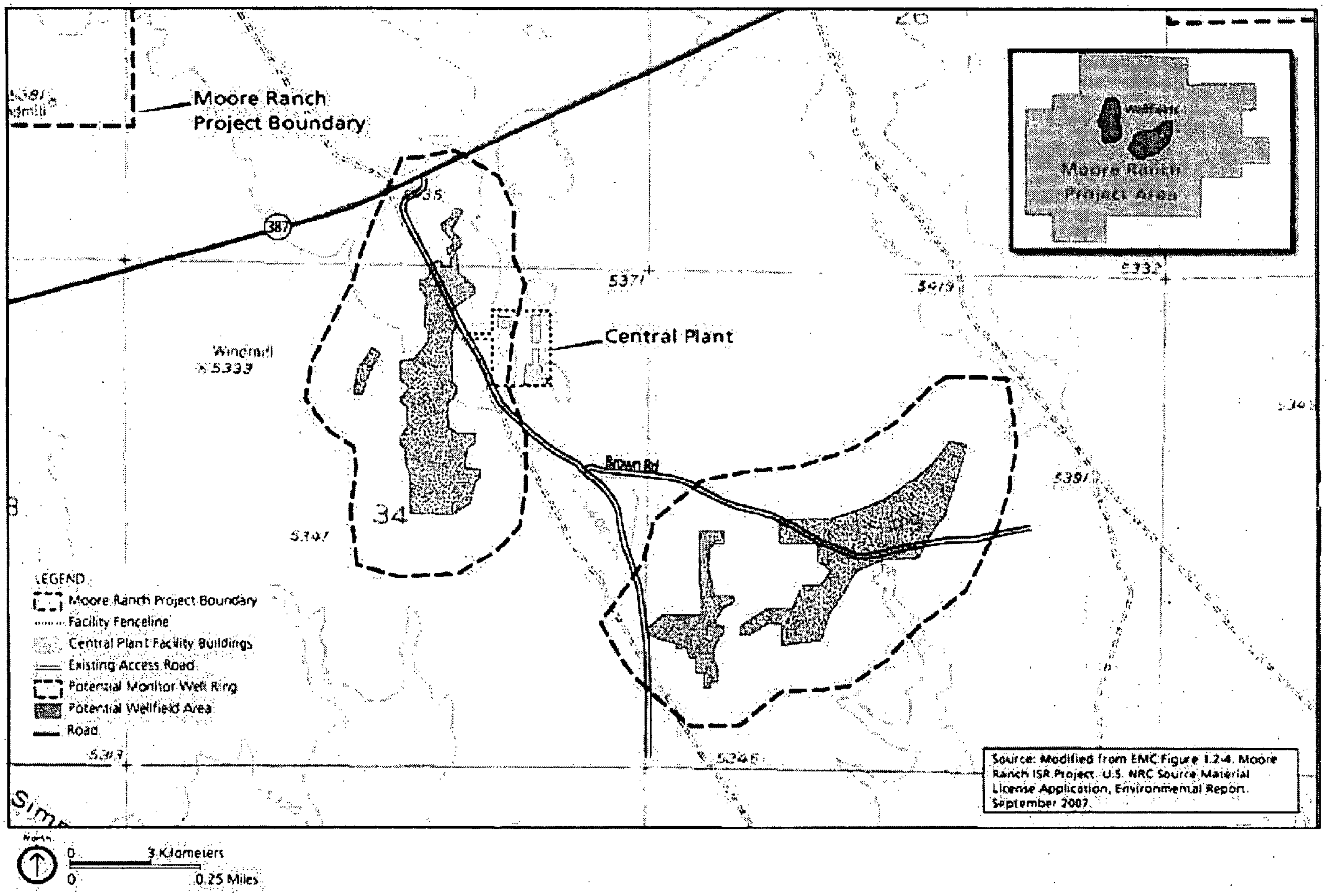

Figure 2-1. Site Layout at the Proposed Moore Ranch Project

Under the proposed action, NRC would issue a license for the construction, operation, aquifer restoration, and decommissioning of facilities for ISL uranium milling and processing at the Moore Ranch Project. During the construction phase of the action, buildings, access roads, well fields, and pipelines would be constructed as described in Section 2.1.1.2 of this SEIS. Most of the significant surface and subsurface disturbance would coincide with the area of the central plant (Figure 2-1) and result in the disturbance of approximately a 2.4 ha (6-ac) area. Wellfield 1 would cover an area of approximately 9.3 ha (23 ac) and Wellfield 2 would be developed over an area of about 13.7 (34 ac) (Figure 2-1); the development of the well fields would entail laying pipeline and trunkline; and about 2 km (1.25 mi) of new gravel road would be constructed.

In addition, under the proposed action two Underground Injection Control (UIC) Class I injection wells would also be drilled for disposal of liquid effluent generated from production bleed, from restoration (reverse osmosis brine), and from miscellaneous plant wastewater. The formations into which the wells would be drilled are thousands of feet below the proposed ore production zone at the Moore Ranch Project and they are described in more detail in Chapter 3. The Class I injection wells are being permitted under the authority of the Wyoming Department of Environmental Quality (WDEQ). The permits would also be reviewed under the NRC 20.2002 disposal authority. One Class I injection well would be located in Section 34 of T 42 N, R 75 W to support operations in Wellfield 1. A second Class I injection well would be located in Section 35 of T 42 N, R 75 W to support operations in Wellfield 2. Two different geologic formations are being considered for deep well disposal, the shallower formation occurs at a depth ranging from 1,128 – 2,286 m (3,700 – 7,500 ft) below the surface; the second formation occurs at a depth ranging from 2,431 – 2,929 m (7,916 – 9,610 ft) below the surface. The proposed wells would be permitted for a capacity of 473.5 L/min (125 gal/min) per well, thus providing a total disposal capacity of 947 L/min (250 gal/min). Disposal during the operations phase has been estimated at approximately 151.5 L/min (40 gal/min). However, during the restoration phase disposal could be as high as 530 L/min (140 gal/min) (EMC, 2007a). One well would be used to handle flow during operations and the second well would be used as backup. A third Class I injection well could be added for backup during the restoration phase of the project which would provide a total disposal capacity of 1,420 L/min (375 gal/min).

The proposed operations phase at the Moore Ranch Project would last approximately 12 years; however; each well field would be operational for about 3.25 years (Griffin, 2009). The central plant would operate at a maximum flow rate of about 11,364 L/min (3,000 gal/min) and the plant is expected to produce 2 to 3 million pounds of U_3O_8 per year.

2.1.1.2 *Construction Activities*

General construction activities associated with ISR operations include drilling wells as described in Section 2.4 of the GEIS and include activities such as clearing and grading associated with road construction and building foundations, building assembly, trenching, well drilling, and laying pipelines (NRC, 2009). The facilities to be constructed at the proposed Moore Ranch Project would consist of the central plant and infrastructure such as the well fields, pipelines, and roads that would be constructed for the proposed action. This section describes the physical plant comprised of the central plant including ion exchange columns, well fields, a construction and maintenance shop, warehouse, water treatment equipment, resin transfer facilities, pumps for lixiviant injection, a small laboratory and an employee break room. Figure 2-2 shows the different facilities which would comprise the Moore Ranch Project.

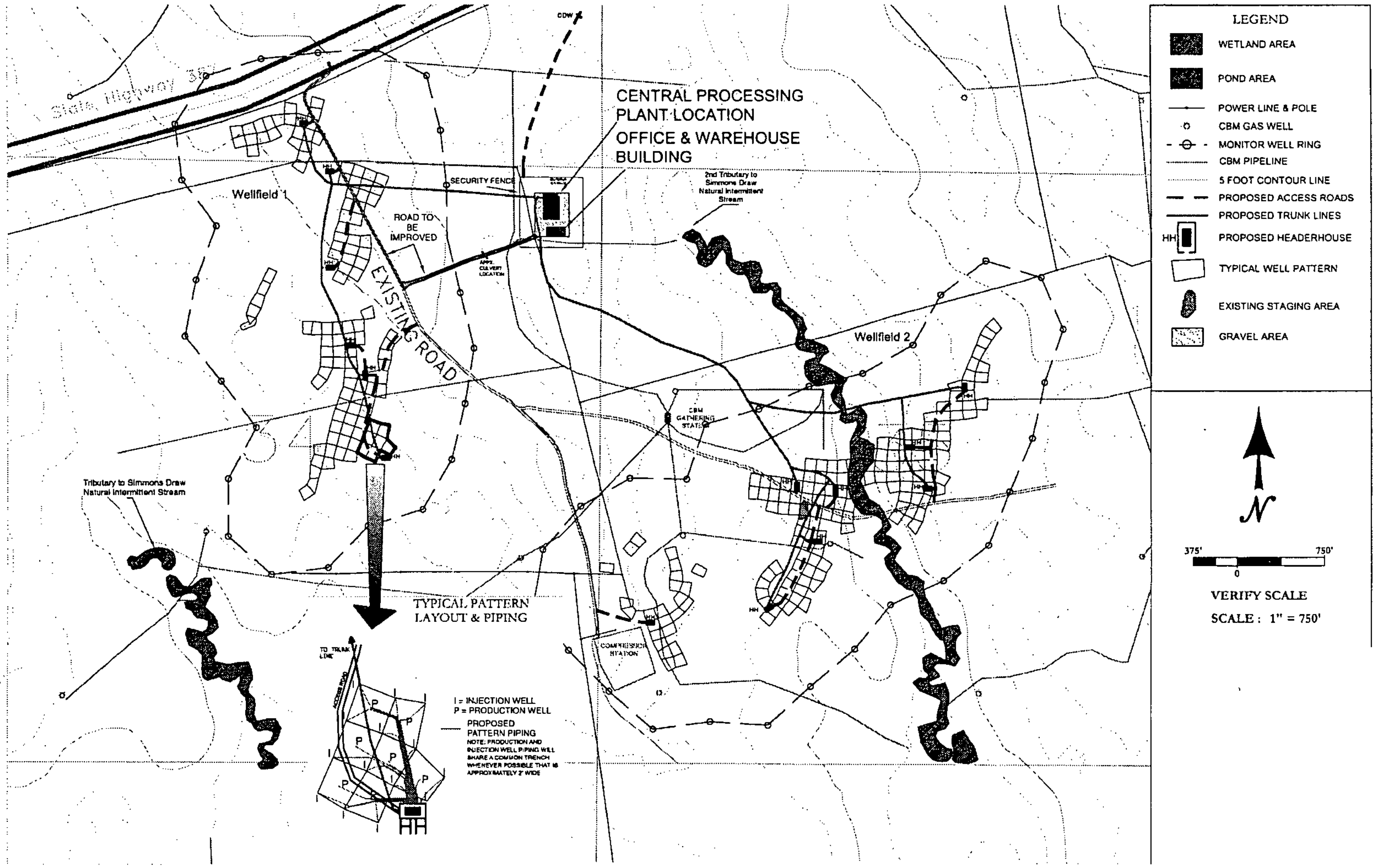

Figure 2-2. Wellfield Patterns and Infrastructure for the Proposed Moore Ranch Project (Uranium One, 2009a)

2.1.1.2.1 Central Plant

The central plant at the Moore Ranch Project would be constructed to provide chemical makeup of recovery solutions, recovery of uranium by ion exchange, resin loading/unloading, elution and precipitation circuits, yellowcake drying capabilities, and groundwater restoration capabilities. The Moore Ranch central plant facilities would be housed in a building with dimensions of approximately 107 x 30 m (350 x 100 ft) located within a 2.4 ha (6-ac) fenced area in the NE1/4, Section 34, T42N, and R75W, and, as stated previously, it would be designed and constructed to produce approximately 2 – 3 million pounds of U_3O_8 per year (EMC, 2007a). Uranium One has indicated that in the future they may process uranium-loaded resin from other potential Uranium One satellite projects in the area and would need to expand the central plant to accommodate an annual throughput of 4 million pounds of U_3O_8 per year. In order to do that, the NRC source material license, if granted, would have to be amended to permit the higher capacity and potentially the processing of off-site uranium-loaded resins. Section 2.1.1.3 of this SEIS describes the processing that would occur in the central plant. Figure 2-3 illustrates the central plant layout.

Chemical storage facilities at the Moore Ranch Project would include both hazardous and non-hazardous material storage areas. Bulk hazardous materials, which had the potential to impact radiological safety, would be stored outside and segregated from areas where licensed materials would be processed and stored. Figure 2-4 shows the proposed location of the supporting structures including the warehouse/shop, an office, a chemical storage facility, and the location of stored carbon dioxide and oxygen tanks. The hazardous chemical storage would include bulk storage within the central plant, a chemical storage facility located about 30.5 m (100 ft) west of the central plant, and separate storage for carbon dioxide and oxygen tanks as shown on Figure 2-4. Anhydrous ammonia and bulk sulfuric acid storage has been identified as being the most hazardous chemicals to store because of their potential to impact chemical and radiological safety (Mackin et al. 2001). A 22,727 L (6,000 gal) tank for sulfuric acid storage, an anhydrous ammonia tank with a capacity of 40,872 kg (90,000 lb), and a 22,727 L (6,000 gal) tank for storage of hydrogen peroxide have been proposed for use in the chemical storage area. These tanks would all be located separately from each other to minimize the potential for chemical reactions and enclosed to limit the amount of vapors released to the atmosphere. An oxygen storage facility would be designed and installed by the oxygen supplier to meet applicable industry standards. It would be delivered to the site by truck and stored on site under pressure in a cryogenic tank in liquid form (EMC, 2007a). Bulk storage of other non-hazardous chemicals such as carbon dioxide, sodium carbonate, sodium chloride would be inside the central plant to provide full containment of released materials.

The surface facilities would be designed and built using standard construction techniques in accordance with appropriate building codes. Construction vehicles could include bulldozers, drilling rigs, water trucks, forklifts, pump hoist trucks, coil tubing trucks, pickup trucks, portable air compressors, and other support vehicles.

2.1.1.2.2 Access Roads

The primary method of transportation to the Moore Ranch Project would be via U.S. or State highways. Access to the site from the east would be from State Highway 59 or State Highway 50 to State Highway 387; from the west, access would be from I-25 to State Highway 259 to State Highway 387. Construction materials would be delivered to the Moore Ranch site via State Highway 87 (Figure 2-1). Access to the site from the highway is available through gravel and two-track roads established from coal bed methane development and agricultural activity. A gravel access road located in T42N, R75W, Section 27 connects to the general location

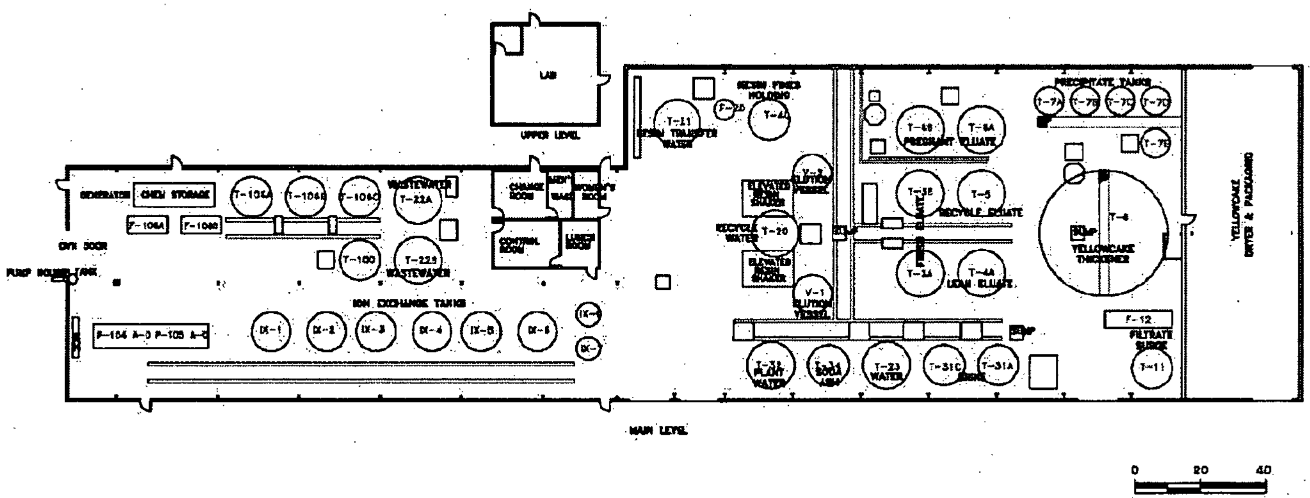

Figure 2-3. Layout of the Central Plant

proposed for construction of the central plant and would require minor improvements and completion of a short spur road to accommodate truck and heavy equipment access during the construction and operation phases of the alternatives. The access road runs south through Section 34 and forks to the east through Section 35; it also continues south through the project boundary. This existing road would provide the primary access to all currently planned well fields and facilities. Construction of the spur road would disturb approximately 1.2 ha (2 ac). There are approximately 43 km (27 mi) of existing two track roads (neither paved nor graveled) used by CBM and the landowners. Secondary roads for well field header houses and facility access would fork off of the existing primary access road (Figure 2-2).

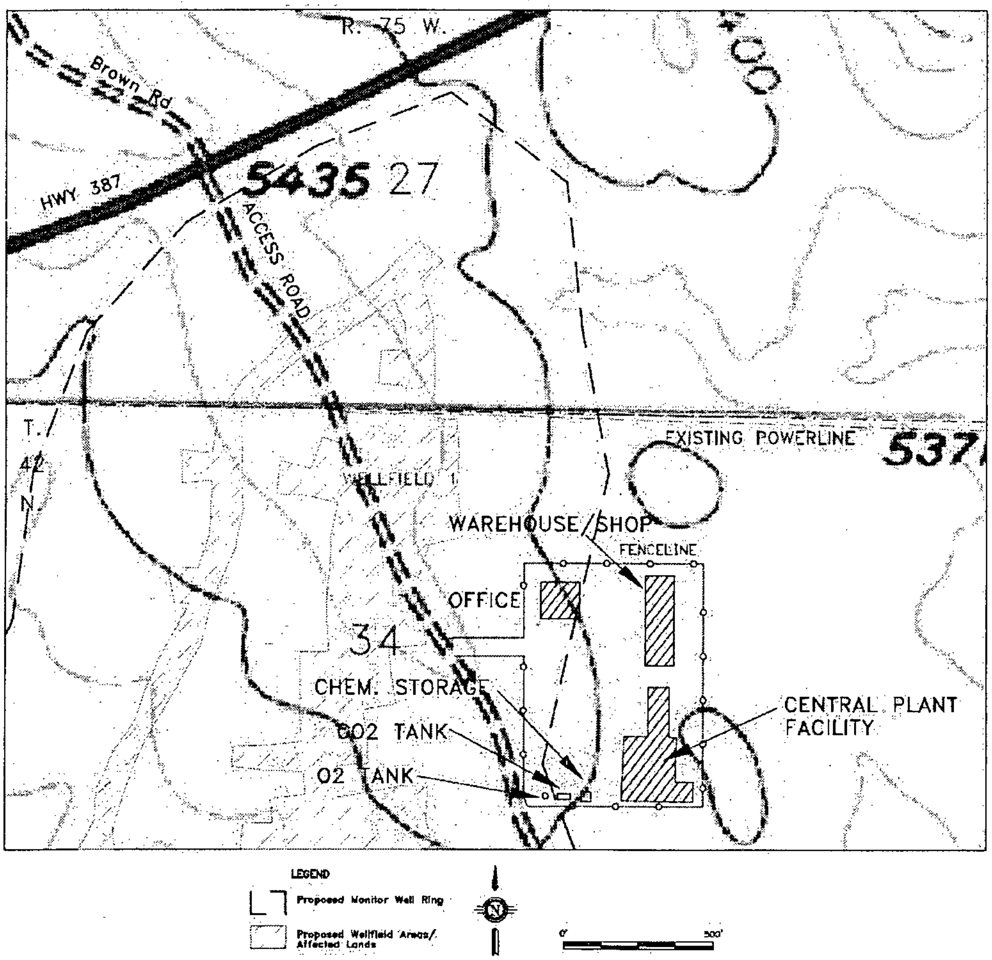

Figure 2-4. Warehouse and Storage at the Central Plant

2.1.1.2.3 Wellfields

The underground infrastructure, consisting of wells and pipelines would be established to inject, produce, and monitor groundwater, and to transfer fluids between the wells and other production facilities. The proposed area to be developed in the well fields is approximately 23 ha (57 ac). The target mineralized zone for in-situ recovery at the Moore Ranch Project is a sandstone formation located approximately 55 to 76 m (180 to 250 ft) below the surface (EMC, 2007b) referred to as the "70-Sand," which averages approximately 24 m (80 ft) thick in the proposed mining areas.. The geology and hydrology of this formation are described in greater detail in Sections 3.4.1 and 3.5.2 of this SEIS, respectively. The overall width of the mineralized area varies from 30 to 300 m (100 to 1000 ft).

Two well fields have been proposed for mining at the Moore Ranch Project as shown in Figure 2-2. Wellfield 1 would encompass approximately 9.3 ha (23 ac) in T42N, R47W in portions of Sections 27 and 34 and is located northwest of Wellfield 2. Wellfield 2 would encompass approximately 13.8 ha (34 ac) located in T42N, R47W, Section 34.

Two types of wells would be installed as part of the operations at the Moore Ranch Project: dual purpose injection/production wells and monitoring wells. Injection wells would be used to introduce lixiviant into the uranium mineralization, production wells would be used to extract uranium solutions, and monitoring wells would be used to assess the impact from ongoing operations and to detect groundwater excursions. The injection/production pattern that would be used at the Moore Ranch Project would be based on a conventional five-spot pattern which would be modified to fit the characteristics of the orebody at the site. The standard production cell, referred to as a pattern, would contain four injection wells surrounding a centrally located production well (Uranium One, 2009a). By drilling dual purposed injection/production wells, Uranium One considers that the well field flow patterns could be changed as needed to improve uranium recovery and that groundwater could be restored more efficiently.

The initial number of wells to be installed at Wellfield 1 has been estimated as 200 injection wells, 106 production wells, and 63 monitor wells. The initial number of wells to be installed at Wellfield 2 has been estimated as 240 injection wells, 153 production wells, and 81 monitor wells. The proposed well field patterns are shown on Figure 2-2. The monitor wells would be established in the overlying and underlying aquifers on four-acre spacings to detect vertical excursions (Uranium One, 2008). The well fields would be brought into operation and restored sequentially. Operations would begin in a portion of Wellfield 2, then move to the remaining portion of Wellfield 2 and part of Wellfield 1, then finish with Wellfield 1. As Wellfield 1 was operating, Wellfield 2 would begin restoration.

Injection and production wells would be connected to manifolds in a well field header house building. Header houses would be used to distribute injection fluid to injection wells and collect production solution from recovery wells. Each header house would be connected to two trunk lines, one for receiving injection fluid from the central plant and one for conveying recovery fluids to the central plant (Uranium One, 2008). The header house includes manifolds, valves, flow meters, pressure meters, booster pumps and oxygen to incorporate into the lixiviant as appropriate. Each header house would service approximately 40 to 60 wells (injection and production). Approximately eight header houses have been proposed for Wellfield 1 and 11 header houses have been proposed for Wellfield 2 (Uranium One, 2009a). The manifolds deliver the recovery solutions to the pipelines that transmit solutions to and from the ion exchange facilities. Flow meters and control valves would be installed in the individual well lines to monitor and control flow rates and pressures. In addition to the injection and production wells, Class I disposal wells have been proposed for the proposed action as described in Section 2.1.1.6.

Within each well field, more water would be withdrawn than injected to create an overall hydraulic cone of depression. Under this pressure gradient the natural groundwater movement would be from the surrounding area to the well field providing primary control of the production solution movement. The difference between the amount of water produced and injected is the well field "bleed." Fluids would be injected at a maximum rate of approximately 11,364 L/min (3,000 gal/ min). The average bleed rate at the Moore Ranch Project has been estimate at 1 percent of the maximum injection rate or 114 L/min (30 gal/min); it would be adjusted as necessary to maintain the well field cone of depression.

2.1.1.2.4 Pipelines

The development of the well fields at the Moore Ranch Project would require the installation of underground piping as described in this section The location of proposed trunk lines installed to support operations at the Moore Ranch Project are shown on Figure 2-2. Individual well lines leading to the injection and production wells would travel to the local header house and trunk lines would lead in and out of the central plant through a pipe vault located on the northwest side of the central plant (Uranium One, 2009)

In general, piping from the central plant, to and within the well field would be constructed of polyvinyl chloride (PVC) or high-density polyethylene pipe with butt welded joints or the equivalent. All pipelines would be pressure tested before final operation (EMC, 2007a). Wellfield piping would have an operating pressure of 150-300 psi. The network of process pipelines and cables would be buried to avoid freezing temperatures and to minimize the possibility of an accident. Burial trenches could be excavated as deep as 1.8 m (6 ft) below the ground surface to avoid any potential freezing problem. Trenches containing pipeline would typically be backfilled with native soil and graded to surrounding ground topography. The only exposed pipes would be at the central plant, at the wellheads, and in the well field header houses. Trunkline flows and manifold pressures would be monitored for process control (EMC, 2007a).

During mud pit excavation associated with well construction, exploration drilling and delineation drilling activities, topsoil would be separated from subsoil with a backhoe. When mud pit use was complete, all subsoil would be replaced and topsoil applied. Mud pits typically remain open for less than 30 days. Similarly, during pipeline construction, topsoil would be stored separate from subsoil and replaced on top of the subsoil after the pipeline ditch was backfilled.

2.1.1.2.5 Schedule

Upon issuance of a license from NRC, the duration of the construction phase of the Moore Ranch Project has been estimated at approximately nine months to construct access roads, build the central plant, and initiate development of Wellfield 2. As noted above the well fields would be developed sequentially along with the supporting infrastructure (i.e. header houses and pipelines). Wellfield 2 would be constructed first followed by the construction of Wellfield 1 within approximately two years (Uranium One, 2008).

2.1.1.3 *Operation Activities*

As described in Section 2.4 of the GEIS, the ISL uranium recovery process involves two primary operations: uranium mobilization that occurs in underground aquifers when lixiviant is injected into the ore body and recovering the solutions when they are uranium laden (NRC, 2009). The uranium laden solutions (referred to as pregnant lixiviant) would be pumped from the production wells to the central plant ion exchange system.

The uranium extracted from the Moore Ranch Project subsurface ore bodies would be loaded onto ion exchange resin in the central plant and then be transferred to other areas of the plant for elution, and ultimately precipitation, drying and packaging of uranium. Barren resin would be returned to the appropriate section of the ion exchange circuit.

This section of the SEIS describes the proposed operations at the Moore Ranch Project. The reader is referred to Section 2.4 of the GEIS for general background information on the operations phase of an ISR facility (NRC, 2009).

2.1.1.3.1 Uranium Mobilization

The uranium recovery process at the Moore Ranch Project would utilize the following steps: (1) injection of lixiviant: oxidation and complexation of the uranium under ground; (2) loading of uranium complexes onto ion exchange resin; (3) reconstitution of the recovery solution by addition of carbon dioxide and/or sodium bicarbonate and an oxidant; (4) elution (recovery) of uranium complexes from the resin, and (5) precipitation of uranium (EMC, 2007b). This process is described below.

2.1.1.3.1.1 *Lixiviant Chemistry*

The selected lixiviant must leach uranium from the host rock and keep it in solution during groundwater pumping from the host aquifer. The composition of the lixiviant is designed to reverse the natural geochemical conditions which led to the original uranium deposition. At the Moore Ranch Project, the proposed lixiviant for uranium recovery operations would be alkaline and consist of varying concentrations and combinations of sodium carbonate/bicarbonate, oxygen, and hydrogen peroxide added to the native groundwater to promote dissolution of uranium as a uranyl carbonate complex. The amenability of uranium deposits to ISL at the Moore Ranch site has been demonstrated by nearby ISL operations in similar ore bodies in the Powder River Basin including the Smith Ranch/Highland and the Christensen Ranch/Irigaray projects (EMC, 2007a). The lixiviant would be made up on a batch basis in the central plant and added continuously to the injection stream. Table 2.4-1 of the GEIS summarizes typical lixiviant chemistry (NRC, 2009). As noted in Section 2.4.1.1 of the GEIS, the principal geochemical reactions caused by the lixiviant are the oxidation and subsequent dissolution of uranium and other metals from the ore body and its subsequent extraction as described below (NRC, 2009).

2.1.1.3.1.2 *Lixiviant Injection and Production*

At the Moore Ranch Project the lixiviant would be pumped down a total of 440 injection wells in the two well fields to the ore body, where it would oxidize and dissolve uranium from the formation. Solutions for mining would be injected at a maximum rate of approximately 11,364 L/min (3,000 gal/min) (EMC, 2007b). A water balance for the proposed project is shown in Figure 2-5 . The liquid waste generated at the central plant would be primarily production bleed containing 11e.(2) byproduct material which has been estimated at an average of 1 percent of the production flow, which would be 114 L/min (30 gal/min) at the maximum flow rate of 11,364 L/min (3,000 gal/min).

Downhole injection pressures would be maintained below the formation fracture pressure. A formation fracture pressure gradient of 1.0 psi for every 0.3 m (1 ft) of depth to the top of the screened interval was used to determine the injection pressures at the Moore Ranch Project. The depth to the top of the anticipated screened interval ranges from approximately

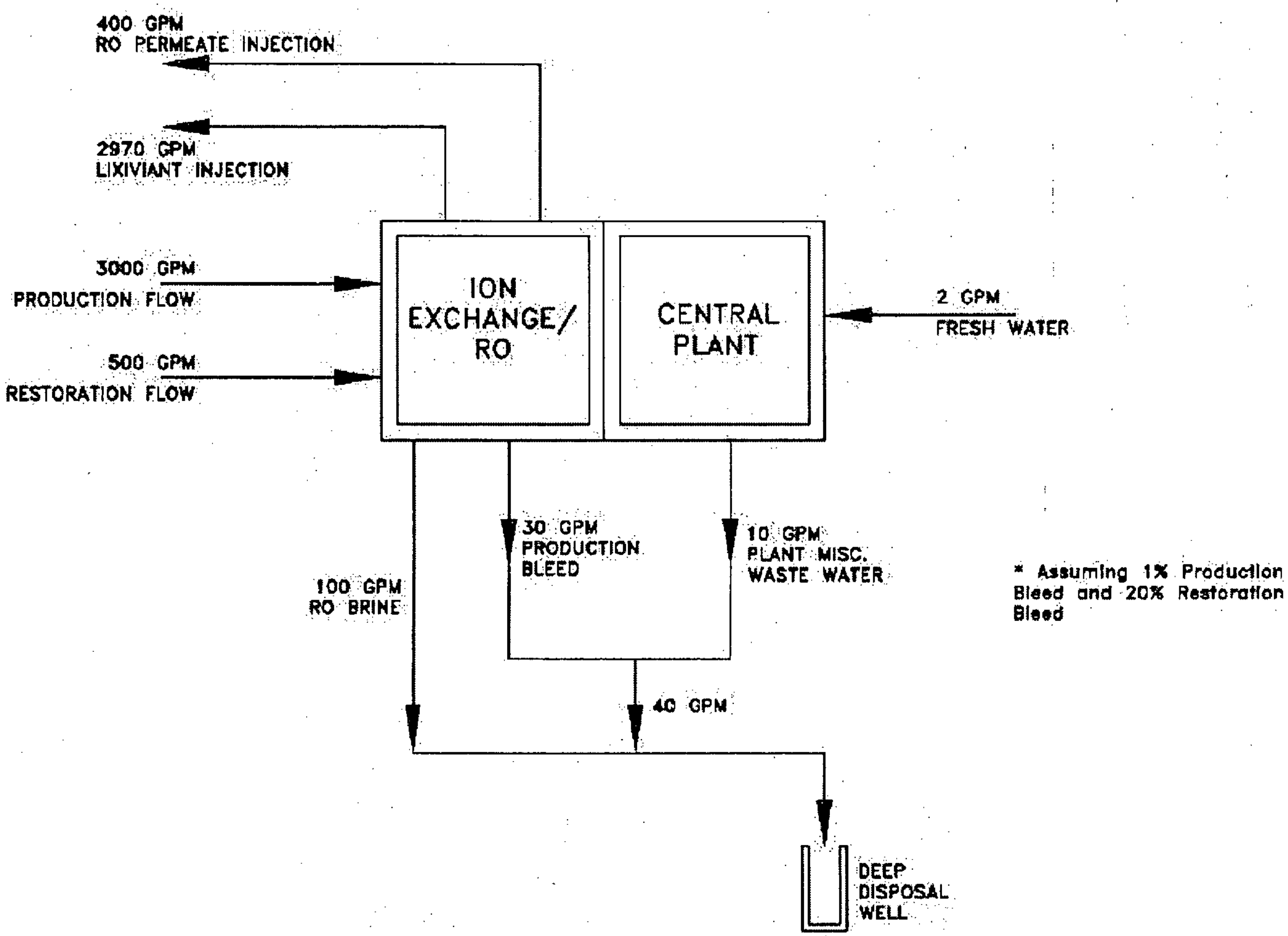

Figure 2-5. Water Balance for the Proposed Moore Ranch Project

49 m (160 ft) below land surface in Wellfield 2 to approximately 91.5 m (300 ft) in Wellfield 1. Therefore, injection pressures would range from 100 psi at the header houses located in shallower ore areas to no greater than 150 psi at header houses located in deeper ore areas (EMC, 2007b).

The uranium-bearing solution would migrate through the pore spaces in the sandstone and be recovered by a total of 259 production wells inclusive of both Wellfields 1 and 2. This uranium-rich pregnant lixiviant would be pumped to the central plant ion exchange facility, where it would be extracted through the processes described in Section 2.1.1.3.2 of this SEIS. Once the uranium has been extracted from the lixiviant (referred to as barren lixiviant), it would be recharged with carbonate/bicarbonate and oxidant and the solution reinjected into the ore body to continue mining.

2.1.1.3.1.3 *Excursion Monitoring*

ISR operations can potentially affect the groundwater quality near a site when lixiviant moves from the production zone away from the injection wells resulting in either a vertical or lateral excursion. Excursion monitoring is performed to control and monitor water flow to avoid a potential excursion. Uranium One proposes to install monitor wells both within the mineralized portion of the ore zone and in a ring outside the ore zone around the well fields to monitor for excursions. Monitor wells would also be installed in the overlying and underlying aquifers at a density of one well per every four acres of pattern area (Uranium One, 2008). The final location of these wells would be determined when the final well field design and the well field package are submitted to WDEQ-LQD. The proposed monitoring program is described in more detail in Chapter 6 of this SEIS.

An excursion occurs when two or more excursion indicators in a monitoring well exceed their upper control limits (UCL) (NRC, 2003a). If an excursion is suspected, the licensee takes several steps to notify NRC and confirm the excursion through additional sampling (NRC, 2003a). As described in NRC guidance (NRC, 2003a, Section 5.7.8.3), licensees typically retrieve horizontal and vertical excursions back into the production zone by adjusting the flow rates of the nearby injection and production wells to increase process bleed in the area of the excursion. Vertical excursions are more difficult to retrieve. If an excursion is suspected in groundwater monitoring wells, then the applicant is required to notify WDEQ and NRC within 24 hours and the suspect wells would be put on excursion monitoring meaning they would be monitored every seven days until the excursion indicators returned to non-excursion levels. If an excursion cannot be recovered, the licensee may be required to stop injection of lixiviant (NRC, 2003a). NRC license conditions require that licensees conduct biweekly sampling to detect excursions.

2.1.1.3.2 Uranium Processing

This section of the SEIS describes the proposed uranium processing for the Moore Ranch Project. The uranium processing proposed for the facility is illustrated in Figure 2-3 and discussed below.

2.1.1.3.2.1 *Ion Exchange*

The uranium-bearing solution or pregnant lixiviant pumped from the well field would be piped to the ion exchange columns in the central plant to extract the uranium. The ion exchange system would consist of eight fixed bed ion exchange vessels to be operated as three sets of two vessels in series with two vessels available for restoration. The ion exchange system would be designed to process recovered solution at a rate of 11,364 L/min (3,000 gal/min) with each vessel sized for 14.2 m^3 (500 ft^3) of resin operated in a pressurized down flow mode. As the solution passed through the ion exchange resin in the vessels, the uranyldicarbonate and uranyltricarbonate would preferentially be removed from the solution. The barren solutions leaving the ion exchange units would be expected to contain less than 2 mg/l of uranium (EMC, 2007b).

After the barren lixiviant left the ion exchange system, carbon dioxide and/or carbonate/bicarbonate would be added as necessary to return the carbonate/bicarbonate concentration to the desired operating level. The solution would then be pumped back to the well field, with the oxidant (O_2 gas) added either as it left the central plant, or just before the solution were to be re-injected into the production zone.

2.1.1.3.2.2 *Elution*

A three-stage elution circuit has been proposed for use at the Moore Ranch Project as illustrated in Figure 2-3. In a three-stage elution, the rich eluate would first pass through the elution vessels which contain the ion exchange resin. The rich eluate would strip approximately 84 percent of the uranyl carbonate ions from the resin and become pregnant eluate containing approximately 15,500 mg/l U_3O_8. Then lean eluate would be contacted with resins and remove approximately 68 percent of the remaining uranyl carbonate to become rich eluate. Finally, fresh eluate would be passed through the resins in the elution vessels and remove approximately 35 percent of the remaining uranyl carbonate from the resins resulting in lean eluate. At this stage the resins would have a residual uranyl carbonate concentration of approximately 3.33 percent. The resins would be washed with fresh water and/or a sodium bicarbonate rinse and either transferred back to the appropriate vessel or to a resin transfer trailer if the resins were to be shipped to an offsite mining area. Each batch of eluate would be transferred from the respective eluate storage tank through the elution vessel at a rate of approximately 795.4 L/min (210 gal/min) (EMC, 2007a).

Approximately 125,000 L (33,000 gal) of eluate would contact 14 m^3 (500 ft^3)of resin. The first elution stage would generate approximately 1,500 ft^3 (11,220 gal) of pregnant eluate containing 10 to 20 g/L U_3O_8. About 1,500 ft^3 (11,220 gal) of fresh eluate would be required per elution batch. The fresh eluate would be prepared by mixing the proper quantities of a saturated sodium chloride (salt) solution and saturated sodium carbonate (soda ash) solution and water to form a solution that would be about 9% NaCl and 2% Na_2CO_3. The saturated salt solution would be generated in a brine generator and the saturated soda ash solution would be prepared by passing warm water (>105°F) through a bed of soda ash. The eluate would be passed through a bank of 10 micron bag filters to remove entrained particulates prior to contacting the resin beds in the elution vessels (EMC, 2007a).

2.1.1.3.2.3 *Precipitation, Drying, and Packaging*

Approximately 795 L (210 gal) of sulfuric acid would be added to the pregnant eluate to break the uranyl carbonate complex thus liberating carbon dioxide and freeing uranyl ions to form a uranyl sulfate ion complex. The acidic, uranium rich fluid would then be pumped to the first of five agitated tanks arranged in series. The fluid would flow by gravity from one tank to the next. Hydrogen peroxide would be added to the first two tanks to form an insoluble uranyl peroxide compound. Ammonia would then be diffused into solution in the third tank and compressed air added to the ammonia stream prior to injection into the tank. Ammonia and air would also diffused into solution into the final tank in series. The addition of ammonia would raise the pH of the precipitate solution to near neutral for optimum crystal growth and settling. The uranium precipitate solution would then be pumped from the final precipitation tank to a 38-foot diameter gravity thickener.

The yellowcake would be dried at approximately 250°F. The drying and packaging area would include the vacuum dryer system and the packaging area immediately below the vacuum dryer. When the yellowcake was dry, it would flow through an enclosed chute and be deposited directly into a sealed hood on the drum for packaging. The off gases generated during the drying cycle would be filtered through a baghouse. Two rotary vacuum dryers would be located in a separate building containing the dryers and associated equipment but attached to the central plant.

The dried yellowcake would be removed from the rotary vacuum dryer by passing it through a rotary valve into 208 L (55-gal) steel drums. The vacuum pump for the dryer would be connected to the loading hood to minimize particulate emissions during drum loading. The dried yellowcake product would be stored in the steel drums in a restricted storage area pending shipment by truck to other licensed facilities for further processing. An enclosed warehouse, adjacent to the yellowcake drying area, would be used to store yellowcake. The drummed yellowcake would be shipped by exclusive use transport to a licensed conversion facility in Metropolis, Illinois.

2.1.1.3.3 Schedule

The central plant at the proposed Moore Ranch Project would operate for approximately 12 years; however the individual well fields would be operational for approximately 3.25 years (Griffin, 2009), although they would operate sequentially as described above in Section 2.1.1.2.3.

2.1.1.4 *Aquifer Restoration Activities*

Aquifer restoration within the well field ensures that the water quality and groundwater use in surrounding aquifers would not be adversely affected by the uranium recovery operation as discussed in Section 2.5 of the GEIS (NRC, 2009). After uranium is recovered, the groundwater will contain constituents that were mobilized by the lixiviant. The purpose of groundwater restoration is to protect groundwater adjacent to the mining zone. The process whereby groundwater constituents are selected for monitoring throughout the life of the project is discussed in Section 6.3.1.2 of this SEIS. Aquifer restoration prevents any mobilized constituents from affecting aquifers adjacent to the ore zone. The goal of groundwater restoration is to return parameters in the production zone to their pre-operational baseline, to maximum concentrations in Table 5C of 10 CFR Part 40, Appendix A, or to an alternate concentration limit (ACL) approved by NRC.

Aquifer restoration in each in each well field would begin as the uranium recovery operations end. By doing this, the period of groundwater contamination within the exempted aquifer is shortened. The pre-mining class of use would be determined by the baseline water quality sampling program that would be performed for each well field compared to the use categories defined by the WDEQ, Water Quality Division. Restoration would be demonstrated to meet the requirements of the WDEQ, Land Quality Division Rules and Regulations (EMC, 2007b) and NRC requirements. If the aquifer could not be returned to baseline conditions, NRC requires that the production aquifer be returned to the maximum contaminant levels provided in Table 5C of 10 CFR Part 40, Appendix A, or to Alternate Concentration Limits approved by NRC as discussed above. Evaluation of the degree of groundwater restoration within the production zone would be based on the average baseline quality over the production zone. Baseline water quality data would be collected for each well field from the wells completed in the planned production zone. Restoration would be evaluated parameter by parameter based on "Restoration Target Values" which would be established for a list of baseline water quality parameters.

Prior to initiation of operations and during the aquifer restoration phase, a groundwater monitoring program would have been established as described in Chapter 3 to assess the impacts from operations on local groundwater and its subsequent restoration.

2.1.1.4.1 Groundwater Restoration Methods

The groundwater restoration program at ISR sites typically consists of two stages, the restoration stage and the stability monitoring stage. The restoration stage typically consists of three phases groundwater transfer, groundwater sweep, and groundwater treatment as described in Sections 2.5.1, 2.5.2, and 2.5.3 of the GEIS, respectively (NRC, 2009). These phases are designed to optimize restoration equipment used in treating groundwater and to minimize the volume of groundwater consumed during the restoration stage. The following sections describe the proposed groundwater restoration methods proposed for use at the Moore Ranch Project.

Based on aquifer testing at Moore Ranch, Uranium One determined that efficient ground sweep during the operations and restoration phases could be accomplished by "pulsing" the extraction wells by cycling them on and off. The pulsing would be achieved by either switching groups of extraction wells on and off or by alternating between injection and extraction cycles within individual well patterns. By doing this, those portions of the aquifer that may have been temporarily dewatered by an extraction well could be effectively resaturated (EMC, 2007a).

The sequence of groundwater restoration activities would be determined based on operating experience and waste water system capacity. The specific mix of groundwater transfer, groundwater sweep, and groundwater treatment would be determined as part of the groundwater restoration plan for each individual well field. A reductant such as sulfide or sulfite could also be added to the injection stream at any time during the restoration stage to lower the oxidation potential of the mining zone.

The Moore Ranch Project would monitor the quality of groundwater in selected wells as needed during restoration to determine the efficiency of the operations and to decide if additional or alternate techniques would be necessary as described in Section 4.5.2 of this SEIS. The evaluation of groundwater restoration within the production zone would be based on the average baseline quality over the production zone (EMC, 2007a). Online production wells used in restoration would be sampled for uranium concentration and for conductivity amongst other constituents to determine the progress of restoration on a pattern-by-pattern basis.

2.1.1.4.1.1 *Groundwater Transfer*

During the ground water transfer phase of groundwater restoration at the Moore Ranch Project, water could be transferred between a well field commencing restoration and another commencing mining operations. Ground water transfer could also occur within the same well field, if one area of the well field is in a more advanced state of restoration than another.

Baseline quality water from the well field commencing mining would be pumped and injected into the well field in restoration. The higher total dissolved solids (TDS) water from the well field in restoration would be recovered and injected into the well field commencing mining. The direct transfer of water would lower the TDS in the well field being restored by displacing affected ground water with baseline quality water.

The goal of the ground water transfer phase is to blend the water in the two well fields until they become similar in conductivity. The water recovered from the restoration well field could be passed through ion exchange columns and/or filtered during this phase if there were a significant amount of suspended solids that could block injection well screens.

For groundwater transfer between well fields, a newly constructed well field must be ready to commence mining. Therefore, this phase could be initiated any time during the restoration process. If a well field is not available to accept transferred water, ground water sweep or some other activity could be the first phase of restoration. The groundwater transfer technique is advantageous to reduce the amount of water to be disposed.

2.1.1.4.1.2 *Groundwater Sweep*

Ground water sweep could be used at the Moore Ranch Project as a stand-alone process where ground water would be pumped from the well field without injection, causing an influx of baseline quality water from the perimeter of the mining unit, thus sweeping the affected portion of the aquifer. The cleaner baseline water would have lower ionic concentration to remove cations that attached to the clays during mining. The plume of affected water near the perimeter of the well field would also drawn inside the boundaries of the well field. Ground water sweep and groundwater treatment can be used in conjunction. The water produced during groundwater sweep would be disposed of via deep well injection. The rate of groundwater sweep depends on the wastewater disposal system capacity and the ability of the well field to sustain the rate of withdrawal.

2.1.1.4.1.3 *Groundwater Treatment*

During the groundwater treatment phase, water is pumped from the mining zone to the surface for treatment. Ion exchange, reverse osmosis, or electro dialysis reversal treatment equipment have been proposed for use during the groundwater treatment phase of the Moore Ranch Project.

During this phase of aquifer restoration, groundwater recovered from the restoration well field is passed through an ion exchange system via either reverse osmosis or electro dialysis reversal prior to treatment to the majority of the contained soluble uranium for chloride or sulfate. Following treatment in the ion exchange unit, groundwater would either be reinjected into the well field or disposed. Prior to or following ion exchange treatment, the groundwater could be passed through a de-carbonation unit to remove residual carbon dioxide remaining in groundwater after mining.

All or some portion of the restoration recovery water could be sent to the reverse osmosis unit to reduce the total dissolved solids in the affected groundwater, to reduce the quantity of water that must be removed from the aquifer to meet restoration limits, to concentrate the dissolved constituents into a smaller brine volume to facilitate waste disposal, and to enhance the exchange of ions from the formation due to the large difference in ion concentration. The reverse osmosis unit passes a high percentage of the water through the membranes, leaving 60 to 90 percent of the dissolved salts in the brine water or concentrate. The clean water, called permeate, is re-injected into the well field or stored for use in the mining process. The permeate could also be de-carbonated prior to re-injection into the well field. The brine water contains the majority of dissolved salts in the affected groundwater and would be disposed of via deep well injection. Make-up water, which could come from water produced from a well field that is in a more advanced state of restoration, water being exchanged with a new mining unit, water being pumped from a different aquifer, the purge of an operating well field or a combination of these sources, could be added prior to the reverse osmosis or well field injection stream to control the amount of "bleed" in the restoration area.

At any time during the process, a reductant (either biological or chemical), which would be used to create reducing conditions in the mining zone, could be metered into the restoration well field injection stream. The concentration of reductant injected into the formation would be determined by how the mining zone groundwater reacts with the reductant. The goal of reductant addition would be to decrease the concentrations of certain trace elements. Bio-remediation could also be employed as a reduction process. Reductants are beneficial because several of the metals, which are solubilized during the leaching process, are known to form stable insoluble compounds, primarily as sulfides. Dissolved metal compounds that are precipitated under reducing conditions include those of arsenic, molybdenum, selenium, uranium and vanadium.

The groundwater restoration phase at the Moore Ranch Project has been estimated to consume about 65.5 million and 94.2 million gal of water at Wellfields 1 and 2, respectively. The numerical modeling to support this calculation is provided in Uranium One's technical report (EMC, 2007a). Upon completion of restoration activities, a minimum six month groundwater stability monitoring period would be implemented to demonstrate that the restoration goal has been adequately maintained in accordance with WDEQ guidelines. Chapter 6 of this SEIS describes the restoration stability monitoring that would be conducted.

2.1.1.4.2 Schedule

The aquifer restoration phase of Wellfields 1 and 2 is estimated to last approximately 3.5 and 5.25 years, respectively (Griffin, 2009). The stabilization monitoring following completion of aquifer restoration is estimated to last approximately one year.

2.1.1.5 *Decontamination, Decommissioning, and Reclamation Activities*

The decommissioning of an ISR facility would be based on an NRC-approved decommissioning plan. Section 2.6 of the GEIS describes the general process for decontamination, decommissioning and reclamation of an ISL facility (NRC, 2009). The NRC license would be amended to initiate the decommissioning process and to provide NRC the detailed information required for NRC to evaluate the proposed decommissioning plan. Uranium One would submit a decommissioning plan to the NRC for review and approval at least 12 months before the planned commencement of final decommissioning.

All lands disturbed by the mining project would be returned to their pre-mining land use unless an alternative were justified and approved by both the state and the landowner. For example, a rancher could decide to retain access roads, etc. The goal of the decommissioning and reclamation process would be to return disturbed lands to production capacity of equal or better than existed prior to mining. The sections below describe the proposed decommissioning and surface reclamation plans for the Moore Ranch Project. As part of this process wells would be plugged and abandoned, disturbed lands would be reclaimed, contaminated equipment and materials would be removed, appropriate cleanup criteria for structures would be determined, items to be released for unrestricted use would be decontaminated to meet NRC requirements, and surveys would be performed to determine if there was residual contamination in soils and structures. The following sections described the general decommissioning activities that would occur at the Moore Ranch Project.

2.1.1.5.1 Wellfield Decommissioning

Wellfield plugging and surface reclamation would be initiated once the regulatory agencies concur that the groundwater has been adequately restored and that the water quality is stable. All production, injection and monitoring wells and drill holes would be abandoned and plugged in accordance with WS-35-11-404 and Chapter VIII, Section 8 of the WDEQ-LQD Rules and Regulations to prevent adverse impacts to groundwater quality or quantity. This process would involve removing pumps and tubing from the wells, plugging them with either cement or clay, cutting off the casing three feet below the ground surface, placing a steel plate atop the casing which identifies the well and the date of plugging, and emplacing a cement plug at the top of the casing.

Surface reclamation in the well field production unit would involve removing surface equipment which would consist primarily of the injection and production feed lines, the header houses, electrical and control distribution systems, well boxes, and wellhead equipment, removing the buried well field piping, re-contouring, if necessary, and conducting a final background gamma survey over the well field to identify contaminated earthen materials requiring removal, final re-vegetation of the well field areas according to a re-vegetation plan, and surveying all piping, equipment, buildings, and wellhead machinery for contamination prior to release in accordance with NRC decommissioning guidelines.

It is estimated that a significant portion of the equipment would meet radiological release limits, which would allow for disposal at an unrestricted landfill as discussed in Section 2.1.1.6.3 of this SEIS. Other materials would be decontaminated until they could be released. Equipment and materials that could not be decontaminated to meet release limits would be disposed of at a licensed facility.

Wellfield decommissioning would be an ongoing operation throughout the mining sequence. Once a well field has been mined and groundwater restoration and stability has been accepted by the regulatory agencies, the well field would be scheduled for decommissioning and surface reclamation.

2.1.1.5.2 Topsoil Handling and Replacement

Topsoil at Moore Ranch would be salvaged from building sites, permanent storage areas, main access roads, graveled well field access roads and chemical storage sites in accordance with WDEQ-LQD requirements. Conventional rubber-tired, scraper-type earth moving equipment is typically used to accomplish topsoil salvage operations. The exact location of topsoil salvage operations would be determined by well field pattern emplacement and designated access roads, which would be designated during final construction activities.

The topsoil thickness within the licensed area varies from nonexistent to several feet.. However, typical topsoil stripping depths are expected to range from 0.7 to 1.5 cm (3 to 6 in). Salvaged topsoil would be stored in designated stockpiles generally located on the leeward side of hills to minimize wind erosion and drainage channels would be avoided. The perimeter of large stockpiles would be bermed to control sediment runoff.

Surface soils would be cleaned up in accordance with the requirements in 10 CFR Part 40, Appendix A considering ALARA goals for cleanup of soils. The methodologies for conducting post-reclamation and decommissioning radiological surveys are discussed in Section 6.4 of EMC (2007a) and the cleanup goals for radium-226 and natural uranium are summarized in Table 2-1.

Table 2-1. Soil Cleanup Criteria and Goals

	Radium-226 (pCi/gm)		Natural Uranium (pCi/gm)	
Layer Depth	Limit	Goal	Limit	Goal
Surface (0-15 cm)	5	5	225	150
Subsurface (15 cm)	15	15	225	225

2.1.1.5.3 Final Contouring and Re-vegetation

The land surface would be recontoured, as necessary, to restore it to a surface configuration that would blend in with the natural terrain and would be consistent with the post mining land use. No major changes in the topography are anticipated for the proposed Moore Ranch Project.

Re-vegetation practices would be conducted in accordance with WDEQ-LQD regulations and the mine permit. During mining operations the topsoil stockpiles, and the disturbed well field areas would be seeded as much as practicable to establish a vegetative cover to minimize wind and water erosion. The WDEQ-LQD would approve the selected seed mix.

The success of permanent re-vegetation in meeting land use and reclamation standards would be assessed prior to application for bond release by utilizing the "Extended Reference Area" method as detailed in WDEQ-LQD Guideline No. 2 – Vegetation (March 1986). This method compares, on a statistical basis, the reclaimed area with adjacent undisturbed areas of the same vegetation type. The Extended Reference Area would be selected in consultation with the WQED-LQD to ensure the representativeness of the undisturbed chosen area to the reclaimed area being assessed.

2.1.1.5.4 Procedures for Removing and Disposing of Structures and Equipment

Upon completion of the uranium recovery process, buildings, equipment, pipelines and associated materials would be removed as discussed below.

2.1.1.5.4.1 *Preliminary Radiological Surveys and Contamination Control*

Prior to decommissioning the central plant and associated structures, a preliminary radiological survey would be conducted to characterize the levels of contamination on structures and equipment to identify any potential hazards and to support the development of procedures for dealing with such hazards prior to commencement of decommissioning activities. Based on the results of preliminary radiological surveys, gross decontamination techniques would be employed to remove loose contamination before decommissioning activities were initiated. This gross decontamination would generally consist of washing all accessible surfaces with high-pressure water. In areas where contamination is not readily removed by high-pressure water, a decontamination solution (e.g., dilute acid) may be used.

2.1.1.5.4.2 *Removal of Process Buildings and Equipment*

The majority of equipment in the process building would be reusable, as well as the building itself. Alternatives for the disposition of buildings and equipment would also be evaluated including removal to a new location for future use, removal to another licensed facility for either permanent use or disposal, or decontamination to meet unrestricted release criteria. All potentially contaminated equipment and materials at the central plant including tanks, filters, pumps, piping, etc., would be inventoried, listed and designated as discussed above. For the Moore Ranch Project, the process building would be decontaminated, dismantled and released for use at another location. Materials that could not be decontaminated to meet release criteria would be sent to a permanent licensed disposal facility. Cement foundation pads and footings would be broken up and trucked to a solid waste disposal site or to a licensed disposal facility if the residual materials could not meet release criteria.

2.1.1.5.4.3 *Building Materials, Equipment and Piping Released for Unrestricted Use*

Salvageable building materials, equipment, pipe, and structures would be surveyed for alpha contamination in accordance with NRC guidance and alpha contamination limits. Surface decontamination would be conducted in accordance with ALARA to reduce surface contamination levels as far below the limit as practical. Decontamination would focus in particular on inaccessible portions of equipment and structures in which radiological materials could accumulate such as piping, traps, junctions, and access points. Non-salvageable contaminated equipment, materials, and dismantled structural sections would be sent to a licensed facility for disposal. In most cases, the byproduct material would be shipped as Low Specific Activity (LSA-I) material, UN2912, pursuant to 49 CFR 173.427.

2.1.1.5.5 Schedule

Wellfield and plant decommissioning is estimated to take approximately one year (Griffin, 2009).

2.1.1.6 *Effluents and Waste Management*

The operation of an ISR facility generates various types of waste. The types of and volumes of waste to be generated by operation of the proposed Moore Ranch Project are described in this section. Potential disposal facility locations are described in Section 3.13 and the impact from dispositioning those wastes generated by the operation of the Moore Ranch Project are described in Chapter 4 of this SEIS.

2.1.1.6.1 Gaseous or Airborne Particulate Emissions

During the construction, operations, aquifer restoration, and decommissioning phases of the Moore Ranch Project, airborne emissions would be generated from fugitive dust; combustion engine exhaust; radon gas emissions from lixiviant circulation; and uranium particulate emissions from yellowcake drying. Fugitive dust and engine exhaust emissions would be generated primarily during construction, transportation, and decommissioning activities by travel on unpaved roads and from land disturbance associated with the construction of buildings, well fields, roads, and support facilities. Combustion engine exhaust due to vehicular exhaust from workers commuting to the site, materials transport to the site, and diesel emissions from drill rigs, diesel-powered water trucks, and other equipment used during the construction phase would also contribute to gaseous particulate emissions. The total dust from vehicle traffic on gravel roads was estimated at 15.5 tons per year (EMC, 2007b).

The primary radioactive airborne effluent at the Moore Ranch Project would be radon-222 gas occurring in the pregnant lixiviant. The preoperational radon monitoring described in Section

3.12.1 of this SEIS indicates a relatively minor degree of spatial variability in radon concentrations across the site (EMC, 2007a). The potential radon-222 emissions from the Moore Ranch Project were calculated as approximately 605 curies per year from well field production releases from operation of the central plant, from groundwater restoration activities, from well field development activities, and from transferring resins from nearby satellite facilities (EMC, 2007a).

A separate ventilation system would be installed for all indoor non-sealed process tanks and vessels where radon-222 or process fumes would be expected. The system would consist of an air duct or piping system connected to the top of each of the process tanks. Redundant exhaust fans would direct collected gases to discharge piping that would exhaust fumes to the outside atmosphere. The design of the fans would be such that the system would be capable of limiting employee exposures with the failure of any single fan. Discharge stacks would be located away from building ventilation intakes to prevent introducing exhausted radon into the facility as recommended in Regulatory Guide 8.31. Airflow through any openings in the vessels would be from the process area into the vessel and the ventilation system, controlling any releases that occur inside the vessel. Separate ventilation systems may be used as needed for the functional areas within the plant

The work area ventilation system would be designed to force air to circulate within the plant process areas. The ventilation system would exhaust outside the building, drawing fresh air in. During favorable weather conditions, open doorways and convection vents in the roof would provide work area ventilation. The design of the ventilation system would be adequate to ensure that radon daughter concentrations in the facility are maintained below 25 percent of the derived air concentration specified in 10 CFR Part 20.

To ensure that the emission control system is performing within specified operating conditions, instrumentation would be installed that provides an audible alarm if the air pressure (i.e. vacuum level) falls below specified levels. Operation of this system would be checked and documented during dryer operations. In the event of system failure, the operator would perform and document checks of the differential pressure or vacuum every four hours. Additionally, during routine operations, data from the air pressure differential gauges for other emission control equipment would be observed and documented at least once per shift during dryer operations.

2.1.1.6.2 Liquid Wastes

The operation of the ion exchange process during operations would generate production bleed, the primary source of liquid waste. Any waste water generated during or after the uranium extraction phase of site operations would be classified as 11e.(2) byproduct material (NRC, 2000). The expected liquid waste stream would be non-hazardous under the Resource Conservation and Recovery Act and the anticipated water chemistry of the injected waste stream is summarized in Table 2-2. The production bleed would be disposed of via deep well injection. Other liquid waste streams from the central plant would include plant wash down water and bleed stream from the elution and precipitation circuits during operations, but these other liquid waste streams make up a very small portion of the total.

Table 2-2. Anticipated Waste Stream to be Disposed via Deep Well Disposal

Chemical Species	Minimum (mg/L)	Maximum (mg/L)
pH	6	9
Ammonia as N	50	500
Sodium	150	3,000
Calcium	200	1,000
Potassium	10	1,000
Bicarbonate as HCO3	1,500	4,000
Carbonate as CO3	0	500
Sulfate	80	2,000
Chloride	200	4,000
Uranium as U3O8	1	15
Ra-226 (pCi/l)	300	3,000
TDS	4,000	15,000

Source: Uranium One, 2009

Uranium One submitted a permit application on August 17, 2009, to WDEQ for two UIC Class I disposal wells (Uranium One, 2009a). Uranium One has proposed use of two different geologic formations for injection of liquid effluent from the proposed Moore Ranch Project. One formation occurs at depths from 2,322 to 2,930 m (7,916 to 9,610 ft), thousands of feet below the proposed ore production zone and the hydrologic properties of this potential injection zone would allow injection rates of 114 L/min (30 gal/min) per well. The water quality in this formation is expected to exceed 3,000 parts per million (ppm total dissolved solids (TDS) (Uranium One, 2009a). Aquifers with TDS concentrations greater than 3,000 ppm are not a potentially useable underground source of drinking water.

The second formation being considered for injection of liquid effluent at the proposed Moore Ranch Project is the Lance Formation which occurs from depths ranging from 1,186 to 2,286 m (3,700 to 7,500 ft) (Uranium One, 2009a). The WDEQ will evaluate the suitability of these formations for Class I deep well injection and to ensure human health and the environment is protected. Stormwater runoff would also need to be managed at the Moore Ranch Project. Facility drainage would be designed to route storm runoff water away or around the plant, ancillary building and parking areas, and chemical storage areas. The status of obtaining industrial and construction stormwater permit at the proposed Moore Ranch Project as required under the National Pollutant Discharge Elimination System is summarized in Table 1-2 of this SEIS. Uranium One would develop a Best Management Practices (BMP) containing the procedures and engineering controls that would be implemented to manage stormwater runoff (EMC, 2007a).

2.1.1.6.3 Solid Wastes

All phases of the operational lifecycle of the Moore Ranch Project would generate solid wastes. These wastes would include spent resin, empty chemical containers, pipes and fittings, tank sediments, contaminated soil from leaks and spills, and municipal solid waste.

2.1.1.6.3.1 *Uncontaminated Solid Waste*

The Moore Ranch Project expects to produce approximately 1,530 m^3 (2,000 yd^3) per year of uncontaminated solid waste. Waste minimization and recycling processes would be used to reduce the quantity of solid waste generated. Since typical contract waste haulage vehicles range in capacity from 15 to 30 m^3 (20 to 40 yd^3), a nominal capacity of 15 m^3 (20 yd^3) per vehicle was assumed resulting in approximately 100 nonradioactive solid waste shipments per year or an average of approximately two shipments per week (Uranium One, 2009b). Chapter 3 describes the expected disposal site location and Chapter 4 describes the impact of disposing of uncontaminated solid waste from the Moore Ranch project.

2.1.1.6.3.2 *Byproduct Material*

The Moore Ranch Project is estimated to annually produce 76 m^3 (100 yd^3) of 11e.(2) byproduct material (EMC, 2007b). These materials would be stored on site inside the restricted area until such time that a full shipment could be made to a licensed waste disposal site or mill tailings facility. Based on the use of covered roll-offs with a nominal capacity of 15 m^3 (20 yd^3), approximately five byproduct material shipments would occur per year. Chapter 3 describes the expected disposal site location and Chapter 4 describes the impact of disposing of 11e.(2) byproduct material.

2.1.1.6.3.3 *Septic System Solid Waste*

Domestic liquid wastes from the restrooms and lunchrooms would be disposed in an approved septic system to meet WDEQ requirements for Class V underground injection wells. The septic system for the Moore Ranch Project includes an approximately 3,788 L (1000 gal) shop septic tank and a 7,575 L (2000 gal) plant septic tank (Uranium One, 2009b). Disposal of solid materials collected in septic systems would be in accordance with WDEQ regulations.

2.1.1.6.3.4 *Hazardous Waste*

Based on a preliminary screening of processes and materials to be used at the Moore Ranch Project, it is expected that the facility would be classified as a Conditionally Exempt Small Quantity Generator (CESQG), under the Resource Conservation and Recovery Act (RCRA). A CESQG is defined as a generator that both generates less than 100 kg (220 lb) of hazardous waste in a calendar month and complies with all applicable hazardous waste program requirements. The Moore Ranch Project is expected to generate only used waste oil and universal hazardous wastes such as spent batteries. The facility would develop management programs to meet the WDEQ regulatory requirements.

2.1.1.7 *Transportation*

A variety of vehicles would visit the project area from construction through decommissioning, including cranes, bulldozers, graders, track hoes, trenchers, drill rigs, front-end loaders, light through heavy duty trucks, and passenger vehicles. During the construction and decommissioning phases, Uranium One expects that approximately 40-60 workers would be employed, while during the operational and restoration phases of the project, there would be an expected maximum workforce of 24 employees (Uranium One, 2009a). The production of yellowcake would be approximately 1,814,500 kg (4 million pounds) per year. With each outgoing truckload containing approximately18,145 kg (40,000 lb), there would be 100 trips per year to the Honeywell Uranium Conversion Facility in Metropolis, Illinois or the Cameco Corporation facility in Port Hope, Ontario, Canada. This equates to an average of one shipment every 3.6 days (EMC, 2007a).

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 an applicant 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 (NRC, 2009). Uranium One would maintain surety instruments in the form of an Irrevocable Letter of Credit to cover the costs of reclamation including the costs of groundwater restoration, the decommissioning, dismantling and disposal of all buildings and other facilities, and the reclamation and revegetation of affected areas. An updated Annual Surety Estimate Revision would be submitted to the NRC and WDEQ to adjust the surety instrument amount to reflect existing and planned construction or operation in the following year in accordance with NRC and WDEQ requirements. Uranium One would revise the surety instrument to reflect a revised amount based on review and approval from NRC and WDEQ. The NRC reviews financial surety in detail as part of its review for the Safety Evaluation Report (SER).

2.1.2 No-Action (Alternative 2)

Under the No-Action alternative, the NRC would not approve the license application for the proposed Moore Ranch Project. The No-Action alternative would result in Uranium One not constructing, operating, restoring the aquifer, or decommissioning the proposed Moore Ranch Project. No facilities, road, or well fields would be built; no pipeline would be laid as described in Section 2.1.1.2. No uranium would be recovered from the subsurface orebody; therefore, injection, production, and monitoring wells would not be installed to operate the facility. No lixiviant would be introduced in the subsurface and no buildings would be constructed to process extracted uranium or store chemicals. Because no uranium would be recovered, neither aquifer restoration nor decommissioning activities would occur. No liquid or solid effluents would be generated. The No-Action alternative is included to provide a basis for comparing and evaluating the potential impacts of the other alternatives, including the proposed action.

2.2 Alternatives Eliminated from Detailed Analysis

As required by NRC regulations, the NRC staff considered other alternatives to the construction, operation, aquifer restoration, and decommissioning of the proposed Moore Ranch Project. The range of alternatives was determined by considering the purpose and need for the proposed action. This section describes alternatives to the proposed action that were considered but not carried forward for detailed analysis for reasons described in the following sections. Sections 2.2.1 and 2.2.2 describe different mining and associated milling alternatives for the project site. Section 2.2.2 discusses an alternate geographic location, Section 2.2.3 discusses the use of different lixiviant chemistry, and Section 2.2.4 discusses the use of alternate disposal methods for process-related liquid waste streams (Uranium One, 2009b).

2.2.1 Conventional Mining and Milling at the Moore Ranch Project

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

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

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

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

Ore extracted from the open pit or underground mine would be processed in a conventional mill. As discussed in Appendix C of the GEIS (NRC, 2009), ore processing at a conventional mill involves a series of steps (handling and preparation, concentration, and product recovery). While the conventional milling techniques recovers approximately 90 percent of the uranium content of the feed ore (NRC, 2009), the process does generate substantial wastes (known as tailings) since roughly 95 percent of the ore rock is disposed as waste (NRC, 2006). This process also can consume large amounts of water (e.g., approximately 534 liters per minute (Lpm; 141 gallons per minute [gpm]) for the proposed Pinon Ridge mill in Colorado (EFRC, 2009)).

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

Open pit and underground mining were used to mine uranium deposits during the early 1970s through the mid-1980s in the Powder River Basin, where the Moore Ranch Project is located. Even though open pit mining was evaluated at the Moore Ranch site for the proposed Conoco Sand Rock Mill Project (NRC, 1982), the environmental impacts from mining and conventional milling are more substantial than impacts from the ISR process at this site (see Chapter 4). For these considerations, this alternative is not carried forward for detailed analysis.

2.2.2 Conventional Mining and Heap Leaching at the Moore Ranch Project

Heap leaching is discussed in Appendix C of the GEIS (NRC, 2009). 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 U3O8 content. Once heap leaching is complete, the depleted materials are AEA, as amended by UMTRCA, section 11e.(2) byproduct material that must be placed in a conventional mill tailings impoundment unless NRC grants an exemption for disposal in place. While the impacts from heap leaching may be less than those from conventional milling, the impacts from the associated open pit or underground mining would still be substantial. For these considerations, similar to those listed in Section 2.2.1, this alternative is not carried forward for detailed analysis.

2.2.3 Alternate Site Location

An alternative location within the proposed Moore Ranch Project was considered but was determined to be less suitable because more changes to the existing topography would be required for the proposed plant layout than evaluated under the proposed action. At the alternate site more cut and fill activity would have been required thus resulting in more land disturbance and the potential impact to biotic and cultural resources.

2.2.4 Alternate Lixiviants

Alternate lixiviant chemistry was also considered for the operations phase of the proposed action including acid leach solutions and ammonia-based lixiviants. Acid-based lixiviants such as sulfuric acid dissolve heavy metals and other solids associated with uranium in the host rock and other chemical constituents that require additional remediation and have greater environmental impacts. At a small-scale research facility in Wyoming, test patterns were developed using acid-based lixiviants. During operations, two significant problems developed. The mineral gypsum precipitated on the well screens and in the aquifer which plugged the wells and reduced the efficiency of the well field restoration. Aquifer restoration had limited success because of the gradual dissolution of the precipitated gypsum which resulted in increased salinity and sulfate levels in the affected groundwater (Uranium One, 2009b). Because it is technically more difficult to restore acid mine sites, the use of an acid-based lixiviant was eliminated from detailed analysis in the SEIS.

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

2.2.5 Alternate Waste Disposal Methods

A range of liquid treatment alternatives that considered the three primary waste streams generated at an ISR facility: plant eluant, well field purge water, and reverse osmosis reject produced during well field restoration were considered for use at the Moore Ranch Project. These methods included mechanical evaporation, chemical precipitation, and the use of evaporation ponds as discussed in the paragraphs below.

Although mechanical evaporation could produce the smallest possible volume of brine for disposal, it would require larger storage tanks than the proposed action, require more offsite shipment of materials than the proposed action, the brine would be concentrated waste that could potentially be characterized as either hazardous or mixed waste, the energy consumption would be approximately 16 times that required for the proposed action, additional labor would be required to operate the Moore Ranch project compared to the proposed action, and from an environmental perspective mechanical evaporation would have a larger carbon footprint because of the greater power requirements (Uranium One, 2009b). From a safety perspective mechanical evaporation would require operating at high temperatures and pressures and would have high chemical requirements for solidification chemicals, thus increasing the potential for occupational exposure and accidents. Finally, the capital cost for mechanical evaporation would be approximately 4 times greater than that for an ISR facility (Uranium One, 2009b). For these reasons, mechanical evaporation was eliminated from detailed analysis in the SEIS.

Chemical precipitation and reverse osmosis to either pre-treat the wastewater for more efficient operation of the reverse osmosis system or for brine treatment was also considered. This practice would result in the both a brine residual and a sludge being formed. This method of treatment produces a higher volume of liquid residues and requires greater storage capacity than the proposed action 757,575 L (200,000 gal) brine storage tank compared to a 37,878 L (10,000 gal) storage tank for the proposed action), the brine would be concentrated waste that could potentially be characterized as either hazardous or mixed waste. The energy consumption for this treatment method would be approximately four times that of the proposed action, the labor would be approximately six times higher than that for the proposed action. This treatment method would involve the handling of the greatest amount of residues requiring onsite storage and transportation for offsite disposal, thus increasing the potential for occupational exposure and transportation accidents. For these reasons, chemical precipitation and reverse osmosis were eliminated from detailed analysis in the SEIS.

As noted in Section 2.7.2 of the GEIS, evaporation ponds have also been used at ISR facilities to retain process-related liquid effluents that cannot be discharged directly into the environment (NRC, 2009). These effluents are 11e.(2) byproduct material that typically remain in the ponds until the ponds are decommissioned and the sludges are disposed of as 11e.(2) byproduct material at a licensed disposal facility. The evaporation ponds at NRC-licensed facilities are designed with leak detection systems to detect liner failures and the licensee must maintain sufficient reserve capacity in the retention pond system so the pond contents could be transferred to other ponds in the event of a leak and subsequent corrective action and liner repair (NRC, 2009).

NRC evaluated the use of evaporation ponds at the proposed Moore Ranch Project in 1982 (NRC, 1982). Conoco, Inc. proposed to use conventional mining techniques to mine uranium in the same area as the proposed Moore Ranch Project and requested the issuance of a NRC Source and Byproduct Material License authorizing operation of the proposed Sand Rock Mill Project. Eleven different geographic locations at the site were evaluated to meet the performance objectives of reducing the length of slurry pipelines to minimize the potential for leaks and spills and to locate a prospective evaporation pond to minimize the potential impact on ecological resources. Because the development of a conventional mine would result in the disturbance of a larger land area with a greater risk to wildlife than an ISR facility, and the fugitive dust emissions would be greater with a conventional mine compared to an ISR facility and require more maintenance with an associated increase in occupational exposure compared to an ISR facility, the use of evaporation ponds at the proposed Moore Ranch Project was eliminated from detailed analysis.

2.3 Comparison of the Predicted Environmental Impacts

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

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

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

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

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

Chapter 4 of this SEIS presents a more detailed evaluation of the environmental impacts from the proposed action and the No-Action alternative. Table 2-3 compares the environmental impact by ISR phase of implementing the proposed action and the No-Action alternative and identifies the section of the SEIS where more detailed information can be found.

Table 2-3. Comparison of Predicted Environmental Impacts

4.2 Land Use Impacts	Alternative 1—Proposed Action	Alternative 2—No-Action
Construction	SMALL 4.2.1.1	NONE 4.2.2
Operation	SMALL 4.2.1.2	NONE 4.2.2
Aquifer Restoration	SMALL 4.2.1.3	NONE 4.2.2
Decommissioning	SMALL 4.2.1.4	NONE 4.2.2

Table 2-3. Comparison of Predicted Environmental Impacts

4.3 Transportation Impacts	Alternative 1—Proposed Action	Alternative 2—No-Action
Construction	SMALL 4.3.1.1	NONE 4.3.2.
Operation	SMALL 4.3.1.2	NONE 4.3.2
Aquifer Restoration	SMALL 4.3.1.3	NONE 4.3.2
Decommissioning	SMALL 4.3.1.4	NONE 4.3.2
4.4 Geology and Soils Impacts	**Alternative 1—Proposed Action**	**Alternative 2—No-Action**
Construction	SMALL 4.4.1.1	NONE 4.4.2
Operation	SMALL 4.4.1.2	NONE 4.4.2
Aquifer Restoration	SMALL 4.4.1.3	NONE 4.4.2
Decommissioning	SMALL 4.4.1.4	NONE 4.4.2
4.5.1 Water Resources Impacts (Surface Water)	**Alternative 1—Proposed Action**	**Alternative 2—No-Action**
Construction	SMALL 4.5.1.1.1	NONE 4.5.1.2
Operation	SMALL 4.5.1.1.2	NONE 4.5.1.2
Aquifer Restoration	SMALL 4.5.1.1.3	NONE 4.5.1.2
Decommissioning	SMALL 4.5.1.1.4	NONE 4.5.1.2
4.5.2 Water Resources Impacts (Groundwater)	**Alternative 1—Proposed Action**	**Alternative 2—No-Action**
Construction	SMALL 4.5.2.1.1	NONE 4.5.2.2
Operation	SMALL 4.5.2.1.2	NONE 4.5.2.2
Aquifer Restoration	SMALL 4.5.2.1.3	NONE 4.5.2.2
Decommissioning	SMALL 4.5.2.1.4	NONE 4.5.2.2

Table 2-3. Comparison of Predicted Environmental Impacts		
4.6 Ecological Resources Impacts (Vegetation)	Alternative 1—Proposed Action	Alternative 2—No-Action
Construction	SMALL 4.6.1.1.1	SMALL 4.6.2
Operation	SMALL 4.6.1.2.1	SMALL 4.6.2
Aquifer Restoration	SMALL 4.6.1.3	SMALL 4.6.2
Decommissioning	SMALL 4.6.1.4	SMALL 4.6.2
4.6 Ecological Resources Impacts (Wildlife)	Alternative 1—Proposed Action	Alternative 2—No-Action
Construction	SMALL 4.6.1.1.1	SMALL 4.6.2
Operation	SMALL 4.6.1.2.2	SMALL 4.6.2
Aquifer Restoration	SMALL 4.6.1.3	SMALL 4.6.2
Decommissioning	SMALL 4.6.1.4	SMALL 4.6.2
4.7 Meteorology, Climatology, and Air Quality Impacts	Alternative 1—Proposed Action	Alternative 2—No-Action
Construction	SMALL 4.7.2.1	NONE 4.7.3
Operation	SMALL 4.7.2.2	NONE 4.7.3
Aquifer Restoration	SMALL 4.7.2.3	NONE 4.7.3
Decommissioning	SMALL 4.7.2.4	NONE 4.7.3
4.8 Noise Impacts	Alternative 1—Proposed Action	Alternative 2—No-Action
Construction	SMALL 4.8.1.1	NONE 4.8.2
Operation	SMALL 4.8.1.2	NONE 4.8.2
Aquifer Restoration	SMALL 4.8.1.3	NONE 4.8.2
Decommissioning	SMALL 4.8.1.4	NONE 4.8.2

Table 2-3. Comparison of Predicted Environmental Impacts

4.9 Impacts to Historical and Cultural Resources	Alternative 1—Proposed Action	Alternative 2—No-Action
Construction	SMALL 4.9.1.1	SMALL 4.9.2
Operation	SMALL 4.9.1.2	SMALL 4.9.2
Aquifer Restoration	SMALL 4.9.1.3	SMALL 4.9.2
Decommissioning	SMALL 4.9.1.4	SMALL 4.9.2
4.10 Visual and Scenic Resources Impacts	**Alternative 1—Proposed Action**	**Alternative 2—No-Action**
Construction	SMALL 4.10.1.1	SMALL 4.10.2
Operation	SMALL 4.10.1.2	SMALL 4.10.2
Aquifer Restoration	SMALL 4.10.1.3	SMALL 4.10.2
Decommissioning	SMALL 4.10.1.4	SMALL 4.10.2
4.11 Socioeconomic Impacts (Demographics)	**Alternative 1—Proposed Action**	**Alternative 2—No-Action**
Construction	SMALL 4.11.1.1.1	SMALL 4.11.2.1
Operation	MODERATE 4.11.1.2.1	SMALL 4.11.2.2
Aquifer Restoration	SMALL 4.11.1.3	SMALL 4.11.2.3
Decommissioning	SMALL 4.11.1.4	SMALL 4.11.2.4
Socioeconomic Impacts (Income)	**Alternative 1—Proposed Action**	**Alternative 2—No-Action**
Construction	SMALL 4.11.1.1.2	SMALL 4.11.2.1
Operation	SMALL 4.11.1.2.2	SMALL 4.11.2.2
Aquifer Restoration	SMALL 4.11.1.3	SMALL 4.11.2.3
Decommissioning	SMALL 4.11.1.4	SMALL 4.11.2.4

Table 2-3. Comparison of Predicted Environmental Impacts		
Socioeconomic Impacts (Housing)	Alternative 1—Proposed Action	Alternative 2—No-Action
Construction	SMALL 4.11.1.1.3	SMALL 4.11.2.1
Operation	MODERATE 4.11.1.2.3	SMALL 4.11.2.2
Aquifer Restoration	SMALL 4.11.1.3	SMALL 4.11.2.3
Decommissioning	SMALL 4.11.1.4	SMALL 4.11.2.4
Socioeconomic Impacts (Employment Structure)	Alternative 1—Proposed Action	Alternative 2—No-Action
Construction	SMALL 4.11.1.1.4	SMALL 4.11.2.1
Operation	MODERATE 4.11.1.2.4	SMALL 4.11.2.2
Aquifer Restoration	SMALL 4.11.1.3	SMALL 4.11.2.3
Decommissioning	SMALL 4.11.1.4	SMALL 4.11.2.4
Socioeconomic Impacts (Local Finance)	Alternative 1—Proposed Action	Alternative 2—No-Action
Construction	SMALL 4.11.1.1.5	SMALL 4.11.2.1
Operation	MODERATE 4.11.1.2.5	SMALL 4.11.2.2
Aquifer Restoration	SMALL 4.11.1.3	SMALL 4.11.2.3
Decommissioning	SMALL 4.11.1.4	SMALL 4.11.2.4
Socioeconomic Impacts (Education)	Alternative 1—Proposed Action	Alternative 2—No-Action
Construction	SMALL 4.11.1.1.6	SMALL 4.11.2.1
Operation	SMALL 4.11.1.2.6	SMALL 4.11.2.2
Aquifer Restoration	SMALL 4.11.1.3	SMALL 4.11.2.3
Decommissioning	SMALL 4.11.1.4	SMALL 4.11.2.4

Table 2-3. Comparison of Predicted Environmental Impacts		
Socioeconomic Impacts (Health and Social Services)	Alternative 1—Proposed Action	Alternative 2—No-Action
Construction	SMALL 4.11.1.1.7	SMALL 4.11.2.1
Operation	MODERATE 4.11.1.2.7	SMALL 4.11.2.2
Aquifer Restoration	SMALL 4.11.1.3	SMALL 4.11.2.3
Decommissioning	SMALL 4.11.1.4	SMALL 4.11.2.4
4.12 Environmental Justice Impacts	Alternative 1—Proposed Action	Alternative 2—No-Action
Construction	NONE 4.12.1	NONE 4.12.2
Operation	NONE 4.12.1	NONE 4.12.2
Aquifer Restoration	NONE 4.12.1	NONE 4.12.2
Decommissioning	NONE 4.12.1	NONE 4.12.2
4.13 Public Occupational Health and Safety Impacts	Alternative 1—Proposed Action	Alternative 2—No-Action
Construction	SMALL 4.13.1.1	NONE 4.13.2
Operation	SMALL 4.13.1.2	NONE 4.13.2
Aquifer Restoration	SMALL 4.13.1.3	NONE 4.13.2
Decommissioning	SMALL 4.13.1.4	NONE 4.13.2
4.14 Waste Management Impacts	Alternative 1—Proposed Action	Alternative 2—No-Action
Construction	SMALL 4.14.1	NONE 4.14.2
Operation	SMALL 4.14.1	NONE 4.14.2
Aquifer Restoration	SMALL 4.14.1	NONE 4.14.2
Decommissioning	SMALL 4.14.1	NONE 4.14.2

2.4 Preliminary Recommendation

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

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

- Potential impacts to nearly all environmental resource areas are expected to be SMALL, with the exception of socioeconomics (specifically, demography, housing, employment rate, local finance, health and human services) during operations, where such impacts would be MODERATE.
- ISR operations would take place in ore zone aquifers exempted by the U.S. Environmental Protection Agency as a potential public drinking water source. Additionally, the applicant would be required to monitor for excursions of lixiviant from the production zones and to take corrective actions in the event of an excursion. Finally, the applicant would be required to restore groundwater parameters affected by ISR operations to levels that are protective of public health and safety.
- The regional benefits of building the proposed project would be increased employment, economic activity, and tax revenues in the region.
- The costs associated with the proposed project are, for the most part, limited to the area surrounding the site.

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3 AFFECTED ENVIRONMENT

3.1 Introduction

The Moore Ranch Project is located in the Powder River Basin in southwest Campbell County, Wyoming in the Wyoming East Uranium Milling Region defined in the GEIS (NRC, 2009a). The Powder River Basin is an energy rich area that possesses some of the largest coal, CBM and natural gas deposits in the United States. The proposed project is located approximately 80 km (50 mi) southwest of Gillette, Wyoming and approximately 80 km (50 mi) northeast of Casper, Wyoming (see Figure 1-1). The proposed license area encompasses approximately 2,879 ha (7,110 ac) of land, the portion of that area in which the land surface could be directly disturbed by ISR construction and operations has been estimated at approximately 61 ha (150 ac).

This chapter describes the existing site conditions at the proposed Moore Ranch Project. For the purposes of this SEIS, the term license area refers to the 2,879 ha (7,110 ac) Moore Ranch Project plus an area extending 3.2 km (2 mi) as suggested in NUREG-1569 unless a different radius for a particular resource is specified (NRC, 2003). The resource areas described in this section include land use, transportation, geology and soils, water resources, ecology, noise, air quality, historical and cultural resources, visual and scenic resources, socioeconomics, public and occupational health, and current waste management practices. Issues identified based on agency and public concerns and regulatory and planning requirements have been considered in the description of the affected environment. The information in this chapter forms the basis for assessing the potential impacts (see Chapter 4) of the proposed action and each alternative (Chapter 2).

3.2 Land Use

The Moore Ranch Project is located in the northeast portion of Wyoming within the Powder River Basin in the following township and ranges: Township 42 North, Range 75 West, Sections 26, 27, 33, 34, 35, 36 and portions of Sections 25 and 28; Township 41 North, Range 75 West, Sections 1, 2, 3 4, and portions of Sections 9 and 10; and Township 42 North, Range 74 West, portions of Sections 30 and 31.

Section 3.1.2.2 of the GEIS described the concept of split estate where the surface and mineral rights of land can be owned by different entities, and in particular, where BLM owns the mineral rights (NRC, 2009A). This situation occurs at the Moore Ranch Project. Of the 2,879 ha (7,110 ac) comprising the Moore Ranch Project, over 85 percent of the surface rights are owned by private entities, about 14 percent of the surface rights are owned by the State of Wyoming. About 59 percent of the mineral rights are owned by BLM but have been leased to Uranium One, about 26 percent of the mineral rights are privately owned, and the State of Wyoming owns the mineral rights underlying their surface ownership. Figures 3-1 and 3-2 show the surface and mineral rights owners, respectively, on the proposed Moore Ranch Project. The central plant would be located on privately owned land and no mineral exploration (i.e., no wells to extract uranium) would occur at that location. At both Wellfields 1 and 2, the surface rights are privately owned; however, the mineral rights at Wellfield 1 have been leased from the BLM and at Wellfield 2 the mineral rights are both publicly and privately owned. The Permit to Mine application submitted to WDEQ shows the location of mineral leases in Wellfield 2.

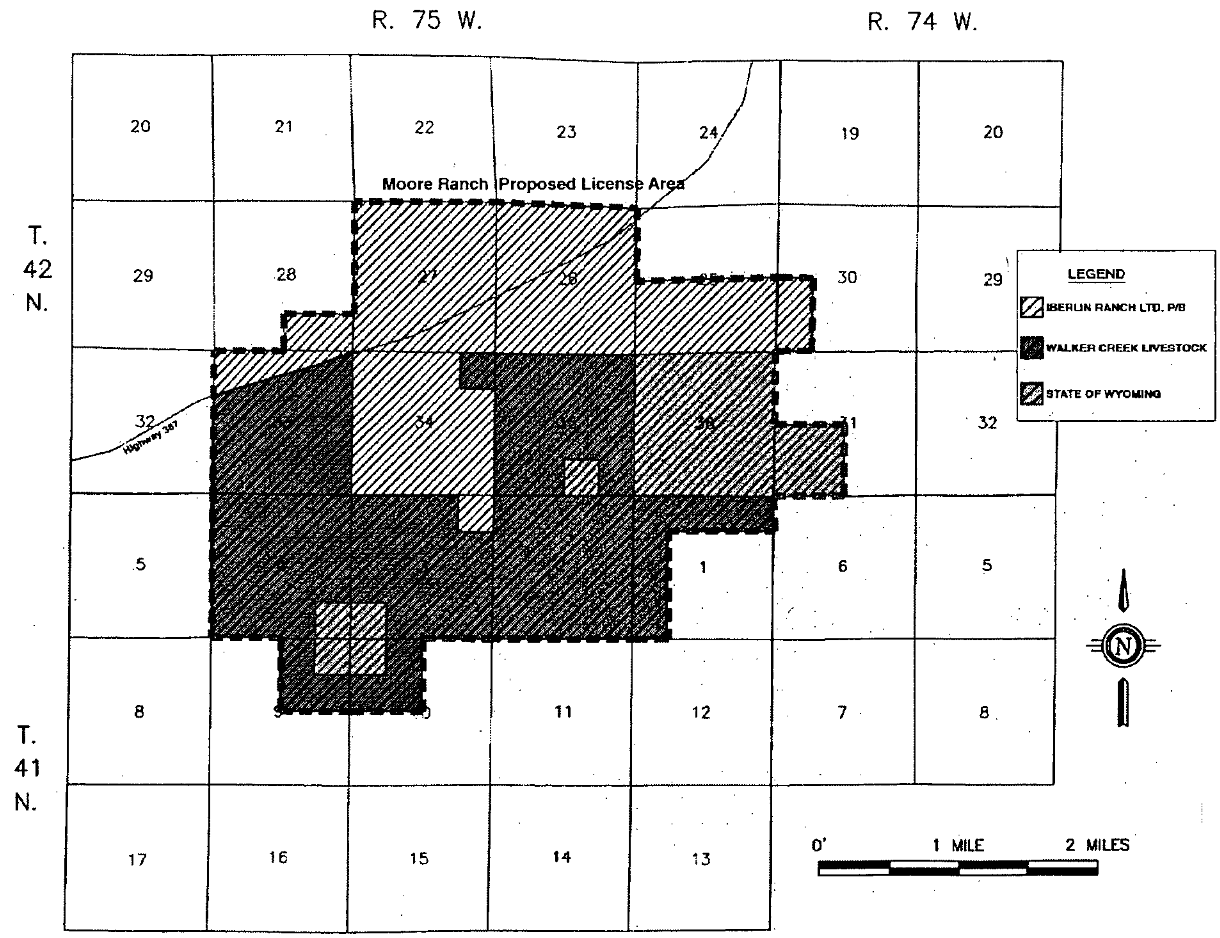

Figure 3-1. Surface Ownership at the Proposed Moore Ranch Project

3.2.1.1 *Existing Uses*

The proposed license area for the Moore Ranch Project is currently used for growing grass and grain for animal feed (pastureland), cattle grazing (rangeland), and for various types of CBM and oil and gas extraction, which are classified as a subcategory of rangeland. There are no other known land uses within the proposed Moore Ranch Project, or within a 3.2 km (2 mi) radius surrounding the property boundaries.

The proposed Moore Ranch Project would be accessed from the east via SR 59 and SR 50, to SR 387 and from the west via I-25, to SR 259, to SR 387. The main access road connecting the proposed Moore Ranch Project with SR 387 is located in T42N, R75W, Section 27. Detailed discussion on transportation routes is provided in Section 3.3 of this SEIS.

3.2.1.2 *Rangeland and Pasture Land*

Ranching is the predominant land use on and in the vicinity of the proposed Moore Ranch Project. Approximately 2,326 ha (5,748 ac) of land is used as rangeland supporting herds of cattle and sheep which graze among large herds of deer and antelope. Approximately 544 ha (1,344 ac) of land currently is being used as pastureland within the proposed Moore Ranch

Project (EMC, 2007b). SR 387 is the only major transportation route which bisects the northern portions of the proposed Moore Ranch Project (see Figure 2-1).

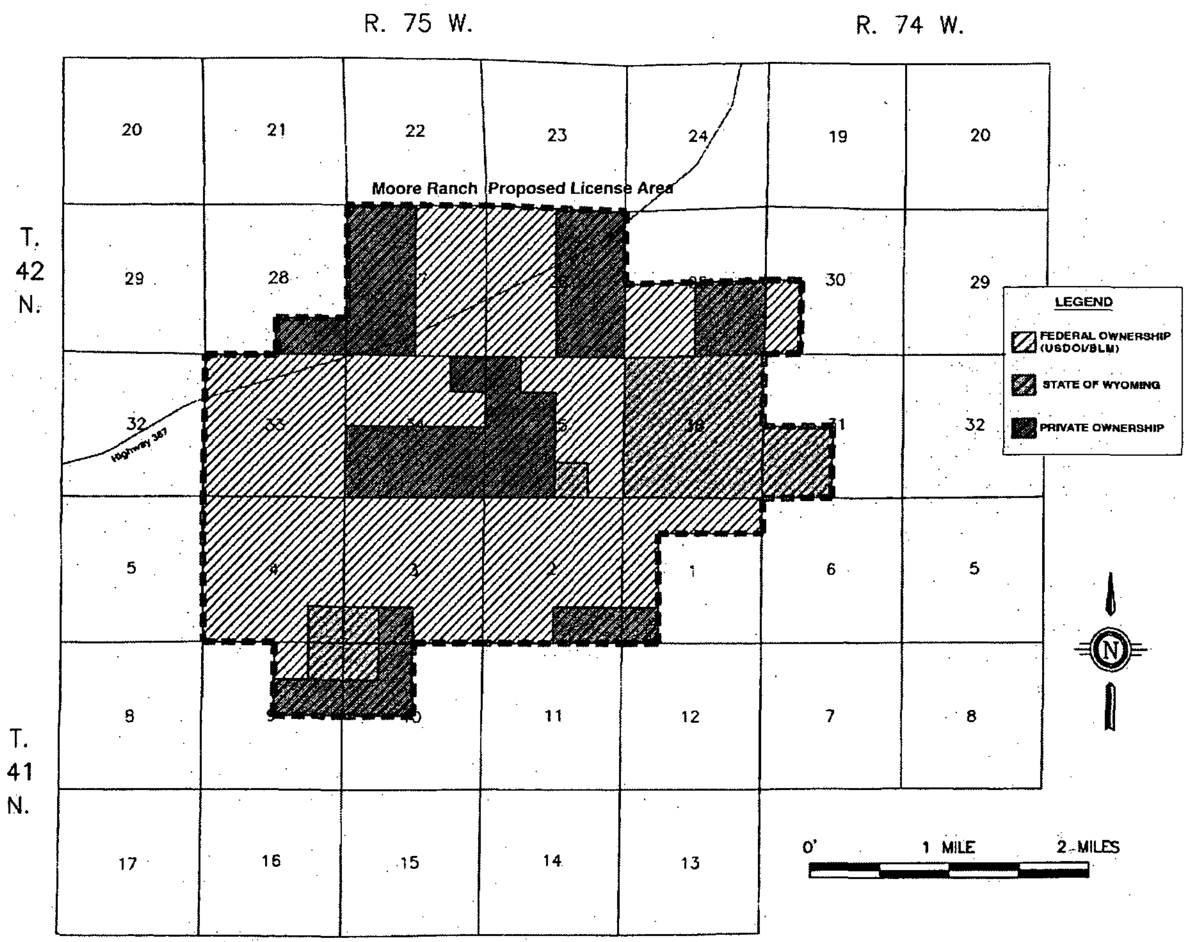

Figure 3-2. Mineral Rights Ownership at the Proposed Moore Ranch Project

3.2.1.3 *Minerals and Energy*

Uranium exploration has occurred in this portion of the Powder River Basin since the 1950s and CBM development began in the 1980s. With advancements in technology, development and production of CBM has substantially increased in the Powder River Basin since the mid-1990s (BLM 2003). There were 465 wells either located on or within a 3.2 km (2-mi) radius of the proposed Moore Ranch Project as of June 2009 for use as CBM or stock CBM wells (Uranium One, 2009b). These energy extraction facilities have attendant infrastructure systems including pipelines, well fields, and utility lines that occupy the land surface and the subsurface in the vicinity of the proposed Moore Ranch Project. As shown on Figure 3-3, there is approximately 15 km (10 mi) of either crude oil or natural gas pipeline that crosses the proposed Moore Ranch Project. However, no pipeline is located in areas where earthmoving activities would occur as part of the proposed action or alternatives. Approximately 64 km (40 mi) of either crude oil or natural gas pipelines occur within a 3.2 km (2-mi) radius of the proposed Moore Ranch Project as shown in Figure 3-3.

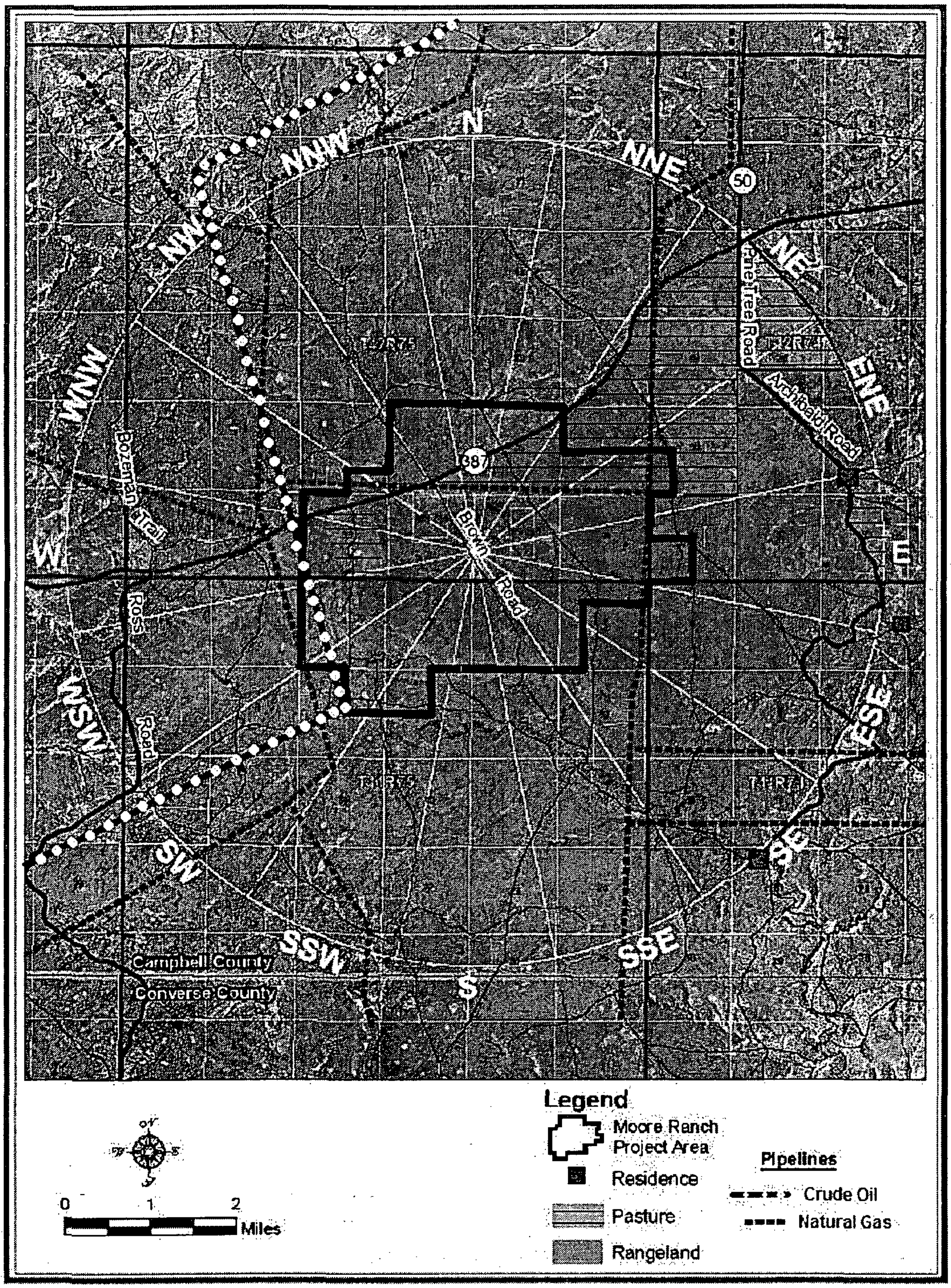

Figure 3-3. Land Use in the Vicinity of the Proposed Moore Ranch Project

3.3 Transportation

As noted in the GEIS, the operation of ISR facilities has historically relied on roads for transportation of goods and personnel. Local roads are used to transport construction equipment and materials to support facility and well field construction activities (NRC, 2009a). The Moore Ranch Project is located in an area served by two four-lane interstate highways. I-25, which is located approximately 48 km (30 mi) west of the proposed Moore Ranch Project, extends north from Colorado, terminating where it merges with I-90 at Buffalo, Wyoming, about 120 miles to the northwest of the proposed Moore Ranch Project (Figure 1-1).

The primary transportation route to the proposed Moore Ranch Project from nearby communities would be via SR 387, a bi-directional (two lane opposing travel) asphalt-paved highway which connects the proposed license area to regional population and economic centers along Interstate 25 to the west and State Highway 59 to the east (Uranium One, 2009b). The City of Gillette is located approximately 80 km (50 mi) northeast of the proposed Moore Ranch Project. SR 387 runs east-west from Wright to I-25 at Midwest, bisecting the northern portion of the proposed license area (Figure 1-1). State Highway (SR) 50 commences in Gillette and runs to the south and connects with SR 387 approximately 6.4 km (4 mi) east of the proposed Moore Ranch Project. State Highway (SR) 59 connects with SR 387 at the town of Wright, located approximately 48 km (30 mi) east of the proposed Moore Ranch Project. Both SR 50 and SR 59 are also bidirectional asphalt-paved highways in good to average condition. The lanes on SR 50, 59 and 387 are 3.6 m (12 ft) wide and the total width of paved roadway ranges from 8 to 12 m (26 to 40 ft) based on the varying width of the paved shoulder (Uranium One, 2009b).

All state highways adjacent to the proposed Moore Ranch Project are access controlled and maintained year round by the Wyoming Department of Transportation. Highway maintenance includes snow removal, debris removal and road repairs (Uranium One, 2009b). Onsite road maintenance would include periodic grading of the primary access roads, snow plowing, applying water or other agents for controlling fugitive dust emissions, and regular inspections to ensure the adequacy of erosion control measures (Uranium One, 2009b).

Approximately 7.2 km (4.5 mi) of SR 387 crosses the northern portion of the proposed Moore Ranch Project (Figure 2-1). 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 common. Brown Road, an existing gravel road accesses the general location selected for construction of the central plant and is currently used for agricultural and oil and gas activities in the area. The proposed location of the central plant would be approximately 0.8 km (0.5 mi) from the intersection of SR-387 and Brown Road. Brown Road may require minor improvements to accommodate access by trucks and heavy equipment during the construction and operation phases of the proposed Moore Ranch Project. In addition, approximately 1.2 km (0.8 mi) of gravel roads would be constructed to connect the central plant to Brown Road, to connect Wellfield 1 to Brown Road and to connect Wellfield 2 to an existing access road (Figure 2-2). Other roads enter the proposed Moore Ranch Project, but none provide access to residences or other public destinations.

Annual average daily traffic counts for trucks using SR 387 in the vicinity of the proposed Moore Ranch Project ranged from 220 to 410 trucks in 2006. The figure for all vehicle types was 970 to 3,130 per day (NRC, 2003). For SR 50, the annual average daily traffic count for all vehicles was 550 in 1999 (BLM, 2003). No traffic count data are available for Brown Road. Table 3-1 provides traffic count data for the surrounding state routes:

Table 3-1. Annual Average Daily Traffic Counts							
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, 2003a

3.4 Geology and Soils

The Moore Ranch Project is located in the Pumpkin Buttes Uranium District in the Powder River Basin within the Wyoming East Uranium Milling Region evaluated in the GEIS (NRC 2009a). Section 3.3 of the GEIS provides a general description of the geology and soils of the Powder River Basin and Pumpkin Buttes Uranium District where the Moore Ranch Project is located. Section 3.4.1 of this SEIS provides a site-specific discussion of the geology and soils in the vicinity of the proposed Moore Ranch Project.

The Powder River Basin is a large structural and topographic depression that parallels the Rocky Mountains. The basin is bounded to the north by the Miles City Arch in southeastern Montana, to the south by the Hartville Uplift and the Laramie Range, to the east by the Black Hills, and to the west by the Big Horn Mountains and the Casper Arch on the west. As indicated in the GEIS, the basin was formed during the Laramide Orogeny (mountain-building era) approximate 50 to 65 million years ago (NRC, 2009a). 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 sedimentary rock sequence in the basin ranges in age from recent (Holocene) to early Paleozoic (Cambrian - 500 million to 600 million years ago) and overlies a basement complex of Precambrian (more than a billion years old) igneous and metamorphic rocks. As noted in the GEIS, erosion has removed the upper part of the sedimentary sequence 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. It is underlain by the Wasatch of Eocene Age. The Paleocene age Fort Union Formation directly underlies the Wasatch Formation, which directly overlies the Cretaceous Lance Formation. Figure 3.3-5 of the GEIS provides a stratigraphic section of Tertiary-age formations in the Wyoming East Uranium Milling Region (NRC, 2009a). The Tertiary-aged Wasatch Formation hosts the uranium deposits proposed for mining at the Moore Ranch Project.

3.4.1 Geology

The early Eocene Wasatch formation unconformably overlies the Fort Union Formation around the margins of the Powder River Basin. However, within the basin center and in the vicinity of the Moore Ranch Project, the two formations are conformable. The relative amount of coarse, permeable clastics increases near the top of the Fort Union, and the overlying Wasatch Formation contains numerous sandstone beds which can be correlatable over wide areas. Except in isolated areas of the Powder River Basin, the Wasatch-Fort Union contact is arbitrarily set at the top of either thick coals or a thick sequence of clays and silts. The applicant considers the top of the Roland coal as the boundary of the Wasatch Formation at the Moore Ranch Project.

The Wasatch Formation reaches a maximum thickness of about 488 m (1,600 ft) and outcrops at the surface in the proposed license area. The Wasatch Formation is comprised of interbedded sandstones, siltstones, clays, and coals and was deposited in a fluvial (river) environment. These sandstone horizons are the host rock for several uranium deposits in the southern Powder River Basin. Within the Moore Ranch Project, mineralization occurs in a 15 to 30 m (50 to 100 ft) thick sandstone lens which extends over an area of several townships. This formation dips gently to the northwest from one degree to two and a half degrees in the southern part of the Powder River Basin (EMC, 2007b).

Locally, remnants of the overlying White River Formation are known to occur on top of the Pumpkin Buttes. A basal conglomerate forms the resistant cap rock on top of the buttes. This formation is not known to contain significant uranium resources in this area.

Detailed stratigraphic analysis of a portion of the Wasatch Formation was performed since the target ore zone occurs within the sands in this formation. The site-specific stratigraphy has been characterized based on subsurface data collected from thousands of well borings in and around the proposed license area in the 1970s and 1980s associated with Conoco's application to NRC to construct and operate a uranium mill associated with an open-pit mine in the same area being evaluated for the proposed Moore Ranch Project (NRC, 1982). This data was supplemented with data collected from additional well borings drilled by the applicant in late 2006 and early 2008. The underlying Fort Union Formation was not studied in detail since it would not be influenced by the project. The top of the Roland Coal, which separates the Wasatch Formation from the underlying Fort Union Formation is approximately 335 m (1,100 ft) thick across the Moore Ranch Project.

The applicant adopted the nomenclature used by Conoco for the hydrostratigraphic units of interest within the Moore Ranch Project. Sands occurring stratigraphically above the Roland Coal are numbered, increasing toward the surface. Figure 3-4 illustrates the stratigraphic sequence at the proposed Moore Ranch Project. The applicant generated 13 geologic cross sections to characterize the vertical and lateral stratigraphy at the site. An isopach map of the 70 Sand showing the areal distribution and thickness of the unit containing the ore zone is included as Figure 3-5. Figure 3-6 illustrates the stratigraphy in Wellfield 1 and Figure 3-7 illustrates the stratigraphy in Wellfield 2. Figures and maps showing the areal distribution and thickness of overlying and underlying sand and shale sequences are provided in the applicant's technical report (EMC, 2007b).

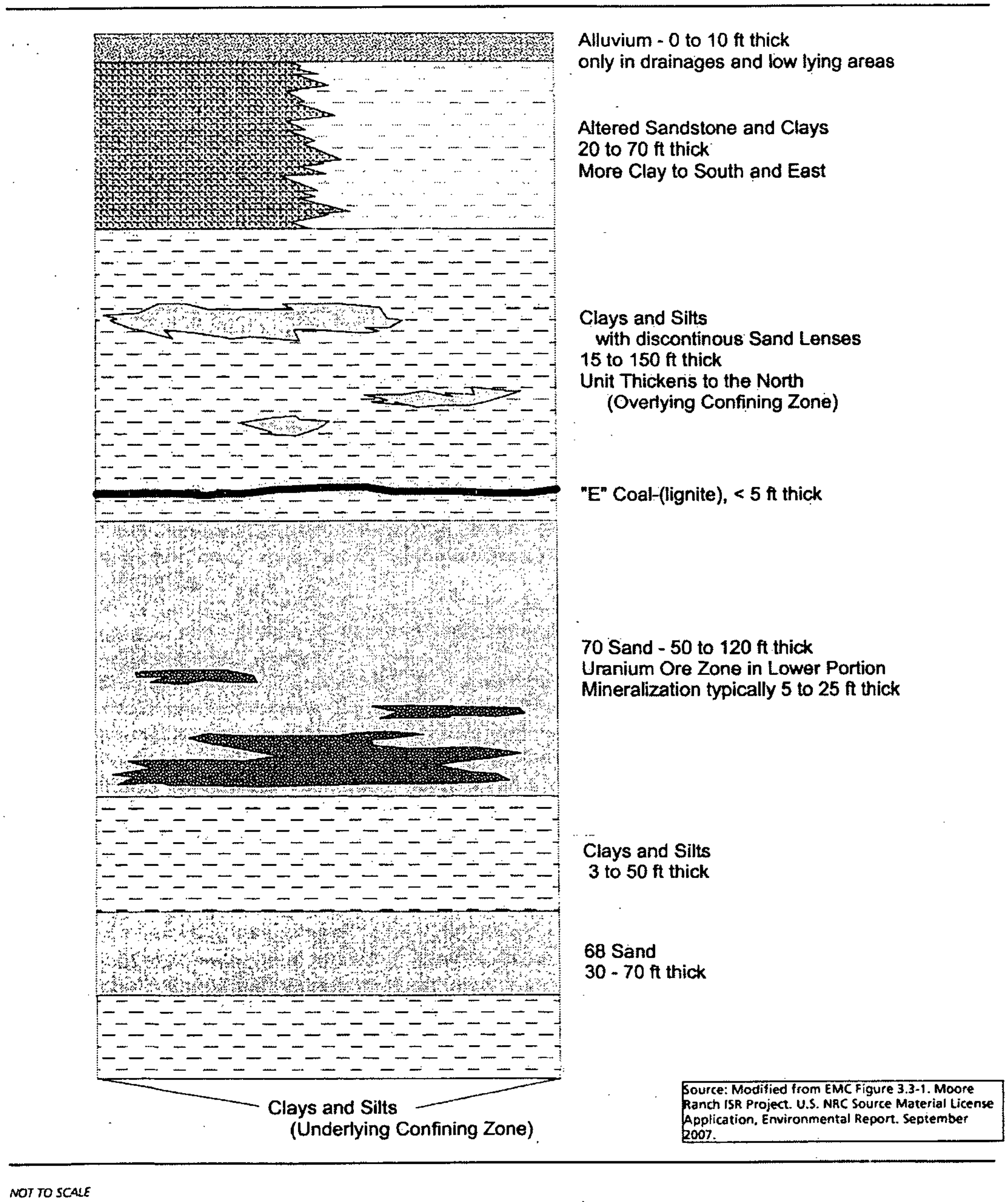

Figure 3-4. Generalized Stratigraphy Sequence Showing the 70 Sand Ore Production in the Wasatch Formation

The 40 and 50 Sands which occur immediately above the Roland Coal are regionally extensive and considered significant aquifers (EMC, 2007b). The approximate thickness of the 40 and 50 Sands within the Moore Ranch Project are 24 and 27 m (80 and 90 ft), respectively. A 1.5 to 12 m (5 to 40 ft) thick shale or mudstone separates the 40 and 50 Sands. The overlying 58 Sand varies in thickness from 1.5 to 24 m (5 to 80 ft) across the project area. The overlying 60 Sand is approximately 30 m (100 ft) thick, is continuous throughout the project area, and separated from the 58 Sand by about 1.5 to 21 m (5 to 70 ft) of shale and mudstone. The 68 Sand is the first sand underlying the 70 Sand, which contains the economic ore deposits in the Moore Ranch Project. The 68 Sand is separated from the 60 Sand by 0 to 8 m (0 to 25 ft) of shale or mudstone. The 68 Sand ranges from to 12 to 30 m (40 to 100 ft) across the proposed license area and coalesces with the 60 Sand on the west side of the proposed license area.

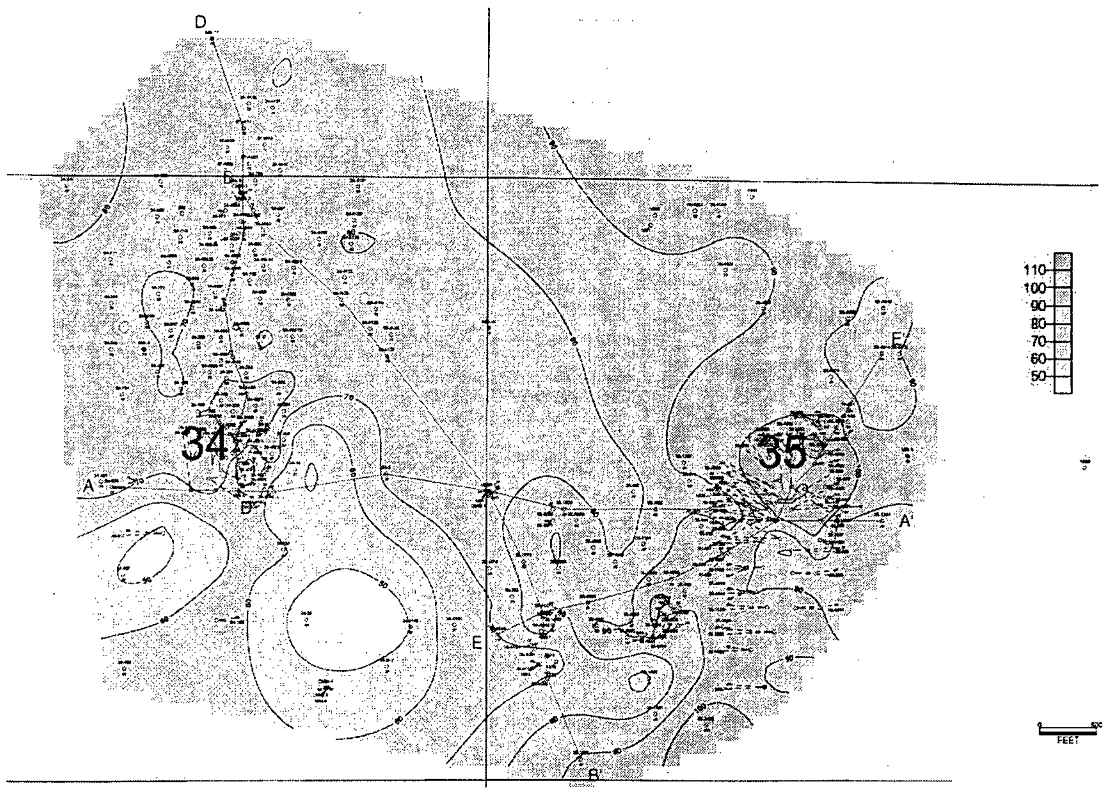

Figure 3-5. Isopach Map Showing the Thickness of the 70 Sand

The 70 Sand, the proposed ore production zone, coalesces with the 68 Sand in Wellfield 2. The 70 Sand is laterally extensive and ranges from 12 m to 37 m (40 to 120 ft) thick across the proposed Moore Ranch Project. The dip is generally less than one degree toward the northwest. A coal layer, referred to as the E Coal that ranges in thickness from 0.3 to 9 m (1 to 3 ft) typically occurs a few feet above the top of the 70 Sand. The 72 Sand overlies the 70 Sand and is the shallowest sand occurring across the project area. The 70 Sand is separated from the overlying 72 Sand by a shale sequence ranging in thickness from a few feet to 49 m (160 ft) in some areas.

Two different injection zones have been proposed for use in waste disposal at the proposed Moore Ranch Project. The applicant has submitted an underground injection control permit application to WDEQ that evaluates injection into the Teapot-Teckla-Parkman interval at a depth ranging from 2,413 to 2,930 m (7,916 to 9,610 ft) below ground surface and the Lance Formation and Fox Hills Sandstone, at a depth ranging from 1,128 to 2,287 m (3,700 to 7,500 ft) below ground surface. Both of these formations are thousands of feet deeper than the 70 Sand ore production zone.

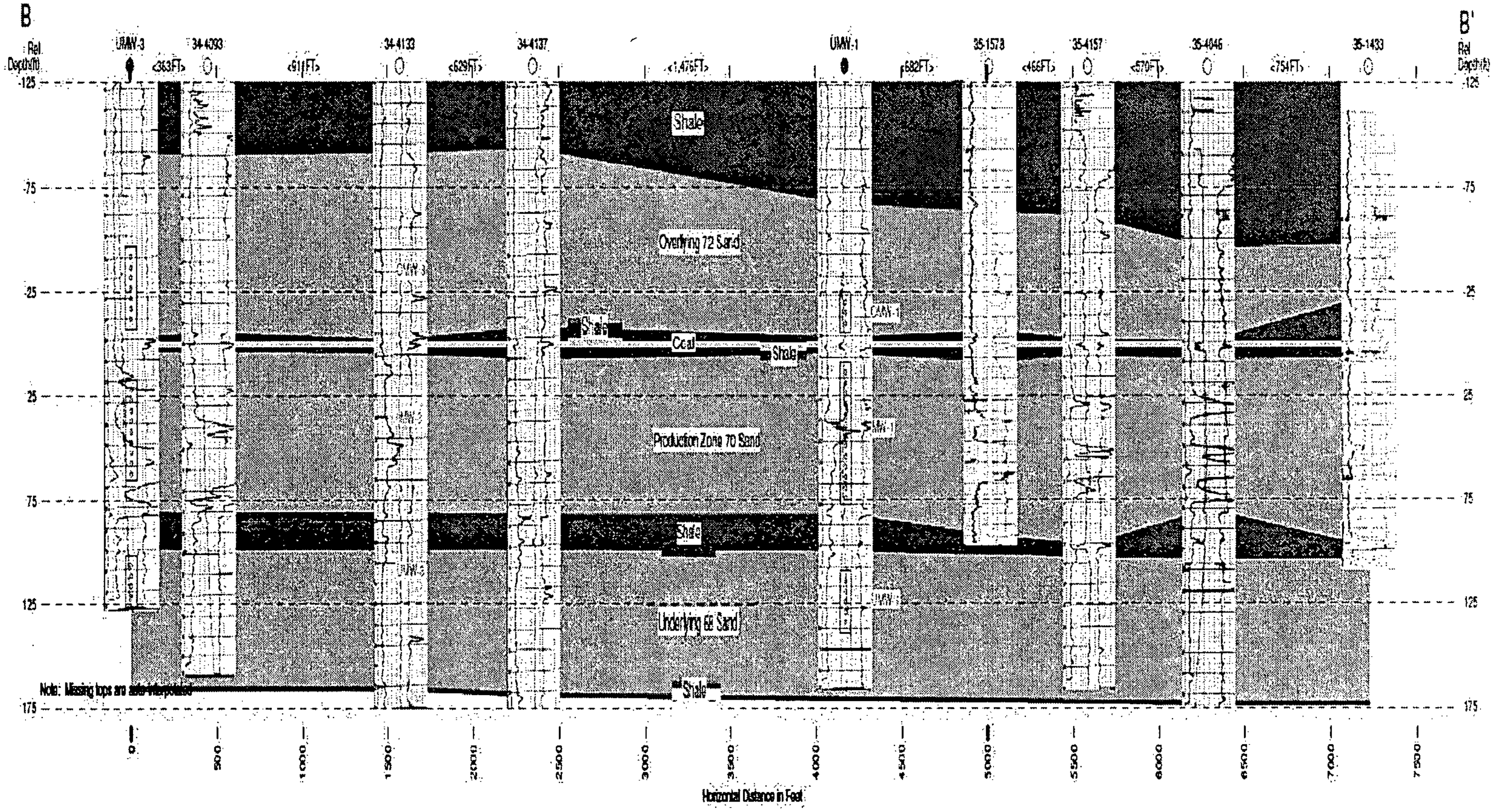

Figure 3-6. West-East Stratigraphic Cross Section of Wellfield 1

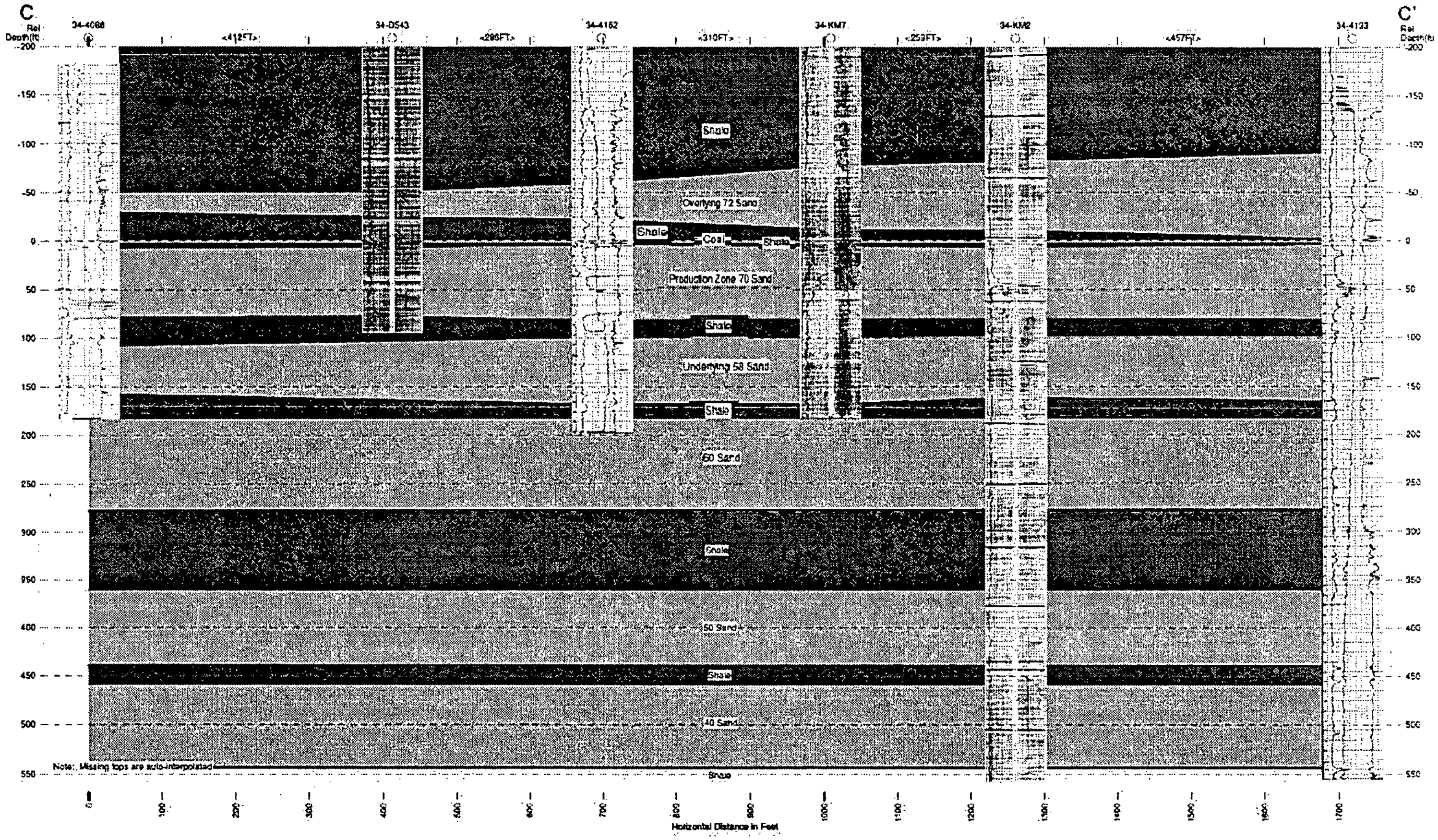

Figure 3-7. West-East Stratigraphic Cross Section of Wellfield 2

3.4.2 Soils

A soil survey of the proposed Moore Ranch Project was performed in 2007 to both define the existing topsoil resource and to determine the extent, availability, and suitability of soils material for use in reclamation. A site-specific map was generated to show the areal distribution of different soil types and soil map units and soil series descriptions were include in the applicant's environmental report (EMC, 2007b). The general topography of the Moore Ranch Project includes rolling hills and ridges, as well as drainages. Soils occurring in this area were generally fine-textured throughout with patches of sandy loam on upland areas. Fine-textured soils occur near or in drainages. The project area contains deep soils on lower toe slopes and flat areas near drainages; shallow and moderately deep soils occur on upland ridges and shoulder slopes. Soils on the Moore Ranch Project are typical for semi-arid grasslands and shrublands in the Western United States. Most soils have some suitable topsoil. The primary limiting factor is texture.

The 2007 soil fieldwork characterized the soils within the proposed license area with respect to topsoil salvage depths and related physical and chemical properties. Based on data from samples collected from within the proposed license area, from field observations and knowledge of the soils in southern Campbell County, an approximate salvage depth for each map series was identified. These salvage depths ranged from 0.24 m to 1.5 m (0.8 to 5 ft). An average salvage topsoil depth over the proposed Moore Ranch Project was estimated as 1.1 m (3.6 ft).

The potential for wind and water erosion of soil within the proposed Moore Ranch Project varies from slight to severe and is mainly a factor of the texture and organic content of the surface soil. Since the surface soils throughout the proposed Moore Ranch Project have a fine loamy and sandy, the soils are more susceptible to erosion from wind than water.

No prime farmland has been documented at the Moore Ranch Project based on a reconnaissance survey by the NRCS.

3.5 Water Resources

3.5.1 Surface Waters and Wetlands

As noted in Section 3.3.4.1 of the GEIS, the Wyoming East Uranium Milling Region encompasses 10 primary watersheds (NRC, 2009a). The Antelope Creek Watershed drains the location for the proposed Moore Ranch Project. Surface waters features both in the vicinity of and within the proposed license area include intermittent streams that flow to the southeast ultimately to the Cheyenne River. Water bodies within the Wyoming East Uranium Milling Region are mainly classified as Class 3B surface waters according to the state classification of designated uses. The designated uses for Class 3B surface waters are recreation, aquatic life other than fish, wildlife, agriculture, industry, and scenic value.

3.5.1.1 *Drainage Basins*

The Moore Ranch Project area lies within the Ninemile Creek drainage basin which covers an area of 163 km^2 (63 mi^2). Ninemile Creek is a tributary to Antelope Creek which is a tributary of the South Cheyenne River that ultimately flows to the Missouri River. Seven sub-watersheds occur within the proposed license area and are associated with Ninemile Creek, Simmons Draw, Pine Tree Draw and their tributaries (Figure 3-8). Each of these sub-watersheds drains to the southeast; Simmons Draw and Pine Tree Draw flow into Ninemile Creek. As can be seen on Figure 3-8, Wash No. 1 is an intermittent tributary to Simmons Draw and flows to the west of

Wellfield 1. Upper Wash No. 2 is another intermittent stream to Simmons Draw and it bisects the central portion of Wellfield 2.

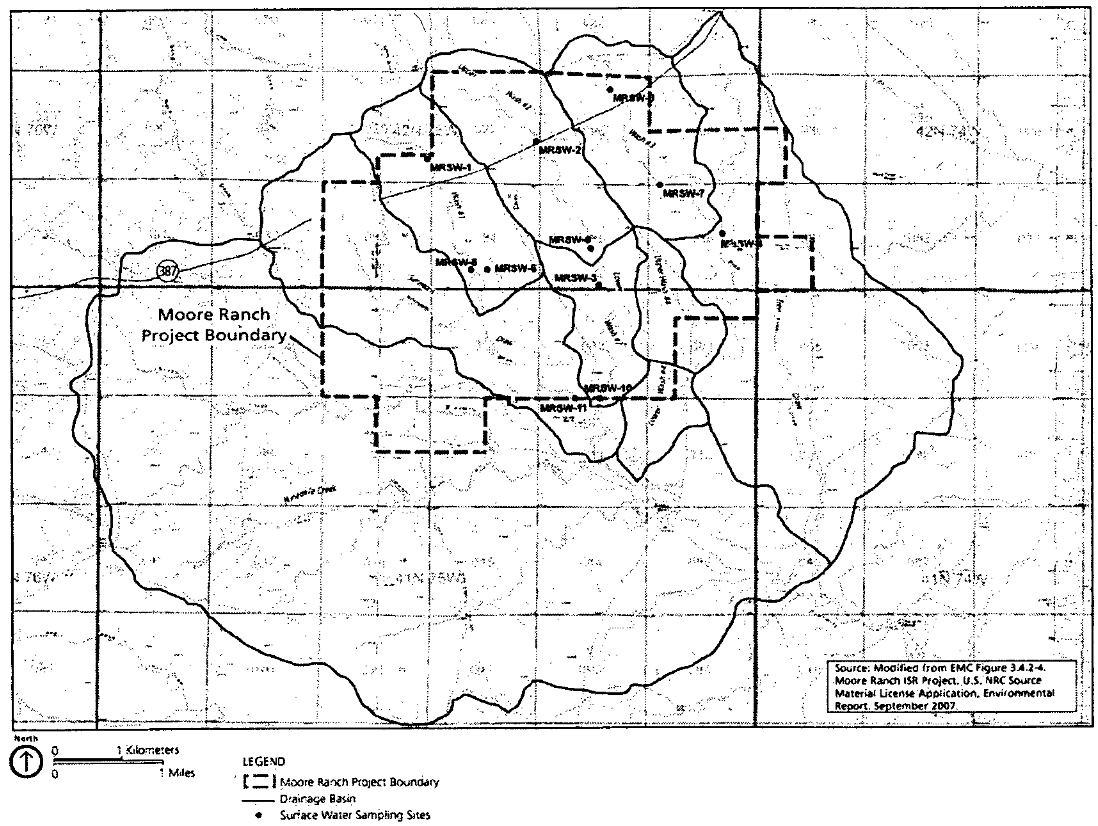

Figure 3-8. Drainage Basin and Sub-Watersheds at the Proposed Moore Ranch Project

3.5.1.2 *Surface Water Features*

The arid conditions in eastern Wyoming limit the formation of year round surface water and wetland features. Regional annual rainfall averages approximately 35.5 cm (14 in) per year while annual lake evaporation may reach 101 cm (40 in) per year. Surface waters, particularly in the upper headwaters of watersheds, are seasonal in nature, responding to spring-time snow melt. In some instances, surface waters may manifest intermittent flow conditions in response to extreme rainfall events. Otherwise, rainfall is normally absorbed into the soil.

Despite the arid conditions and headwater setting, linear wetland features and nine small, artificial ponds persist and are scattered across the Moore Ranch Project within low-lying drainages in response to the CBM operations that occur throughout the area. CBM-produced water in the vicinity of the proposed Moore Ranch Project is estimated to contribute 9 to 52 percent of surface flows and could result in perennial flows in formerly intermittent channels (Uranium One, 2009a). Approximately 31 CBM wells occur within the proposed license area, with another 101 located within a 3.2-km (2-mi) radius of the boundary of the proposed Moore Ranch Project (Figure 3-9). These operations discharge extracted groundwater onto the surface and are responsible for sustaining the existing surface water features (wetlands and ponds).

The CBM discharges are monitored through three Wyoming Pollutant Discharge Elimination System (WYPDES permits) issued to operators located either within or adjacent to the proposed license area. Surface water flow is discussed in Section 3.5.1.3 of this SEIS.

3.5.1.2.1 Intermittent Streams

Ninemile Creek, Simmons Draw, and Pine Tree Draw are the dominant streams within the proposed license area. Each of these intermittent streams,collect surface water runoff from the numerous drainages or "washes" carved into the landscape (Figure 3-8). Because these channels remain dry most of the year, the channels contain upland vegetation growth. Hydrophytes (plants adapted to saturated soil conditions) persist yearlong only in short reaches where near-surface soil saturation extends well into the summer months from discharge from CBM and livestock wells. As previously noted, none of these intermittent streams drain the basins which encompass the proposed well fields except for Upper Wash #1 and Upper Wash #2.

The stream channels on the proposed Moore Ranch Project are briefly described below. For purposes of this document, unnamed channels are given designated such as "Tributary A" or "Wash #1." Sub-title designations such as "Upper" and "Lower" relate to sub-watersheds based on water quality sampling stations discussed later in Section 3.5.1.4. A map of the stream channels and contributing watersheds is provided in Figure 3-8.

Ninemile Creek flows through approximately 2.4 km (1.5 mi) of the southwest corner of the proposed license area and drains a total area of 16,316 ha (63 mi^2). The elevation difference from the headwaters to the mouth of Ninemile Creek is 186 m (610 ft) over an approximate channel length of 32 km (20 mi), with an average gradient of 0.6 percent to 0.7 percent.

Simmons Draw, a tributary to Ninemile Creek, flows to the southeast through the western boundary of the proposed license area approximately 13.8 km (6.8 mi) at a gradient of 0.7 percent, with a drainage area of 21 km^2 (8.1 mi^2). The total basin elevation difference is 79 m (260 ft). Simmons Draw has two main tributaries: Simmons Draw Tributary A (Wash #1) and Simmons Draw Tributary B (Wash #2). Wash #1 has a length of approximately 4.5 km (2.8 mi) with a 1.4 percent gradient Tributary B (subdivided into Upper Wash #2 and Lower Wash #2) have drainage areas of 4.9 and 2.5 km^2 (1.9 and 0.95 mi^2), respectively, with channel lengths of 0.74 and 2.1 km (0.46 and 1.3 mi) with average gradients of 0.012 and 0.007 ft/ft, respectively. Each of these tributaries are intermittent with fragmented wetlands and ponds based primarily on discharges from CBM and livestock wells.

Pine Tree Draw has a drainage area of 124-ha (8.2-mi^2) and drains the eastern side of the proposed license area. The total basin elevation difference is 110 m (360 ft) over a a channel length of approximately 12.2 km (7.6 mi) resulting in a gradient near 0.9 percent. Pine Tree Draw Tributary A has a drainage area of 4.6 km^2 (1.8 mi^2), a channel length of 5.1 km (3.2 mi), and an average gradient of 0.014 ft/ft.

Pine Tree Spring, a relatively short tributary to Pine Tree Draw, drains the far eastern side of the proposed license area and has a channel length of approximately 1.1 km (0.7 mi).

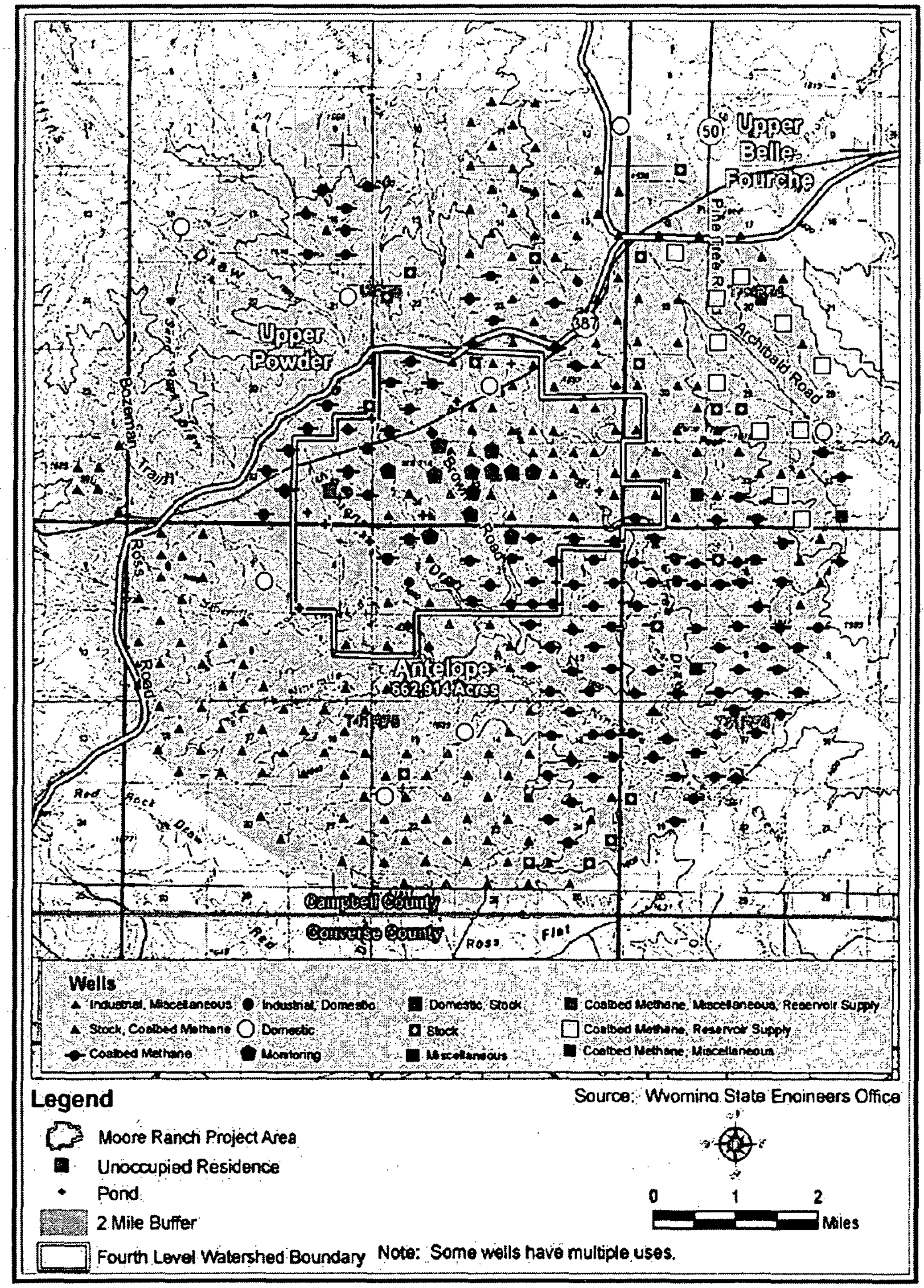

Figure 3-9. Coalbed Methane Production Near the Proposed Moore Ranch Project

3.5.1.2.2 Ponds

Nine small, disconnected artificial ponds (reservoirs) are scattered across the proposed license area and occur within the channels of Ninemile Creek, Simmons Draw, Pine Tree Draw, and their principal tributaries. These reservoirs have been permitted through the Wyoming State Engineers Office (WSEO) within the proposed license area since they could be impacted by CBM produced water discharge. The ponds are classified as palustrine unconsolidated bottom (PUB) in accordance with the Cowardin classification system (Cowardin et al. 1978) and are generally less than 0.4 ha (1 ac) in size. These surface water features result from accumulation behind structures (dams and dikes), in excavated pits, or from the discharge of pumped groundwater from CBM operations, windmills, or livestock watering tanks.

3.5.1.3 *Surface Water Flow*

The CBM produced water in the vicinity of the Moore Ranch Project is estimated to contribute 9 to 52 percent of the surface water flows and could result in perennial flows in formerly intermittent channels (Uranium One, 2009a). The CBM discharges are monitored through three WYPDES permits issued to CBM operators located either within or adjacent to the proposed license area. Thirty outfalls are monitored under the three WYPDES permits; seven outfalls are located upstream of the proposed Moore Ranch Project and the remaining 22 outfalls are located on the proposed Moore Ranch Project. Eight of these locations are in the vicinity of Wellfield 1 and Wellfield 2.

The average historic discharge rate of the CBM unit with the most permitted outfalls on the Moore Ranch Project was 106,061 L/day (28,800 gal/day) over a period of eight years (2000 to 2008) compared to a maximum permitted limit of 2.6 x 10^6 L/day (680,000 gal/day). Flow from this CBM unit is anticipated to be less than 22,727 L/day (6,000 gal/day) by the year 2013 (EMC, 2007b). The average discharge from outfalls located in the vicinity (which were not dry) was approximately 57,197 L/day (15,100 gal/day).

Peak flood flows were also calculated for each of the drainage basins on the Moore Ranch Project as part of the Draft EIS for the Sand Rock Mill Project, docket No. 40-8743 (NRC, 1982). The Draft EIS calculations were reviewed to determine the validity of the analytical methods and to estimate surface water runoff. The applicant used different methods to estimate peak flood discharges as described in EMC (2007b). Based on this analysis, it was determined that Wellfield 1 and the central plant were located higher than any region that could potentially be flooded. However, Wellfield 2 could potentially be flooded by a 100-year flood event. Therefore, the applicant proposed to minimize damage to infrastructure in a potential flooding event by avoiding installation in main channels of drainages, properly sizing culverts, and implementing best management practices for embankments, culverts, and drainage crossings.

3.5.1.4 *Surface Water Quality*

The Moore Ranch Project lies entirely within the Antelope Creek drainage basin as shown in Figure 3-8. Antelope Creek and its tributaries are listed as not having been impaired surface waters by the EPA. The WDEQ classifies Antelope Creek Class 3B surface water, meaning it is suitable for recreation, other aquatic life, wildlife, agriculture, industry, and scenic value.

All surface water sample locations within the proposed Moore Ranch Project are characterized as existing stock ponds or areas in drainages where ponding occurs. Water ponded at all surface water locations are typically fed by springtime snowmelt runoff or high intensity rain events in the summer.

As noted above, 31 CBM outfalls occur in the proposed license area under three WYPDES permits. These permits monitor maximum flow, pH, specific conductance, chlorides, total recoverable arsenic and barium, and dissolved iron. Other chemical species are also monitored including total radium-226.

Three sets of surface water samples collected during fall 2006, early spring 2007, and late spring 2007 were analyzed from nine locations within the Moore Ranch Project as shown on Figure 3-8. No surface water samples were collected from locations MRSW-10 and MRSW-11 which were both dry during the above sampling events. Table 3-2 summarizes the sample results.

The sample results indicate a seasonal variability in surface water quality largely influenced by the CBM operations in the area. The surface water in the ponds typically exhibit saline characteristics of CBM surface discharge (higher conductivity, total dissolved solids, and bicarbonate readings) in the summer and fall when there is less precipitation. The surface water sample results indicate that surface waters are basic, with numerous samples exceeding the CBM permitted pH limit of 9.0. The average of all pH readings during all sampling periods was 9.08, which is above the Wyoming Class I (domestic use), Class II (agricultural use), and Class III (livestock use) standards. Although sampling for lead appears to exceed the 0.015 mg/L Class I standard, the minimal detection limit in the laboratory for lead was set at 0.05 mg/L for the fall 2006 samples. Therefore, the actual lead concentration fell below the 0.05 mg/L detection limit. Subsequent sampling indicated lead concentrations below the lead Class I standard.

As expected, the water samples taken during the fall months at CBM discharge locations commonly exhibited significantly higher values for bicarbonate, carbonate, chloride, conductivity, fluoride, TDS, gross alpha, gross beta, nitrogen, arsenic, potassium, magnesium, and sodium compared to samples taken during the spring months indicating that surface water quality improves during the springtime as a result of diluted surface water from snow melt and/or large precipitation events.

3.5.1.5 *Wetlands*

Wetlands are areas that are inundated or saturated by surface or ground water at a frequency and duration to support, and under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions (USACE, 1987).

A wetland delineation was performed as part of the baseline assessment for the proposed Moore Ranch Project using the methodologies outlined in the Regional Supplement to the USACE Wetland Delineation Manual: Great Plains Region (2006) to support reclamation planning and well field infrastructure (EMC, 2007b). The wetland survey methodology is described in EMC (2007b). Identification of potential wetlands was based on visual assessment of vegetation and hydrology indicators, and intrusive soil sampling to determine the presence of wetland criteria indicators (EMC, 2007b).

The proposed license area was found to contain nine wetlands classified as palustrine emergent based on the Cowardin et al. (1979) wetland classification system (EMC, 2007b). Emergent wetlands are located in channels and total 12.6 ha (31.2 ac). Similarly, nine ponds classified as palustrine open water were delineated, totaling 1.7 ha (4.1 ac). These wetlands and ponds are shown on Figure 3-10.

Wetlands comprise narrow, linear emergent systems within drainages and stream channels as a direct result of CBM and livestock well discharges. Several CBM outfalls also jointly serve as

Table 3-2. Surface Water Quality at the Proposed Moore Ranch Project

Sample Parameters	MRSW-1[+]	MRSW-2	MRSW-3	MRSW-4	MRSW-5	MRSW-6[#]	MRSW-7[#]	MRSW-8	MRSW-9[#]
Bicarbonate as HCO3,mg/l	782	763	161	199	1064	457	665	402	99
Carbonate as CO3, mg/L	37	36	7	21	63	61	17	580	14
Chloride, mg/L	5	5	5	11	8	3	6	8	2
Conductivity, umhos/cm	1305	1170	694	1087	1843	839	979	1528	204
Fluoride, mg/L	0.5	0.6	0.5	0.5	0.7	0.5	0.5	1.1	0.2
pH, s.u.	8.99	8.96	9.10	9.37	8.80	9	9	9.40	9
Solids, Total Dissolved TDS @ 180C, mg/L	801	729	327	711	1159	540	646	1017	122
Sulfate, mg/L	14	4	219	350.33	62	6	13	8	4
Gross Alpha, pci/L	3.9	2.25	10.3	4.05	6.7	1.1	5.4	3.35	1
Gross Beta, pci/L	16.05	11.85	11.6	9.75	21.85	6.9	13.1	15.5	2
Lead 210 pci/L*	57.3*	<1.0	<1.0	1.0	4.0	<1.0	<1.0	<1.0	4.8
Polonium 210 pci/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Radium 226, pci/L	<0.2	<0.2	<0.2	0.2	1.3	0.9	<0.2	<0.2	<0.2
Radium 228, pci/L	<1.0	<1.0	1.3	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Thorium 230, pci/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nitrogen, Ammonia as N,mg/L	0.12	<0.05	0.08	0.27	0.20	0.14	0.09	0.33	<0.05
Nitrogen, Nitrate+Nitrite as N,mg/L	0.3	<0.1	<0.1	0.1	0.4	<0.1	<0.1	<0.1	<0.1
Aluminum, mg/L	0.6	0.1	<0.1	0.1	<0.1	0.7	0.3	0.1	0.2
Arsenic mg/L	0.003	0.002	0.002	0.006	0.005	0.004	0.004	0.011	0. 002
Barium, mg/L	0.4	0.5	0.1	0.1	0.2	0.3	0.4	0.3	<0.1
Boron, mg/L	<0.1	<0.1	<0.1	0.1	0.1	<0.1	<1.0	0.1	<0.1
Cadmium, mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Calcium, mg/L	21	17	50	26	32	18	21	10	14
Chromium, mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Copper,	<0.01	0.02	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Table 3-2. Surface Water Quality at the Proposed Moore Ranch Project

Sample Parameters	MRSW-1+	MRSW-2	MRSW-3	MRSW-4	MRSW-5	MRSW-6#	MRSW-7#	MRSW-8	MRSW-9#
mg/L									
Iron, mg/L	0.25	0.11	0.08	0.13	0.35	0.33	0.65	0.32	0.11
Lead, mg/L	<0.05	0.019	<0.05	0.050	<0.05	0.001	<0.001	<0.05	<0.001
Magnesium, mg/L	35	30	16	22	54	13	14	26	5
Manganese, mg/L	<0.01	0.02	<0.01	0.02	0.03	0.02	0.02	0.01	<0.01
Mercury, mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Molybdenum mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel, mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Pottasium, mg/L	12	10	7	8	16	7	9	12	5
Selenium, mg/L	<0.0002	<0.0002	0.001	0.001	0.002	<0.002	<0.001	0.0013	<0.001
Silica, mg/L	5.1	2.6	4.8	6.8	7.5	7.6	8.0	5.6	5.2
Sodium, mg/L	244	238	84	189	348	155	218	369	22
Uranium, mg/L	0.0022	0.000467	0.0097	0.0044	0.0022	0.0003	0.0005	0.0020	0.0017
Vanadium, mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Zinc, mg/L	<0.01	0.015	<0.01	0.010	0.01	0.01	<0.01	<0.01	<0.01
Iron, TOTAL mg/L	0.65	0.157	0.22	0.16	0.45	0.62	0.69	0.374	0.14
Manganese, TOTAL mg/L	0.02	0.013	0.015	0.05	0.04	0.03	0.03	0.01	<0.01
Lead 210, suspended pci/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Polonium 210 suspended pci/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Radium 226, suspended pci/L	<0.2	<0.2	<0.2	<0.2	0.97	0.3	<0.2	<0.2	<0.2
Thorium 230 suspended pci/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Uranium suspended, pci/L	<0.0003	<0.0003	<0.003	<0.0003	<0.0003	<0.0003	<0.0003	<0.003	<0.0003

Source: EMC, 2007b

Refer to Figure 3-8 for sample locations.

+ The average of three samples collected from 2006 to 2007 except as noted.

The average of two samples collected during either 2006 or 2007.

* Average contains an anomalous value considered analytical error.

No samples collected from MRSW-10 and MRSW-11; location was always dry.

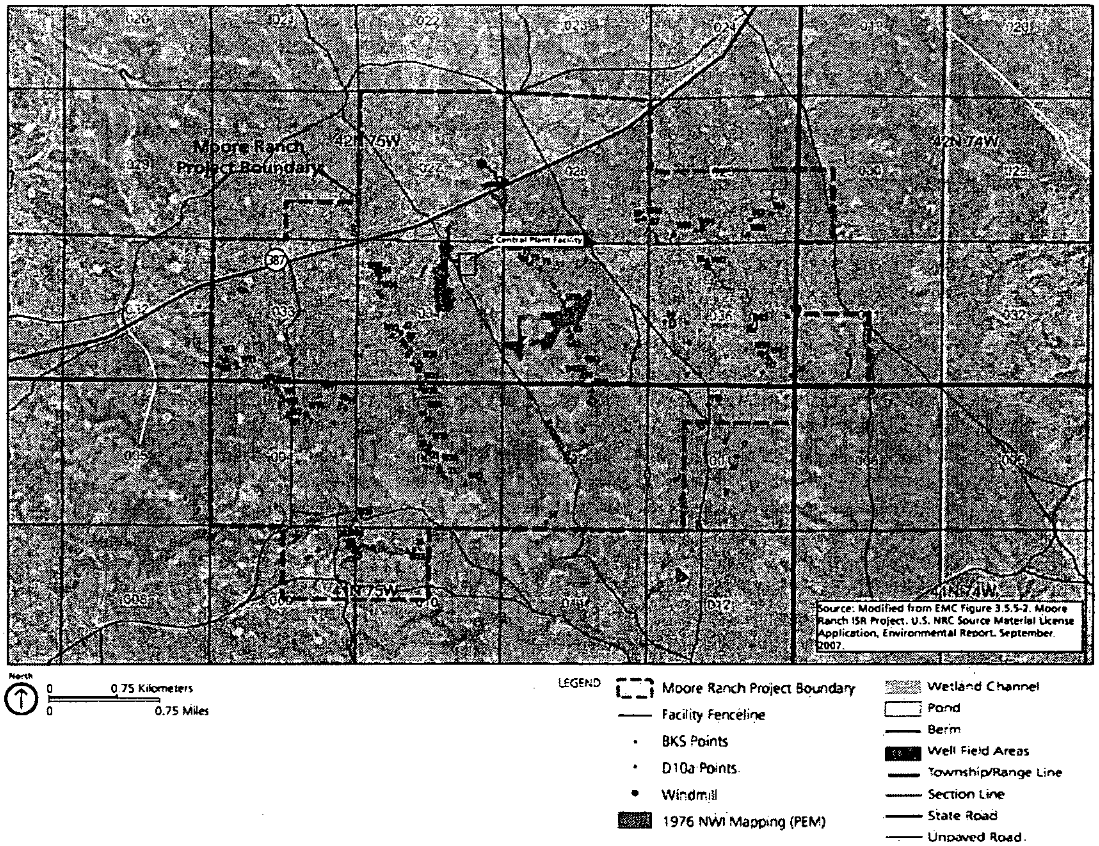

Figure 3-10. Wetlands Located on the Proposed Moore Ranch Project

livestock watering holes, comprising open water pools located along or within drainages. Some of the outfalls, and accompanying watering tanks, were observed releasing water and influencing the presence of wetland parameters. In those drainages where water is released, the wetland characteristics are actively present. In those drainages where there is a gradual decrease in the volume of CBM water being discharged via the outfalls described in Section 3.5.1.3 of this SEIS, the wetland parameters are receding, particularly wetland hydrology and hydrophytic vegetation, and upland vegetation is encroaching into the streambeds.

The wetlands delineated on the proposed Moore Ranch Project include the following systems: a single thread confined to the Ninemile Creek channel at the southern end of the proposed license area; three systems found within the Simmons Draw channel; one wetland within Simmons Draw Tributary A and Simmons Draw Tributary B; and three wetlands within the Pine Tree Draw drainage basin as shown in Figure 3-10.

The disconnected, isolated nature of these pond and wetland systems render them not jurisdictional under Section 404 of the Clean Water Act since there is no connection to navigable waters. However, final determination of the jurisdictional determination is pending the ongoing USACE review.

3.5.2 Groundwater

3.5.2.1 *Regional Groundwater Resources*

As noted in Section 3.3.4.3 of the GEIS, the Powder River Basin where the proposed Moore Ranch Project is located is part of the Wyoming East Uranium Milling Region (NRC, 2009a). In this region, uranium bearing aquifers are part of the Northern Great Plains regional aquifer system which extends over one-third of Wyoming.

The Northern Great Plains aquifer system consists of five major aquifers which from shallowest to deepest are designated as the Lower Tertiary, Upper Cretaceous, Lower Cretaceous, Upper Paleozoic, and Lower Paleozoic aquifers. The shallowest Lower Tertiary aquifers are located in sandstone beds within the Wasatch and Fort Union Formations which are up to 1400 m (4600 ft) thick. These aquifers act as important regional water supplies for drinking water and livestock. Below them are the Upper Cretaceous aquifers which are found in sandstone beds in the Lance, Hell Creek and Fox Hills sandstones. These formations when combined are up to 1070 m (3850 ft) thick. The Fox Hills Sandstone is a significant water source. The next Lower Cretaceous aquifers are located beneath a regional thick sequence of shales known as the Pierre, Lewis and Steele shales. Water yielding aquifers in the Lower Cretaceous are widespread and include the Muddy Sandstone and the Inyan Kara in the Powder River Basin. These Lower Cretaceous aquifers contain little freshwater. The Upper Paleozoic aquifers are the Madison and the Tensleep Limestone in the western portion of the Powder River Basin and the Minnelusa Formation in the eastern portion. They are deeply buried and contain little to no freshwater. The Lower Paleozoic aquifers are the Winnipeg sandstone, the Red River limestone and Stonewall limestone formations. They are not typically used for water supplies as they are very deep and slightly saline to moderately saline in the southern extent and contain freshwater only in a small area in north-central Wyoming.

3.5.2.2 *Local Groundwater Resources*

The uranium-bearing aquifer at the proposed Moore Ranch Project is located in the Wasatch Formation which is part of the shallow Lower Tertiary aquifer system. The Wasatch formation is described as an arkosic fine-to coarse-grained sandstone with siltstone, claystone, and coals. The contact between the underlying Fort Union Formation and the Wasatch is gradational in the vicinity of Moore Ranch and is generally arbitrarily set at the top of the thicker coals or thick sequence of clays and silts. The applicant has identified the boundary between the two formations to be the top of the Roland Coal. The total thickness of the Wasatch Formation ranges between 244 and 335 m (800 and 1,100 ft) in the project area. In the southern portion of the Powder River Basin, the Wasatch generally dips to the northwest at 1.0 to 2.5 degrees.

There are commonly multiple water-bearing sands within the Wasatch Formation. Due to their higher permeability, these water bearing sands provide the primary sources for groundwater withdrawal. Groundwater within the Wasatch aquifers is typically under confined (artesian) conditions, although locally unconfined conditions exist. Well yields from the Wasatch in the southern part of the Powder River Basin where the site is located are reported to be as high as 1,900 Lpm (500 gal/min). The overall flow of groundwater in the shallow aquifers in the vicinity of the proposed Moore Ranch Project is toward the Powder River to the north-northwest.

As previously discussed in Section 3.4.1, the applicant has adopted the nomenclature used by Conoco for the hydrostratigraphic units of interest within the Moore Ranch project. Sands above the Roland Coal are numbered, increasing upward. The 40 and 50 Sands lie immediately above the Roland Coal and are regionally extensive sands that are considered significant aquifers. The approximate thickness of the 40 and 50 Sands in the proposed license area are 24 to 27 m (80 and 90 ft), respectively. The 58 Sand varies in thickness from 1.5 to 24 m (5 to 80 ft). The 60 Sand is approximately 30 m (100 ft) thick and is continuous throughout the project area. It is separated from the 58 Sand by about 1.5 to 21 m (5 to 70 ft) of shale and mudstone. The 68 Sand is the first sand underlying the 70 Sand which contains the economic ore deposits in the area. The 68 Sand ranges from 12 to 30 m (40 to 100 ft) across the proposed license area and coalesces with the 60 Sand on the west side of the proposed license area. The 70 Sand is the proposed ore production zone and coalesces with the 68 Sand in one of the proposed well fields. The 72 Sand overlies the 70 Sand and is the shallowest sand over the majority of the proposed license area. The 70 Sand is separated from the overlying 72 Sand by a continuous shale layer ranging in thickness from 1 to 49 m (3.3 - 160 ft) in some areas. Over small portions of the proposed license area, the 80 Sand overlies the 72 Sand.

3.5.2.3 *Uranium-Bearing Aquifers*

The 70 Sand is the proposed production aquifer located 30.5- 91.4 m (100-300 ft) below ground surface in the project area. The 70 Sand is laterally extensive and ranges from 12.2 to 36.6 m (40 to 120 ft) thick. The 70 Sand dips to the northwest at about 1 degree. It outcrops approximately 1.6 km (1 mi) south of the project area. The 70 Sand is not completely saturated over its thickness in most of the proposed license area. Since the water levels in the 70 Sand are below the overlying shale, it is defined as an unconfined aquifer. Water produced from wells in unconfined aquifers comes from physical drainage of water from the formation pores, not from compression of the sediments and expansion of water due to pressure decreases as in confined aquifers. The natural groundwater flow is estimated to be to the northwest in the 70 Sand at about 2.4 m/yr (7.8 ft/year) based on the reported gradient of 0.004 ft/ft and hydraulic conductivity of 5.36 ft/day.

3.5.2.3.1 Hydrogeologic Characteristics

The hydraulic properties of the 70 Sand production aquifer have been evaluated through a series of pumping tests. Aquifer testing was performed between 1978 and 1980 while Conoco was investigating the Moore Ranch site as a possible surface mine site. Additional pumping tests were conducted by the applicant in 2007 and 2008. Analysis of data from the 2008 test estimated the transmissivity and hydraulic conductivity of the 70 Sand to be 37.6 m^2/day (405 ft^2/day) and 1.63 m/day (5.36 ft/day), respectively. Estimates of specific yield for the unconfined aquifer ranged from 0.011 to 0.039.

3.5.2.3.2 Level of Confinement

The 70 Sand is separated from the overlying 72 Sand by a continuous shale and coal seam across the license area. Water levels in the 72 Sand are much higher than the 70 Sand. The 70 Sand is also not completely saturated. These two features demonstrate that the aquifers are not hydraulically connected. All of the pumping tests conducted in the 70 Sand to date have demonstrated no response in the 72 Sand, which supports the lack of a hydraulic interconnection. As the 70 Sand is not completely saturated, the groundwater in the 72 Sand is likely perched on the shale separating the two aquifers.

The 70 Sand is separated from the underlying 68 Sand by a shale over much of the project area. Pumping tests conducted to date have identified no hydraulic interconnection between these sands in proposed Wellfield 1. In portions of proposed Wellfield 2, however, boring data indicates that the shale is missing or less than five feet thick. In this area the 68 Sand coalesces with the 70 Sand. Pumping tests in Wellfield 2 where the shale is absent have shown a hydraulic connection between the 68 and 70 Sand. Water levels in the 68 and 70 Sands are also similar, supporting a potential hydraulic connection. In the area in Wellfield 2 where the 68 and the 70 Sands coalesce, the applicant considers the 60 Sand to be the underlying aquifer.

3.5.2.3.3 Groundwater Quality

Baseline groundwater quality programs have characterized the quality of groundwater within the shallow Wasatch aquifers within the Moore Ranch project area (Table 3-3). Groundwater quality in the 72 Sand aquifer and production zone 70 Sand exceed the WDEQ Class I standards for TDS and sulfate. The radionuclides radium-226 and uranium are elevated above EPA Maximum Contaminant Levels (MCLs) for drinking water in the majority of samples collected from the production zone 70 Sand aquifer and the underlying 68 Sand aquifer. The average radium 226-228 concentration in the production zone is an order of magnitude greater than the EPA MCL. The 68 Sand aquifer also exceeds the EPA MCL for selenium. In Wellfield 2, the 60 Sand aquifer exceeds the EPA MCL for selenium and uranium. Elevated concentrations of these radionuclides is consistent with the presence of uranium ore-bodies.

Table 3-3. Average Pre-Operational Baseline Groundwater Quality for Site Aquifers

Water Quality Parameter	Average		
	"72 sand"	"70 sand"	"68 sand"
Bicarbonates as HCO3 (mg/l)	208.2	277.2	148.6
Carbonates asCO3(mg/l)	1.6	1.0	10.4
Chloride (mg/l)	4.1	2.3	2.0
Conductivity (umhos/cm)	1051.6	1034.2	753.3
Fluoride (mg/l)	0.2	0.2	0.2
pH (s.u.)	8.07	7.58	8.99
Total Dissolved Solids (mg/l)	770.6	712.5	416.5
Sulfate (mg/l)	401.0	330.3	162.0
Gross Alpha (pCi/l)	5.7	259.1	78.24
Gross Beta(pCi/l)	14.4	80.6	40.09
Lead 210 (pCi/l)	2.0	9.2	6.81
Polonium 210(pCi/l)	1.2	5.6	3.55
Radium 226 (pCi/l)	1.1	95.6	21.1
Radium 228 (pCi/l)	1.9	1.7	1.2
Thorium 230 (pCi/l)	0.3	0.3	0.2
Nitrogen, Ammonia as N (mg/l)	0.214	0.1	0.5
Nitrogen, Nitrate+Nitrite as N (mg/l)	0.4	0.2	0.3
Aluminum (mg/l)	0.1	0.1	0.1
Arsenic (mg/l)	0.001	0.002	0.002
Barium (mg/l)	0.1	0.1	0.1
Boron (mg/l)	0.1	0.1	0.1
Cadmium (mg/l)	0.005	0.005	0.005
Calcium (mg/l)	137.4	135.2	54.4
Chromium (mg/l)	0.05	0.05	0.05
Copper (mg/l)	0.01	0.01	0.011
Iron (mg/l)	0.082	0.151	0.052
Lead (mg/l)	0.001	0.002	0.005
Magnesium (mg/l)	37.3	31.8	7.4
Manganese (mg/l)	0.064	0.033	0.016
Mercury (mg/l)	0.001	0.001	0.001
Molybdenum (mg/l)	0.1	0.1	0.1

Table 3-3. Average Pre-Operational Baseline Groundwater Quality for Site Aquifers			
Water Quality Parameter	Average		
	"72 sand"	"70 sand"	"68 sand"
Nickel (mg/l)	0.05	0.05	0.05
Potassium (mg/l)	16.6	10.2	14.7
Selenium (mg/l)	0.001	0.025	0.135
Silica(mg/l)	10.9	13.0	11.2
Sodium (mg/l)	32.3	33.3	63.4
Uranium (mg/l)	0.001	0.161	0.050
Vanadium (mg/l)	0.1	0.1	0.1
Zinc (mg/l)	0.01	0.01	0.01
Lead 210, suspended (pCi/l)	1.0	18.8	2.1
Polonium 210, suspended (pCi/l)	1.0	17.6	3.7
Radium 226, suspended (pCi/l)	0.3	1.8	3.2
Thorium 230, suspended (pCi/l)	0.3	0.5	3.3
Uranium suspended (pCi/l)	0.0006	0.0033	0.0182

Using WDEQ standards, Uranium One classified the class of use for each shallow aquifer on a well by well basis in the proposed license area. WDEQ Class I is drinking water, Class II is agricultural use, Class III is for livestock use and Class VI is water that is unsuitable for any of these uses. The single well in the perched 80 Sand aquifer was classified as Class VI. One well in the 72 Sand aquifer was classified as Class I, another as Class II and two others as Class III. In the 70 Sand production zone aquifer, all eight wells were Class VI and one well outside the ore zone was Class I. All four wells in the 68 Sand and three wells in the 60 Sand were found to be Class VI.

For ISR operations to be conducted in an aquifer, it must be declared as an exempt aquifer under either State or Federal UIC regulations. An exempt aquifer is one that is not nor will ever be used for drinking water given its water quality. In Wyoming, the EPA has the authority to make this declaration. The water quality of the 70 Sand production zone aquifer in the project area is Class VI under WDEQ standards, which means the groundwater can not be used for drinking, livestock or agricultural use as a consequence of its uranium and radium-226 concentrations. It would therefore be a candidate for an exempt aquifer declaration. The 68 Sand would also be a candidate given its water quality is also Class VI.

3.5.2.3.4 Current Groundwater Uses

According to a search of the WSEO database, there are 559 wells with groundwater rights located within the 3.2-km (2-mi) radius of the proposed Moore Ranch Project as of June 2009. Groundwater rights for wells are granted on a well by well basis through the WSEO (Uranium One, 2009b). Domestic and stock wells have a limit of 94.7 L/min (25 gal/min) per well. There are no minimum water levels entitled with the groundwater rights. The vast majority of water rights in and near the Moore Ranch project area are for CBM activities in the Fort Union formation at depths exceeding 244 m (800 ft).

Of the wells identified in the search, 465 are CBM or stock–CBM wells. All of these CBM and stock-CBM wells which have completion records are greater than 213 m (700 ft) deep. Of those with no completion records it is unlikely they are completed in shallower Wasatch sands as the target for CBM production is the Fort Union formation which is located at depths exceeding 244 m (800 ft) in the Moore Ranch project area. Given the depth of these wells, it is unlikely they will be impacted by operations in the 70 Sand production zone.

Within the 3.2-km (2-mi) radius, there are three domestic water wells ranging from 41.7 to 134 m (137 to 440 ft) in depth. Two are located east of the Moore Ranch project area near the limit of the 3.2 km (2 mi) radius. One well is located in the license area and is permitted as an industrial, domestic well by Rio Algom Mining Corporation. While these wells are permitted for domestic use, there are no currently occupied residences within the project area and 3.2-km (2-mi) radius. Therefore, these wells are not being primarily utilized for human consumption. Given the depth of these wells is close to the depth of the 70 Sand production zone, they could potentially be impacted by ISR operations.

Also within the 3.2-km (2-mi)) radius there are twenty seven permitted stock wells, of which three are located in the project area. Of these wells, twenty five are completed at depths greater than 213 m (700 ft) and two less than 213 m (700 ft). At least four other unpermitted stock wells are known to be in the project area for which no completion information is available, but they are estimated to be in the 68, 70 and 72 Sands. An inoperable windmill with an unpermitted well is also located in the project area. Some of these wells which are located in the shallow 68, 70 and 72 Sands may be impacted by operations within the 70 Sand production zone.

There are no irrigation water wells in the 3.2-km (2-mi) radius. The deepest water well which has groundwater rights within the 3.2-km (2-mi) radius is permitted as a CBM well and is 430 m (1410 ft) deep. It is not likely to be impacted by ISR operations. The remaining deep wells in the project area are oil and gas wells.

3.5.2.4 *Surrounding Aquifers*

In addition to the sands of the Wasatch discussed above, the underlying Fort Union Formation and Fox Hills Sandstones include potentially important aquifers. However, due to the relatively shallow depth of 30.5- 91.4 m (100-300 ft) for the 70 Sand production zone in the overlying Wasatch, these deeper aquifers which are separated by thick sequences of shales are not likely to be impacted by ISR operations in the production zone.

The shallowest potential target for deep well disposal is the Lance formation at depths of 1128 – 1738 m (3700- 5700 ft) below ground surface, The aquifers at these depths are not typically used as drinking water, livestock or irrigation wells because of their depth and poor water quality. They are therefore not expected to be impacted by the operation of a deep disposal well in the Lance Formation.

3.6 Ecology

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

> The Northwestern Great Plains encompass the Missouri Plateau section of the Great Plains. This area includes semiarid rolling plains of shale and sandstone derived soils punctuated by occasional buttes and badlands. For the most part, it has not been influenced by continental glaciation. Cattle grazing and agriculture

> with spring wheat and alfalfa farming are common land uses. Agriculture is affected by erratic precipitation and limited opportunities for irrigation. In Wyoming, mining for coal and coal-bed methane production is prevalent, with a large increase in the number of coal-bed methane wells drilled in recent years. Native grasslands and some woodlands persist, especially in areas of steep or broken topography (Chapman, et al., 2004).

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

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

The applicant conducted a number of ecological studies have been conducted at the proposed Moore Ranch Project to accomplish the objectives specified in NUREG-1569, *Standard Review Plan for In situ Leach Uranium Extraction License Applications*, and to meet the applicable State of Wyoming requirements. These studies include vegetation and wetland surveys conducted in the spring/summer of 2007 and wildlife surveys conducted from fall 2006 through summer 2007.

3.6.1 Terrestrial Ecology

The project area is comprised primarily of grassland with areas of sagebrush in the southwest corner. Interspersed among those major plant communities are less abundant seeded grasslands (improved pastures) habitats and intermittent streams as described below. No perennial streams or other permanent water bodies exist within the proposed Moore Ranch Project (EMC, 2007a).

3.6.1.1 *Vegetation*

Baseline vegetation and wetland surveys were conducted by the applicant during the spring/summer of 2007 in accordance with applicable state and federal guidelines. EMC (2007a) provides a detailed description of the survey results. The spatial distribution of the vegetation types within the proposed Moore Ranch Project are shown in Figure 3-11.

The proposed license area for the Moore Ranch Project is approximately 2,879 ha (7,110 ac) and consists primarily of four vegetation communities: Meadow Grassland, Upland Grassland, Agricultural Grassland, and Big Sagebrush Shrubland as shown on Figure 3-11. Approximately 61 ha (150 ac) or about 2 percent of the proposed license area would be disturbed by the proposed action. Each vegetation community was investigated to establish a baseline in support of the NRC license application. No threatened or endangered plant species were encountered within the proposed license area. Two State listed species of concern, or State designated weeds, Canada thistle (*Cirsium arvense*) and field bindweed (*Convolvulus arvensis*), were identified in the project area and should be managed. Table 3-4 summarizes the area of each vegetation community within the proposed license area. The applicant's environmental report summarizes the vegetation community mapping units for the Moore Ranch Project (EMC, 2007a). Upland grassland is the predominant vegetation type within the proposed license area as summarized in Table 3-4.

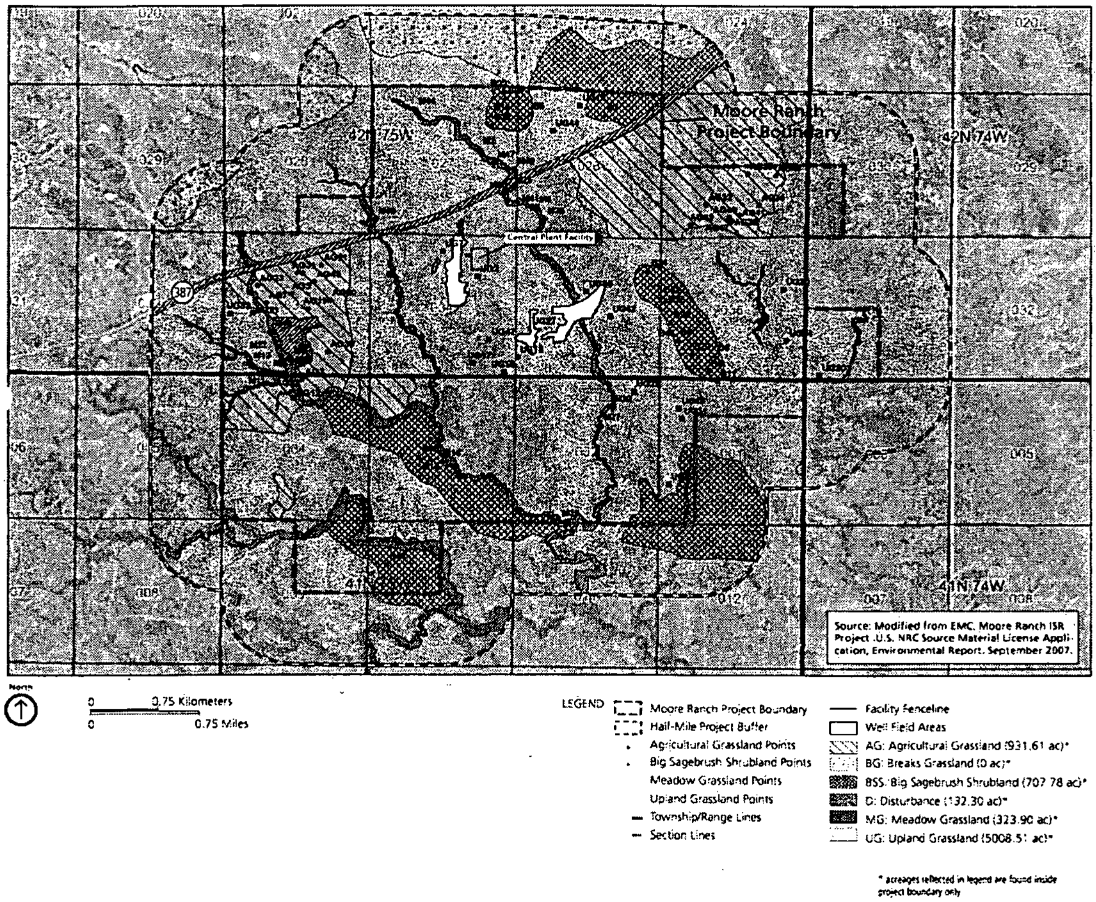

Figure 3-11. Vegetation Communities on the Proposed Moore Ranch Project

Table 3-4. Areal Distribution of Vegetation Communities within the Proposed License Area

Mapping Unit	Proposed License Area (in hectares)	Proposed License Area (in Acres)	Percent of Area
Meadow Grassland	130.9	323.32	5
Upland Grassland	2,027	5,006.69	70
Agricultural Grassland	377	931.19	13
Big Sagebrush Shrubland	286.43	707.48	10
Disturbance	53.5	132.15	2
TOTAL	2,875	7,100.83	100

Reference: EMC, 2007a

3.6.1.2 *Wildlife*

Baseline wildlife information for the proposed Moore Ranch Project are available from previous data collection efforts conducted for CBM plans-of-development that generally covered all but the extreme southeastern and western sections of the proposed Moore Ranch Project area and the perimeter. These annual surveys were conducted from the years 2003 through 2006 and included numerous wildlife species, habitat features such as bald eagle nesting and winter roost sites, sage-grouse leks, and raptor nests, and surveys for avian species of concern. In addition, the applicant conducted a site-specific survey from October 2006 through June 2007. Detailed results of these investigations are documented in EMC (2007a). Since much of the proposed license area has been included in annual wildlife monitoring since 2003, the WGFD delineated the study area for raptors and other migratory birds to those portions of the proposed Moore Ranch Project and a 1.6-km (1-mi) perimeter not encompassed by the previous overlapping studies. Site-specific wildlife surveys of the proposed Moore Ranch Project targeted bald eagle winter roost sites, sage-grouse leks, nesting raptors (including eagles), mountain plovers, and other avian species of concern.

3.6.1.2.1 Big Game

Pronghorn antelope (*Antilocapra Americana)* and mule deer (*Odocoileus hemionus)* are the only two big game species that regularly occur on the proposed license area. No crucial big game habitat or migration corridors occur on or within several kilometers of the area (University of Wyoming, 2004 and 2008). Pronghorn antelope are more abundant than mule deer in the Moore Ranch Project area, but neither species is prevalent since it is not preferred habitat. The WGFD classified the proposed license area as yearlong pronghorn antelope range, meaning that a portion of a population of animals makes general use of this habitat on a year-round basis. The Moore Ranch Project spans two WGFD pronghorn antelope herd units bisected by highway SR 387. The WGFD estimated the 2006 post-season pronghorn antelope populations in those two hunt areas to be approximately 36,500 and 32,300, respectively; above the WGFD population objectives to manage and regulate big game herds (WGFD, 2006).

Mule deer use nearly all habitats but prefer sagebrush-grassland and are not abundant in the proposed license area. Monitoring data indicate that mule deer are not very migratory in the vicinity of the proposed Moore Ranch Project. The majority of the proposed license area has been classified by WGFD as yearlong mule deer range except portions south of the highway that are considered inadequate to support mule deer. The WGFD estimated the 2006 post-season mule deer population to be approximately 12,350 and 9,700 animals, compared to herd objectives of 11,000 and 9,100, respectively (WGFD, 2006).

3.6.1.2.2 Avian Species

This section of the SEIS describes bird species that have been identified at the proposed Moore Ranch Project based on the surveys described above.

Upland Game Birds

The mourning dove (*Zenaida macroura*) is the only upland game bird known to regularly occur in the vicinity of the Moore Ranch Project and it is a relatively common breeder in Campbell County. Most sightings at the Moore Ranch Project occur during migration near sites with water sources or trees, though they were occasionally recorded in upland grassland habitats.

The greater sage-grouse (*Centrocercus urophasianus)* is listed as an avian species of special concern in Wyoming (WGFD, 2005a). Sage-grouse are found in sagebrush shrubland habitats, and sagebrush is essential during all seasons and for every phase of their life cycle. It is rare in the vicinity of the Moore Ranch Project because of the limited habitat to support its existence. No large expanses of contiguous sagebrush occur within several kilometers of the Moore Ranch Project. Consequently, few sage-grouse have been documented in the area; and no grouse leks have ever been discovered either on or near the proposed Moore Ranch Project. The nearest known sage-grouse lek is located approximately 4.0 km (2.5 mi) to the northwest of the Moore Ranch Project area (BLM, 2009).

Raptors

Suitable habitat for several raptor species occurs on the proposed Moore Ranch Project and within a 1.6-km (1-mi) perimeter) of the site. These raptor species include golden eagle (*Aquila chrysaetos*), ferruginous hawk (*Buteo regalis)*, red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni)*, northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius)*, prairie falcon (*Falco mexicanus*), great horned owl (*Bubo virginianus)*, burrowing owl (*Athene cunicularia*), and short-eared owl (*Asio flammeus*) (EMC, 2007a). Nests have been observed for the ferruginous hawk, red-tailed hawk, great horned owl, and Swainson's hawk but not for the other raptors based on BLM data (BLM, 2007).

Thirty-six raptor nest sites have been identified within the vicinity of the proposed Moore Ranch Project since 2003 (EMC, 2007a). Nineteen nest sites were located within the proposed Moore Ranch Project and the remaining 17 were located around the perimeter of the site (EMC, 2007a).

Waterfowl and Shorebirds

The proposed Moore Ranch Project has extremely limited and marginal habitat for waterfowl and shorebirds because of the lack of surface water. Natural aquatic habitats are mainly present during spring migration and consist of small, isolated pools which can be completely dry during summer. Recent CBM development in the Moore Ranch Project area has increased the number of localized water sources with limited depth, geographic area, and duration. Several common species of waterfowl and shorebirds including the mallard (*Anas platyrhynchos)* and killdeer (*Charadrius vociferus*) have been infrequently observed on the proposed Moore Ranch Project (EMC, 2007a).

3.6.1.2.3 Other Mammals, Reptiles, and Amphibians

A variety of small and medium-sized mammal species occur in the vicinity of the proposed Moore Ranch Project. These include predators and furbearers such as the coyote (*Canis latrans*), red fox (*Vulpes vulpes)*, swift fox (*Vulpes velox*), bobcat (*Lynx rufus*), striped skunk (*Mephitis mephitis)*, weasels, badger (*Taxidea taxus)*, muskrat (*Ondatra zibethicus*), and raccoon (*Procyon lotor)*. Prey species include various rodents, such as mice, rats, voles, gophers, ground squirrels, and chipmunks, and lagomorphs (jackrabbits and cottontails). These prey species are cyclically common and widespread throughout the region, and are important for raptors and other predators. No occupied black-tailed prairie dog (*Cynomys ludovicianus)* colonies have been documented on or in the vicinity of the proposed Moore Ranch Project based on repeated surveys (EMC, 2007a).

Few reptiles and amphibians have been recorded during recent wildlife surveys because of the lack of suitable habitat (EMC, 2007a). The common bullsnake (*Pituophis melanoleucas sayi)* was the only herpetological species recorded on the proposed Moore Ranch Project in the baseline studies conducted in 2006 and 2007.

3.6.2 Aquatic Ecology

Aquatic habitat on and near the proposed Moore Ranch Project is limited by the intermittent nature of surface waters in the proposed license area. The lack of deep-water habitat and extensive and persistent water sources precludes the presence of fish, and limits the abundance and diversity of other aquatic species. No perennial drainages are present in the proposed license area.

3.6.3 Protected Species

Threatened and Endangered Species

Table 3-5 presents species that are Federally-listed under the Endangered Species Act (ESA) of 1973, State-listed under the Final Comprehensive Wildlife Conservation Strategy for Wyoming, and/or BLM-listed as sensitive species[1] and that occur in Campbell and Johnson Counties.

No threatened and endangered species occur within the proposed Moore Ranch Project study area. Based on consultation with the USFWS (USFWS, 2008), federally listed T&E species (or their designated habitat) that could potentially occur in the project area are discussed below.

The Ute ladies'-tresses orchid (Spiranthes diluvialis) is Federally-listed as threatened. The species is a perennial, terrestrial orchid that occurs in Nebraska, Wyoming, Colorado, Utah, Idaho, Montana, and Washington. Within Wyoming, it inhabits moist meadows with moderately dense, but short vegetative cover. The species is found at elevations of 1,280 to 2,130 m (4,200 to 7,000 ft), though no known populations occur in Wyoming above 1,680 m (5,500 ft) (Fertig, 2000). Generally, this orchid is found in low densities of four to eight flowering plants per square meter (Fertig, 2000). The species is likely to inhabit silt, sand, or gravely soils in areas with ample sunlight (Fertig, 2000). It is characterized by 12- to 50-cm (4.7- to 20-in) stems with linear basal leaves up to 28 cm (11 in) long and spikes of small white to ivory flowers that bloom between early August and early September (Fertig, 2000). Urbanization, livestock grazing, pesticide use, competition with noxious weeds, and loss of pollinators threaten this species survival (Fertig, 2000). This species was not identified during vegetation inventories conducted by the applicant and is not known to occur on or in the vicinity of the proposed site.

The black-footed ferret (Mustela nigripes) is listed as an endangered species that inhabits prairie dog colonies. A black-footed ferret survey was not required, since black-footed ferrets live exclusively in prairie dog colonies, which are not present on or within 1.6 km (1 mi) of the Moore Ranch Project area.

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

The bald eagle (Haliaeetus leucocephalus) 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. Potential habitat for bald eagle nesting and roosting activities is quite limited within the proposed license area because of the lack of trees. Nor does the proposed Moore Ranch Project contain unique or sizeable, concentrated prey sources (e.g., fisheries, waterfowl wintering areas) that would be expected to attract bald eagles. There have been no bald eagle sightings during either site-specific winter roost surveys or other baseline surveys completed by the applicant in 2006 and 2007 nor have they been observed in annual surveys conducted since 2003 (EMC, 2007a).

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

The swift fox (Vulpes velox) is a State of Wyoming species of concern and a BLM-designated sensitive species. The species was removed from the Endangered Species Act Candidate List in 2002 due to successful conservation measures and reintroduction efforts in western states. The species is native to the Great Plains region, and in Wyoming, the swift fox inhabits flat terrain east of the Continental Divide with shortgrass or mixed-grass prairie and is often associated with prairie dog colonies (WGFD, 2005b). Swift foxes are nocturnal and use underground dens year-round. Threats to the species' continued survival include loss of prairie habitat, trapping and hunting, and predator control campaigns (WGFD, 2005b). This species was not identified during vegetation inventories conducted by the applicant and is not known to occur on or in the vicinity of the proposed site.<u>Species of Concern</u>

The Wyoming Field Office of the USFWS uses the list, Migratory Bird Species of Management Concern in Wyoming (MBSMC, also known as Migratory Birds of High Federal Interest [MBHFI]) for conducting reviews related to non-coal surface disturbance projects (FWS, 2002). This list is based on the Wyoming Bird Conservation Plan (Nicholoff, S.H., compiler. 2003). Seventy-seven avian species of concern are identified on this list; 22 species are identified as being species in need of conservation action (Level I) and the remaining 55 species are classified as Level II concern, for which continued careful monitoring is recommended.

Surveys for avian species of concern, including mountain plovers (*Charadrius montanus*), sage-grouse, and bald eagles, were annually conducted from 2003 through 2007 at the proposed Moore Ranch Project. Most surveys have occurred in the spring and summer to document migrating and breeding birds; winter surveys were conducted for bald eagle roost sites. The study area for previous surveys included most of the proposed project area and a 0.8-km (0.5-mi) perimeter (1.6-km [1-mi] for bald eagles). The entire proposed Moore Ranch Project was surveyed by the applicant from fall 2006 through early summer 2007.

Table 3-5. Federally- and State-listed Species

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

Table 3-5. Federally- and State-listed Species

Scientific Name	Common Name	Federal Status[a]	State Status[b]	County of Occurrence[c]
Stizostedion canadense	sauger	–	SGCN	CAM; JOH
Mammals				
Corynorhinus townsendii	Townsend's big-eared bat	–	BLM-SS; SGCN	CAM; JOH
Cynomys leucurus	white-tailed prairie dog	–	SGCN	JOH
Cynomys ludovicianus	black-tailed prairie dog	–	SGCN	JOH
Euderma maculatum	spotted bat	–	BLM-SS	CAM; JOH
Lasionycteris noctivagans	silver-haired bat	–	SGCN	CAM; JOH
Lasiurus cinereus	hoary bat	–	SGCN	CAM; JOH
Lontra canadensis	river otter	–	SGCN	JOH
Martes pennanti	fisher	–	SGCN	JOH
Microtus richardsoni	water vole	–	SGCN	JOH
Mustela nigripes	black-footed ferret	E	SGCN	CAM; JOH
Mustela nivalis	least weasel	–	SGCN	JOH
Myotis ciliolabrum	western small-footed myotis	–	SGCN	JOH
Myotis evotis	long-eared myotis	–	BLM-SS; SGCN	CAM; JOH
Myotis thysanodes	fringed myotis	–	BLM-SS; SGCN	JOH
Myotis volans	long-legged myotis	–	SGCN	JOH
Perognathus fasciatus	olive-backed pocket mouse	–	SGCN	CAM; JOH
Sorex haydeni	Hayden's shrew	–	SGCN	JOH
Sorex nanus	dwarf shrew	–	SGCN	CAM; JOH
Vulpes velox	swift fox	–	BLM-SS; SGCN	CAM; JOH
Reptiles				
Coluber constrictor flaviventris	eastern yellowbelly racer	–	SGCN	CAM; JOH
Plants				
Anemone narcissiflora ssp. zephyra	zephyr windflower		PSC	JOH
Arnica lonchophylla	northern arnica	–	PSC	JOH
Cymopterus williamsii	Williams' waferparsnip	–	BLM-SS; PSC	JOH
Cypripedium montanum	mountain lady-slipper	–	PSC	JOH
Draba fladnizensis var. *pattersonii*	white artiv whitlow grass	–	PSC	JOH
Festuca hallii	Hall's fescue	–	PSC	JOH
Juncus triglumis var. *triglumis*	three-flower rush	–	PSC	JOH
Papaver kluanense	alpine poppy	–	PSC	JOH
Parnassia kotzebuei	Kotzebuei's grass-of-parnassus	–		JOH
Pedicularis contorta var. *ctenophore*	coil-breaked lousewort	–	PSC	JOH
Penstemon haydenii	blowout penstemon	E	–	CAM; JOH
Physaria lanata	woolly twinpod	–	PSC	CAM; JOH
Polygala verticillata	whorled milkwort	–	PSC	CAM
Polygonum spergulariiforme	fall knotweed	–	PSC	JOH
Potamogeton amplifolius	large-leaved pondweed	–	PSC	JOH
Psilocarphus brevissimus	dward woolly-heads	–	PSC	CAM
Puccinellia cusickii	Cusick's alkali-grass	–	PSC	JOH
Pyrrocoma clementis var.	hairy tranquil goldenweed	–	HCP	JOH

Table 3-5. Federally- and State-listed Species

Scientific Name	Common Name	Federal Status[(a)]	State Status[(b)]	County of Occurrence[(c)]
villosa				
Rubus acaulis	northern blackberry	–	PSC	JOH
Schoenoplectus heterochaetus	slender bulrush	–	PSC	CAM
Sesuvium verrucosum	sea purslane	–	PSC	CAM
Spiranthes diluvialis	ute ladies'-tresses	T	–	CAM; JOH
Sporobolus compositus	longleaf dropseed	–	PSC	CAM
Triodanis leptocarpa	slim-pod Venus' looking-glass	–	PSC	CAM

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

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

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

Table 3-6 lists the five avian species of concern that were observed on the proposed Moore Ranch Project area during the 2006-2007 baseline studies conducted by the applicant, including their primary nesting habitats and historical occurrence in the general area. For these five species, BLM Wyoming has enacted the Sensitive Species Policy and List to focus species management efforts within BLM lands and ensure that actions authorized, funded, or carried out by BLM do not contribute to the need for any species to become listed under the Endangered Species Act.

Table 3-6. Migratory Bird Species of Management Concern Observed on the Proposed Moore Ranch Project			
Species	**Primary Nesting Habitat(s)**	**Status/Occurrence in Project Region[1]**	**Occurrence Within Proposed License Area**
Species Of Level I Concern - Conservation Action Needed			
McCown's longspur *Calcarius mccownii*	Short-grass prairie, shrub-steppe	Breeder	Observed, presumed breeder
Ferruginous hawk *Buteo regalis*	Shrub-steppe, grasslands	Breeder	Observed, breeder
Species Of Level II Concern - Continued Monitoring Recommended			
Lark Bunting *Calamospiza melanocorys*	Short-grass prairie, shrub steppe	Breeder	Observed, presumed breeder
Chestnut-collared Longspur *Calcarius ornatus*	Short-grass prairie	Potential breeder	Observed, likely breeder
Vesper Sparrow *Pooecetes gramineus*	Shrub-steppe	Breeder	Observed, presumed breeder

Reference: EMC, 2007a
[1] *Wyoming lat/long encompassing Moore Ranch Project.*

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 altitude prairies. The closest mountain ranges to the proposed Moore Ranch Project are the Bighorn Mountains, the Black Hills, and the northern Laramie Range located approximately 80, 137, and 80 km (50, 85, and 50 mi, respectively) from the proposed Moore Ranch Project. Because of these distances, the site does not experience significant wind channeling or shielding from any of these three mountain ranges (Uranium One, 2008). The average elevation over the eastern and southern prairie region, also known as the High Plains region, is over 1,828 m (6,000 ft) AMSL. The Rocky Mountains are perpendicular to the prevailing westerly winds and provide an effective barrier to the significant Pacific-generated weather systems. Much of the moisture produced from these systems is dropped along the western slopes of the Rocky Mountains, thereby leaving the eastern portion of the state in a semiarid condition.

The proposed Moore Ranch Project is located within the Powder River Basin in northeastern Wyoming. The physical setting of the Powder River Basin is characterized by semi-arid plains with low hills and buttes, little vegetation, and few substantial topographical features. The basin stretches approximately 190 km (120 mi) east to west and 320 km (200 mi) north to south in southeast Montana and northeast Wyoming. The region has extensive natural resources such as coal, CBM, and uranium. It is both a topographic drainage and geologic structural basin. The Moore Ranch Project area is located at 43°33'29.17" N latitude, 105°55'18.54" W longitude in the south-central portion of the Powder River Basin. The elevation of the project area is approximately 1,670 m (5,500 ft) AMSL. This region of Wyoming experiences diverse weather patterns that fluctuate throughout the year, largely because of its proximity to the Rocky Mountain system and its relatively high elevation. The area is characterized by long winters, generally from December to April, which can bring frequent snow storms. Summer can be hot in the Powder River Basin due to the lack of moisture; however the summer season tends to be short, with occasional hail, thunder, or snow storms. The Powder River Basin is treated as a single air quality control area by state and federal regulators because of the uniformities in geography and climate.

Because of the extensive surface coal mining that has developed over the last 30 years, the Powder River Basin airshed is heavily monitored. Coal production in the Powder River Basin grew from a few million tons in 1973 to over 400 million tons in 2006. A parallel growth in ambient air quality monitoring throughout the Powder River Basin accompanied the growth in coal production through the enactment of the Clean Air Act and the Surface Mining Control and Reclamation Act of the 1970s. There are more than 100 particulate monitoring samplers and more than 20 meteorological monitoring towers in the Powder River Basin to support air quality permitting, compliance and research objectives (Uranium One, 2008).

Since no onsite meteorological data are available for the Moore Ranch Project, data from the Antelope Mine, located approximately 40 km (25 mi) southeast of the proposed Moore Ranch Project were used to describe the expected meteorological conditions in the project area. The Antelope mine location has similar topographic features as the Moore Ranch Project area characterized by mildly rolling hills covered with grass and sparse shrubs. No mountain ranges either channel or shield the wind between these two locations nor are there bodies of water that would alter the general meteorological conditions at either the proposed Moore Ranch Project or the Antelope mine (Uranium One, 2008).

3.7.1.1 *Temperature*

Temperatures fluctuate greatly throughout the year in the Powder River Basin. Located in a semi-arid climate, summer temperatures at the project site can be quite warm, while winters are commonly quite cold. The annual average temperature in the project area region is 7 °C (46 °F). The average maximum daily temperature is 32 °C (90 °F), with July yielding the warmest average temperatures. The average minimum daily temperature is -12 °C (10 °F), with January being the coldest month on average. Large diurnal temperature variations occur in the region due to its high altitude and low humidity. Spring and summer daily variations of 8 to 14 °C (15 to 25 °F) are common with maximum temperature variations of 17 to 21 °C (30 to 40 °F) observed during extremely dry periods. Less daily variation is observed during the cooler portions of the year as fall and winter have fluctuations of 5 to 7 °C (10 to 15 °F; EMC, 2007a).

3.7.1.2 *Wind*

Wyoming is quite windy, and frequently during winter winds reach 48 to 64 kph (30 to 40 mph) with gusts to 80 to 97 kph (50 or 60 mph). Prevailing wind directions vary from west-southwest through west to northwest. In many localities winds are so strong and constant that trees (when present) show a definite lean towards the east or southeast. Average wind speeds vary from 24 to 27 kph (15 to 17 mph) from the west/northwest throughout the year within the project area.

Wind data for the project area were obtained from Glenrock Coal Company (GCC), approximately 70 km (45 mi) south of the project area, and Antelope Coal Company (ACC), approximately 60 km (35 mi) east of the project area. The average annual wind speed is approximately 20.6 kph (14.8 mph) at GCC and approximately 17.9 kph (11.1 mph) at ACC. Maximum hourly averages of greater than 80 kph (50 mph) have been recorded at both mine sites. Seasonal wind roses for the ACC site are shown in Figure 3-12. As noted in Section

3.7.1, data from the ACC are considered to be most representative of the proposed Moore Ranch Project.

3.7.1.3 *Precipitation*

The project area receives relatively little rainfall. The mean annual precipitation within the area is approximately 35 cm (13.7 inches). May has been the wettest, and January has been the driest month on average. The actual annual moisture may be somewhat higher since precipitation gages capture only a small proportion of snowfall under windy conditions. Severe storms generated from severe weather conditions that could bring wind, rain, snow or hail from any given direction are rare because the surrounding mountains effectively block or weaken storms (EMC, 2007a).

Table 3-7 summarizes average temperature, precipitation, and snow fall trends taken from a National Climate Data Center weather station located in the town of Midwest, approximately 32 km (20 mi) southwest of the project area. Table 3-7 reflects the large temperature fluctuations between seasons, as well as the relatively small amount of precipitation that occurs at the project area.

Table 3-7. Climate Data for Midwest, Wyoming Climate Station

Temperature (°C/ °F)	Mean-Annual	7.5/ 45.5
	Low-Monthly Mean	-5.7/ 21.7
	High-Monthly Mean	21.5/ 70.7
Precipitation (cm/ in)	Mean-Annual	35.0/ 13.7
	Low-Monthly Mean	1.4/ 0.5
	High-Monthly Mean	6.5/ 2.5
Snowfall (cm/ in)	Mean-Annual	135/ 53
	Low-Monthly Mean	0/ 0
	High-Monthly Mean	22.6/ 8.8

Source: NRC, 2009a

3.7.1.4 *Evaporation*

As discussed in Section 3.3.6.1 of the GEIS, the annual evaporation rates in the Wyoming East Uranium Milling Region range from about 102 to 127 cm (40 to 50 in) (NWS, 1982 in NRC, 2009a). The low humidity, sunshine, and high winds contribute to a high rate of evaporation.

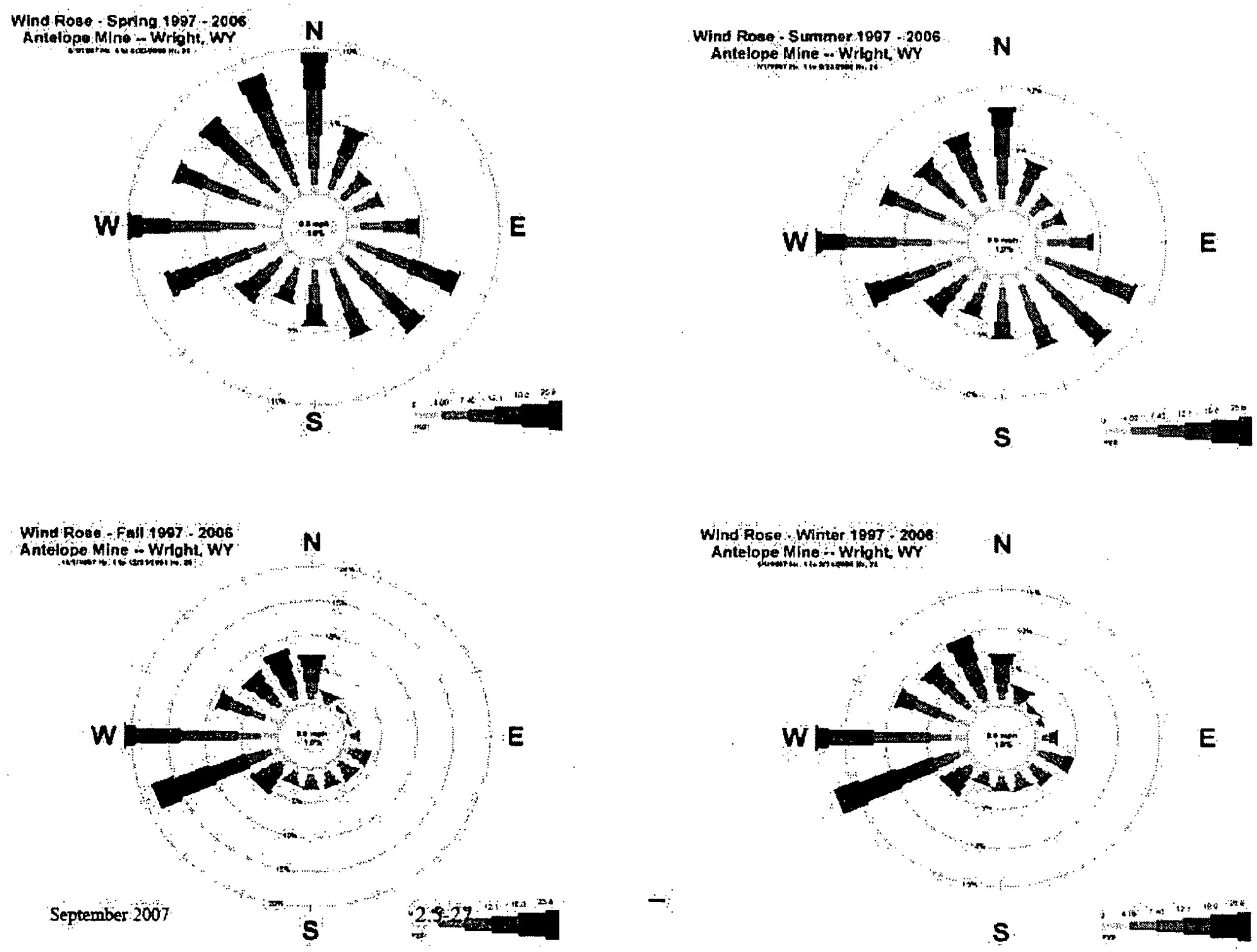

Figure 3-12. Seasonal Wind Roses for the Antelope Coal Company

3.7.2 Air Quality

The proposed Moore Ranch Project is located in an attainment area for all the primary pollutants. The terrain within the area combined with windy conditions provides good conditions for dispersion of air pollutants. The closest resident is approximately 4.5 km (2.8 mi) east of the proposed Moore Ranch Project. The primary land use on the site is cattle grazing which does not generate air emissions.

The Wyoming Department of Environmental Quality adopted the EPA's National Ambient Air Quality Standards as summarized in Table 3.2-8 of the GEIS (NRC, 2009a). The Moore Ranch Project is located in Campbell County, Wyoming, which is in attainment area for all the primary pollutants. The dominant emissions from activities at the proposed Moore Ranch Project would be carbon monoxide (CO) and particulate matter (PM). CO is an odorless and colorless pollutant. In general, CO at ISR projects would be generated primarily by engine combustions (including all vehicles as well as stationary motors such as generators). Over 90 percent of CO comes from motor vehicles.

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

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

WDEQ monitors air quality and annually reports the results to EPA. The 2007 monitoring results are consistent with the areas attainment status (WDEQ, 2009). Construction activities at two locations resulted in a couple of anomalous PM10 readings; however, these were attributable to localized, temporary construction activities, and, therefore, not representative. Table 3-8 presents the air quality monitoring data for all of the monitoring stations.

Table 3-8. Existing Conditions - 2007 Ambient Air Quality Monitoring Data

Monitoring Stations	Wamsutter	Casper	Lander	Murphy Ridge	
Distance to Site	**290 km (180 mi)**	**97 km (60 mi)**	**258 km (160 mi)**	**484 km (300 mi)**	
Pollutant					**Standards Averaging Time**
Carbon Monoxide	N/A	N/A	N/A	0.7 ppm	8-hour
	N/A	N/A	N/A	0.9 ppm	1-hour
Lead	1.5 ug/m^3	N/A	N/A	N/A	Quarterly Average
Nitrogen Dioxide	0.007 ug/m^3	N/A	N/A	0.003 ug/m^3	Annual (Arithmetic Mean)
Particulate Matter (PM_{10})	227.0 ug/m^3 (Note: 2006 was 73.0 ug/m^3)	30 ug/m^3	40 ug/m^3	64 ug/m^3	24-hour
Particulate Matter ($PM_{2.5}$)	N/A	N/A	26.0 ug/m^3	N/A	Annual (Arithmetic Mean)
	N/A	N/A	7.6 ug/m^3	N/A	24-hour
Ozone	0.064 ppm	N/A	N/A	0.068 ppm	8-hour
Sulfur Dioxide	0.001 ppm	N/A	N/A	0.001 ppm	Annual
	0.010 ppm	N/A	N/A	0.002 ppm	24-hour

3.8 Noise

The Moore Ranch Project area is located in rural Campbell County, Wyoming. The known land uses within both the Moore Ranch Project and within a 3.2-km (2-mi) radius of the project boundary are grazing, wildlife habitat, and CBM recovery operations none of which generate significant noise. Traffic along the road leading to the site would also generate some noise. Sound levels from CBM operations would be expected to be unnoticeable from distances of 490 m (1,600 ft) and beyond (BLM, 2003). The closest residence to the Moore Ranch Project is located approximately 4.5 km (2.8 mi) east of the proposed license border. No people reside in the proposed license area (EMC, 2007a).

The Federal Highway Administration (FHWA) and the Wyoming Department of Transportation (WYDOT) have noise impact assessment procedures and criteria to help protect the public health and welfare from excessive vehicle traffic noise. FHWA established Noise Abatement Criteria (NAC) described in Table 3-9 according to land use, recognizing that different areas are sensitive to noise in different ways. A person is considered to be impacted by noise according to WYDOT procedures when existing or expected future sound levels approach (within 1 dBA), are either at, or exceed the NAC, or when expected future sound levels exceed existing sound levels by a substantial amount (15 dBA). These criteria were used to assess impacts at the proposed Moore Ranch Project.

Table 3-9. Noise Abatement Criteria (NAC) : One-Hour, A-Weighted Sound Levels in Decibels (dBA)		
Activity Category	Leq(h)*	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purposes.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	--	Undeveloped lands
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

* $L_{eq}(h)$ is an energy-averaged, one-hour, A-weighted sound level in decibels (dBA).

Source: 23 CFR Part 772 - *Procedures for Abatement of Highway Traffic Noise and Construction Noise.*

Cattle grazing, the primary land use within the project area, generates minor noise. However, SR 387, which crosses through the northern portion of the project area and Brown Road, which accesses the site, are line sources of noise. The sound from vehicular traffic at a distance of 15 m (50 ft) from the receptor has been estimated at 54 to 62 decibels (dBA) for passenger cars and 58 to 70 dBA for heavy trucks (NRC, 2009a). Since noise from line sources such as roads is reduced by approximately 3 dB per doubling of distance (NRC, 2009a), the maximum truck sound level of 70 dBA on the shoulder of either SR 387 or Brown Road would diminish to the level of a Category "A" Activity shown in Table 3-9 approximately 480 m (1,575 ft) from the source excluding the noise dampening characteristics of topographic interference, and vegetation.

It was assumed that sound levels beyond a distance of 480 m (1,575 ft) from SR 387 and Brown Road would approximate 40 dBA to conservatively overestimate a baseline that is consistent with the GEIS statement that existing ambient noise levels in this region would be 22 to 38 dBA (NRC, 2009a). Figure 3.2-17 of the GEIS provides examples of sound levels for common activities (NRC, 2009a).

With regard to wildlife located on the site, field observations suggest that noise from oil and gas and CBM operations could affect greater sage-grouse lek activity (Braun et al., 2002). The construction and operation of ISR facilities would involve similar activities. However, sage-grouse leks have not been discovered on or near the project area based on a 2007 survey (EMC, 2007a).

3.9 Historical and Cultural Resources

Section 3.3.8 of the GEIS provides a general overview of historical and cultural resources for the Wyoming East Uranium Milling Region in which the proposed Moore Ranch Project is located (NRC, 2009a). This section describes the site-specific historical and cultural resources investigations for the Moore Ranch Project which include a cultural resources overview of the area, identification of historic properties, historic properties listed in the National and State Registers, and tribal consultation discussed in Sections 3.9.1, 3.9.2, and 3.9.3 and 3.9.4, respectively.

No structures or buildings were evaluated for the proposed Moore Ranch Project site since potential buildings and structures were previously investigated. All of the sites were determined ineligible for listing on the National Register of Historic Places (NRHP) by the Wyoming SHPO on August 16, 2007 (Uranium One, 2009b). Brunette (2007) noted the occurrence of "active and abandoned ranch headquarters/ranching related buildings [and] earthen dikes/stock ponds" in and around the proposed Moore Ranch Project. None of these sites are located in the immediate vicinity of the central plant and proposed well fields. Site 48CA146 includes features and remains associated with an abandoned ranch located about 0.8 km (0.5 mi) south of the proposed well field areas Site 48CA3400, the remains of an historic homestead, is located "at least 1.5 miles southwest of the areas currently proposed for in-situ uranium mining activity" (Brunette, 2007). Site 48CA6173 also consists of the remains on an historic homestead. Located near the southern boundary of Site 48CA146, the site is located southwest of the areas currently proposed for in-situ uranium mining activity" (Brunette, 2007).

The historical and cultural resources for the proposed Moore Ranch Project are being considered under NEPA and the NHPA, as amended (36 CFR 800) as part of the NEPA process. Cultural resources identification and assessment also has taken into consideration the ARPA (16 United States Code [USC] 469-469c-e) as amended, which covers permitting of archaeological investigations on public land such as that managed by the BLM. Finally, State of Wyoming laws dealing with protection of archaeological resources also were considered. These various laws and regulations were discussed in Appendix B of the GEIS.

The NRC initiated consultation with the Wyoming SHPO, under Section 106 of the NHPA (NRC, 2008). A response to NRC's letter was received from Wyoming SHPO on June 5, 2008. The Wyoming SHPO has assigned project control number 0608RLC007 to the project.

3.9.1 Cultural History

The archeological cultural sequence for the proposed Moore Ranch Project is divided between the prehistoric periods (Paleoindian, Archaic, and Late Prehistoric) and the recent protohistoric/historic era. The former 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 ranges from A.D. 1700 to A.D. 1959, the 50-year cutoff date for possible inclusion on the 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 semisubterranean 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 Historic and Cultural Resources Identified and Places of Cultural Significance

3.9.2.1 *Previous Cultural Resources Investigations*

Seven cultural resources investigations have been conducted on the proposed license area covering the period from 1981 to the present. These investigations have been conducted in support for energy extraction activities including the data used to support the analysis in the NRC draft EIS for the Moore Ranch Uranium Project (NRC, 1982). Four historic investigations overlap the areas that could potentially be directly disturbed by the proposed action.

3.9.2.1.1 Archaeology – Identification and Evaluation

The proposed Moore Ranch Project has been subjected to three Class III surveys; two of the surveys were completed for earlier projects. In 1981, the Office of the Wyoming State Archaeologist (project #WY 56-81) completed a survey in support of Conoco's license application to the NRC for the Moore Ranch Uranium Project (Brunette, 2007). The second survey was conducted for permitting CBM wells (Brunette, 2007).

Systematic cultural resources investigations for the proposed Moore Ranch Project were conducted in 2007 (Brunette, 2007) and the results of the site file research and the archaeological survey of the project are filed under BLM Cultural Resource Use Permit (CRUP) No. 320-WY-SR05. Brunette (2007) requested or conducted site file searches in August and December 2006 and April 2007 prior to fieldwork. Archaeological surveys were conducted in phases between September 2006 and July 2007 using standard BLM-mandated survey approaches and following the general guidance provided in the State Protocol for the execution of Class III surveys.

Brunette systematically surveyed a total of 492 ha (1215 ac) using 30 m (100-ft) transects. Brunette's 2006 and 2007 surveys resulted in the relocation of Sites 48CA962 through 48CA965, 48CA967, 48CA970, the identification of seven new sites, and the recording of 25 isolated resources. Per the State Protocol between BLM and the Wyoming SHPO, isolated finds are ineligible to the NRHP and no further archaeological consideration was recommended (Brunette, 2007). Table 3-10 summarizes newly identified and relocated archaeological sites at the proposed Moore Ranch Project.

Table 3-10. Newly Identified and Relocated Archaeological Sites by Location and Site Characteristics

48CA962	Multicomponent lithic and historic scatter	To be determined through consultation with SHPO
48CA963	Multicomponent lithic and historic scatter	To be determined through consultation with SHPO
48CA964	Multicomponent lithic and historic scatter with historic feature	Eligible; as plotted, the site is outside areas proposed for development. The site would not be impacted by proposed actions as currently planned.
48CA965	Prehistoric: lithic scatter	To be determined through consultation with SHPO
48CA967	Prehistoric: lithic scatter	To be determined through consultation with SHPO
46CA970	Multicomponent lithic and historic debris scatters	To be determined through consultation with SHPO
48CA6691	Prehistoric: lithic scatter with hearth	Not eligible: the site has no potential to address significant research themes.
48CA6692	Prehistoric: lithic scatter with hearth and FCR concentration	Not eligible: the site has no potential to address significant research themes..
48CA6693	Multicomponent lithic and historic debris scatters with hearth	Not eligible: the site has no potential to address significant research themes.
48CA6694	Multicomponent lithic and historic debris scatters with shallow historic depression	Eligible: data from the site can be used to address multiple research themes. The site is outside areas proposed for development. The site would not be impacted by proposed actions as currently planned.
48CA6695	Prehistoric: lithic and FCR scatter	Not eligible: the site has no potential to address significant research themes.

Table 3-10. Newly Identified and Relocated Archaeological Sites by Location and Site Characteristics

48CA6696	Prehistoric: lithic, FCR, and groundstone scatter.	Eligible: data from the site can be used to address multiple research themes. The site is outside areas proposed for development. The site would not be impacted by proposed actions as currently planned.
48CA6697	Historic: dump	Not eligible: the site has no potential to address significant research themes.

Source: Brunette 2007

The seven newly identified cultural resources include Sites 48CA6691 through 48CA6697. Of this grouping, Brunette (2007) recommended Sites 48CA6694 and 48CA6696 as eligible to the NRHP. Brunette (2007) also relocated six previously recorded sites from the 1981 survey including area sites 48CA962 through 48CA965, 48CA967, and 48CA970. A list of newly identified and relocated sites are provided in Table 3-10. Of the newly identified and relocated sites, three were recommended eligible to the NRHP (48CA964, 48CA6694, and 48CA6696). These sites are discussed in detail in Section 3.9.3.

3.9.2.1.2 Ethnology–Identification and Evaluation

Consultation with the Tribes that have heritage interest in the proposed Moore Ranch Project 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. No response has been received indicating that traditional cultural properties or landscapes of importance occur within the proposed license area.

3.9.3 Historic Properties Listed in the National and State Registers

No cultural resources on the proposed Moore Ranch Project are currently listed in either the State of Wyoming or National Registers of Historic Places. Three sites on the proposed Moore Ranch Project were recommended eligible to the NRHP: 48CA964, 48CA6694, and 48CA6696. Two of the sites are multicomponent; Site 48CA6696 has only prehistoric artifacts.

Site 48CA964 was originally recommended eligible to the NRHP by archaeologists from the Office of the Wyoming State Archaeologist (project #WY 56-81). The site is a multicomponent, prehistoric/historic site. The site has two distinct areas separated by an intermittent drainage. The historic artifacts date from the 19th century and include solder dot cans, an oval iron ring, and a tin stove. The prehistoric component consisted of a corner-notched projectile point and chipped stone flakes. The 1981 flake types are not noted in Brunette's (2007:21) summary of the site, however the occurrence of two chert, tertiary flakes was noted during the 2007 relocation of the resource.

Site 48CA6694 is also a multicomponent prehistoric/historic site located near the central plant and proposed well fields. Historic components recovered include architectural remains of a structure and associated 20th century refuse. Prehistoric artifacts recovered include fire-cracked rock (FCR), a groundstone mano, an Eden projectile point, bifaces, unifaces, and flakes. The Eden point is representative of the late Paleoindian Cody Complex. Brunette (2007:12) notes that two of the bifaces may be Paleoindian point fragments as well. No subsurface investigations were conducted at the site so it is unknown if the FCR is associated with subsurface features. This site was recommended to be eligible to the NRHP because of its diagnostic prehistoric artifacts and the possibility that data from the site could be used to address research questions concerning settlement patterns, subsistence strategies, seasonal migration rounds, landscape evolution, and climatic reconstruction (Brunette, 2007).

Site 48CA6696 is located to the east of the proposed Moore Ranch Project. The site is prehistoric and consists of a surface scatter of artifacts including groundstone, FCR, chipped stone tools and tools. The tool assemblage lacks temporal diagnostics but does include both formed and expedient tools. The flakes recovered suggest that late stage reduction and tool maintenance may have occurred at the site. Brunette (2007) recommended the site eligible to the NRHP because dates obtained from it could be used to address research questions concerning settlement, subsistence, and landscape use strategies.

3.9.4 Tribal Consultation and Places of Cultural Significance

Consultation with Native American tribes was initiated in 2008 (see Section 3.9.2.1.2 above). No places of cultural significance have been identified by Native American tribes or others in the project area. Consultation is ongoing and will continue throughout this review.

3.10 Visual and Scenic Resources

The proposed Moore Ranch Project is located on private land; therefore, no public agency protects scenic quality. However, it is located in prairie landscape of the Powder River Basin in the vicinity of public lands that are administered by the Buffalo Field Office of the BLM. The BLM evaluates the scenic quality of the land it administers through a Visual Resource Inventory (BLM, 2007b) 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 portion of the Powder River Basin in which the proposed Moore Ranch 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 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 proposed license area is comprised of about 2,879 ha (7,110 ac) of privately owned land. The surface area affected by the proposed operation would be about 61 ha (150 acres), and would consist of the central plant, well fields, and support facilities such as warehouses and chemical storage facilities.

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

The area considered for visual resources associated with the proposed Moore Ranch Project includes the project site, access roads, and a 3.2 km (2 mi) buffer area outside of the proposed license area. Beyond this distance, any changes to the landscape would be in the background distance zone, which would either be 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

No parks, recreation areas, wilderness study areas, or residential areas occur within the proposed Moore Ranch Project. As shown in Figure 2-1, State Highway 387 traverses the northern section of the proposed project site. In addition to the highway, the project area is currently used for pastureland, rangeland, and for various types of CBM and coal and gas extraction (See Section 3.2, Land Use). These energy extraction facilities have attendant infrastructure systems including pipelines, well-fields, and utility lines that occupy land surface areas in the vicinity of the project area.

The BLM has inventoried the landscape within the Moore Ranch Project and the surrounding 3.2 km (2 mi) area and rated the areas as VRM Class IV. The management objective of VRM Class IV is to provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high, and the proposed action is compatible with these objectives.

3.11 Socioeconomics

Section 3.3.10 of the GEIS provided a socioeconomic description of the Wyoming East Uranium Milling Region, in which the proposed Moore Ranch Project is located (NRC, 2009a). This section of the SEIS provides a description of the area that could potentially be affected by the proposed action. Wyoming, and particularly the resource rich counties within the state, have been experiencing a boom in the last several years. Wyoming was ranked first in the U.S. for employment growth at 3.4 percent growth by the end of 2008. The leader in job growth was the natural resources and mining industry, which added 2,100 jobs in 2008. However the State is experiencing the effects of the global recession largely through the reduction in natural gas prices which has affected gas exploration and production (Wyoming Economic Analysis Division, 2009a). It is expected that the lower demand for electricity will also affect the coal market and thus state employment and revenue. This downturn is expected to be temporary but highlights the variability associated with employment in the extractive industries.

The proposed Moore Ranch Project is located in a rural portion of Campbell County between the small towns of Midwest and Wright. The city of Gillette is located approximately 85 km (53 miles) to the northwest of the proposed project site, and is home to over half of the Campbell County population (approximately 20,000 people). The city of Casper is located approximately 85 km (53 mi) southwest of Moore Ranch. Casper is located in Natrona County and has a relatively large resident population of approximately 50,000. The city of Douglas, located approximately 96 km (60 mi) southwest of the proposed project area, and the town of Glenrock, located approximately 77 km (48 mi) south of the proposed project area may also provide workers and housing for the proposed ISR construction and operations (NRC 2009b, US Census Bureau, 2009).

3.11.1 Demographics

Workers for the proposed ISR facility would likely come from several surrounding populations in Campbell County, as well as from areas in Converse, Johnson, and Natrona counties. The populations of these counties are as follows: Johnson County: 8,142, Converse County: 40,433, Natrona County: 71,750 (US Census, 2009).

Campbell County is home to approximately 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. The breakdown is detailed 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 (US Census Bureau, 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: US Census Bureau, 2009

3.11.2 Income

The estimated median household income in Campbell County is $67,627. Mining is the major industrial activity and accounts for over 40 percent of all earnings in Campbell County (Bureau of Economic Analysis, 2007). Campbell County is the third most expensive county in the state in which to live (Wyoming Economic Analysis Division, 2009). However when compared to the nation, the 2008 cost of living index shows Campbell County with an index score of 82.9, which is below the national average of 100 (US Census Bureau, 2009).

Unemployment has been low, typical of counties with extractive industries, ranging from 2-3 percent throughout 2008 (Wyoming Department of Employment, 2009). However those rates doubled by the first quarter of 2009 to 4.1 percent as a result of the global recession reducing demand/prices for energy.

3.11.3 Housing

According to the latest economic summary for the state, "Wyoming's housing market thrived along with the strong economy from 2002 to 2007. During this span, residential building permits more than doubled, and home prices increased nearly 70 percent, making the housing affordability degrade fast, particularly for workers in low paying industries" (Wyoming Economic Analysis Division, 2009b). The average household size is 2.9 (compared to 2.4 for the state), the higher size reflecting group living arrangements.

In general, workers locate in the largest towns nearest their work. The population centers in the area are Gillette, Casper and Buffalo. Both Gillette and Casper are located approximately 50 miles from Moore Ranch. Casper has been steadily expanding for the last 5 years, and has a large inventory of homes for sale. According to the Senior Planner for the City of Gillette, the town is currently experiencing a zero percent vacancy rate in apartments but he expects some loosening of the housing market when Basin Electric finishes construction of a power plant nearby in 2011 (Basin Electric, 2009). The smaller neighboring towns such as Wright, Midwest, and Glenrock have a low supply of available housing. Gillette is taking steps to increase the supply through annexation and water and sewer extensions (NRC, 2009a).

3.11.4 Employment Structure

The largest source of employment in Campbell County is the mining industry, which accounts for 27 percent of all jobs but 40 percent of all earnings in the county. Government related jobs are the second largest employers in Campbell, providing 13 percent of the total job force, and retail trade accounts for 10 percent of the employment. Unemployment, however, is on the rise due to the decrease in demand for energy.

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 5.0 percent in 2009 (Wyoming Department of Employment, Research and Planning, 2009).

The largest sector of employment in the state is sales and office occupations. The largest type of industry is educational, health, and social services. The largest class of worker is private wage and salary workers (U.S. Census Bureau, 2009). Wyoming was ranked first in the U.S. for year over year employment growth at 2.9 percent growth for 2008. The leader of the job growth was the Natural Resources and Mining industry, which added 2,100 jobs in 2008. There are no corporate or personal state income taxes, or inventory taxes collected in Wyoming. (WBC, 2008). However there are a variety of taxes levied on commercial enterprises (discussed below).

3.11.4.2 *County Data*

Campbell County includes approximately 12,376 square km (4,797 square miles) of land area and is home to approximately 40,433 residents, the majority of which lie in the 35-54 age group. Unemployment has been low, typical of counties with extractive industries, ranging from 2-3 percent throughout 2008 (Wyoming Department of Employment, 2009). However, as noted in Section 3.11.2, those rates doubled by the first quarter of 2009 to 4.1 percent as a result of the global recession reducing the demand/prices for energy.

3.11.5 Local Finance

The state allows, and the County does tax, 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). The County determines assessed valuation of commercial property at 11.5 percent of the market value and applies a mill levy of around 60 mills (WDOR, 2001). In addition industrial enterprise, contractor, and subcontractors operating in the state must pay a use tax to the 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).

The State has 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 and use tax for a total of 5.25 percent (Liu, 2008). The additional tax added by the county comes back directly to the county while the county only receives a portion of the 5 percent. The average property tax rate in Campbell is 6.25 percent. Property taxes on both residential and commercial property are calculated as follows: 9.5 percent of fair market value, multiplied by the average county tax rate (Wyoming Department of Revenue Excise Division, 2009). Additionally under Wyoming statute cities, towns, and counties, by voter approval, may impose an excise tax of up to 4 percent on all sleeping accommodations for guests staying less than thirty days. This tax also extends to mobile accommodations such as tents, trailers, and campers. Campbell County does not impose a lodging tax.

3.11.6 Education

The Campbell County School district, which is the third largest school district in Wyoming, currently enrolls 7,500 students. There are 24 county school facilities that include: a junior/ senior high school, a high school, an alternative transitional school, two junior high schools, 15 elementary schools, and an aquatic center.

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 is 19.2 to 1 (Campbell County School District, 2009). State student to teacher ratio for school year 2007 was 12.4 (WDE, 2007). With the slowdown of the extractive industries, it is likely that the student teacher ratio will improve temporarily.

There are two major college level institutions in Campbell County, both of which are located in Gillette; Northern Wyoming Community College, Gillette campus, and University of Wyoming/ Casper College Center, which is an outreach school from the main campus in Laramie. There are a variety of various trade and occupational schools located in Gillette as well.

3.11.7 Health and Social Services

The primary care facility in Campbell County is the Campbell County Memorial Hospital, which is located in Gillette. The hospital offers a wide variety of services including 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 (WHA, 2009). The branch clinic in Wright is located approximately 36 km (22 mi) northeast of the proposed Moore Ranch Project. The closest medical center offering full service emergency services is the Wyoming Medical Center in Casper, located approximately 87 km (54 mi) southwest of the proposed Moore Ranch Project. The shortest route from the project area is southwest on SR 387 then south on Highway 87.

The two closest police stations to the proposed Moore Ranch Project are the Midwest Police Station in Midwest and the Campbell County Police Station #9 in Wright. The stations are 38 km (23 mi) and 36 km (22 mi) distant from the project area, respectively. The Campbell County Fire Station #9 is collocated with the Campbell County Police Station #9 in Wright, and is the closest station to the proposed Moore Ranch Project. The closest waste collection and transfer stations are in or near the town of Midwest, approximately 50 km (33 mi) south of the project area. The Midwest Industrial Landfill is just north of the town of Midwest on Highway 259. There are a variety of utility service providers in the area who could supply Moore Ranch with wastewater, power and telecommunications.

3.12 Public and Occupational Health and Safety

The purpose of this section is to summarize the natural background radiation levels in and around the Moore 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 of the document 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 radiation. 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)]. 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 Part 40, Appendix A, Criterion 7, a pre-operational monitoring program was developed and implemented to establish baseline conditions at the proposed site. Results of the baseline radiological environmental monitoring provide data on background levels that can be used for evaluating future impacts from routine facility operations or from accidental or unplanned releases. The scope of the baseline program conducted for the proposed Moore Ranch Project is generally consistent with NRC's guidelines in Regulatory Guide 4.14 (NRC, 1980).

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

- An integrated gamma scan survey using gamma sensitive NaI(Tl) detectors using global positioning systems (GPS) for mapping the ambient gamma radiation levels across the site;
- Soil samples, including surface soil (top 5 cm depth), 15 cm depth samples and one-meter depth samples. All samples were analyzed for radium-226. Selected samples were also analyzed for uranium, thorium-230, and lead-210;
- Sediment samples from primary stream drainage areas and surface water impoundments;
- Ambient gamma and radon monitoring, using thermoluminescent dosimeters (TLDs) for total ambient gamma and alpha track etch dosimeters for radon;
- Airborne particulate sampling, collected weekly with quarterly composite (by location) analysis. Samples were analyzed for uranium, thorium-230, radium-226, and lead-210;
- Groundwater and surface water sampling with analysis for gross alpha and gross beta, uranium, thorium-230, radium-228, radium-226, polonium-210, and lead-210; and

- Vegetation (short grasses and clover) samples with analysis for uranium, thorium-230, radium-226, polonium-210, and lead-210.

The intent of the overland gamma survey was to characterize and quantify natural background or preoperational radiation level and radionuclide concentrations in soils throughout the proposed license area. As shown in Section 6.1.2 of the Environmental Report, the average results for measure gamma radiation are within the range of concentrations typically measured in this region of Wyoming. Elevated areas were identified by the applicant as likely attributable to their physical features, such as hilltops and exposed rock, which are known to demonstrate elevated levels of natural background radioactivity (EPA, 2006). Similar variability in surface or near-surface measurements taken at other Wyoming sites have been attributed to natural radioactivity potentially influenced by weathering factors such as erosion and/or deposition (Whicker et al., 2008).

Surface and subsurface soil samples were analyzed for radium-226, uranium, thorium-230, and lead-210. As presented in Section 6.1.3 of the Environmental Report and Addendum 2.9A, results for the surface soil samples were consistent with typical background ranges for the U.S. (EMC, 2007a). The average radium-226 concentration for surface samples from the proposed Moore Ranch Project was 1.2 pCi/g with a maximum value of 4.8 pCi/g. The average radium-226 concentration for subsurface samples was 2.5 pCi/g with a maximum value of 9.2 pCi/g.

Sediment samples collected from streambeds were analyzed for radium-226, uranium, thorium-230, and lead-210. As presented in Section 6.1.4 and Addendum 2.9A of the applicant's Environmental Report, results for the majority of the sediment samples were consistent with typical background ranges for the U.S. (EMC, 2007a). The average radium-226 concentration was 1.2 pCi/g with a maximum value of 3.1pCi/g. The uranium average was 1.9 pCi/g with a maximum value of 9.6 pCi/g. The lead-210 average was 3.3 pCi/g with a maximum value of 11 pCi/g. The thorium-230 average was 1 pCi/g with a maximum value of 3.2 pCi/g. Generally, all average values are consistent with the typical range of background concentrations (0.5 to 2 pCi/g) for these radionuclides (EMC, 2007a). Similar results were reported for pond sediment samples.

Radon samplers along with passive gamma detectors were placed in ten downwind and upwind locations and were used for baseline measurements. Twelve months of sampling results are presented in Section 6.1.5 of the applicant's Environmental Report and Addendum 2.9A (EMC, 2007a). Reported average radon-222 results for all sampling locations range between 0.1 to 1.7 picocuries per liter in air and are consistent with typical background levels. Gamma measurements collected at these same sampling locations range between 0.41 and 0.78 mSv (41 and 78.5 mrem) per quarter are consistent with typical background levels for the U.S. (NCRP, 2009).

Air particulate samples were collected at four locations over 12 consecutive months. Air samples were collected on a weekly basis to prevent dust loading the filters, composited for a given quarter, and analyzed for radium-226, uranium, thorium-230, and lead-210. Air samplers were located at the nearest resident, upwind (background) location, and selected downwind locations within the proposed license area based on NRC regulatory Guide 4.14 criteria. Results were reported in Section 6.1.6 of the applicant's Environmental Report and Addendum 2.9A and include the following (EMC, 2007a):

- Uranium: Concentrations ranged from zero (with a detection level of 1×10^{-16} microcuries per milliliter) to 7.22×10^{-16} □Ci/mL.
- Thorium-230 (Th-230): Concentrations ranged from zero (with a detection level of 1×10^{-16} □Ci/mL) to 2.14×10^{-15} □Ci/mL.
- Radium-226 (Ra-226): Concentrations ranged from zero (with a detection level of 1×10^{-16} □Ci/mL) to 8.64×10^{-16} □Ci/mL.
- Lead-210 (Pb-210): Concentrations ranged from zero (with a detection level of 2×10^{-15} □Ci/mL) to 3.59×10^{-14} □Ci/mL.

These values are within levels measured at other locations across the region and the U.S. (NCRP, 2009).

Groundwater samples were collected at eleven locations over 12 consecutive months. Water samples were collected on a quarterly frequency and analyzed for gross alpha, gross beta, radium-226, radium-228, uranium, thorium-230, polonium-210, and lead-210. Monitoring wells are located within the production and project areas based on NRC Regulatory Guide 4.14 criteria. The monitoring results are reported in Section 6.18 of the applicant's Environmental Report and Addendum 2.9A (EMC, 2007a). Except for a limited number of elevated values for radium and uranium, as may be expected for an environment with such a number of elevated uranium deposits and where there was historic drilling and exploration activity, the results were consistent with typical background levels in groundwater.

Surface water samples were collected at eleven locations over two consecutive quarters. There was insufficient water to sample during the last two quarters of the year. Water samples were collected on a quarterly frequency and analyzed for gross alpha, gross beta, radium-226, radium-228, uranium, thorium-230, polonium-210, and lead-210. Sampling locations were located within the production and project areas following NRC Regulatory Guide 4.14. The sampling results are reported in Section 6.1.9 of the applicant's Environmental Report (EMC, 2007a). Except for lead-210 and uranium, sample concentration results were either below limits of detection and/or considered consistent with the range of values for typical background measurements in surface water. Two samples from within the same drainage area had lead-210 results above the proposed EPA drinking water standard of 1 pCi/L in the Fall of 2006. One of the samples is considered an analytical error (EMC, 2007a). Follow-up samples taken 5 months later from the same sample points were below analytical reporting limits for lead-210. Most sample results identified dissolved uranium above analytical reporting limits, with some results approaching the EPA drinking water standard of 30 □g/L (approximately 20 pCi/L). These elevated uranium results appear to be the background levels for dissolved uranium in surface water for the area.

Section 6.1.10 of the applicant's Environmental Report presents results for three vegetation samples collected within the proposed license area (EMC, 2007a). Vegetation types sampled included sage brush and grasses. Samples were analyzed for radium-226, uranium, thorium-230, lead-210, and polonium-210. All results are consistent with typical background levels in vegetation.

The results of the sampling and analysis as summarized in Section 6.1 of the applicant's ER provide data suitable for describing the natural, pre-operational background radiation levels for the area surrounding the proposed facility (EMC, 2007a).

3.12.2 Public Health and Safety

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

A review of the area in and around the proposed facility indicated that there is one current and several potential uranium mining facilities:

- Smith Ranch-Highland – An operational in-situ uranium facility located approximately 58 km (36 mi) south of Moore Ranch
- Christensen Ranch-Irigaray – Located approximately 31 and 42 km (19 and 26 mi) (respectively) northwest of Moore Ranch. The Christensen Ranch site was recently granted an NRC license amendment to restart in-situ recovery operations.
- North Butte Project – Located approximately 26 km (16 mi) north of Moore Ranch, this is a satellite facility for the Smith Ranch-Highland facility. It is not currently constructed or operational.
- Ruth Project – Located approximately 21 km (13 mi) west of Moore Ranch, this is a satellite facility for the Smith Ranch-Highland facility. It is not currently constructed or operational.
- Nichols Ranch-Hank Unit – Located approximately 32 km (20 mi) northwest of Moore Ranch, this is a proposed in-situ uranium facility that is currently undergoing licensing activities.

Because of their relative distances, none of these projects are expected to cause an appreciable contribution to the background radiation exposures to individuals in the 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 proposed site.

3.12.3 Occupational Health and Safety

Occupational health and safety risks to workers from exposure to radiation are regulated by the NRC, mainly through its Radiation Protection Standards contained in 10 CFR Part 20. In addition to annual radiation dose limits, these regulations incorporate the principal of maintaining doses "as low as reasonably achievable," (ALARA) taking into consideration the purpose of the licensed activity and its benefits, technology for reducing doses, and the associated health and safety benefits. To comply with these standards, radiation safety measures are implemented for protecting workers at 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 emissions from access roads and well field activities, and various chemical used in the in-situ extraction process. Industrial safety aspects associated with the use of hazardous chemicals at the proposed Moore Ranch Project would be regulated by 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 permitted levels are discussed in Section 4.13.1.

As an industry, in-situ uranium recovery 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 (IAEA, 2001, EMC 2007a).

3.13 Waste Management

Chapter 2 of this SEIS described the types and volumes of liquid and solid waste that would be generated by the operation of the proposed Moore Ranch Project. The disposal options being considered include the use of a sanitary landfill for disposal of non-radioactive solid wastes, a licensed waste disposal site or mill tailings facility for 11e.(2) byproduct material, deep disposal wells for liquid effluent waste, and an onsite septic system for sanitary waste. No mixed waste would be generated from implementing the alternatives. As discussed in Section 2.1.1.6.3.4 of this SEIS, the proposed Moore Ranch Project is expected to be classified as a Conditionally Exempt Small Quantity Generator of hazardous waste under the Resource Conservation and Recovery Act. Section 2.1.1.6 of this SEIS discusses the expected annual waste volumes that would be generated. This section describes the disposition of the wastes that would be generated by the proposed Moore Ranch Project.

3.13.1 Solid Waste

The applicant has proposed to dispose of non-radioactive municipal solid waste in a sanitary landfill near the town of Midwest, Wyoming approximately 39 km (24 mi) from the proposed Moore Ranch Project. Solid waste generated by the proposed Moore Ranch Project would include such items as piping, valves, instrumentation, equipment, and any other items that are not contaminated or which could be successfully decontaminated (EMC, 2007b). As noted in Section 2.1.1.6.3 of this SEIS, the proposed activities would annually generate a small volume of solid waste.

3.13.2 Liquid Waste

Liquid wastes generated from operation of the proposed Moore Ranch Project would include both sanitary waste and liquid waste effluent generated by the ISR process described below.

Domestic liquid wastes from the restrooms and lunchrooms would be disposed of in an approved septic system that meets WDEQ requirements. The liquid waste effluent generated from production bleed and plant wash down water would be disposed of via deep well injection as described in Section 2.1.1.6.2 of this SEIS.

3.13.3 Radioactive Solid Wastes

The applicant has indicated the preferred destination for 11e.(2) byproduct material generated by operations of the proposed Moore Ranch Project would be the Pathfinder Mines Corp. (PMC) Shirley Basin site located approximately 213 km (132 mi) from the Moore Ranch Project although a disposal agreement has not yet been finalized (Uranium One, 2009a). The Pathfinder Mines Corp. is limited under an agreement with the WDEQ to receiving a total of 37,490 m^3 (49,000 yd^3)of waste. As discussed in Section 2.1.1.6.3.2, approximately 76 m^3 (100 yd^3) of byproduct material would be produced each year, a small fraction of the disposal capacity at the PMC site.

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4 ENVIRONMENTAL IMPACTS AND MITIGATIVE ACTIONS

4.1 Introduction

The GEIS evaluated the potential environmental impact of implementing ISR operations in four distinct geographic regions including the Wyoming East Uranium Milling Region in which the proposed Moore Ranch Project is located. This chapter evaluates the potential environmental impacts from implementing the proposed action and the No-Action Alternative at the Moore Ranch site. Other reasonable alternatives considered at Moore Ranch included an alternative site location, alternative waste disposal methods, alternate lixiviants, and conventional mining and milling at the site, and conventional mining and heap leach processing at the site, all of which have been eliminated from detailed study for the reasons explained in Section 2.2 of this SEIS and are not evaluated further.

This chapter analyzes the four lifecycle phases of ISL uranium recovery (construction, operations, aquifer restoration, and decommissioning/reclamation) at the proposed Moore Ranch Project consistent with the analytical approach used in the GEIS (NRC 2009a). The results of the GEIS impact analyses for the Wyoming East Uranium Milling Region, summarized in Table 1-1 of this SEIS, were used to focus the site-specific environmental analysis at the proposed Moore Ranch Project. If the GEIS concluded that that there could be a wide range of impacts on a particular resource area (e.g., the impacts could range from SMALL to LARGE, for example) then that resource area was evaluated in greater detail within this site-specific SEIS.

Sections 4.2 through 4.14 evaluates the impact from both the proposed action (which includes construction, operation, aquifer restoration, and decommissioning/reclamation using a Class I injection well for management of process-related liquid waste streams) and the No-Action alternative which means no ISR facility would be built and operated at the proposed Moore Ranch Project and it is assessed to provide a baseline for the comparison to the potential impacts from the proposed action.

NRC established a standard of significance for assessing environmental impacts in the conduct of environmental reviews based on the Council of Environmental Quality's regulations as discussed in NRC (2003a) and summarized below:

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

MODERATE: The environmental effects are sufficient to noticeably alter, 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.

4.2 Land Use Impacts

A potential environmental impact on land use at the proposed Moore Ranch Project could occur during all phases of the ISR facility's lifecycle. The impact could be from land disturbance as part of construction and decommissioning; grazing and access restrictions; and competing access for mineral rights. Potential impacts on land use could 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. At the end of operations all lands would be returned to their pre-mining land use of livestock grazing and wildlife habitat unless an alternative use is justified and is approved by the state and the landowner, i.e. the rancher desires to retain roads or buildings (EMC, 2007a).

Detailed discussion of the potential environmental impacts on land use from construction, operation, aquifer restoration, and decommissioning are provided for the proposed Moore Ranch Project in the following sections.

4.2.1 Proposed Action (Alternative 1)

4.2.1.1 *Construction Impacts*

Section 4.3.1.1 of the GEIS described land use impacts that could occur during construction from land disturbances (including alterations of ecological cultural or historic resources) and access restrictions that could limit 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 the restricted area, the 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. As summarized in Table 1-1, the GEIS determined that potential construction impact to land in the Wyoming East Uranium Milling Region could range from SMALL to LARGE depending on the factors described above (NRC, 2009a). The following discussion assesses the impacts at the proposed Moore Ranch Project.

Construction phase activities would have the largest direct impact on land use from drilling, trenching, excavating, grading, and surface facility construction. Disturbance from construction related activities would affect approximately 61 ha (150 ac) of the proposed Moore Ranch Project from constructing the central plant which would disturb approximately 2.4 ha (6 ac), from developing the well fields which would disturb approximately 23 ha (57 ac), and from developing the infrastructure that includes laying pipeline and constructing access roads. Topsoil would be stripped and stockpiled, and lands would be graded in the construction of access roads and central plant. The first phase of construction which would include the first of the two well fields and the central plant and ancillary facilities is estimated to last for approximately 9 months (Griffin, 2009). Livestock that currently reside within the areas proposed for development would be moved, which could temporarily alter current rangeland leases within the affected area and could affect rangeland use. However, since the potentially impacted area would be less than 2 percent of the land in the proposed license area, the existing land use in the surrounding area would not change although access to certain areas would be limited from livestock by fences, and no protected ecological or historical cultural resources would be affected the impact would be SMALL. Furthermore, the ongoing CBM activities would be unaffected by the proposed activities.

The construction of the central plant, well fields, and access roads would have the largest direct impact on current land use. The central plant would require a number of specialized contractors to complete the work and the commuting workforce would increase traffic volume and noise, disturbing the natural environment. The well field construction would limit rangeland uses as described above. CBM, oil and gas, and other exploratory drilling would be restricted from the 57 acres being developed for the well fields.

The visual presence of the pipelines and wells would also impact the natural setting. However, since the pipeline would be buried in the subsurface, this would have less of an effect on the natural setting. Close communication between Uranium One and CBM operators during the laying of pipeline would help to further minimize the potential impact on land use. While the largest direct impacts to land use would occur during the construction phase of the proposed Moore Ranch Project, the construction phase would be of short duration. Since these impacts would be temporary, the impact to land use at the proposed Moore Ranch Project would be SMALL.

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

4.2.1.2 *Operation Impacts*

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 the access restrictions during the construction phase because the infrastructure would be in place. No additional land disturbances would be expected to occur from operational activities. Since 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.

As noted in the GEIS, during the operations phase of the proposed Moore Ranch Project land use would be restricted as described in Section 4.2.1.1 of this SEIS. Livestock grazing and natural resources extraction and drilling would be restricted from the well fields and the central plant during the operations phase which is estimated to last approximately 11 years. Since the two well fields would not be mined simultaneously, active operations would shift from one well field to the next, thus limiting the impact to land and opening up the decommissioned well field for other uses such as grazing. Although the operations phase of the proposed Moore Ranch Project would be the longest phase of the ISR operation, the direct impact to land use would be less than that during either the construction or decommissioning phases of the ISR project. The impact would be SMALL.

Additionally, after its independent review of Uranium One's license application (EMC 2007a; EMC 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for land use and incorporates by reference the GEIS's conclusions that the impacts to land use during operations are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.2.1.3 *Aquifer Restoration Impacts*

Section 4.3.1.3 of the GEIS describes aquifer restoration impacts to land use (NRC, 2009a). Since aquifer restoration uses the same infrastructure that existed during operations, the land use impacts from aquifer restoration would either 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, the GEIS concluded aquifer restoration impacts to land use would be expected to be SMALL.

As noted in the GEIS, land use impacts from groundwater sweep and aquifer restoration would be similar to those during the operations phase. Wellfields would still be restricted from other uses as described in Section 4.2.1.1 of this SEIS during the aquifer restoration phase which is estimated to last for approximately 3.5 to 5.25 years for Well Fields 1 and 2, respectively (Griffin, 2009). Since these impacts would be temporary, the impact from aquifer restoration would be SMALL.

Additionally, after its independent review of Uranium One's license application (EMC, 2007a; EMC 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for land use and incorporates by reference the GEIS's conclusions that the impacts to land use during aquifer restoration are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.2.1.4 *Decommissioning Impacts*

The impact from decommissioning on land use is discussed in Section 4.3.1.4 of the GEIS. The GEIS concluded that decommissioning an ISR facility would have an impact on land use comparable to that described for the construction phase, with a temporary increase in land-disturbing activities for dismantling, removing, and disposing of facilities, equipment, and excavated contaminated soils. Access restrictions would remain until decommissioning and reclamation were completed; although a licensee could decommission and reclaim the site in stages. Reclamation of land to preexisting conditions and uses would help mitigate long-term potential impacts. For those lands administered by the BLM or other surface management agencies, other reclamation standards may also be applicable. The GEIS determined that impacts to land use during decommissioning could range from SMALL to MODERATE, and would be SMALL once decommissioning and reclamation were completed.

At the proposed Moore Ranch Project, the impact from dismantling and decontaminating the central plant, roads, and support facilities would be consistent with the conclusions reached in the GEIS. The 61 ha (150 ac) potentially disturbed as part of the proposed action (less than 2 percent of the proposed license area) would be returned to its pre-mining condition and available for other uses such as livestock grazing. Topsoil removed and stored as part of the proposed action would be replaced and areas reseeded. The areas most directly impacted would include the central plant, well fields and their infrastructure (i.e., pipeline and header houses) and access roads constructed for the proposed action. As decommissioning and reclamation proceeded, the area of disturbed land would decrease. Individual wells would be plugged and abandoned and the wellheads would remain, but would be cut flush with the ground surface and capped. Since no protected ecological resources or historic or cultural resources would be affected, the impact to land use would be SMALL

Additionally, after its independent review of Uranium One's license application (EMC 2007a; 2007b); *the site visit, meeting with federal, state, local, and tribal officials; other stakeholders;* and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to land use during decommissioning are expected to range from SMALL to LARGE. The staff concludes that site-specific impacts for the proposed Moore Ranch Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

During decommissioning surface reclamation would be performed to return disturbed land equal to pre-mining uses. All contaminated equipment and materials and structures would be removed from the site to a licensed facility for disposal or reuse. Equipment decontaminated to levels consistent with NRC requirements would be released for unrestricted use. All production, injection and monitor wells and drillholes would be abandoned in accordance with applicable WDEQ-LQD Rules and Regulations to prevent adverse impacts to groundwater quality or quantity (EMC, 2007a). Well casing would be cut off at least three feet below the ground surface. Final surface reclamation of each well field production unit would be completed after approval of groundwater restoration stability and the completion of well abandonment activities. Surface preparation would be accomplished as needed to blend any disturbed areas into the contour of the surrounding landscape (EMC, 2007a). Permanent vegetation would be established on disturbed areas (EMC, 2007a).

4.2.2 No-Action (Alternative 2)

Under the No-Action Alternative, the proposed Moore Ranch Project would not be licensed and the land would be available for other uses such as grazing and CBM and oil and gas production. No construction activities would occur so none of the 61 ha (150 ac) of land surface that could potentially be disturbed during the proposed action would not be disrupted; no access restrictions would be in-place to restrict wildlife usage. No wells would be drilled, no pipeline would be laid, and no access roads would be constructed.

There would be no operations impacts to land use since no ISR facility would have been constructed, and no subsurface injection of lixiviant would occur. The current land uses of natural resources extraction and grazing lands would continue with no access restrictions within the proposed license area as noted above. Operations impacts to current land uses from the continued CBM and oil and gas extraction activities within the study area could occur from accidental breaks or failures in equipment and infrastructure systems; however, the occurrence of such accidents is beyond the scope of this SEIS. There would be no impact from operations activities associated with the proposed Moore Ranch Project.

Under the No-Action Alternative, there would be no impact from aquifer restoration activities such as the injection, production, or monitoring of subsurface fluids since the proposed Moore Ranch project since no wells would have been drilled or well fields developed; Aquifer restoration activities that could involve the pumping of wells would not occur and there would be no impact to the current land uses.

There would be no impact to land use from decommissioning activities since the proposed Moore Ranch Project would not be developed. No buildings requiring decontamination and decommissioning would exist, no topsoil would need to be reclaimed, no land surfaces would need to be revegetated.

4.3 Transportation Impacts

Potential environmental impacts from transportation to and from an ISR facility could occur during all phases of the facility's lifecycle. Impacts would result from workers commuting to and from the site, and from the shipment of materials and chemicals used in the ISR process. Impacts could occur from fugitive dust emissions, noise, and incidental wildlife or livestock kills, increased traffic on local roads, and from the occurrence of accidents.

Detailed discussion of the potential environmental impacts from transportation to and from the proposed Moore Ranch Project during construction, operation, aquifer restoration, and decommissioning is provided in the following sections.

4.3.1 Proposed Action (Alternative 1)

4.3.1.1 *Construction Impacts*

Section 4.3.2.1 of the GEIS concluded that ISR construction activities would generate a little additional traffic (relative to local traffic counts) and would not significantly increase traffic or accidents on many of the roads in the region. Roads that have low traffic counts could be moderately impacted by the additional worker commuting traffic during periods of peak employment. Additionally, the GEIS concluded that there could be a moderate impact from fugitive dust, noise, and incidental wildlife or livestock kill on, or near, site access roads because there would be more vehicles on the road. For these reasons, the GEIS determined that the construction phase of ISR projects could result in transportation impacts that ranged from SMALL to MODERATE (NRC, 2009a). This section of the SEIS discusses the potential impact on the local transportation system from implementing the proposed action at the proposed license area.

The primary access road to the proposed Moore Ranch Project is Brown Road, a gravel road that intersects SR 387 roughly 6.4 km (4 mi) west of SR 50 and 48 km (30 mi) east of I-25 (Figure 1-1). As discussed in Section 3.3, SR 387 is the primary transportation route to the proposed license area and it connects the site to regional population and economic centers along I-25 to the west and State Highway 59 to the east. The maximum anticipated increase in vehicle traffic was estimated and tabulated for each phase of the proposed Moore Ranch Project and is summarized in Table 4-1. Vehicle traffic, as reported by the Wyoming Department of Transportation, was broken into "truck" vs. "auto." Truck traffic includes trucks that haul heavy equipment (cranes, bulldozers, graders, track hoes, trenchers, front-end loaders) to the construction site, and the average daily increase in auto traffic was estimated based on the workforce level which varies depending on the phase of the ISR project. It was conservatively assumed that there would be one employee per vehicle for each vehicle trip in the auto traffic projections. As shown in Table 4-1, during the construction phase of the proposed Moore Ranch Project there would be at most a 9.1 percent increase in daily truck traffic and a 4.8 percent increase in automobile traffic along sections of SR-387 (Uranium One, 2009a).

Brown Road, the spur road to the central plant, and access roads to the well fields would be periodically graded and cleared of snow as necessary to ensure site access was maintained. The road surfaces would be sprayed with water for dust suppression and inspected regularly for erosion and sediment control. Figure 2-2 shows the location of the proposed spur road, well field roads, and other access roads that would be required to support the proposed Moore Ranch Project.

It has been estimated that approximately 50 percent of the construction workforce (25 workers) would be based in Campbell County. Shorter commuting distances would reduce road surface wear and the likelihood of traffic accidents. Traffic interactions between commuters and tractor trailers would be minimized since heavy equipment would be transported primarily during off-peak hours.

Because of the small increase in anticipated traffic and the nine month duration of the construction phase, this phase of the proposed Moore Ranch Project was estimated to be SMALL.

Table 4-1. Estimated Traffic During the Construction Phase of the Proposed Moore Ranch Project

Section Description	Mile Route Signs	2007			Projected Volume	% Increase	Projected Volume	% Increase
	Begin*** (mile marker)	All Vehicles	Trucks	% Trucks	Trucks	Trucks	Auto traffic	Auto traffic
Johnson-Campbell County Line	118.726	1500	370	24.7	390	5.4	1162	2.8
JCT 300 (WY50 & Pinetree JCT)	131.793	890	220	24.7	240	9.1	702	4.8
JCT County Roads North & South	137.12	900	220	24.4	240	9.1	712	4.7
JCT Local Roads North & South	149.24	2000	410	20.5	430	4.9	1622	2.0
Wright	150.63	3390	480	14.2	500	4.2	2942	1.1

*Year 2007 used as base for projected traffic volume
**Travel Direction for Traffic Volume (I=increasing Mile Markers, B=Decreasing mile markers
***Begin=Mile Marker Start of Section
Construction phase traffic: Assuming a construction workforce of 10 plus 6 well field staff traveling one round trip per day to the site (32 auto traffic trips per day), and 10 truck round trips (20 trips) per day for equipment being hauled to the site.

Additionally, after its independent review of the Uranium One license application (EMC 2007a; 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to transportation during construction would range from SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Moore Ranch Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.3.1.2 *Operation Impacts*

As discussed in Section 4.3.2.2 of the GEIS, the low level of facility-related traffic would not be expected to noticeably increase traffic or the occurrence of accidents on most roads, although local less travelled roads could be moderately impacted during periods of peak employment. There could be impacts from fugitive dust emissions, noise, and possible incidental wildlife or livestock kills either on or near site access roads as described in Section 4.3.1.1 for the construction phase of ISR facilities.

The GEIS also assessed the potential for and consequence from accidents involving the transportation of hazardous chemicals and radioactive materials. The GEIS recognized the potential for high consequences from a severe accident involving transportation of hazardous chemicals in a populated area, the probability of such accidents occurring was determined to be low because of the small number of shipments, comprehensive regulatory controls, and the 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. The GEIS also estimated a low radiological risk in the unlikely event of an accident. Emergency response protocols would help to mitigate the consequences of severe accidents that involved the release of uranium. The GEIS determined that the potential environmental impact from transportation during operations could range from SMALL to MODERATE (NRC, 2009a).

The operations phase of the proposed Moore Ranch Project would last approximately 12 years and involve a peak workforce of approximately 24 employees which equates to a maximum average of 48 auto trips per day conservatively assuming one employee per vehicle per one-way vehicle trip (Uranium One, 2009a). Truck traffic during this phase of the proposed Moore Ranch Project would include yellowcake shipments, shipment of 11(e)2 byproduct material, and the shipment of solid waste, and regular operation deliveries. The highest levels of project-related automobile traffic would be from the operations workforce commuting to and from the site. The maximum anticipated increase in vehicle traffic on SR 387 was estimated for the operations phase of the proposed Moore Ranch Project as summarized in Table 4-2. The maximum expected increase in truck and automobile usage of SR 387 was estimated at 0.5 and 7.2 percent, respectively, during the operations phase.

Onsite road maintenance during the operations phase would consist of periodic grading of the primary access roads, snow plowing, applying water or other agents for to control fugitive dust emissions, and regular inspections to ensure the adequacy of erosion control measures.

Section 4.2.2.2 of the GEIS evaluated yellowcake transportation assuming shipment volumes that ranged from 34 – 145 yellowcake shipments per year which could result in a risk of 0.04 and 0.003 latent cancer fatalities if an accident were to occur given the larger number of shipments (NRC, 2009a). The annual production rate of yellowcake at the proposed Moore Ranch Project, the annual production rate for yellowcake was estimated at 40,000 pounds per year which would result in a total maximum of 100 shipments per year or an average of one shipment every 3.6 days (Uranium One, 2009a). Therefore, the shipment of yellowcake at the proposed Moore Ranch Project is bounded by the GEIS analyses and the number of shipments would not significantly affect the project-related traffic relative to the expected commuting workforce. Therefore, the environmental impact from transportation during the operations phase of the proposed Moore Ranch Project are consistent with the assumptions stated in the GEIS and would be expected to be SMALL.

Table 4-2. Estimated Traffic During the Operations Phase of the Proposed Moore Ranch Project

Section Description	Mile Route Signs	2007			Projected Volume	% Increase	Projected Volume	% Increase
	Begin*** (mile marker	All Vehicles	Trucks	% Trucks	Trucks	Trucks	Auto traffic	Auto traffic
Johnson-Campbell County Line	118.726	1500	370	24.7	371	0.3	1178	4.2
JCT 300 (WY50 & Pinetree JCT)	131.793	890	220	24.7	221	0.5	718	7.2
JCT County Roads North & South	137.12	900	220	24.4	221	0.5	728	7.1
JCT Local Roads North & South	149.24	2000	410	20.5	411	0.2	1638	3.0
Wright	150.63	3390	480	14.2	481	0.2	2958	1.6

*Year 2007 used as base for projected traffic volume
**Travel Direction for Traffic Volume (I=increasing Mile Markers, B=Decreasing mile markers
***Begin=Mile Marker Start of Section

Operational phase traffic: Assuming a site workforce of 24 (48 auto traffic trips per day),and 1.12 average total truck trips per day (yellowcake shipments= 100 round trips per year or 200 truck trips/year= .548 trips/day; non radioactive waste shipments= 100 round trips/year or 200 trucks trips/year= 0.548 trips/day; radioactive byproduct waste shipments = 5 round trips/year or 10 trips/year= 0.027 trips/day.

The GEIS reported that accidents involving yellowcake releases result in about 30 percent of shipment contents being released which is less than the fraction used in the above calculation (NRC, 2009a). To minimize the risk of an accident involving either resin or yellowcake transport, all such materials would be transported in accordance with the USDOT and NRC regulations, handled as low-specific activity materials, and shipped using exclusive use only vehicles. Only properly licensed and trained drivers would transport low-specific activity materials.

Uranium One would be required to develop an emergency response plan for yellowcake and other transportation accidents that could occur either during shipment to or from the proposed Moore Ranch Project and would ensure their personnel received proper emergency response training.

Emergency response protocols would include communication equipment and emergency spill kits on each vehicle and emergency response kits at shipping and receiving facilities. Yellowcake shipments would be made in accordance with U.S. Department of Transportation and NRC regulations (EMC, 2007a). Section 5.2 of the Moore Ranch ER (EMC, 2007a) and Section 7.5.5 of the TR (EMC, 2007b) provides additional details on Uranium One's emergency response plan.

It is estimated that approximately four bulk chemical, fuel, and supply deliveries would be made per day throughout the operations phase of the proposed Moore Ranch Project (Uranium One, 2009a). The incoming process chemicals are commonly used in industrial applications and their transport would be made in accordance with the applicable U.S. Department of Transportation hazardous materials shipping provisions. Similarly, the transport of low level radioactive 11e.(2) by-products or contaminated equipment poses minimal environmental impact in the event of an accident. Trip frequency and the associated risk of accident would be curtailed by storing 11e.(2) waste in a restricted area within the central plant until such time that a full shipment could be transported for disposal. The applicant has estimated an annual production rate of 76.5 m^3 (100 yd^3) for 11e.(2) byproduct material. Based on the use of roll-off containers with a nominal capacity of 15.3 m^3 (20 yd^3), there would be 5 shipments to a licensed disposal facility. Shipments of non-radioactive waste to the Midwest-Edgerton landfill would be required approximately twice a week.

Additionally, after its independent review of Uranium One's license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that transportation impacts during operations would range from SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Moore Ranch Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.3.1.3 *Aquifer Restoration Impacts*

Section 4.3.2.3 of the GEIS estimated that the magnitude of transportation activities during aquifer restoration would be lower than that for the construction and operations phases of an ISR facility. Aquifer restoration-related transportation activities would primarily be limited to supply shipments, chemical waste shipments, onsite transportation and employee commuting. The GEIS concluded that transportation impacts from the aquifer restoration phase of an ISR facility could range from SMALL to MODERATE if the roads traveled had less traffic (NRC, 2009a).

At the proposed Moore Ranch Project, the transportation impacts during aquifer restoration were estimated to be the same as that described for operations phase, but less than that which would occur during the construction phase of the proposed Moore Ranch Project. The maximum anticipated increase in vehicle traffic on SR 387 was estimated for the aquifer restoration phase as summarized in Table 4-3. The expected increase in truck and automobile usage of SR 387 was estimated at 0.5 and 7.2 percent, respectively, during the aquifer restoration phase (Uranium One, 2009a). Therefore, transportation impacts during the aquifer restoration phase would be expected to be SMALL.

Additionally, after its independent review of Uranium One's license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that transportation impacts during aquifer restoration would range from SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Moore Ranch Project would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

Table 4-3. Estimated Traffic During the Aquifer Restoration Phase of the Proposed Moore Ranch Project

Section Description	Mile Route Signs	2007			Projected Volume	% Increase	Projected Volume	% Increase
	Begin*** (mile marker	All Vehicles	Trucks	% Trucks	Trucks	Trucks	Auto traffic	Auto traffic
Johnson-Campbell County Line	118.726	1500	370	24.7	371	0.3	1178	4.2
JCT 300 (WY50 & Pinetree JCT)	131.793	890	220	24.7	221	0.5	718	7.2
JCT County Roads North & South	137.12	900	220	24.4	221	0.5	728	7.1
JCT Local Roads North & South	149.24	2000	410	20.5	411	0.2	1638	3.0
Wright	150.63	3390	480	14.2	481	0.2	2958	1.6

*Year 2007 used as base for projected traffic volume
**Travel Direction for Traffic Volume (I=increasing Mile Markers, B=Decreasing mile markers
***Begin=Mile Marker Start of Section

Aquifer restoration phase traffic: Assuming a site workforce of 24 (48 auto traffic trips per day) and maximum of 1.12 truck trips per day (using production truck traffic data).

4.3.1.4 *Decommissioning Impacts*

Section 4.3.2.4 of the GEIS concluded that the types of transportation activities that would occur during decommissioning would be similar to those which occurred during the construction and operation phases of an ISR facility, except that the magnitude of transportation activities (e.g., number and types of waste and supply shipments, no yellowcake shipments) could be lower than that during operations (NRC, 2009a). Therefore, the potential impact would be smaller. The accident risk from transportation during decommissioning would be bounded by the yellowcake transportation risk during operations. The GEIS concluded that the potential environmental impact from transportation activities during the decommissioning phase would be SMALL because fewer transportation activities would occur.

The site-specific analysis at the proposed Moore Ranch Project was in agreement with the GEIS conclusions. The maximum anticipated increase in vehicle traffic on SR 387 was estimated for the decommissioning phase as summarized in Table 4-4. During the decommissioning phase, the maximum expected increase in automobile usage of SR 387 was estimated at 1.5 percent, while the increase in truck traffic would not be noticeable. Based on the foregoing analysis, the site-specific conditions were determined to be consistent with the assumptions stated in the GEIS. Therefore, transportation impacts during the decommissioning phase of the proposed Moore Ranch Project would be expected to be SMALL.

Table 4-4. Estimated Traffic During the Decommissioning Phase of the Proposed Moore Ranch Project

Section Description	Mile Route Signs	2007			Projected Volume	% Increase	Projected Volume	% Increase
	Begin*** (mile marker	All Vehicles	Trucks	% Trucks	Trucks	Trucks	Auto traffic	Auto traffic
Johnson-Campbell County Line	118.726	1500	370	24.7	370	0.0	1140	0.9
JCT 300 (WY50 & Pinetree JCT)	131.793	890	220	24.7	220	0.0	680	1.5
JCT County Roads North & South	137.12	900	220	24.4	220	0.0	690	1.5
JCT Local Roads North & South	149.24	2000	410	20.5	410	0.0	1600	0.6
Wright	150.63	3390	480	14.2	480	0.0	2920	0.3

*Year 2007 used as base for projected traffic volume
**Travel Direction for Traffic Volume (I=increasing Mile Markers, B=Decreasing mile markers
***Begin=Mile Marker Start of Section

Decommissioning phase traffic: Assuming a site workforce of 5 (10 auto traffic trips per day) and 1 truck round trip per week (2 truck trips per week= 0.285 trips/day) for equipment and waste shipments.

All well field access roads would be reclaimed during project decommissioning and subsequent to the completion of any required monitoring. The primary gravel access road joining the central plant to Brown Road would be left in place for future use.

Additionally, after its independent review of Uranium One's license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for transportation and incorporates by reference the GEIS's conclusions that the impacts to transportation during decommissioning are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.3.2 No-Action (Alternative 2)

Under the No-Action Alternative, traffic volumes and patterns would remain the same as described in Section 3.3 of this SEIS. There would be no transportation of materials to and from the site to support licensed activities. There would be no transportation of either radioactive or solid waste attributable to the proposed action since the facility would neither be licensed nor constructed and operated. The current transportation activities to support ongoing CBM and oil and gas exploration and production activities would continue. Land use activities would persist and perhaps intensify, including oil and gas extraction and grazing. Two companies have active CBM claims within the proposed license area.

4.4 Geology and Soils Impacts

Potential environmental impacts to geology and soils could occur during all phases of the Moore Ranch ISR Facility lifecycle. However, these impacts would largely be concentrated during the construction phase of the project.

4.4.1 Proposed Action (Alternative 1)

4.4.1.1 *Construction Impacts*

Section 4.3.3 of the GEIS indicated that during construction of ISR facilities, the principal impacts on geology and soils would result from earthmoving activities associated with constructing surface facilities, access roads, well fields, and pipelines (NRC, 2009a). Earthmoving activities that could impact soils would include the clearing of ground or top soil and preparing surfaces for the processing plant, satellite facilities, pump houses, access roads, drilling sites, and associated structures. Similarly, excavating and backfilling trenches for pipelines and cables could impact soils in the project area.

The GEIS indicated that the impact of construction activities on geology and soils would 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, earthmoving activities would result in only SMALL and temporary (months) disturbance of soils-impacts that are commonly mitigated using accepted best management practices. Construction activities would also increase the potential for erosion from both wind and water due to the removal of vegetation and the physical disturbance from vehicle and heavy equipment traffic. However, these activities would result in SMALL impacts if equipment operators adopt construction best management practices that prevent or substantially reduce erosion (NRC, 2009a).

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

At the proposed Moore Ranch Project, a maximum of 61 ha (150 ac) out of the 2879 ha (7110 ac) license area or approximately 2 percent of the total license area would be disturbed by the proposed action. Soil disturbance would be primarily limited to the central plant area, the well fields, access roads, and from the development of the drill sites and laying pipeline. These disturbances would be temporary since affected areas would be restored and reclaimed as described in Section 2.1.1.5 of this SEIS.

Topsoil removed from areas to be disturbed by the proposed action (i.e., the central plant and well field header houses) would be removed from these areas prior to the construction of these facilities and stored in designated topsoil stockpiles. Conventional rubber-tired, scraper-type earth moving equipment would typically be used to accomplish such topsoil salvage operations. Stockpiles would generally be located on the leeward side of hills to minimize wind erosion and drainage channels or other locations that could result in a loss of material would be avoided. Large stockpiles could be surrounded by a berm to control sediment runoff and seeded with wheatgrass to minimize sediment runoff.

The interpretation of soil mapping conducted across the Moore Ranch Project site indicates the potential for water erosion (see Sec. 3.4.2 of the SEIS) varies from slight to severe and the potential for wind erosion varies from moderate to severe (EMC, 2007a). Soils across the

Moore Ranch Project are more prone to wind erosion because of their fine loamy and sandy texture and the semi-arid climate. Within the 2.4-ha (6-ac) fenced area where the central plant would be located, the underlying soils have a slight potential for water erosion and a severe potential for wind erosion. The soils within the proposed well fields have a moderate to severe risk from both wind and water erosion.

Mitigation measures would be taken to minimize soil impacts including reestablishing temporary or permanent native vegetation as soon as possible after disturbance and implementing best management practices to retain sediment within the disturbed areas to include silt fencing or retention ponds, for example (Uranium One, 2009b). Roads would be constructed to minimize erosion by surfacing with a gravel road base, constructing stream crossings at right angles using adequate embankment protection and culvert installation, and by providing adequate road drainage with runoff control structures.

During well field construction, drilling activities and the installation of piping would impact soils since mud pits would be used during drilling activities. Approximately 850 wells would be drilled in the development of Wellfields 1 and 2. Excavating mudpits would entail first removing topsoil and then placing it in a separate location. The subsoil would then be removed and deposited next to the mud pit. After use of the mud pit was complete (usually within 30 days of initial excavation), the subsoil would then be redeposited in the mud pit and topsoil replaced on top. Pipeline ditch construction would follow a similar sequence, 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, the implementation of the best management practices, and the short duration of the use of mudpits, the potential environmental impacts to geology and soils from construction activities at the proposed Moore Ranch Project would be SMALL.

Additionally, after its independent review of Uranium One's license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for geology and soils and incorporates by reference the GEIS's conclusions that the impacts to geology and soils during construction are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.4.1.2 *Operation Impacts*

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

The removal of uranium from the target sandstones during ISR operations would result in a permanent change to the composition of uranium-bearing rock formations. However, the uranium mobilization and recovery process in the target sandstones does not result in the removal of rock matrix or structure and, therefore, no significant matrix compression or ground subsidence is expected. Therefore, the GEIS concluded the impacts on geology from ground subsidence at ISR projects are expected to be SMALL (NRC, 2009a).

Section 4.3.3.2 of the GEIS also indicated soils could be impacted from ISR operations if pipelines were to leak during transfer of barren and pregnant uranium-bearing lixiviant to and from the processing facility in aboveground and underground pipelines. If a pipe ruptured or failed, lixiviant could 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. If spills from pipeline leaks and ruptures occur, licensees would be expected to establish immediate spill responses through onsite standard operation procedures established ahead of time (*e.g.*, NRC, 2003b, Section 5.7). As part of the monitoring requirements at ISR facilities, licensees must report certain spills to the NRC within 24 hours. Licensees in the State of Wyoming must also comply with applicable WDEQ requirements for spill response and reporting.

Based on these considerations, the GEIS (Section 4.3.3.2) 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 would be temporary, and the overall long-term impact to soils would be expected to be SMALL.

The response to surface releases would be discussed in a Spill Contingency Plan developed for the site (EMC, 2007a). Potential failures of process tanks would be contained within the central plant because it would be designed to drain to a sump to transfer spilled solutions to appropriate tankage or the waste disposal system. As noted above, the potential also exists for a release from breaks, leaks, or separations within the piping system that transfers fluids between the central plant and the well field. These types of releases would generally be small because engineering controls would be used to detect pressure changes in the piping system and an alarm system would alert the plant operator. The program to program to monitor well field and pipeline flow and pressure is discussed in Chapter 6. If a release were to occur, the applicant would be required to remediate the release, remove contaminated soils and dispose of contaminated materials at a licensed disposal facility.

Based on these considerations, the potential environmental impacts to soils from spills during operation at the proposed Moore Ranch Project could range from SMALL to LARGE depending on whether a release occurred and the volume of soil potentially affected. The central plant and and shop buildings would be self-contained and all exterior chemical and fuel tanks would have secondary containment (Uranium One, 2009b). Because of the design of the central plant which includes containment, the regulatory requirement for immediate response at ISR facilities, spill recovery actions, and the required routine monitoring programs, the impact from a potential spill would be temporary, and the long-term impact to soils would be expected to be SMALL consistent with GEIS conclusions.

The planned mining operations at the Moore Ranch Project would not remove rock matrix; therefore no significant matrix compression or ground subsidence would be expected since the volume of fluid (bleed) withdrawn from the formation would be typically be one percent or less. No subsidence would result from the collapse of overlying rock strata in the mining zone. No other geologic impacts are anticipated to occur during the ISR mining at the Moore Ranch site. Therefore, the potential environmental impacts from subsidence during operations would be expected to be SMALL.

Additionally, after its independent review of Uranium One's license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for geology and soils and incorporates by reference the GEIS's conclusions that the impacts to geology and soils during construction are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.4.1.3 *Aquifer Restoration Impacts*

Section 4.3.3.3 of the GEIS describes aquifer restoration which typically uses 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 (NRC 2009a). The groundwater sweep and recirculation process does not remove rock matrix or structure and, therefore, no significant matrix compression or ground subsidence would be expected. The water pressure in the aquifer is decreased during restoration. A negative water balance is maintained in the well field being restored to ensure that water flows into the well field from its edges, thus reducing the potential spread of contamination. However, the change in reservoir pressure is limited by the recirculation of treated groundwater; therefore, it is very unlikely that ISR operations would reactivate any local faults and extremely unlikely that any earthquakes would be generated. Therefore, in the Wyoming East Uranium Milling Region, where the Moore Ranch site is located, the potential impact on the geology from aquifer restoration would be SMALL.

The potential for and handling of a surface release would be comparable to that described during the operations phase as described in Section 4.4.1.2 of this SEIS. Therefore, the potential impact to soils from spills could range from SMALL to LARGE depending on the magnitude of the spill and the volume of affected soil. Because of the design of the facility which includes containment, the regulatory requirements for immediate responses at ISR facilities, spill recovery actions, and routine monitoring programs, the potential impact from a spill would be expected to be temporary and the long-term impact to soils would be SMALL. Likewise, the spill and leak detection program implemented during operations would be followed during aquifer restoration and the potential environmental impacts to soils from spills would be expected to be SMALL. Because of the required immediate response, the spill recovery actions, and the routine monitoring programs, impacts from spills would be temporary and the long-term impact to soils would be expected to be SMALL.

Since the planned mining operations at the Moore Ranch Project would not remove rock matrix; no significant matrix compression or ground subsidence would be expected since the volume of fluid (bleed) withdrawn from the formation would be typically be one percent or less and no subsidence from collapse of the overlying rock strata in the mining zone would be expected to occur consistent with the assumptions in the GEIS. Therefore, the potential for subsidence during aquifer restoration would be expected to be SMALL.

Additionally, after its independent review of Uranium One's license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for geology and soils and incorporates by reference the GEIS's conclusions that the impacts to geology and soils during construction are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.4.1.4 *Decommissioning Impacts*

Section 4.3.3.4 of the GEIS discussed decommissioning of ISR facilities which 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 could begin, the licensee would be required to submit to NRC a decommissioning plan for review and approval. Any areas potentially impacted by operations would be included in surveys to ensure all areas of elevated soil concentrations are identified and properly cleaned up to comply with NRC regulations at 10 CFR Part 40, Appendix A, Criterion 6-(6) (NRC, 2009a).

The GEIS concluded that most of the impacts to geology and soils from decommissioning would be detectable but SMALL. Disruption and/or displacement of existing soils would be relatively slight. Changes in the amount and location of impervious surfaces would be measurable but would not be at a great enough scale to noticeably alter existing natural conditions (NRC, 2009a).

During the decommissioning phase of the proposed Moore Ranch Project, all lands that were disturbed would be restored to their pre-mining land use of livestock grazing and wildlife habitat. The central plant and storage facilities would be decontaminated as required to meet regulatory standards, and either demolished and disposed of or turned over to the land owner if desired. Baseline soils, vegetation, and radiological data would be used to guide and evaluate final reclamation. Twelve months prior to the planned decommissioning of either a well field or portion of the project, a decommissioning plan would be sent to the NRC for review and approval (NRC, 2003b).

Short-term impacts to soil could occur as reclamation progressed; however, the outcome of this phase of the proposed Moore Ranch Project would be to return the area to pre-mining land use. Based on the above analysis, site-specific conditions are consistent with the GEIS conclusions. Therefore, the potential environmental impacts to geology and soils associated with decommissioning the proposed Moore Ranch Project would be detectable but SMALL.

Additionally, after its independent review of Uranium One's license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for geology and soils and incorporates by reference the GEIS's conclusions that the impacts to geology and soils during construction are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.4.2 No-Action (Alternative 2)

Under the No-Action Alternative, neither the soils would be disturbed from earthmoving activities nor would the subsurface geology potentially be affected by the injection of fluids because no license would be issued to authorize construction, operations, aquifer restoration, and decommissioning of the proposed Moore Ranch Project. No buildings would be constructed, no wells would be drilled, no well fields would be developed including laying pipeline to connect the well fields to the central plant, thus no soils would be disturbed from earthmoving activities that could change the existing topography.

Grazing and CBM operations in the proposed license area would continue which could produce localized impacts to soil and the existing topography, but there would be no impact from the proposed action.

4.5 Water Resources Impacts

4.5.1 Surface Water and Wetlands Impacts

Potential environmental impacts to surface water at the proposed Moore Ranch Project would be limited because of the lack of surface water bodies and because the channels at the site have intermittent flow depending on the amount of precipitation and the volume of CBM discharges in the area. Surface water could potentially be impacted during all phases of the ISR facility lifecycle. Impacts could result from road construction and crossings, erosion runoff, spills or leaks of fuel and lubricants, stormwater discharges, and potentially process-related fluids, and discharge of well field fluids as a result of pipeline or well head leaks.

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

4.5.1.1 *Proposed Action (Alternative 1)*

Section 4.3.4.1.1 of the GEIS identified potential impacts to surface water and wetlands that result from construction of road crossings, filling, erosion, runoff, spills or leaks of fuels and lubricants for construction equipment. These potential impacts would be mitigated through proper planning, design, construction methods, and best management practices. U.S. Army Corps of Engineers (USACE) permits could be required when filling and crossing of jurisdictional wetlands. The GEIS concluded 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. The GEIS also noted that even though accidental spills of drilling fluids could flow into surface water bodies, these flows would be temporary and mitigated. The GEIS concluded that construction impacts to surface water would be SMALL in most cases, but could potentially be MODERATE if a USACE permit was required.

4.5.1.1.1 Construction Impacts

As noted in Section 2.1.1.2 of this SEIS, the ground surface at the proposed Moore Ranch Project would be disturbed during construction to build the central plant, to develop the well fields (which would include both laying pipeline and drilling the wells), constructing the access roads and installing electric lines. Section 3.5.1 and Figure 2-2 of this SEIS shows the location of these activities with respect to the intermittent channels and potential wetlands located on the proposed Moore Ranch Project. As can be seen from Figure 2-2, only activities at Wellfield 2 would likely have the potential to impact Upper Wash #2 to Simmons Draw as identified on Figure 3-10 since this intermittent channel bisects the proposed well field. Construction work would occur during the summer and fall months when the intermittent channels were dry. Furthermore, as noted in Table 1-2 of this SEIS, Uranium One would obtain construction and industrial stormwater National Pollutant Discharge Elimination System (NPDES) permits in accordance with Wyoming Department of Environmental Quality regulations. Best management practices would be implemented to reduce potential erosion impacts according to the stormwater management plans that would be developed for those permits (EMC, 2007a).

The central plant and support buildings would be constructed landward of all intermittent channels and above their peak flood elevation. The specific plant location was chosen because of the relatively flat terrain and the minimum amount of soil movement that would be necessary to create a level pad. Surface water runoff from precipitation (rain and snowmelt) would flow from the central plant area to natural drainages. Furthermore, the central plant and chemical and fuel tanks would be located within a bermed area to provide secondary containment (Uranium One, 2009b). Locally, surface water drainage would be directed away from facilities, roads, and topsoil stockpiles using shallow ditches and/or berms (Uranium One, 2009b).

One culvert would be installed during the development of the site access roads to maintain existing site surface drainage conditions (Uranium One, 2009b) This culvert would be located on the access road connecting the central plant to the main access road. The new temporary access roads to Wellfields 1 and 2 cross an intermittent channel at several locations in Wellfield 2 as noted above. Within this impacted area, there would be no new road crossings. However, there would be one trunkline pipe crossing and 14 small (approximately 1-in.) diameter pipeline crossings to connect individual injection and production wells to a header house. The small lines would be combined into common trenches wherever possible (Uranium One, 2009b). Vehicles would only cross channels if either there was low flow or the channels were dry (Uranium One, 2009b). The existing culvert crossings would be used when the channels were flowing. Sedimentation and erosion control measures would be implemented to minimize surface water runoff into channels, and disturbed soil would be re-seeded (Uranium One, 2009b).

The placement of wood poles to support power lines installed to transmit electricity to the central plant and other facilities would be installed landward of any intermittent channel and during the development of Wellfield 2, no wells would be installed in existing ponds and the placement of wells directly within the channel, washes, and delineated wetlands would be avoided, if possible (Uranium One, 2009b). If this were not possible, then the wells would be installed during the dry season, and erosion and sedimentation control measures would be implemented to mitigate the impact. For a well located in an intermittent channel, pumped water released directly into the channel would be expected to be quickly absorbed into the soil when the channel was dry. The wellhead would be designed to withstand intermittent flows. Measures would be taken to stabilize loose soil such as re-seeding and mulching.

As noted in Section 2.1.1.2.4 of this SEIS, nearly a mile and a half of pipeline would be laid in support of the development of the proposed Moore Ranch Project. The installation of this pipeline would bisect non-jurisdictional wetlands and intermittent channels at several locations within the Upper Wash Tributary to Simmons Draw. An estimated eight well field patterns would be partially or fully within the wetland area in the Upper Wash Tributary to Simmons Draw, including approximately seven production wells and six injection wells (Uranium One, 2009b). Ponds would be avoided where possible and the work would be performed when the channels were dry using small scale excavation equipment that would create a narrow, shallow trench. Excavated native soil would be returned to the trench at the pre-existing grade after the pipes had been installed to restore the channel to the original condition. Exposed soil would be re-seeded and mulched for stability (Uranium One, 2009b).

A single trunkline would be installed that connects the pipeline network to the header houses. This trunkline would be located in uplands, and would not bisect any tributary washes or channels. After the trunkline was installed, the soil would be backfilled to pre-construction contours and seeded with native grass seed to stabilize loose soil. If an accidental spill were to occur during the construction phase of the proposed Moore Ranch Project it would be promptly mitigated in accordance with the site-specific emergency response plan.

The proposed construction activities described above would have the potential to generate a limited amount of surface water runoff and since the occurrence of surface water at the proposed Moore Ranch Project is very limited and flow is intermittent in the channels, NRC staff concluded the potential impact to surface water and wetlands from the construction phase of the proposed Moore Ranch Project would be SMALL.

Additionally, after its independent review of Uranium One's license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for surface water and wetlands and incorporates by reference the GEIS's conclusions that the impacts to surface water and wetlands during construction would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.5.1.1.2 Operation Impacts

Section 4.3.4.1.2 of the GEIS stated that federal and state agencies regulate the discharge of both stormwater runoff and the discharge of wastewater to surface waters through their permitting process (NRC, 2009a). The potential impact from these discharges would be mitigated through conditions imposed in their operating permits. The expansion of facilities or the addition of pipeline during the operations phase would be expected to result in impacts similar to that seen during the construction phase described in Section 4.5.1.1.1. If a spill occurred, the potential impact would depend on the size of the spill, the success of remediation, the proximity to and use of surface water, and the relative contribution of aquifer discharge to surface water. For these reasons, the GEIS concluded that impacts to surface waters during operations could range from SMALL to MODERATE.

No impact to surface water would be expected during the operations phase of the proposed Moore Ranch Project since no permitted discharge of wastewater to surface waters would occur, the infrastructure would be in place to manage stormwater discharge, no large earthmoving activities that could generate surface water runoff would occur, and as discussed above the occurrence of surface water within the proposed license area is very limited and surface water flow in the channels and washes occurs intermittently. Lixiviant injection and subsequent extraction of the uranium-rich groundwater would occur within a closed and pressurized system of pipes at or near the ground surface. Processing of the uranium into yellowcake would be performed within the enclosed central plant. Accidental spills would be collected and maintained in storage tanks for later disposal via deep well injection and a spill prevention and response plan would be in place.

The central plant would be constructed on a concrete slab surrounded by a protective berm to control accidental spills. A stormwater management plan would be implemented in accordance with WDEQ requirements to detain or treat runoff from the central plant. Runoff would be diverted away from the facility, where it would be absorbed in the soil. No wastewater discharge to surface water channels would occur.

Because of the limited occurrence of surface water at the proposed Moore Ranch Project, the construction of the central plant to minimize potential spills, the requirements of the stormwater permit and stormwater management plan, and the implementation of a site-specific emergency response plan to address accidental spills, the potential impact to surface water from the operations phase of the proposed Moore Ranch Project was determined to be SMALL.

Additionally, after its independent review of Uranium One's license application (EMC, 2007a: EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for surface water and wetlands. The GEIS concludes that impacts to surface water and wetlands could range from SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Moore Ranch Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.5.1.1.3 Aquifer Restoration Impacts

Section 4.3.4.1.3 of the GEIS identified aquifer restoration activities that could potentially impact surface water (NRC, 2009a). These activities included management of produced water, stormwater runoff and accidental spills, and management of brine reject from the reverse osmosis system. The GEIS concluded the potential impacts from these activities would be similar to the impacts that would occur during the operational phase because the same infrastructure and similar activities would be occurring (e.g., well field operation, transfer of fluids, water treatment, stormwater runoff). For these reasons, the GEIS determined aquifer restoration impacts to surface water and wetlands could range from SMALL to MODERATE.

The aquifer restoration phase at the proposed Moore Ranch Project would generate wastewater that would be disposed of via deep well injection. Automated sensors would monitor the injection process to detect potential leaks or pipe/well ruptures that could result in a surface discharge. No wastewater would be discharged to surface water; therefore, a SMALL impact to surface water would be expected during the aquifer restoration phase of the proposed Moore Ranch Project.

Additionally, after its independent review of Uranium One's license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to surface water and wetlands during the aquifer restoration phase could range from SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Moore Ranch Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.5.1.1.4 Decommissioning Impacts

Section 4.3.4.1.4 of the GEIS discussed impacts from the decommissioning phase of an ISR project and concluded the impacts from this phase would be similar to the impacts from construction (NRC, 2009a). The clean up, recontouring, and reclamation of disturbed lands during decommissioning would be expected to mitigate any long-term impacts to surface water. The GEIS concluded that the potential impacts to surface water from decommissioning could range from SMALL to MODERATE depending on the site-specific conditions.

During the decommissioning phase of the proposed Moore Ranch Project, the central plant, storage facilities, and pipelines would be removed. The wells would be plugged and abandoned. The impact from the removal of the building and infrastructure would have impacts similar to those described in Section 4.5.1.1.1.

Temporary soil disturbances would occur during building and pipeline removal. This work would require the temporary soil disturbance within the channel that bisects Wellfield 2 and would be conducted during the dry season to minimize potential sedimentation. The stockpiled topsoil 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.

Areas disturbed during the decommissioning phase would be graded to pre-construction contours and seeded with a native seed mix in accordance with a restoration plan approved by the WDEQ. Access roads that would not continue to be used would be reclaimed and restored in a similar manner.

The proposed decommissioning activities described above would have the potential to generate a limited amount of surface water runoff; since the occurrence of surface water at the proposed Moore Ranch Project is very limited and flow is intermittent in the channels, the potential impact to surface water and wetlands from the decommissioning phase of the proposed Moore Ranch Project was determined to be SMALL. Furthermore, the mitigative measures described in Section 4.5.1.1.1 would also be implemented during the decommissioning phase.

Additionally, after its independent review of Uranium One's license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to surface water and wetlands during the decommissioning phase could range from SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Moore Ranch Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.5.1.2 *No-Action (Alternative 2)*

Under the No-Action Alternative, there would be no impact to surface water features from the construction and operation of the proposed Moore Ranch Project. The current land use in the proposed license area is primarily livestock ranching and CBM activities as discussed in Section 3.2.1.3 of this SEIS. There are no residences and no recreational activities that occur on the proposed license area. The combination of the ranching and CBM activities could result in specific actions that could potentially affect surface water features.

The proposed Moore Ranch Project has an existing network of gravel and two-track roads for access to ranching and CBM facilities which cross channels and washes at various locations. Under the No-Action Alternative, these two-track roads would continue to be used in their current conditions resulting in localized fugitive dust emissions that could potentially settle on surface water features. Under the No-Action Alternative there would be no impact to surface water quality from the proposed Moore Ranch Project since the facility would not be licensed and the central plant, well fields, additional access roads, or pipeline would not be laid.

Livestock would continue to graze in channels and washes and would have unrestricted access to those channels and washes that would have limited access under the proposed action. The CBM production in the proposed license area would continue and the 61 ha (150 ac) that would be restricted from CBM production under the proposed action would be available for production or for other uses. Under the No-Action Alternative, the 31 CBM wells located on the proposed license area would continue to operate and discharge surface water to channels and washes via outfalls permitted through the State.

4.5.2 Groundwater Impacts

Potential environmental impacts to groundwater at the proposed Moore Ranch Project could occur during all phases of the ISR facility's lifecycle, but primarily during operations and aquifer restoration. Detailed discussion of the potential environmental impact to groundwater from the construction, operation, aquifer restoration, and decommissioning at the proposed Moore Ranch Project is described in the following sections.

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

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

4.5.2.1 *Proposed Action (Alternative 1)*

4.5.2.1.1 Construction Impacts

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

The consumptive water use during construction would be generally limited to dust control, drilling support, and cement mixing. Most water used for construction at the proposed Moore Ranch Project would be extracted from a well completed in the 40 and 50 Sands. These sands are significant aquifers located at depths of 143-180 m (470-590 ft) below surface and hydrologically separated from the 70 production sand and 72 Sand surficial aquifer at Moore Ranch. The consumptive water use during construction is expected to be SMALL and temporary relative to the water supply available in the 40 and 50 Sands.

The volume of drilling fluids and muds used during well installation is expected to be limited and best management practices would be applied to prevent, identify and correct impacts to soils and the surficial 72 Sand aquifer at Moore Ranch. Drilling fluids and muds would be placed into mud pits to control the spread of the fluids, to minimize the area of soil contamination and to enhance evaporation. According to Figure CR3.4.3.2 in the applicant's technical report, the depth to the water table in the surficial 72 Sand at Moore Ranch ranges from 9 to 61 m (30-200 ft) below ground surface (EMC, 2007b). Therefore any small amount of leakage from the pits or spills from drilling activities should result in only a small amount of infiltration and not cause any changes in the 72 Sand surficial aquifer water quality. The introduction of drilling fluids to the 72 Sand, 70 Sand, 68 and 60 Sand aquifers may occur during drilling of production wells and monitoring wells, but is expected to be small, since drilling muds are designed to seal the hole so casing may be set.

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

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

Based on this analysis, consumptive groundwater use during the construction phase would be limited and would be expected to have a SMALL and temporary impact. The impact to groundwater resources during well field and facility construction would be SMALL based on the limited nature of construction activities and implementation of best management practices to protect soils and shallow groundwater.

Additionally, after its independent review of Uranium One's license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for groundwater and incorporates by reference the GEIS's conclusions that the impacts to groundwater during construction are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.5.2.1.2 Operation Impacts

Section 4.3.4.2.2 of the GEIS discussed potential impacts to shallow (near-surface) aquifers during ISR operations. During this phase of an ISR operation, shallow aquifers could potentially be affected by lixiviant leaks from pipelines, wells, or header houses and to waste management practices such as the use of evaporation ponds and disposal of treated wastewater by land application. Potential environmental impacts to groundwater resources in the production and surrounding aquifers also include consumptive water use and changes to water quality that could result from normal operations in the production aquifer and from possible horizontal and vertical lixiviant excursions beyond the production zone. Disposal of processing wastes by deep well injection during ISR operations could also potentially impact groundwater resources (NRC, 2009a).

4.5.2.1.2.1 *Impacts to Shallow (Near-Surface) Aquifers from Operations*

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

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

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

Hydrogeologic data from the Moore Ranch site indicates that the 72 Sand is the first aquifer encountered below the land surface. In some small areas, isolated occurrences of perched water are encountered in the 80 Sand which overlies the 72 Sand across the proposed license area. The 72 Sand is not saturated in the southern portion of the proposed license area. In these areas the 70 Sand is the surficial aquifer.

Because of the shallow depth to groundwater in the 72 Sand and 80 Sand where they occur, they could potentially be impacted by releases at or near the ground surface during operations. A surface release could potentially impact the groundwater depending on the depth to the water table, the permeability of the materials in the unsaturated zone, the potential adsorption of constituents in the unsaturated zone, and the volume of any potential releases. The 72 and 80 Sand aquifers could also be subject to the impact from potential well casing leaks during operations.

As indicated in the GEIS, the potential impact of surface releases on shallow groundwater could be greatly reduced by leak detection programs required by the NRC. All wells would be tested for mechanical integrity every five years to prevent casing leaks. Wells that failed mechanical integrity tests would be corrected or removed from operation. An aggressive leak detection and spill cleanup program would also be followed during operations. High and low flow alarms for individual wells would be employed as the primary means for timely identification of a pipe rupture. Header houses would be equipped with a “wet building” alarm to detect the presence of liquids in building sumps. In addition, a program of daily visual inspections of well field monitoring would be conducted. Spills exceeding 1,590 L (420 gal) would be required to be reported to the WDEQ accompanied by a report to NRC. Following repair of well field leaks, contamination surveys would be performed; and contaminated soils may could either be immediately remediated if concentrations exceeded regulatory requirements or left in place and cleaned up during decommissioning. The concrete curb around the perimeter of the central plant and the underlying concrete pad would be designed to contain the contents of the largest tank within the central plant in the event of a rupture. Plant fluid spills would be contained and would drain to the sump system and be pumped to the waste disposal system. Thus, the best management practices would include various measures to minimize the potential release of wastes and to mitigate their potential impact on shallow groundwater.

Since the 72 Sand is the overlying aquifer to the 70 Sand production zone it would be monitored by monitoring wells installed to detect vertical excursions. These monitoring wells would be located in the well fields at a density of one well to every four acres. The wells would be sampled every two weeks for excursion parameters to detect the presence of production fluids. This monitoring would provide an extra level of surveillance in the well fields to detect any impacts to the 72 Sand aquifer from either surface spills or casing leaks.

No water wells for domestic, agricultural or livestock use are completed in the 72 Sand within the proposed Moore Ranch license area. Therefore, the shallow aquifer in the 72 Sand is not an important source for local domestic or agricultural water supplies. Furthermore, the 72 Sand is a perched aquifer over the majority of the proposed license area; therefore, it is not hydraulically connected to other locally or regionally important aquifers. Where the 72 Sand aquifer is not perched, it is underlain by a sufficiently thick shale layer to prevent a hydraulic connection to other significant aquifers.

Based on this analysis, the impact of operations on shallow groundwater in the 72 Sand and on any groundwater in the perched 80 Sand aquifer at the proposed Moore Ranch Project would be expected to be SMALL. Impacts to any surrounding aquifer from an impact in the 72 Sand would also be expected to be SMALL.

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

4.5.2.1.2.2 *Impacts to Production and Surrounding Aquifers from Operations*

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

<u>Water Consumptive Use</u>:

As discussed in Section 4.3.4.2.2.2 of the GEIS, groundwater is withdrawn and reinjected into the production zone during ISR operations (NRC, 2009a). Most of the water withdrawn from the aquifer is returned to the aquifer. That portion of groundwater that is not returned to the aquifer is referred to as consumptive use. The consumptive use is primarily from production bleed and also includes other smaller losses. Production bleed is the net withdrawal maintained to ensure groundwater hydraulic gradients draw water in toward the production network to minimize the potential movement of lixiviant and its associated contaminants out of the well field.

The portion of an aquifer where the production occurs must be designated as an exempt aquifer by EPA pursuant to the Federal underground injection control (UIC) regulations before any production begins. An exempt aquifer designation means the aquifer is not, nor would it ever be a source of drinking water in the location covered by the exemption. At the proposed Moore Ranch Project, portions of the 70 Sand in which production operations would occur and typically a buffer zone would be sought to be declared as exempt by EPA. Groundwater in the aquifer outside the designated exempt zone would still be considered a possible source of drinking water, if of appropriate quality.

Consumptive water use during ISR operations could potentially impact local water users who also extract water from wells completed in the production aquifer outside the exempted zone. This potential impact would result from drawing down water levels in nearby wells, thus potentially reducing the yield of these wells. Furthermore, if the production zone is hydraulically connected to other aquifers above and/or below, consumptive use could impact the water levels in both overlying and underlying aquifers and create a drawdown in water level, thus reducing the potential yield from nearby wells using water from these aquifers (NRC, 2009a).

As previously discussed in Section 3.5.2, the 70 Sand production zone at the Moore Ranch Project is not completely saturated over much of the proposed license area. Therefore, it is an unconfined aquifer. The unconfined conditions in the production zone help to reduce the potential impact of the consumptive use anticipated during ISR operations. For a given net withdrawal, an unconfined aquifer exhibits substantially less drawdown in water level over a smaller area relative to that exhibited in a confined aquifer. As shown in Figure 4-1, the water produced from a well in an unconfined aquifer (water level below overlying aquitard) comes from dewatering of the aquifer pore space in the production zone.

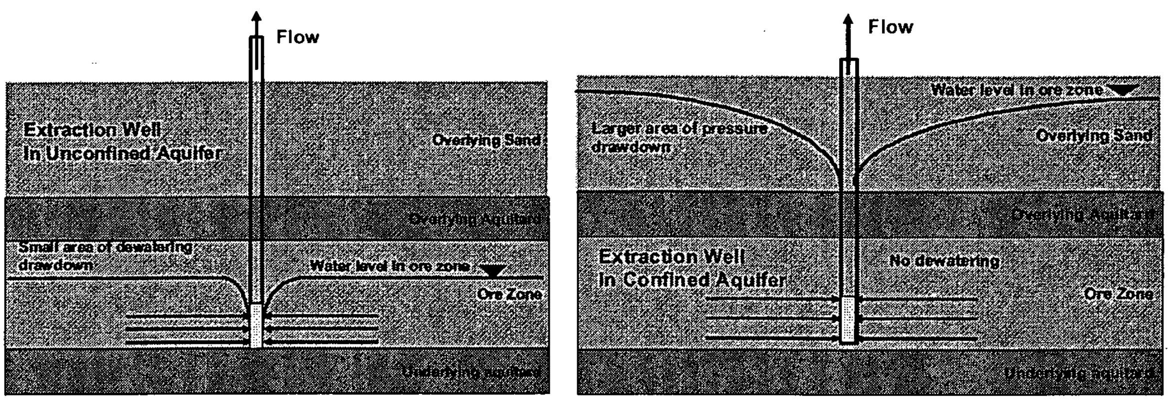

Figure 4-1 Difference In Size and Type of Drawdown in an Unconfined Aquifer and Confined Aquifer from an Extraction Well Operating at a Same Rate

However, the water moving to a well in a confined aquifer (water level above overlying aquitard) comes from the compression of the sediments and expansion of water from the pressure drawdown in the production zone, but does not drain the pore spaces. Therefore, much more water is produced from dewatering drawdown over a small area of an unconfined aquifer to meet the well rate, whereas the pressure drawdown to produce water from a confined aquifer must occur over a larger area to meet the well rate.

To assess the potential drawdown in the unconfined aquifer at Moore Ranch, an unsaturated groundwater flow model was developed for the 70 Sand over the entire proposed license area. The model was created within the Groundwater Vistas platform and used MODFLOW –

SURFACT Version 3.0, an industry standard unsaturated groundwater flow code. The model was calibrated to site specific conditions and verified by Moore Ranch field pumping test data. The modeling, which was reviewed and found acceptable by NRC staff, is presented in Appendix B-4 of the applicant's technical report (EMC, 2007b).

The model analyzed drawdowns during various phases of ISR production and aquifer restoration. For production operations, it assumed production rates of approximately 11,360 L/min (3,000 gal/min) and production bleeds ranging between 0.8 and 1.3 percent which translates into a production consumptive use rate of 90.9 L/min to 147.6 L/min (24 gal/min to 39 gal/min).

The model simulations of drawdown in the 70 Sand predicted at the end of production operations for the above consumptive use rates were provided in Figure CR4.4.2.1-1b of the applicant's technical report (EMC, 2007b). The end of production provides the best estimate of the maximum drawdown for total consumptive use during the operations phase. The results of the drawdown simulations show that the cone of depression created by the consumptive use at the end of operations results in a drawdown of about 0.30 to 1.2 m (1- 4 ft) at the proposed license area boundary. The drawdown contour of 1 ft extends outside the proposed license area to the north, northwest, west and southwest for approximately one to two miles.

To estimate the potential impact of the simulated drawdown on private wells, private well users with wells completed in the 68-70 Sand, 70 Sand, and 70-72 Sand located within 3.2 km (2 mi) of the proposed Moore Ranch Project boundary were identified. Their locations are shown in Figure CR4.4.2.1-1a of the applicant's technical report (EMC, 2007b). The drawdown in each of these private wells was simulated and the results shown in Table CR4.4.2-1-2b of the applicant's technical report (EMC, 2007b). Only one private well, drilled to a depth of 108 m (355 ft) below ground surface with a static water level of 46 m (150 ft) below ground surface, and completed in the 70 Sand was impacted by a drawdown of more than one foot. This well was located just outside the northwest portion of the proposed license area. The drawdown in this well was estimated to be 1.08 m (3.53 ft) at the end of the operations phase which would result in a negligible impact on well yield.

Given the hydraulic isolation separating the 72 Sand and 70 Sand production zone, there appears to be little potential impact on water levels in the 72 Sand resulting from the consumptive use in the 70 Sand production zone. However, there appears to be hydraulic interconnection between the underlying 68 Sand and the 70 Sand production zone in the portion of Wellfield 2 where the 68 and 70 Sands coalesce (See Section 3.5.2). In this portion of Wellfield 2, the 68 Sand would be included as part of the production zone, although no production wells would be installed.

To determine the impact of production operations on water levels in the 68 Sand and surrounding users, a worst case estimate scenario was assumed. In this scenario, the drawdown in the 68 Sand, which would not have any operating wells completed in it, was assumed to be the same as that simulated for the 70 Sand at the end of production operations. This is a conservative drawdown estimate since pumping tests indicate that there will be less drawdown in the 68 Sand where the 70 and 68 Sands coalesce. Using this assumption, Table CR4.4.2.1-2b shows that three wells completed in the 68 Sand and located to the northeast and southeast outside of the proposed license area would have nominal drawdowns of 0.02, 0.07, and 0.003 m (0.08, 0.23 and 0.01 ft), respectively (EMC, 2007b). These drawdown values would not be expected to affect well yields.

Based on the consumptive use and groundwater modeling predictions of drawdown in the 70 production sand and the 68 Sand during operations, private wells within 3.2 km (2 mi) radius surrounding the proposed license area would have only a small or nominal drawdown in their private wells which would not impact well yields. Therefore, the potential environmental impact to groundwater supplies and users in the production and other surrounding aquifers would be expected to be SMALL.

Excursions and Groundwater Quality.

As discussed in the GEIS (NRC, 2009a), groundwater quality in the production zone would be degraded as part of ISR operations. The portion of the aquifer used for production would be recommended for exemption by WDEQ to EPA as an underground source of drinking water. After production operations are completed, the licensee would be required to initiate aquifer restoration activities to restore the production zone to baseline water quality, if possible. If the aquifer could not be returned to baseline conditions, NRC requires that the production aquifer be returned to the maximum contaminant levels provided in Table 5C of 10 CFR Part 40 Appendix A or to Alternate Concentrations Limits (ACLs) approved by NRC. For proposed ACLs to be approved, they must be shown to be protective of public health at the site. For these reasons, potential impacts to the water quality of the uranium-bearing production zone aquifer as a result of ISR operations would be expected to be SMALL.

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

To prevent horizontal excursions, inward hydraulic gradients are expected to be maintained in the production aquifer during ISR operations (NRC, 2009a). These inward hydraulic gradients are created by the net groundwater withdrawals (production bleeds) maintained through continued pumping during ISR operations. Groundwater flows in response to these inward hydraulic gradients, thus ensuring that groundwater flow is toward the production zone. This inward groundwater flow toward the extraction wells prevents horizontal excursions of lixiviant solutions away from the production zone.

NRC also requires the licensee to take preventive measures to reduce the likelihood and consequences of potential excursions. A ring of monitoring wells within and encircling the production zone is required for early detection of horizontal excursions. If excursions are suspected, corrective actions are required. The impacts from these excursions would therefore be expected to be SMALL.

The GEIS also discussed potential for vertical excursions into aquifers overlying or underlying the production zone aquifer. The GEIS analysis indicated, the potential for migration of leaching solution into an overlying or underlying aquifer is SMALL if the thickness of the aquitard separating the production zone from the overlying and underlying aquifer is of sufficient thickness and the aquitard has low permeability (NRC, 2009a). The vertical hydraulic gradient between the production zone and overlying or underlying aquifers is also used to determine the potential for vertical excursions. The NRC also requires monitoring in the overlying and underlying aquifers. Corrective action is also required if any vertical excursions are detected.

At Moore Ranch, the 70 Sand aquifer would be designated as an exempt aquifer before production operations began, which means that it neither has nor will it ever be used as a source of drinking water. The groundwater chemistry will be changed as lixiviant is injected to mobilize uranium for extraction. At the end of operations, aquifer restoration using Best Practicable Technology would be initiated to return the 70 Sand aquifer to baseline conditions, or the maximum contaminant levels provided in Table 5C of 10 CFR Part 40 Appendix A or to ACLs. Restoration to these standards would ensure that groundwater within the exemption boundary after restoration will not pose a threat to surrounding groundwater. For these reasons, potential impacts to the water quality of the 70 Sand production zone aquifer and surrounding aquifers as a result of ISR operations would be expected to be SMALL.

The occurrence of an unconfined aquifer in the 70 Sand production zone at the proposed Moore Ranch Project presents special considerations when evaluating the creation of the necessary inward hydraulic gradient, the reliability of monitoring around the periphery of the well field, and the capability to pull back a potential horizontal excursion. As discussed earlier, an unsaturated numerical groundwater model was developed to simulate drawdown in the unconfined conditions in the 70 Sand production zone at Moore Ranch. The model was calibrated using site-specific hydraulic data and presented in Appendix B-4 of the applicant's technical report (EMC, 2007b). Model simulations indicate that it would be possible to maintain the necessary inward gradient during ISR operations to prevent horizontal excursions (EMC, 2007b)

To detect horizontal excursions from the proposed well fields at the Moore Ranch Project, monitoring well rings would be installed at each well field with the monitoring wells completed in the 70 Sand production zone. The monitoring wells would be located approximately 500 ft from the edge of each well field and spaced 152 m (500 ft) apart around the perimeter of the well field. The wells would be sampled biweekly for chloride, alkalinity and conductivity which are excursion parameters indicative of the presence of production fluids. Any well with samples found to contain more than two of these excursion indicators at prescribed levels derived based on baseline values would be placed on excursion status and WDEQ and NRC must be notified in 24 hours. All wells on excursion status would be monitored every seven days until the indicators return to non-excursion levels. Wellfield operations would be modified as necessary near wells on excursion status to correct the excursion. If the well remained on excursion for more than 60 days, a plan would be provided to NRC to correct the excursion.

Given the maintenance of an inward hydraulic gradient to prevent excursions and the presence of a monitoring well ring to detect excursions as well as a plan to correct them, it would be expected that the impact from horizontal excursions at the proposed Moore Ranch Project would be SMALL.

The 72 Sand aquifer overlies the 70 Sand production aquifer. The water table within the 72 Sand is perched on the underlying aquitard that separates the 72 Sand from the 70 Sand production aquifer. The water levels in the 72 Sand are generally much higher than in the 70 Sand. The combination of the perched water table and the high water levels in the 72 Sand relative to the 70 Sand demonstrate the absence of a hydraulic interconnection between the 72 and 70 Sands. The unconfined conditions in the 70 Sand further support this conclusion. Pumping tests conducted to date not demonstrated any hydraulic connection between the 70 and 72 Sands. Therefore, the potential for vertical excursions from the production zone into the overlying 72 Sand would be expected to be SMALL.

A relatively thick and low permeability aquitard separates the 70 Sand production aquifer from the underlying 68 Sand throughout much of the proposed license area. Pumping tests conducted to date indicate that the 68 Sand is hydraulically isolated in Wellfield 1. Therefore, the potential for vertical excursions from the production zone into the underlying 68 Sand in Wellfield 1 is very SMALL. In portions of Wellfield 2; however, the aquitard separating the 68 and 70 Sand is missing as previously discussed in Section 3.5.2. The 68 and 70 Sands coalesce where the aquitard is missing, and the two aquifers appear to be hydraulically interconnected. The 68 Sand would be included as part of the production zone in the area where the 68 and 70 Sands coalesce. The underlying 60 Sand, which is separated by a continuous shale layer, would be treated as the underlying aquifer. The potential for vertical excursions from the production zone in Wellfield 2 into the underlying 60 Sand is SMALL.

To detect potential vertical excursions at the proposed Moore Ranch Project, the aquifers that overly and underlie the 70 Sand, which include the 72, 68 and 60 Sands, would be monitored by a spacing of one well per four acres. The same sample constituents and process would be followed to monitor for vertical excursion as was described above for horizontal excursions.

Given the isolation of the overlying and underlying aquifers from the 70 Sand production zone by low permeability shale layers and the use of monitoring wells to detect excursions and correct them, the impact from a potential vertical excursion at the proposed Moore Ranch Project would be expected to be SMALL.

Additionally, after its independent review of Uranium One's license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions regarding potential excursions and groundwater quality are comparable to that described in the GEIS. The GEIS concludes that impacts to production and surrounding aquifers during operations would be SMALL The staff concludes that site-specific impacts for the proposed Moore Ranch Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.5.2.1.2.3 *Impacts to Deep Aquifers Below the Production Aquifers from Operations*

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

Class I disposal wells would only be permitted by WDEQ if the groundwater quality in the injection zone would not be suitable for domestic or agricultural uses (e.g., high salinity), could not be designated as an underground source of drinking water, and if the injection zone was confined above by sufficiently thick and continuous low permeability layers.

The GEIS (Section 4.3.4.2.2.3) indicates that in the Wyoming East Uranium Milling Region, where the proposed Moore Ranch Project is located, the Paleozoic aquifers are hydraulically separated from the aquifer sequence that includes, from the shallowest to the deepest, the Wasatch Formation, the Fort Union Formation, the Lance Formation, and the Fox Hills Formation by thick low permeability confining layers that include the Pierre Shale, the Lewis

Shale, and the Steele Shale (Whitehead, 1996). Hence, non-karstic Paleozoic aquifers (e.g., Tensleep Sandstone) can be investigated further for suitability of disposal of leaching solutions. The GEIS concluded that in the Wyoming East Uranium Milling Region, considering the relatively low water quality in and the reduced water yields from non-karstic Paleozoic aquifers and the occurrence of thick and regionally continuous aquitards confining them from above, the potential environmental impacts due to deep injection of leaching solution into non-karstic Paleozoic aquifers could be SMALL. The Pierre Shale was reported to be fractured in some places at the regional scale (Whitehead, 1996). Considering potential heterogeneities in the hydrogeologic properties of the Pierre Shale, the potential impacts could be SMALL to MODERATE where the Pierre Shale might be locally fractured.

Up to four Class I wells could be drilled at the proposed Moore Ranch Project for deep disposal of liquid effluent depending on the production rates and the capacity of each disposal well. Two permit applications for Class I disposal wells at the proposed Moore Ranch Project are under review by the State of Wyoming. The first application is for injection into the Teapot-Teckla-Parkman formation with an injection depth of 2,431 m – 2,929 m (7,916 – 9,610 ft) Injection rates for this interval are expected to be about 30 gal/min. Since the water quality in this formation is anticipated to exceed 3000 mg/L TDS, it would not be classified as an underground source of drinking water. The second application is for injection into the Lance formation at depths of 1128 m – 2286.m (3700 – 7500 ft); since the Lance formation has a much greater injection capacity, only two Class I disposal wells would be required to support the proposed Moore Ranch operations. However, the water quality in the Lance formation could be less than 3000 mg/L TDS; therefore, it could potentially be an underground source of drinking water which would eliminate it from consideration as an injection zone for a Class I deep disposal well.

The WDEQ will evaluate the suitability of the formations proposed for deep well injection and would only grant such a permit to Uranium One if it can be demonstrated that liquid effluent could be safely isolated in a deep aquifer. Consequently, it has been assumed that the potential environmental impact to deep aquifers from deep well disposal of waste in the proposed Moore Ranch Project would be SMALL.

4.5.2.1.3 Aquifer Restoration Impacts

The potential environmental impacts to groundwater resources during aquifer restoration are related to groundwater consumptive use and waste management practices, including deep well injection of wastes. In addition, aquifer restoration directly affects groundwater quality in the vicinity of the well field being restored. As discussed in the GEIS, the impacts of consumptive groundwater use during aquifer restoration are generally greater than during ISR operations since a larger volume of groundwater is generally withdrawn if groundwater sweeps are used during the aquifer restoration phase. Larger withdrawals could produce larger drawdowns in the production aquifer resulting in a greater impact on the yields of nearby wells.

The impacts from consumptive use during ISR production operations was previously discussed in Section 4.5.2.1. 2.2 of this SEIS which describes the use of an unsaturated numerical groundwater flow model to estimate drawdown for production phase consumptive use of the 70 Sand production zone. The same model was used to predict the drawdowns in Wellfield 1 and Wellfield 2 at the end of aquifer restoration using assumed consumptive use rates for each phase.

The predicted drawdown in the 70 Sand from model simulation of the end of aquifer restoration in Wellfield 1 is shown in Figure CR4.4.2.1-1c of the applicant's technical report (EMC, 2007b). The drawdown simulation results indicate that the cone of depression created by consumptive use during aquifer restoration would result in a drawdown in the water level of about 0.3 – 2.7 m (1- 9 ft) at the proposed license area boundary. The drawdown contour of 0.3 m (1 ft) extends outside the proposed license area to the north, northwest, west and southwest for approximately one to four miles.

The model simulation of drawdown in the 70 Sand at the end of aquifer restoration in Wellfield 2 is shown in Figure CR4.4.2.1-1d of the applicant's technical report (EMC, 2007b). The drawdown simulation results show that the cone of depression created by consumptive use during aquifer restoration would result in a drawdown of about 0.3 – 1.8 m (1 – 6 ft) at the proposed license area boundary. The drawdown contour of 0.3 m (1 ft) extends outside the proposed license area to the north, northwest, west and southwest for approximately one to four miles.

To estimate the impact of the simulated drawdown on private well users, all private wells within 3.2 km (2 mi) radius of the proposed Moore Ranch Project completed in the 68-70 Sand, 70 Sand, and 70-72 Sand were identified. Only one private well completed in the 70 Sand, located just northwest of the proposed license area would be affected by a drawdown of more than 0.3 m (1 ft) during the restoration phases of both Wellfield 1 and Wellfield 2. The drawdown in this well at the end Wellfield 1 aquifer restoration was estimated as 2.4 m (7.87 ft). The drawdown at the end of the Wellfield 2 restoration was estimated as 1.80 m (5.90 ft). The well was completed to a depth of 108 m (355 ft) below ground surface with a static water level of 46 m (150 ft) below ground surface indicating an operating water level of 62 m (205 ft). A decrease of 1.8 - 2.4 m (5.9 – 8.0 ft) would likely result in a negligible impact on well yield.

Given the hydraulic isolation of the overlying 72 Sand from the production zone, there would be little potential to impact water levels in the 72 Sand from groundwater consumptive use in the production zone during aquifer restoration. However, as previously noted since there is an apparent hydraulic interconnection between the underlying 68 Sand and the 70 Sand production zone in a portion of Wellfield 2 where the 68 and 70 Sands coalesce (see Section 3.5.2), the 68 Sand would be included as part of the production zone at this location.

To determine the impact of restoration operations on water levels in the 68 Sand and to surrounding users, a worst case estimate scenario was simulated in which the drawdown in the 68 Sand (in which no operating wells would be completed), was assumed to be the same as that simulated for the 70 Sand at the end of aquifer restoration The simulation showed three wells, completed in the 68 Sand located outside of the proposed license area to the northeast and southeast would have nominal drawdowns of 0, 21, 0.28, and 0.001 m (0, 68, 0.91 and 0.04 ft) at the end of Wellfield 1 aquifer restoration, and drawdowns of 0.3, 0.4, and 0.001 m (1.08, 1.20 and 0.04 ft) at the end of Wellfield 2 aquifer restoration. These drawdowns would not be expected to impact the yield of these wells.

Based on the consumptive use and groundwater modeling predictions of drawdown in the 70 Sand and 68 Sand in Wellfield 2 resulting from aquifer restoration, private wells within 3.2 km (2 mi) surrounding the proposed license area would only experience a small or nominal drawdown in water level which would not be expected to impact well yields. Therefore, the potential environmental impact on groundwater supplies and to other users of both the production and other surrounding aquifers would be expected to be SMALL.

The use of deep well injection is planned for disposal of waste fluids during aquifer restoration. The potential impacts from deep well injection were discussed in Section 4.5.2.1.2.3 and the potential impact would be expected to be SMALL.

Aquifer restoration should directly impact groundwater quality in the production zone. As discussed in Section 4.5.2.1.3, aquifer restoration is intended to restore groundwater quality in the production zone to baseline conditions, if possible. If the aquifer could not be returned to baseline conditions, NRC requires that the production aquifer be returned to the maximum contaminant levels provided in Table 5C of 10 CFR Part 40 Appendix A or to Alternate Concentration Limits approved by NRC.

The restoration of the 70 Sand production zones, including the potentially impacted portion of the 68 Sand in Wellfield 2 would be expected to restore the groundwater quality to water quality standards which are protective of human health and the environment and would not impact surrounding aquifers. Therefore, the impact of aquifer restoration on groundwater quality would be expected to be SMALL.

Additionally, after its independent review of Uranium One's license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions during aquifer restoration would be comparable to those described in the GEIS. The GEIS concludes that impacts to groundwater during aquifer restoration would range from SMALL to MODERATE The staff concludes that site-specific impacts for the proposed Moore Ranch Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.5.2.1.4 Decommissioning Impacts

Section 4.3.4.2.4 of the GEIS discussed potential impacts to groundwater during construction as being are primarily from consumptive use of groundwater, potential spills of fuels and lubricants, and well abandonment. The consumptive use of groundwater during decommissioning would be much less than during either ISR operations or aquifer restoration. Fuel and lubricant spills during decommissioning activities could potentially impact shallow groundwater. Implementation of best management practices during decommissioning would reduce the likelihood of such spills and the impact to groundwater resources in shallow aquifers from decommissioning would be SMALL.

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

As part of the restoration and reclamation activities, all monitor, injection, and recovery wells at the proposed Moore Ranch Project would be plugged and abandoned in accordance with the Wyoming UIC program requirements. If this process was properly implemented and the abandoned wells are properly isolated from the flow domain, the potential environmental impacts would be SMALL.

Additionally, after its independent review of Uranium One's license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions at the proposed Moore Ranch Project would be comparable to that described in the GEIS for groundwater and incorporates by reference the GEIS's conclusions that the impacts to groundwater during decommissioning would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.5.2.2 No-Action (Alternative 2)

Under the No-Action Alternative no construction or operational activities would occur on site that might impact shallow groundwater. No lixiviant would be injected into the subsurface; therefore, there would be no affect on the aquifer and no consumptive use of groundwater. No liquid effluents would be generated; therefore, there would be no Class I well constructed for disposal of liquid wastes. Therefore, under the No-Action alternative there would be no impact to groundwater above the baseline described in Section 3.5.2.

4.6 Ecological Resources Impacts

Potential environmental impacts to ecological resources including both flora and fauna at the proposed Moore Ranch Project could occur during all phases of the ISR facility's lifecycle. Impacts could 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. Impacts to wildlife could include loss, alteration, and/or incremental fragmentation of habitat; displacement of and stresses on wildlife; and direct and/or indirect mortalities. Aquatic species could 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)

Section 4.3.5.1 of the GEIS discussed potential impacts to terrestrial vegetation from construction 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. Potential impacts to wildlife include (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 (NRC, 2009a).

As further indicated in the GEIS, the percent of vegetation removed and land disturbed by construction activities would disturb a SMALL portion (from less than 1 percent up to 20 percent) of the total licensed area and surrounding plant communities. The clearing of herbaceous vegetation in an open grassland or shrub steppe community would be expected to have a short-term, SMALL impact given the rapid colonization by annual and perennial species in the disturbed areas and restoration of the vegetative cover. The clearing of wooded areas could have a long-term impact given the pace of natural succession, and such impacts could range from SMALL to MODERATE, depending on the acreage of the surrounding wooded area. Noxious weeds would be expected to be controlled with appropriate spraying techniques and therefore, impacts would be SMALL (NRC, 2009a).

The GEIS also noted that construction impacts to wildlife habitat would be minimized with the timely reseeding of disturbed areas following construction. In general, wildlife species would be expected to disperse from the proposed license area as construction activities approached, although smaller, less mobile species could perish during clearing and grading. Habitat fragmentation, temporary displacement, and direct or indirect mortalities would be possible; thus, the potential impact from construction could range from SMALL to MODERATE. The impact and the potential impact to sage grouse and big game species could be mitigated if BLM and Wyoming Fish and Game Department guidelines were followed. Impacts to raptor species from power distribution lines could be mitigated if the Avian Power Line Interaction Committee guidance was followed, and disturbing areas near active nests and prior to the fledgling of young was avoided.

In-stream channel activities would be expected to temporarily disturb aquatic species; therefore, the impacts would be SMALL. Sediment loads would be expected to taper off quickly both in time and distance; therefore, long-term impacts would be SMALL. The use of Wyoming Fish and Game Department standard management practices would help to limit impacts to aquatic life.

If threatened or endangered species were identified in the project site during surveys, the impacts could range from SMALL to LARGE, depending on site conditions. Mitigation plans to avoid and reduce impacts to potentially affected species would be developed.

4.6.1.1 *Construction Impacts*

As noted above, ecological resources could be affected by land disturbance during ISR facility construction. The construction phase of the proposed Moore Ranch Project could potentially impact ecological resources from clearing vegetation to construct the central plant and to develop the well fields including drilling wells, building header houses, constructing access roads, and clearing field laydown areas. Construction is expected to take 9 months to complete, and impacts are considered accordingly. Potential impacts to ecological resources from construction are discussed below.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for ecological resources and incorporates by reference the GEIS's conclusions that the impacts to ecological resources during construction are expected to be SMALL if mitigative measures are implemented. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.6.1.1.1 Impacts to Vegetation

The well fields and central plant at the proposed Moore Ranch Project would be constructed within the upland grassland vegetation communities (see Figure 3-11). Direct impacts would include the short-term loss of vegetation (modification of structure, species composition, and areal extent of cover types). An estimated 61 ha (150 ac) of upland grassland would be affected by construction disturbance under current development plans. Indirect impacts would include the short-term and long-term increased potential for non-native species invasion, establishment, and expansion; potential soil erosion; shifts in species composition or changes in vegetative density; reduction of wildlife habitat; reduction in livestock forage; and changes in visual aesthetics.

The construction activities, increased soil disturbance, and increased traffic during construction could stimulate the introduction and spread of undesirable and invasive, non-native species within the proposed license area. Two State-designated weeds, Canada thistle and field bindweed, were observed in the Moore Ranch area during the baseline surveys conducted by the applicant along with other undesired annual grass species such as cheat grass brome. The applicant would conduct weed control as needed to limit the spread of undesirable and invasive, non-native species on disturbed areas (EMC, 2007a).

To mitigate the potential impact to vegetation, disturbed areas would be both temporarily and permanently revegetated in accordance with WDEQ-LQD regulations and the mine permit. Disturbed areas would be seeded to establish a vegetative cover to minimize wind and water erosion and the invasion of undesired plant species (EMC, 2007b).

The impact from vegetation removal and surface disturbance would affect about 2 percent of the total licensed area and the impact would be SMALL. Some individual plants would be affected, but since construction activities would not affect 61 ha (150 ac) contiguous acres, the impact would not affect a sizeable segment of the species' population over a relatively large area.

4.6.1.1.2 Impacts to Wildlife

There are three primary impacts of ISR uranium recovery facility construction on terrestrial wildlife: (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.

Generic ISR uranium extraction can have direct and indirect impacts on local wildlife populations. These impacts are both short-term (lasting until successful reclamation is achieved) and long-term (persisting beyond successful completion of reclamation). However, long term impacts are not expected to be substantial due to the relatively limited habitat disturbance associated with the ISR extraction method. The likelihood of injury or mortality to wildlife would be greatest during the construction phase due to increased levels of traffic and physical disturbance during that period. Speed limits would be enforced during all construction and maintenance operations to reduce impacts to wildlife throughout the year, but particularly during the breeding season (EMC, 2007a).

The area to be disturbed during the construction phase has been estimated at 61 ha (150 ac) non-contiguous acreas comprised of two well fields covering an area of 23 ha (57 ac), the central plant and associated storage facilities which cover approximately 1.6 ha (4 ac), approximately 3.2 km (2 mi) of new access road to the central plant and within the proposed well fields, in addition to the infrastructure supporting the well fields (e.g., pipeline connecting the well fields and connecting to a trunkline that connects to the central plant). As indicated, most of the habitat disturbance would consist of scattered, confined drill sites for wells in the well fields that would not result in large expanses of habitat being dramatically transformed from its original character as in other surface mining operations.

Therefore, most indirect impacts would be related to displacement of wildlife from increased noise, traffic, or other disturbances associated with the development of the proposed Moore Ranch Project, as well as from small reductions in existing or potential cover and forage due to habitat alteration, fragmentation, or loss. Indirect impacts typically persist longer than direct impacts. However, ISR uranium extraction does not involve large-scale habitat alteration.

Certain vegetative communities that exist in the proposed license area could be difficult to reestablish through artificial plantings, and natural seeding and recruitment could take many years. Consequently, wildlife species associated with specific habitats such as blue grama grasslands, birdsfoot sagebrush, and big sagebrush could be reduced in number or replaced by generalist species with broader habitat requirements until natural reseeding of certain vegetation occurs or reclamation matures to its target mix. The impact from the construction phase of the proposed Moore Ranch Project would be expected to have a SMALL impact on wildlife because the affected area would be small and non-contiguous.

4.6.1.1.2.1 *Impacts to Big Game*

Pronghorn antelope and mule deer are the only two big game species that regularly occur in the study area for the proposed license area. No crucial big game habitat or migration corridors occur on or within several kilometers of the proposed Moore Ranch Project area (University of Wyoming, 2004 and 2008).

Direct impacts to pronghorn antelope and mule deer as a result of project activities could include the disturbance of a portion of yearlong range, loss of forage, and vehicular collision accidents. An estimated 61 ha (150 ac) would be incrementally disturbed during the approximate 12-year life of the ISR facility. As a result of these habitat disturbances, the 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 revegetated areas becomes productive enough to support big game. No significant increase in the potential for vehicle collision with big game would be expected because of the short distances traveled and required low speeds 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 proposed license area.

Indirect impacts to pronghorn antelope and mule deer could include displacement into surrounding areas from increased human activity and the increased potential for poaching. The human presence during construction could affect pronghorn antelope and mule deer use of adjacent areas. Some short-term disturbance (during the lifecycle of the ISR facility) of big game habitat could occur with project construction. However, the construction phase of the proposed action has been estimated to last nine months. There is adequate habitat for pronghorn antelope and mule deer in the surrounding area; these species could return to the areas affected by construction once these activities were completed (EMC, 2007b). 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 occurring in the vicinity from CBM production. The movement of big game through the proposed license area would not be expected to be impacted by implementing the proposed action. The limited use of fencing to impede ingress to, and egress from, the central plant area and the well fields would mitigate the potential impact from wildlife use of the area. Fencing preferred by the WGFD should be used (WGFD, 2004).

Furthermore, mitigative actions such as implementing speed limits would further reduce big game conflicts associated with the proposed Moore Ranch Project. Since pronghorn antelope and mule deer are highly mobile species the potential impact to them would be expected to be SMALL.

4.6.1.1.2.2 *Impacts to Other Mammals*

A variety of small and medium-sized mammal species occur in the vicinity of the proposed license area, although not all have been observed on the proposed Moore Ranch Project itself. These mammals include the coyote, red fox, swift fox, bobcat, striped skunk, weasels, badger, muskrat, raccoon, rodents (such as mice, rats, voles, gophers, ground squirrels, and chipmunks) and rabbits.

Medium-sized mammals (such as rabbits, coyotes, and foxes) could be temporarily displaced to other habitats during construction activities. Direct losses of some small mammal species (*e.g.*, voles, ground squirrels, mice) could be higher than for other wildlife because of their limited mobility and the likelihood they would retreat into burrows if disturbed, and thus potentially be impacted by topsoil scraping or staging activities. However, given the limited, non-contiguous area that could be disturbed (approximately 61 ha [150 ac]) no major changes or reductions in small or medium-sized mammalian populations would be expected. The species that occur in the area have shown an ability to adapt to human disturbance in varying degrees, as evidenced by their occurrence in areas being developed for CBM (EMC, 2007b). Small mammal species in the area also have a high reproductive potential and tend to re-occupy and adapt to altered and/or reclaimed areas quickly (EMC, 2007b).

Since only a few individuals would be affected and most mammal species would likely travel to suitable habitat adjacent to the construction areas, the proposed Moore Ranch Project would be expected to have SMALL impacts on these mammals.

4.6.1.1.2.3 *Impacts to Avian Species*

Upland Game Birds. The only upland game bird prevalent in the vicinity of the proposed Moore Ranch Project is the mourning dove which is a relatively common breeder in Campbell County, and is the most prevalent upland game bird in the study area (EMC, 2007a). The proposed construction activities could affect approximately 61 noncontiguous hectares (150 ac) of potential foraging and nesting habitat for mourning doves. While woody corridors are not abundant in the vicinity of the project area they also are not unique to the Moore Ranch proposed license area. Habitat that could support mourning doves occurs to the immediate south of the proposed license area where no mining is projected to occur; therefore, the proposed Moore Ranch Project would not be expected to impact the occurrence of mourning doves.

As discussed in Section 3.6.1.2.2, sage grouse neither occur nor is the appropriate habitat present within the proposed license area to support their occurrence. Therefore, there would be no impact to sage grouse from the proposed action.

Waterfowl and Shorebirds Since surface water occurs only intermittently at the proposed Moore Ranch Project, little habitat exists to support large groups or populations of either waterfowl or shorebirds. Therefore, there would be not impact to these species.

Raptors. Three species of raptors occur within the proposed license area: the ferruginous hawk, the red-tailed hawk, and the great horned owl. The populations of these three species are believed to be common and stable in the local vicinity. Nesting success by resident raptors could be reduced from disturbances caused by milling operations and traffic. Two nest sites occur within close proximity of the well fields, but no trees with nests would be removed. Other nest sites occur within the southern half of the proposed license area. Use of the nest sites may continue as birds habituate to milling activities, and the potential impact to the raptor population would range from SMALL to MODERATE. Adherence to WGFD and BLM seasonal noise, vehicular traffic, and human proximity guidelines (WGFD, 2009 and BLM, 2008) would help to ensure the continued nesting success of area raptors and maintain a SMALL impact.

A raptor nest survey would be conducted in late April or early May each year the proposed Moore Ranch project operated to identify any new raptor nests and to assess whether existing nests were being utilized. The purpose of this program would be to protect against unforeseen conditions such as the construction of a nest in an area that could be potentially affected by the operations of the proposed Moore Ranch Project (EMC, 2007b). If nests were discovered during these surveys, the applicant would take appropriate mitigation measures, such as moving the nest, to ensure the protection of the species.

4.6.1.1.2.4 *Impacts to Reptiles and Amphibians*

The only herpetological species recorded within the proposed Moore Ranch Project during the 2006 and 2007 baseline studies conducted by the applicant was the common bullsnake. Because the potential habitat for reptiles and amphibians is limited within the proposed license area, no impacts to reptiles or amphibian populations would be expected.

4.6.1.1.3 Impacts to Aquatic Resources

Because of the limited occurrence of surface water, the potential habitat for aquatic species is also limited within the proposed license area, and occurs primarily as intermittent habitat in the small, scattered stock ponds or drainages in the area. Portions of Pine Tree Draw, Simmons Draw, and Ninemile Creek, and their intermittent tributaries, occur within the proposed license area, but they are not reliable water sources as discussed in Section 3.5.1.2. No aquatic habitat exists on the proposed Moore Ranch Project to support fish or macroinvertebrates. Therefore, there would be no impact to aquatic wildlife.

4.6.1.1.4 Impacts to Threatened and Endangered Species

No federal- or state-listed sensitive plant species, endangered or threatened plant species, or designated critical habitats occur within the proposed license area; therefore, there would be no impact to these species.

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 could occur in the area (FWS, 2008). However, the potential habitat for bald eagle nesting and roosting activities is limited within the proposed license area and a surrounding 1.6-km (1-mi) perimeter. The nearest documented winter roost is along the Powder River, approximately 16 km (10 mi) to the northwest. Project lands disturbed from uranium ISR activities would be unavailable for foraging bald eagles until these areas were reclaimed and prey species returned. The black-footed ferret occurs in active prairie dog colonies, none of which are either present on or within a 1.6 km (1 mi) of the proposed Moore Ranch Project boundary. Therefore, there would be no impact to either the bald eagle or black-footed ferret from construction activities at the proposed Moore Ranch Project.

4.6.1.1.4.1 *Impacts to Species of Concern*

The proposed Moore Ranch Project has the potential to impact 14 avian species of concern (8 Level I species and 6 Level II species) known to occur or potentially be present as seasonal or year-round residents. Direct impacts such as injury or mortality could occur from vehicle or heavy equipment encounters during construction. Indirect impacts could result from habitat loss or fragmentation and increased noise and activity that could deter use of the area by some species. Surface disturbance would be limited to a total of approximately 61 noncontiguous hectares [150 ac]) out of 2879 ha (7100 ac) and would be greatest during construction. Enforced speed limits during all phases of the proposed Moore Ranch Project would reduce impacts to wildlife throughout the year, particularly during the breeding season. Impacts to avian species of concern would potentially be MODERATE. Since construction would only be nine months in duration, the potential impact could be reduced to SMALL by adhering to WGFD and BLM seasonal noise vehicular traffic, and human proximity guidelines (WGFD, 2009 and BLM, 2008). Further, the proposed activities would not be anticipated to threaten the continued existence of these species in the proposed license area.

4.6.1.2 *Operations Impacts*

Section 4.3.5.2 of the GEIS discussed the alteration of wildlife habitats from operations (fencing, traffic, noise), and noted that individual takes could occur due to conflicts between species habitat and operations. Access to crucial wintering habitat and water could be limited by fencing. The State of Wyoming Game and Fish Department specifies fencing construction techniques to minimize impediments to big game movement.

The GEIS further noted the occurrence of temporary contamination or alteration of soils from operational leaks and spills. However, detection and response to leaks and spills (e.g., soil cleanup) and eventual survey and decommissioning of all potentially impacted soil would limit the magnitude of overall impacts to terrestrial ecology. Spill detection and response plans would reduce the potential impact to aquatic species from spills around well heads and leaks from pipelines. Mitigation measures such as perimeter fencing, netting, leak detection and spill response plans, and periodic wildlife surveys would also be expected to limit the impact; therefore, the overall impact would be expected to be SMALL.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for ecological resources and incorporates by reference the GEIS's conclusions that the impacts to ecological resources during operation are expected to be SMALL as discussed below. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.6.1.2.1 Impacts to Vegetation

During the operations phase, the well fields and central plant would be accessed frequently using the defined road network. The installation and operation of the well fields would involve the excavation of trenches for trunk lines and utilities to each site. Surface disturbance increases the susceptibility of the proposed license area to invasive and noxious weeds. 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 mixtures as soon as conditions allow, to prevent the establishment of competitive weeds. Invasive and noxious weeds would be monitored and if they became an issue, other control alternatives, such as the application of an herbicide, would be considered (EMC, 2007b).

Impacts to vegetation from facility operations resulting from spills around well heads and leaks from pipelines would be SMALL and would be handled using best management practices (EMC, 2007b). Leak detection systems and spill response plans to remove affected soils and capture release fluids would be expected to reduce the impact.

4.6.1.2.2 Impacts to Wildlife

Wildlife use of areas adjacent to ISR operations would be anticipated to initially decline from human disturbances during milling operations and steadily increase to near normal levels as animals became habituated to the activity. Some wildlife habituation to human activities has probably occurred in the area from on-going CBM activities. 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 proposed license area. 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 best management practices, impacts to wildlife would be SMALL. Further mitigation could be used to maintain a SMALL impact on wildlife by using fencing discussed in the GEIS (NRC 2009a).

4.6.1.2.2.1 *Impacts to Big Game*

The potential impact to big game during the operations phase would be similar to that described for the construction phase. Therefore, there could be SMALL impacts to big game species during the operations phase.

4.6.1.2.2.2 *Impacts to Other Mammals*

Impacts are the same as construction impacts to other mammals. Since only a few individuals would be affected and most mammal species would likely travel to adjacent suitable habitat adjacent to the construction areas, the proposed Moore Ranch Project is expected to have SMALL impacts on these mammals.

4.6.1.2.2.3 *Impacts to Avian Species*

The potential impact to upland game birds, waterfowl and shorebirds, and to raptors would either be the same or potentially less than that described for the construction phase since earthmoving activities would be more limited during the operations phase; therefore, the impact would be SMALL.

4.6.1.2.2.4 *Impacts to Reptiles and Amphibians*

The potential impact to reptiles and amphibians from the operations phase would be comparable to that experienced during the construction phase; therefore, the impact would be SMALL.

4.6.1.2.3 Impacts to Aquatic Resources

Because of the limited occurrence of surface water on the proposed Moore Ranch Project and because the operating plans do not require surface water discharge, the potential impact to aquatic resources would be SMALL.

4.6.1.2.4 Impacts to Threatened and Endangered Species

No impacts to federally-listed threatened and endangered species would be expected to occur during the operations phase since these species have not been identified within the proposed license area.

Continued mitigation would be implemented to ensure impacts to threatened and endangered species remain SMALL. Examples of mitigation are spill procedures in place by the applicant to reduce impacts to wetland terrestrial species and fencing around the central plant and well fields to reduce the potential impact to land terrestrial species (NRC 2009c, EMC 2007b).

4.6.1.2.4.1 *Impacts to Species of Concern*

As described in Section 4.6.1.1.4.1, the operation of the proposed Moore Ranch Project has the potential to impact 14 avian species of concern (8 Level I species and 6 Level II species) known to occur or potentially be present as seasonal or year-round residents. Impacts to species of concern during facility operation would be similar but less than those discussed for construction because facilities would remain in place during the life of the milling operation. If the best management practices described above in Section 4.6.1.1 were followed, the potential impact to species of concern during the operations phase would be SMALL because only a few individuals would be affected and the continued existence of any particular species would not be threatened. Therefore, the potential impact to avian species of concern would be SMALL.

4.6.1.3 *Aquifer Restoration Impacts*

Section 4.3.5.3 of the GEIS discussed the potential impacts to ecological resources which could occur during the aquifer restoration phase. These impacts could include habitat disruption, but since existing (in-place) infrastructure would be used, little additional ground disturbance would be expected.

The GEIS also indicated that contamination of soils and surface waters could result from leaks and spills and from land application of treated waste water. 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. Implementation of mitigation measures such as perimeter fencing, netting, and leak detection and spill response plans would be expected to maintain SMALL impacts.

There would be no impacts to threatened and endangered species beyond that which occurred during the construction phase because the existing infrastructure from the operations phase would continue to be used. Therefore, the overall impact to threatened and endangered species would be expected to be SMALL.

Because the existing infrastructure would be in place, the potential impact to ecological resources from aquifer restoration activities would be similar to that experienced during the operations phase; therefore, the potential impact to vegetation and wildlife would be expected to be SMALL. Adherence to WGFD and BLM seasonal noise, vehicular traffic, and human proximity guidelines (WGFD, 2009 and BLM, 2008) would further reduce the potential impact from noise, vehicular traffic, and human proximity.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for ecological resources and incorporates by reference the GEIS's conclusions that the impacts to ecological resources during aquifer restoration would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.6.1.4 *Decommissioning Impacts*

Section 4.2.5.4 of the GEIS discussed temporary land disturbance during decommissioning and reclamation from soil excavation, recovery and removal of buried piping, and the demolition and removal of structures. However, re-vegetation and re-contouring would restore habitat previously altered during construction and operations. Wildlife would be temporarily displaced, but would be expected to return upon completion of decommissioning and reclamation and the reestablishment of vegetation and habitat. Decommissioning and reclamation activities could result in temporary increases in sediment load in local streams, but aquatic species would recover quickly as sediment load decreases. For these reasons, the GEIS concluded the overall potential impact during decommissioning would be 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 consultation with the U.S. Fish and Wildlife Service under the Endangered Species Act would help to minimize impacts. Upon completion of decommissioning, re-vegetation, and re-contouring, the habitat would be reestablished; therefore limiting the potential impact. The potential impacts to threatened and endangered species could range from SMALL to LARGE, depending on site conditions.

Impacts to ecological resources during decommissioning would be similar to those experienced during the construction phase with respect to noise, traffic flow, and earthmoving activites. However, the decommissioning phase would not disrupt as much natural habitat as would have occurred during the construction phase of the ISR process. The decommissioning phase would be an estimated 12 months in duration and would be reduced with time as decommissioning and reclamation proceed.

Decommissioning would involve abandonment of the central plant, office and maintenance buildings, the well fields and removal of surface equipment consisting of the injection and production feed lines and buried well field piping. Stockpiled topsoil would be used to regrade the land to pre-construction contours, as required, and seeded with native vegetation once the buildings are removed. No loss of vegetative communities beyond that disturbed during construction would be expected. The removal of piping would impact vegetation that has reestablished itself, although this, too, would be temporary once the disturbed soil is re-seeded. The decommissioning process would be expected to create added noise and traffic as buildings are taken down and hauled away. During this time, wildlife could come in conflict with heavy equipment, or may move elsewhere on the property due to higher-than-normal noise. As required, the applicant 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 were completed.

Decommissioning impacts would be temporary and SMALL. Implementation of the mitigation measures discussed in Sections 4.6.1.1 and 4.6.1.2 would further reduce the potential impact.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for ecological resources and incorporates by reference the GEIS's conclusions that the impacts to ecological resources during decommissioning would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.6.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no ISR facility construction associated with this project, and therefore no land disturbance or vegetation removal associated with construction, operation, aquifer restoration, or decommissioning. The area would continue to provide vegetation communities and wildlife habitat typical of the region. Land would continue to be used for pastureland and grazing leases would continue. Grazing of existing vegetation would continue, particularly the grassland communities. Existing wildlife present within the proposed license area may be affected if continued cattle grazing causes destruction of wildlife habitat or if species are displaced by cattle populations due to lack of forage and cover. However, only a few individuals would be affected and they could relocate to suitable adjacent habitats. There would be no impacts to ecological resources under this alternative compared to the proposed action.

4.7 Meteorology, Climatology, and Air Quality Impacts

Potential environmental impacts to air quality at the Moore Ranch Project could occur during all phases of the ISR facility's lifecycle. Impacts primarily involve fugitive dust and combustion emissions from vehicles and diesel equipment associated with construction, operation, and decommissioning activities. Other dust emissions may be associated with the suspension of dried spill areas and radon releases from well system relief valves, resin transfer or elution. Factors in determining the significance of the potential impacts are (1) whether the air quality for the site's region of influence is in compliance with the National Ambient Air Quality Standards (NAAQS); and (2) whether the facility can be classified as a major source under the New Source Review or operating (Title V of the Clean Air Act) permit programs. An additional concern would be the presence of Prevention of Significant Deterioration (PSD) Class I areas; however, there are no PSD Class I areas in the Wyoming East Uranium Milling Region where the Moore Ranch Project is located.

Radon release impacts are addressed in the Public and Occupational Health and Safety Impacts analyses in Section 4.13. In general, nonradiological emissions from pipeline system venting, resin transfer, and elution would be rapidly dispersed in the atmosphere and would be small, primarily due to the low volume of effluent produced. Such emissions were not considered in the following analysis. Detailed discussion of the potential environmental impacts to air quality from construction, operation, aquifer restoration, and decommissioning the proposed Moore Ranch Project are provided in the following sections.

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 Moore Ranch Project would be expected to be reduced to background levels at the location of the nearest resident 4.5 km (2.8 mi) east of the boundary of the proposed license area. The emission of pollutants that have the potential to result in cumulative impacts, such as ozone precursors and greenhouse gases, would be insignificant.

4.7.1 Proposed Action (Alternative 1)

4.7.1.1 *Construction Impacts*

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 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 Moore Ranch site, non-radiological air quality impacts would be SMALL.

The air quality within the proposed Moore Ranch study area would not be substantially affected by project construction because of the temporary nature of the activity, the limited footprint of the construction area relative to the project area, the relatively low volume of traffic and heavy equipment compared with conventional mining activities, and the low background concentrations of pollutants since the site is located in an attainment area. The impact to air quality from emissions from the operation of construction machinery and by fugitive dust would be SMALL.

A site-specific plan would be developed to identify mitigation measures for fugitive dust emissions. These measures would include maintaining best management practices to ensure that the construction air quality control equipment would be maintained to mitigate fugitive dust emissions. Additional mitigation measures could include 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.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions at the proposed Moore Ranch Project are comparable to those described in the GEIS for air quality and incorporates by reference the GEIS's conclusions that the impacts to air quality during construction are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.7.1.2 *Operation Impacts*

The GEIS (Section 4.3.6.2) notes 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; therefore, potential impacts are expected to be SMALL, due in part to the expected low volume of gaseous 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.

Since the number of vehicles commuting and equipment operating at the proposed Moore Ranch Project would not exceed that evaluated in the GEIS, the potential impact would be expected to be SMALL. The mitigative measures described under Section 4.7.1.1 would further reduce the potential impact.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b) the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for air quality and incorporates by reference the GEIS's conclusions that the impacts to air quality during operations would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.7.1.3 *Aquifer Restoration Impacts*

As discussed in 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 (NRC, 2009a). 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.

Vehicular traffic during the aquifer restoration phase would be limited to delivery of supplies and commuting staff, with a decreasing frequency of offsite yellowcake shipments as restoration proceeds. Therefore, fewer trips would occur than during the operation phase.

Air quality at the proposed Moore Ranch Project would not be substantially affected by the aquifer restoration activities because fewer vehicles would be required during this phase of the project; therefore, the potential impact would be SMALL. The mitigative measures described under Section 4.7.1.1 would further reduce the potential impact.

Additionally, after its independent review of Uranium One's license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for air quality and incorporates by reference the GEIS's conclusions that the impacts to air quality during aquifer restoration would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.7.1.4 *Decommissioning Impacts*

Section 4.3.6.4 of the GEIS notes 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.

In the short term, emission levels could increase, especially for particulate matter from activities such as dismantling buildings and milling equipment, removing any contaminated soil, and grading the surface as part of reclamation activities. The plugging and abandonment of production and injection wells would use equipment that generates gaseous emissions, as would the heavy trucks required to ship non-contaminated waste to local landfills and 11e.(2) waste to a licensed facility. These emissions would also be expected to be limited in duration with respect to the operation and aquifer restoration phases.

Potential air impacts during the decommissioning phase of the proposed Moore Ranch Project would be comparable to that described for the construction phase. In the short term, emission levels would increase for particulate matter from earthmoving activities and dismantling buildings. The mitigation measures described under Section 4.7.1.1 would also be implemented during decommissioning activities.

Additionally, after its independent review of Uranium One's license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for air quality and incorporates by reference the GEIS's conclusions that the impacts to air quality during decommissioning would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.7.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no change in the air quality at the proposed Moore Ranch Project or at any surrounding receptors. While oil and gas extraction activities would continue and perhaps expand in the future (along with CBM operations), these activities have been shown to have very little impact – direct, indirect, or cumulative – on air quality, regardless of geographic scale (BLM, 2003). The generation of fugitive dust is currently minimized by the fact that existing roads are shared and maintained by the natural resource extraction and ranching operations that occur in the area. Roads are also maintained in good repair by these entities and restricted from unpermitted uses.

This area currently meets the NAAQS for attainment status and because there are no significant air pollution sources at the proposed site, it is expected that this area would continue to meet the NAAQS. This alternative would result in neither beneficial nor negative impacts to air quality.

4.8 Noise Impacts

Potential environmental impacts from noise at the Moore 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 and central processing plant activities and equipment. These impacts may affect both humans and wildlife in the vicinity of the site.

As stated in the GEIS, the Occupational Safety and Health Administration (OSHA) has set permissible exposure limits for workplace noise levels (NRC, 2009a). Moore Ranch would be required to limit worker exposure in accordance with these regulations; therefore occupational noise exposure is not discussed in this section but rather in Section 4.13. Instead, it will focus on analyzing the potential dispersion of noise impacts to off-site receptors described in Section 3.8 (NRC, 2009a).

The noise analysis presented below evaluated both mobile and stationary noise sources to assess the potential to impact sound adjacent to the proposed Moore Ranch Project and to determine the site-specific impact. The GEIS concluded that the noise impact at an ISR facility could range from SMALL to MODERATE during all four phases of an ISR project depending on the distance between the nearest resident and the activities occurring at the ISR facility (NRC, 2009a). 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 (Alternative 1)

4.8.1.1 *Construction Impacts*

As discussed in Section 4.3.7.1 of the GEIS, potential noise impacts are expected to be greatest during construction of an ISR facility, due to the heavy equipment involved and given the likelihood that these facilities would be built in rural, previously undeveloped areas where background noise levels are lower. The use of drill rigs, heavy trucks, bulldozers, and other equipment used to construct and operate the well fields, drill wells, construct access roads, and build the production facilities would generate noise that would be audible above the undisturbed background levels. Noise levels are expected to be higher during daylight hours when construction is more likely to occur, and more noticeable in proximity to the operating equipment. Administrative and engineering controls would be expected to maintain noise levels in work areas below Occupational Health and Safety Administration (OSHA) regulatory limits and mitigated by use of personal hearing protection. For individuals living in the vicinity of the site, ambient noise levels would be expected to return to background at distance more than 300 m (1,000 ft) from the construction activities. Wildlife would be expected to avoid areas where noise-generating activities were ongoing; although for certain wildlife (e.g., sage grouse) continuous elevated noise levels may reduce their breeding success. Overall, these types of noise impacts would be SMALL given the distance to the nearest resident.

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 could be MODERATE for lightly traveled rural roads through smaller communities.

As noted above, the construction phase of the Moore Ranch Project would involve the use of heavy equipment to create and improve road surfaces, furnish supplies, excavate footings, erect buildings, and install the wells and pipelines at the well fields. Equipment such as bulldozers, graders, tractor trailers, excavators, cranes, and drill rigs would create noise that would be audible onsite above background noise levels estimated as 40 dBA. However, since the nearest resident lives beyond 300 m (1,000 ft) from the boundary of the proposed Moore Ranch Project, they would notice no change in background noise. Site speed limits would also be used to further mitigate traffic noise impacts (EMC, 2007a).

Truck transport of construction materials would be the primary noise source that could potentially affect the public. However, because of the limited traffic volume associated with the project (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. Thus, project-related transportation noise impacts would be SMALL.

Additionally, after its independent review of Uranium One's license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that noise impacts during construction could range from SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Moore Ranch Project would expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.8.1.2 *Operation Impacts*

Section 4.3.7.2 of the GEIS discussed ISR operations activities that could generate noise. These activities would occur indoors within the central uranium processing facility; therefore, offsite noise from plant operations would be less than could be heard during the construction phase of an ISR project. Wellfield equipment (e.g., pumps, compressors) would be contained within structures (e.g., header houses, satellite facilities), also reducing the potential for noise to be heard by offsite individuals. Traffic noise from commuting workers, truck shipments to and from the facility, and facility equipment would likely be localized, limited to highways in the vicinity of the site, access roads within the site, and well field roads. Relative short-term increases in noise levels associated with this traffic would be SMALL for the larger roads, but could be MODERATE for lightly traveled rural roads through smaller communities.

As noted in the GEIS and described above, it was assumed that a variety of mechanical equipment located at the central plant at the proposed Moore Ranch Project would generate noise. However, because the nearest resident lives more than 300 m (1,000 ft) beyond the boundary of the proposed Moore Ranch Project, this person would not notice any change in sound from the operations phase; therefore, there would be no impact.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that noise impacts during operations could range from SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Moore Ranch Project would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.8.1.3 *Aquifer Restoration Impacts*

Section 4.7.3.3 of the GEIS stated 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 during construction and operation phases of an ISR facility. Therefore, the potential impacts could range from SMALL to MODERATE depending on the location of the nearest resident.

At the proposed Moore Ranch Project, the types of activities described above in the GEIS would occur at the site. Vehicular traffic would be limited to delivery of supplies and staff travel to and from the site, therefore, fewer trips would occur than during the operation phase. Because the nearest resident is located beyond 300 m (1,000 ft) from the boundary of the proposed Moore Ranch Project, this person would not notice a change in background noise. Therefore, there would be no impact.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. As noted above, the GEIS concludes that noise impacts during aquifer restoration could range from SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Moore Ranch Project would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.8.1.4 *Decommissioning Impacts*

Section 4.7.3.4 of the GEIS discussed the potential noise impact from decommissioning activities at an ISR facility. Noise levels generated during decommissioning and reclamation would be expected to be similar to, or less than, that experienced during the construction phase of the project. Equipment used to dismantle buildings and milling equipment, remove potentially contaminated soils, or for surface grading during reclamation would generate above background noise levels. This noise 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. Like the construction phase of an ISR project, noise levels would be higher during daylight hours when decommissioning and reclamation would be more likely to occur, and be more noticeable in proximity to the operating equipment. Workplace noise exposure would be managed using the same administrative and engineering controls described for the construction phase, and given the likely distance to nearby residents from (i.e., greater than 300 m [1,000 ft]), it is not expected that the noise would be discernable to offsite residents or communities.

Sound generated during decommissioning would be similar to that experienced during construction activities and would be generated by earthmoving, excavation, and building demolition activities. Therefore, the noise impacts would be expected to be similar to or less than the construction activities at the site. Decommissioning activities would result in a large, but temporary noise impact on site and just beyond the plant boundary. At the location of the nearest resident who is located more than 300 m (1,000 ft) from the boundary of the proposed Moore Ranch Project, there would be no change in the noise level and there would be no impact. Transportation related noise impacts associated with the transfer of solid waste to the county landfill and of 11e.(2) regulated waste to a licensed facility would result in a SMALL impact above background noise levels.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that noise impacts during decommissioning could range from SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Moore Ranch Project would be expected to be SMALL because of the location of the nearest resident. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.8.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no change in the sound levels either within the proposed license area or to surrounding receptors. While natural resource exploration activities would continue and could potentially expand in the future, they would typically be of short duration and would involve few vehicles and no permanent, noise emitting infrastructure. The rural setting of the project area and the continuation of ongoing natural resource exploration activities, would result in sound levels remaining at or below 40 dBA.

4.9 Impacts to Historical and Cultural Resources

Potential environmental impacts to historic and cultural resources at the proposed Moore Ranch Project could occur during all phases of the ISR facility's lifecycle. These impacts would predominantly result from the loss of, or damage to historical, cultural, and archaeological resources and from temporary access restrictions to these resources.

Detailed discussion of the potential environmental impacts to historic and cultural resources from construction, operation, aquifer restoration, and decommissioning of the proposed Moore Ranch Project are provided in the following sections.

4.9.1 Proposed Action (Alternative 1)

Under the proposed action, the NRC would issue a license for ISR uranium milling and processing at the proposed Moore Ranch Project. The area that could be directly disturbed by the proposed action would be within approximately 61 ha (150 ac) of the 2,879 ha (7,110 ac) proposed license area. For archaeological sites, the impacts from various actions are linked to the physical footprints associated with the proposed action. The potentially impacted areas are described in detail in Section 2.1.1.2 and discussed below. At the proposed Moore Ranch Project, a central plant, two well fields and access roads would be constructed and pipeline would be laid.

The construction of the central plant and storage facilities would disturb approximately 6 acres. Construction of the well fields along with a new access road would disturb approximately 24 ha (59 ac). An existing two-track access road would connect SR-387 to service both Wellfields 1 and 2. However, a new secondary access road would be constructed to connect Brown Road to the central plant (Figure 2-1). This new road would extend east from the main two-track road

(Brown Road) to service the central plant. This secondary access road would encompass about 0.7 ha (1.77 ac). An ISR trunkline would connect Wellfield 2 and the central plant. Various well field-specific service roads also exist and they would connect the header houses, injection wells, and monitor wells.

4.9.1.1 *Construction Impacts*

Section 4.3.8.1 of the GEIS discussed the potential impact to historic and cultural resources from excavation during the construction phase of an ISR facility (NRC, 2009a). Access to, historical, cultural, and archaeological resources could also be temporarily restricted during the construction phase.

A NRC applicant would be expected to conduct the appropriate historic and cultural resource surveys as part of pre-license application activities. The GEIS also noted that the determination of eligibility 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 (TCP) would be conducted as part of the site-specific review.

TCPs are historic and cultural resources that are important for a group to maintain its cultural heritage. Traditional cultural properties are most often associated with Native American religious or cultural practices. Most traditional cultural properties can be identified only through consultation with Federally-recognized Native American Tribes. To determine the presence of significant cultural resources and to mitigate potential impacts, consultation amongst the NRC, the applicant, the State Historic Preservation Offices (SHPO), other government agencies (e.g., U.S. Bureau of Land Management and State Environmental Departments), and Native American Tribes (Tribal government or designated THPO) would be conducted as part of the site-specific review. In addition, as discussed in the GEIS, an NRC licensee would likely be required under conditions in its license, to stop work upon discovery of previously undocumented historic or cultural resources and to consult with the appropriate federal, tribal, and state agencies with regard to the appropriate mitigation measures. The GEIS concluded that the potential impact to historic and cultural resources during the construction phase of an ISR project could range from SMALL to LARGE depending on the site-specific conditions.

Construction resulting from the selection of the proposed action would not have an adverse, direct impact on specific archaeological sites determined to be eligible for listing on the NRHP.

Brunette (2007) reported the results of various Class III surveys that have been conducted at the proposed Moore Ranch Project. The archaeological sites and isolated finds that could be affected during construction were determined to be ineligible for listing on the NRHP (Brunette, 2007). No sites recommended as eligible for listing on the NRHP would be affected by the proposed action. NRC believes these sites are ineligible; however, the SHPO will make the final determination..

Since no sites potentially eligible for listing on the NRHP would be affected by construction phase activities at the proposed Moore Ranch Project, the potential impact to historical and cultural resources would be SMALL.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to historical and cultural resources during construction could range from SMALL to

LARGE. The staff concludes that site-specific impacts for the proposed Moore Ranch Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.9.1.2 *Operation Impacts*

Section 4.3.8.2 of the GEIS concluded that potential impacts to historical, cultural, and archaeological resources from the operations phase of an ISR project would be less than during construction because the infrastructure would be in place and less land disturbance would occur. Since the Wyoming SHPO would require that work stop upon discovery of previously undocumented historic or cultural resources and that the appropriate federal, tribal, and state agencies be notified with regard to mitigation measures and because of the limited land disturbance during the operations phase, the GEIS concluded that impacts to historic and cultural resources from ISR operations would be SMALL.

There would be no impacts to historical and cultural resources recommended eligible to the NRHP from operations at the proposed Moore Ranch Project. The three NRHP eligible sites are located in areas that would be unaffected by facility operation. Therefore, the potential impact to cultural resources from operations at the proposed Moore Ranch Project would be SMALL. Should ground disturbing activities (maintenance activities) occur outside of previously surveyed areas, then archaeological surveys would be conducted prior to the activity.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for historical and cultural resources and incorporates by reference the GEIS's conclusions that the impacts to historical and cultural resources during operation at the proposed Moore Ranch Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.9.1.3 *Aquifer Restoration Impacts*

Section 4.3.8.3 of the GEIS concluded that impacts to historic and cultural resources from aquifer restoration would be expected to be either similar to, or less than, potential impacts during the operations phase because aquifer restoration activities would generally be limited to the existing infrastructure and previously disturbed areas (e.g., access roads, central processing facility). Therefore, the GEIS concluded that the potential impact to historic and cultural resources from aquifer restoration activities would be SMALL.

As noted in Section 4.9.1.2 of this SEIS, the impact to historic and cultural resources during the aquifer restoration phase would be similar to that during operations. There would be no impacts on historical and cultural resources recommended eligible to the NRHP from the aquifer restoration phase of the proposed Moore Ranch Project; therefore, the impact would be SMALL.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for historical and cultural resources and incorporates by reference the GEIS's conclusions that the impacts to historical and cultural resources during aquifer restoration would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.9.1.4 *Decommissioning Impacts*

Section 4.3.8.4 of the GEIS discussed the potential impact to historic and cultural resources from decommissioning. Since decommissioning and reclamation activities would focus on previously disturbed areas, the historic and cultural resources would have been known from the investigations conducted prior to initiating construction. Therefore,the GEIS concluded that the potential impacts to historical, cultural, and archaeological resources from decommissioning and reclamation actions would be SMALL.

As noted in Section 4.9.1.2 of this SEIS, the impact to historic and cultural resources during the decommissioning phase would be similar to that during operations. There would be no impacts to historical and cultural resources recommended eligible to the NRHP from decommissioning actions; therefore, the impact would be SMALL.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions at the proposed Moore Ranch Project are comparable to those described in the GEIS for historical and cultural resources and incorporates by reference the GEIS's conclusions that the impacts to historical and cultural resources during decommissioning would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.9.2 No-Action (Alternative 2)

If the No-Action Alternative is selected there would be no impacts associated with the proposed ISR facility and therefore, no impacts to subsurface or surface historic and cultural resources related to this project. When compared to the action alternatives, there would be no effect in regards to historic and cultural resources (*i.e.* no archaeological sites or isolated cultural resources) would be affected by direct or indirect effects as a result of this alternative.

The impact to the resources resulting from the selection of the No-Action Alternative considers only the consequences of the proposed action. It does not evaluate impacts to the resource categories that may be occurring from other, non-related actions. Other actions that are ongoing in the general area include oil and gas exploration and production and cattle ranching. The impact from cattle ranching on the cultural resources is ongoing. Cultural and ethnographic resources do not have to be inventoried or evaluated for this action to occur. This is not the case, however, for oil and gas exploration and production. State and federal level permits are required and cultural and ethnographic resources are routinely identified and evaluated as part of the permitting process.

one of the archaeological sites identified within the project area have been impacted by oil and gas exploration and production. However, it is likely that most of the archaeological sites have been disturbed by routine cattle grazing. Some sites had been obviously disturbed by two-track roads and cattle related operations such as fences. Overall, there are impacts to cultural resources from actions not related to the current project.

In sum, prior actions may have impacted the cultural and historical resources but the extent of this impact is unknown. If the proposed action is not selected, then impacts to the cultural and historical resources are likely to continue as they have in the past.

4.10 Visual and Scenic Resources Impacts

Potential visual and scenic impacts from the proposed Moore Ranch Project could 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 the central plant and storage 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.

As described in Section 3.10, the BLM Visual Resource Management (VRM) classification of the proposed Moore Ranch Project was VRM Class IV, which allows an activity to contrast with basic elements of the characteristic landscape to a a much greater extent (BLM 2007).

4.10.1 Proposed Action (Alternative 1)

The proposed action would result in temporary, SMALL impacts to the visual and scenic resources of the area. The nature of the impacts would be in keeping with the BLM visual resource classification as a Class IV area (see Section 3.10 of this SEIS).

4.10.1.1 *Construction Impacts*

As discussed in Section 4.3.9.1 of the GEIS, visual impacts during construction can result from equipment (drill rig masts, cranes), dust/diesel emissions from construction equipment, and hillside and roadside cuts. Depending on the location of a proposed ISL facility relative to viewpoints such as highways, process facility construction and drill rigs could be visible. 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 Class I areas require more stringent air quality standards that can affect visual impacts; however, there are no PSD Class I areas in the Wyoming East Uranium Milling Regions. Finally, proposed ISR facilities are expected to be located more than 16 km [10 mi] from the closest VRM Class II area, and the visual impacts associated with ISL construction would be consistent with the predominant VRM Class III and IV classification, Therefore, visual impacts associated with ISL construction would be expected to be SMALL.

Since the land use surrounding the proposed Moore Ranch Project currently has pipelines, well fields, and utility lines that have previously disturbed the landscape, implementing the proposed action would not change the existing character of the landscape. Because a number of wells would be installed to support the ISR operation, multiple drill rigs would likely be operating during well field construction. Once a well was completed and conditioned for use, the drill rig would be moved to a new location to drill the next hole. Because temperatures in the affected environment drop below freezing during the winter, wellheads for completed wells would be covered to prevent freezing and protect the well. These covers would be low structures (1-2 m

[3-6 ft] high) and present only a slight contrast with the existing landscape. Unless the topography is extremely flat and void of vegetation, it is likely that these structures would not be visible from distances on the order of 1 km (0.6 mi) or more.

Most visual and scenic impacts associated with earthmoving activities during construction would be temporary. Roads and structures would be more long-lasting, but would be removed and reclaimed after operations cease. As noted in Section 3.10, the project area has been classified as VRM Class IV according to the BLM classification system which allows an activity to have higher contrast with basic elements of the characteristic landscape. Wellfield development would occur sequentially, with reclamation in the Wellfield 1 concurrent with construction and operations in Wellfield 2. During the construction phase of the proposed Moore Ranch Project mitigation through implementing best management practices such as dust suppression and coloration of well covers would further reduce overall visual and scenic impacts of project construction.

The visible surface structures proposed for the Moore Ranch Project include wellhead covers, header houses, electrical distribution lines, and the central plant. The project would use both existing and new roads to access each header house and the central plant. Temporary and short-term visual impacts during the construction period in each well field would result from header house construction, well drilling, and construction of access roads and electric distribution lines. Following completion of well field installation, temporarily disturbed areas would be reclaimed. Therefore, construction impacts to visual and scenic resources would be expected to be SMALL.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS for visual and scenic resources and incorporates by reference the GEIS's conclusions that the impacts to visual and scenic resources during construction would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.10.1.2 *Operation Impacts*

Section 4.3.9.2 of the GEIS stated 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 and the topography is typically generally rolling, most visual impacts during operations would not be visible from more than about 1 km [0.6 mi] away. 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 evaluated in the GEIS 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.

Because uranium deposits are typically irregular in shape, the network of pipes, wells, and powerlines (6 m [20 ft] tall) would not be regular in pattern or appearance (*i.e.*, not a grid), reducing visual contrast and associated potential impacts. Each wellhead cover approximately 0.9 m (3 ft) high and 0.6 m (2 ft) in diameter typically consists of a weatherproof structure placed over the well and each header house would be a small metal building. The central plant at the Moore Ranch Project would be approximately 122 m (400 ft) by 30 m (98 ft) in size. In addition, maintenance, warehouse, and office structures would be constructed at the Moore Ranch Project. A disturbance area around each header house would be necessary to provide an adequate area for turnaround of operations and maintenance vehicles. Electric distribution lines would connect header houses to existing electric distribution lines

Extensive CBM development has occurred in the vicinity of the proposed Moore Ranch Project and future development is planned. CBM installations are similar in visual impact to those associated with ISR uranium mining. CBM wells are installed in a network of approximately 3 wells per square kilometer (8 wells per square mile connected by underground pipelines to collection and pumping structures that appear similar to ISR header houses. Overhead power lines are installed to each well.

Even though the operations phase of the proposed Moore Ranch Project is estimated to take 12 years, the impacts to visual and scenic resources would be expected to be SMALL because of the VRM Class IV classification, the existing natural resource extraction activities ongoing in the area, and the remoteness of the area.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions at the proposed Moore Ranch Project are comparable to those described in the GEIS for visual and scenic resources and incorporates by reference the GEIS's conclusions that the impacts to visual and scenic resources during operation are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.10.1.3 *Aquifer Restoration Impacts*

Section 4.3.9.3 of the GEIS addressed visual and scenic impacts from aquifer restoration. The GEIS stated that aquifer restoration activities would be 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 were expected to be SMALL (NRC, 2009a).

Visual resource impacts from aquifer restoration at the Moore Ranch Project would be similar to those seen in the operations phase described in Section 4.10.1.2 of this SEIS since the site activity and number of staff to support restoration would be smaller than for the operations phase. No modifications to either scenery or topography would occur during restoration. Therefore, impacts to visual and scenic resources from aquifer restoration would be SMALL.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions at the proposed Moore Ranch Project are comparable to those described in the GEIS for visual and scenic resources and incorporates by reference the GEIS's conclusions that the impacts to visual and scenic resources during aquifer restoration would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.10.1.4 *Decommissioning Impacts*

Section 4.3.9.4 of the GEIS discussed the impact to visual and scenic resources. Since similar equipment use and decommissioning activities would be conducted as those occurring during the construction phase, the potential impact to visual and scenic resources would be similar to, or less than, those experienced during construction. Most potential visual impacts during decommissioning would be temporary since equipment would be moved and they would be mitigated by best management practices (e.g., dust suppression). Visual impacts would be low since ISR sites are expected to be in sparsely populated areas, and diminish as decommissioning activities ceased. NRC licensees are required to conduct final site decommissioning and reclamation under an approved site reclamation plan, with the goal of returning the landscape to preconstruction conditions. While some roadside cuts and hill slope modifications may persist beyond decommissioning and reclamation, the GEIS analysis determined that visual and scenic impacts from decommissioning would be SMALL (NRC, 2009a).

No modifications to scenery or topography would persist after restoration was complete. Once project operations cease (the life of the Moore Ranch Project is estimated at 10 to 12 years), the central plant and support structures would be decommissioned and removed. Reclamation would return the visual landscape to baseline contours and would reduce the visual impact by removing buildings and the associated infrastructure. Uranium One would submit a site reclamation plan to NRC in accordance with10 CFR Part 40 before the license was terminated.

During decommissioning and reclamation, temporary impacts to the visual landscape would be expected to be similar to or less than those during the construction period. For example, equipment used to dismantle buildings and milling equipment, remove contaminated soil, or grade the surface as part of reclamation activities would generate temporary visual contrasts. Overall impacts to the visual landscape would be expected to be minimal and temporary; once decommissioning and reclamation activities were complete, the visual landscape would be returned to baseline except for any required monitoring. Therefore, decommissioning impacts to visual and scenic resources would be SMALL.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions at the proposed Moore Ranch Project are comparable to those described in the GEIS for visual and scenic resources and incorporates by reference the GEIS's conclusions that the impacts to visual and scenic resources during decommissioning would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.10.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no ISR facility construction and therefore no change to existing visual and scenic resources at the proposed project area or in the region. The pipelines, well fields, and utility lines in place within the project area from existing CBM and coal and gas extraction activities would remain and would be considered to cause a small to moderate amount of disturbance to the landscape. No additional structures or uses associated with this project would be introduced that would cause the existing viewscapes to be affected, and the existing scenic quality would be unchanged. The visual resource classification would remain Class IV, as defined in Section 3.10 of this SEIS.

Because there would be no ISR facility construction under the No-Action Alternative, there would also be no facility operation, restoration, or decommissioning. The visual and scenic resources would remain in their current state.

4.11 Socioeconomic Impacts

Potential socioeconomic impacts from implementing activities at the proposed Moore Ranch Project could occur during all phases of the ISR facility's lifecycle. Potential socioeconomic impacts would result predominantly from direct employment at an ISL facility and the indirect demands on the existing public and social services, tourism/recreation, housing, infrastructure (schools, utilities), and the local workforce.

The anticipated impacts as a result of the proposed construction, operation, decommissioning and restoration of the Moore Ranch Project include increased pressure on the area's housing market, increased demand for services and a boost to the local economy from construction and operations worker spending, as well as county and state tax revenues from mining operations. Increased tax revenue would have a positive effect on the local and state economy (although there is a lag between impacts and increases in tax revenue). Indirect employment related to the project could increase that number of project related workers substantially, especially during the operational phase.

Detailed discussion of the potential socioeconomic impact from construction, operation, aquifer restoration, and decommissioning the proposed Moore Ranch Project is discussed in the following sections.

4.11.1 Proposed Action (Alternative 1)

4.11.1.1 *Construction Impacts*

Section 4.3.10.1 of the GEIS discussed the potential socioeconomic impact from construction of an ISR facility (NRC, 2009a). These impacts would result from direct employment at an ISL facility and the indirect demand placed on the existing public and social services sector, tourism/recreation, housing, infrastructure (schools, utilities), and the local work force. The GEIS estimated total peak employment at an ISR facility to be about 200 people, inclusive of both company and local contractor employees, depending on the timing of construction relative to the other ISR lifecycle stages. The GEIS also estimated 140 indirect jobs could be created associated with the ISR facility. During construction of surface facilities and well fields, the GEIS assumed that in general local contractors (drillers, construction) would be used, as available. It was also assumed that building materials and building supplies would be purchased locally to the extent practical.

The GEIS also assumed that most employees at an ISR facility would choose to live in larger communities with access to more services. However, the GEIS also assumed 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 the purchase of goods and services and the payment of taxes. Depending on where the workforce and supplies came from, the GEIS concluded that the potential impact to towns and communities with respect to housing and employment structure, could range from SMALL to MODERATE.

Given the expected short duration of construction activities (the GEIS assumed 12 to 18 months), the GEIS assumed that families would choose to not relocate closer to the site. For this reason, the potential impact to education and use of local services was estimated to be SMALL.

Because of the small size of the ISR construction workforce relative to other construction projects, the GEIS concluded that overall the potential socioeconomic impact from construction at an ISR facility could range from SMALL to MODERATE.

The construction phase of the proposed Moore Ranch Project is expected to be short term (nine months). The workforce needed for the construction of the ISR facility would impact the local economy and infrastructure. Since the proposed license area is located in a rural, low-population density area, the construction workforce would largely come from surrounding towns and cities. The proposed Moore Ranch Project would be expected to employ 40-60 workers during the construction phase of the proposed action (EMC, 2007a).

Rural areas in Wyoming are especially vulnerable to the boom and bust trends that have occurred in the energy sector of Wyoming. Counties and towns whose economies are centered on extractive industry do not have a diversified economy, and have suffered when the natural resources are exhausted, or when the market for the resource becomes depressed. Counties with large resource bases (like Campbell County) and larger towns such as Gillette and Casper have planning offices, a history of growth (and decline) and have built the capacity to manage change This planning capacity coupled with historical experience in coping with change helps mitigate potential impacts though adaptation. The current recession has produced a slowdown in the State of Wyoming and in the resource rich areas such as Campbell County, providing some temporary relief to local governments adapting to the latest boom in energy development. To the extent that project plans and information (such as changes in activity and schedule) are shared with local planners (regularly) and van/car pooling is provided and encouraged (from the larger population centers) impacts to smaller towns and places would be minimized. The potential impact to each component of the socioeconomic system is discussed below.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions at the proposed Moore Ranch Project are comparable to those described in the GEIS. The GEIS concludes that impacts to socioeconomics during construction could range from SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Moore Ranch Project are expected to be SMALL as described below. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.11.1.1.1 Demographics

Bust and boom cycles in population would continue with or without the proposed Moore Ranch Project. The construction phase of the proposed Moore Ranch Project would be expected to last for approximately nine months. Within the Powder River Basin of Wyoming, workers usually choose to locate in larger population centers such as Gillette, but would also commute from towns such as Casper and Buffalo. Some workers would likely locate in the small town of Wright. According to the Johnson County Planning Office, it is likely that some workers would choose to locate in Midwest and Edgerton in Natrona County. Sweetwater 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), lower demand for electricity (and, therefore, coal production), and small number of workers expected during the construction phase, the impact of the proposed action could be SMALL in the short term if the project were to begin in 2009-10.

4.11.1.1.2 Income

No changes to income would be anticipated under the proposed action. The median income in Campbell County is approximately $67,600 (EMC, 2007a). It is expected that workers would be paid the regional rates typical of the area. Impacts would be SMALL.

4.11.1.1.3 Housing

Changes in population drive changes in housing demand. Construction of the central plant at the proposed Moore Ranch Project would precede construction of the well fields, thus minimizing housing demand. The construction phase is expected to last nine months. The construction workforce is estimated to be 50 people, with 25 people coming from Campbell County. The rest of the construction workforce would come from neighboring Natrona County. Most of the construction work force is expected to be found within the existing workforce currently living in these two counties. Therefore while current housing vacancy rates are low, the construction phase should cause only a SMALL impact on the availability of housing (EMC, 2007a).

4.11.1.1.4 Employment Structure

Employment structure represents the resource-based extractive industries of the area. Given the existing downturn in the economy and the associated increase in unemployment, there could be a slight positive effect on unemployment in the area from implementing the proposed action. However, the development of an ISR project would not add to the economic diversity of the resource dependent area. The construction phase of the proposed Moore Ranch Project would have a SMALL impact.

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 workforce would have a long-term SMALL beneficial impact on the local economy though the purchase of local goods and services, as well as contributing to county and state tax revenues. Taxes derived from the value of construction equipment and use tax on purchases for the proposed Moore Ranch Project would also contribute to the Campbell and Johnson County tax base. Tax revenue would accrue to Campbell and Johnson County based on the value of construction equipment on the site from each county. Typically, this equipment would be registered at the County Assessor's Office, and a discount applied to the market value (50 percent) then 11.5 percent of the adjusted value would be taxed at the local tax rate. This income would help offset the increased needs for public services. To the extent that project contractors and subcontractors register equipment as required by Wyoming Statute, the greater the benefit to the counties and the more capable the counties would be to manage growth through increased services.

Distribution of tax revenue could be a problem in some areas. Specifically, because of the structure of the taxing system, taxes might not accrue or be distributed to the localities proportionate to the population/public service impacts experienced by those entities. This would be the case, for example, if workers chose to live in Johnson County. Tax revenue might accrue mainly in Campbell County and to the state. Similarly, small towns experiencing increased population/public service demand might not receive a proportionate level of tax increase as sales tax accrues in the larger population centers. However, the construction period is relatively short and the construction workforce is expected to reside within the existing workforce currently living in these two counties (EMC, 2007a) In general, the construction phase of the proposed Moore Ranch Project would have a SMALL impact on local finances.

4.11.1.1.6 Education

If the construction workforce and their families secure local housing, there could be an impact o on the local infrastructure, schools, and public services. However, given the small estimated construction workforce, and that it is anticipated that most workers would not relocate their entire families for such a short period of time (approximately nine months), impacts to the local infrastructure, schools, and public services from the construction phase of the proposed Moore Ranch Project would have a SMALL impact.

4.11.1.1.7 Health and Social Services

As previously discussed, changes in the size of the population and the population characteristics cause changes in the demand for health and human services. Specifically, during the construction phase of the proposed action an increased demand for doctors, hospitals and police would be expected to service the ISR project workers, worker families and others who migrated to the area to respond to the increased demand for services. The construction period is relatively short and the construction work force is expected to be found within the existing workforce currently living in these two counties (EMC, 2007a) Therefore, the impact on health and social services during the construction phase of the proposed Moore Ranch Project would be SMALL.

4.11.1.2 *Operation Impacts*

Section 4.3.10.2 of the GEIS discussed employment levels during ISR facility operations and assumed 50 to 80 workers would support this phase of the ISR lifecycle (NRC, 2009a). Employment would be expected to be less than that during the construction phase of the ISL lifecycle and peak employment would depend on the timing and overlap with other ISL lifecycle stages. Use of local contract workers and local building materials would diminish, because drilling and facility construction would drop off. Revenues would be generated from federal, state, and local taxes on the facility and the uranium produced. Employment of more technical expertise would be required during the operations phase; the GEIS assumed that the majority of the operations workforce would be staffed from outside the region, particularly during initial operations.

According to the GEIS, the effects on community services (e.g., education, health care, utilities, shopping, recreation) during the operations phase would be expected to be similar to the effects during construction except fewer people would be employed, but the employment would be of longer duration (NRC, 2009).

The operations phase of the proposed Moore Ranch Project is expected to last for approximately 12 years, although each well field would be operational for about 3.25 years each. The operations workforce would impact the local economy through the creation of jobs, the purchasing of local goods and services, as well as the increase in county and state tax revenues. Taxes derived from the value of production equipment and use tax on purchases for the proposed Moore Ranch Project would also contribute to the Campbell County tax base. Severance tax on the uranium extracted would also be collected at the state level and would contribute to the State of Wyoming's general fund.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions are comparable to those described in the GEIS. The GEIS concludes that impacts to socioeconomics during operation would be SMALL to MODERATE. The staff concludes that site-specific impacts for the proposed Moore Ranch Project are expected to range from SMALL to MODERATE as described below. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.11.1.2.1 Demographics

The operations staff to support the proposed Moore Ranch Project would be similar to the number of construction staff; however, the operations staff would remain in the area longer, and, therefore, would be more likely to secure permanent, or semi-permanent housing in the area compared to the construction staff. The operations phase of the proposed Moore Ranch Project would require a number of specialized workers, such as plant managers, technical professionals, and skilled tradesmen. For this reason, operations workers would likely come from outside the local area. The added operations workforce would remain in the area longer than the construction staff (approximately 12 years) potentially resulting in a greater number of children and other full-time residents in the area. This increase in population would create additional jobs to service the larger population. The creation of new service jobs would also foster immigration to the area (along with associated family members). Therefore, the operations phase of the proposed Moore Ranch Project would be expected to have a MODERATE impact on the local demographics.

4.11.1.2.2 Income

The average annual salary for all full-time employees would be roughly $50,000. The total annual payroll is estimated at $2,900,000. Because these salaries are consistent with current salaries in the area, the operations phase of the proposed Moore Ranch Project would have a SMALL impact on local income.

4.11.1.2.3 Housing

As previously noted, changes in population drive changes in housing demand. During the operations phase of the proposed Moore Ranch Project, housing demand would be expected to increase. While most of the area that surrounds the proposed license area is undeveloped private and public lands, the influx of operations workforce could impact the surrounding towns of Wright, Edgerton, and Midwest, and the larger cities such as Gillette and Casper, both of which are within commuting distance. Vacancy rates are low in these and other surrounding towns and cities (EMC, 2007a), and the added workforce could further reduce the housing inventory. Under a hiring scenario that assumes all of the proposed operations workforce would need to relocate to the area, 40 to 60 housing units would be required over the life of the project. Impacts to existing local residents earning less than the median income, and those on fixed incomes could be negatively affected by an upward pressure on the cost of housing. The operations phase of the proposed Moore Ranch Project would have a MODERATE impact on the availability of housing.

4.11.1.2.4 Employment Structure

During the operations phase of the proposed Moore Ranch Project new jobs would be created, such as project managers, plant operators, lab technicians, and drill contractors. Employment structure represents the resource-based extractive industries of the area. Since the proposed Moore Ranch Project would be considered another extractive industry, no changes to the employment structure would be expected during the operations phase; however, the overall level of employment would increase. However, the proposed Moore Ranch Project would negatively contribute to the area's economic diversity. If the economy was more diversified, then it would be better able to withstand fluctuations in one industry without going through a "bust" cycle. As discussed in Section 3.11, the State of Wyoming has been experiencing a boom over the last several years which has led to an increase in employment in the mining industry and a decrease in diversification of the state economy. The same holds true for Campbell County (Wyoming Department of Employment, Research and Planning, 2009). The operations phase of the proposed Moore Ranch Project would have a MODERATE impact on the local economy while not increasing the diversification of the economy from extractive industries.

4.11.1.2.5 Local Finance

Tax revenue would continue to accrue to Campbell County during operations. With respect to the direct operation of the proposed Moore Ranch Project, a personal property tax would be applied to the value of all equipment used as previously discussed in Section 3.11.5. In addition, a state mineral severance tax would be applied to the mined uranium. However, the State severance tax does not come back to the county directly. The county also imposes an ad valorem tax to production.

Campbell County would indirectly benefit from the increased sales tax revenue. Under Wyoming law, there is a 4 percent sales and use tax to which local governments may add up to 3 percent optional tax. Campbell County also has a 2 percent lodging tax. Currently, Campbell County has an additional tax of 1 percent (Wyoming Department of Revenue, 2009). Thus, the operation of the proposed Moore Ranch Project would contribute tax revenue to Campbell County and result in a MODERATE impact. As previously mentioned in the discussion of construction impacts, the distribution of tax dollars could place an uneven benefit/burden on some localities.

4.11.1.2.6 Education

An estimated 40 to 60 people would be required for the operation of the proposed project.. In the event that the entire operations workforce and their families relocated to the counties, the population increase would be a maximum of 150, based on the 2005 average household size of 2.52 in Wyoming (EMC, 2007a). Families moving into the Natrona and Campbell County school districts as a result of the proposed Moore Ranch Project operations would not stress the current school system because it is presently under capacity (EMC, 2007a). The additional influx of population would impact local schools and infrastructure producing a SMALL impact.

4.11.1.2.7 Health and Social Services

Changes in the size of the population and the population characteristics cause changes in demand for health and human services as previously discussed. Specifically, during the operations phase of the proposed Moore Ranch Project there would be an increased demand for doctors, hospitals and police to service the ISR project workers, worker families and others who migrated to the area in response to the increased demand for services. Therefore, the impact on health and social services would be MODERATE. However, because the local area has previously experienced boom and bust cycles, it has developed the capability to manage change.

Therefore, the impact from operations would be anticipated to range from SMALL to MODERATE (EMC, 2007a).

4.11.1.3 *Aquifer Restoration Impacts*

Section 4.3.10.3 of the GEIS indicated that the socioeconomic impact during the aquifer restoration phase would be expected to be similar to the impact from the operations phase because the employment level would be the same and, therefore, the demand for services would be the same.

The socioeconomic impact from aquifer restoration activity would be similar to those anticipated during the operations phase. There could be additions or reductions in numbers of staff to accommodate the change in activity, but the continued presence of the Moore Ranch Project workforce would have a impact on the local economy through the purchase of goods and services, and by possibly offering local employment. There could be a demand on temporary housing during this phase of the proposed Moore Ranch Project because the CBM gas and mineral industries The potential impact on local schools, health care facilities or public services or infrastructure would be expected to be SMALL. The socioeconomic impact from the aquifer restoration phase of the proposed Moore Ranch Project would be SMALL since the local government would have adapted to the changes which occurred from earlier phases of the project.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions at the proposed Moore Ranch Project are comparable to those described in the GEIS for socioeconomics and incorporates by reference the GEIS's conclusions that the socioeconomic impacts during aquifer restoration would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.11.1.4 *Decommissioning Impacts*

Section 4.3.10.4 of the GEIS discussed the potential socioeconomic impacts from decommissioning (NRC, 2009a). The GEIS concluded that decommissioning and reclamation activities (e.g., dismantling surface structures, removing pumps, plugging and abandoning wells, and reclaiming/recontouring the ground surface) would require a skill set comparable to that of the construction workforce. The GEIS assumed employment levels of up to 200 people and that local contractors would support decommissioning activities. The duration of decommissioning activities was assumed to range from 24 to 30 months; therefore, the employment would be temporary. The potential impact to employment structure and housing was expected to be similar to that for the ISR construction phase since a comparable number of people would be employed.

The decommissioning phase of the proposed Moore Ranch Project was estimated to last about one year. During this time the local economy would be positively impacted by project staff spending on goods and services. Impacts to local infrastructure, health care facilities and schools would be expected to be SMALL. There could be an impact on housing supply if vacancy rates were low (including vacancy rates for camp grounds in the cities and towns within commuting distance to the project area). Therefore, the potential socioeconomic impact from decommissioning the proposed Moore Ranch Project would be SMALL.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions at the proposed Moore Ranch Project are comparable to those described in the GEIS. The GEIS concludes that impacts to socioeconomics during decommissioning could range from SMALL to MODERATE. The staff concludes that site-specific impacts at the proposed Moore Ranch Project are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.11.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no added revenues to the local or state economy; no changes in population; no impact to local housing or infrastructure, including schools, hospitals, fire, and police services for the area attributable to the proposed project (not proceeding with any of the action alternatives). Other forms of energy development such as CBM and oil and gas development would continue to impact the regional socioeconomic climate. The changes associated with the continued development of energy resources and the associated socioeconomic impacts are discussed in Chapter 5 under Cumulative Impacts. Under the No-Action Alternative, population associated with the proposed action would not increase and no associated public service impacts would occur.

No permanent changes in population size or population characteristics would occur. Bust and boom cycles in population would continue in this region in response to other mining and oil and gas operations, regardless of whether the proposed Moore Ranch Project were licensed. Since no population change is expected as a consequence of the No-Action Alternative, no changes in the current trend for housing demand are anticipated. There would be no impact on the employment structure beyond what has already been experienced. There would be no impact on local finance beyond what has already been experienced.

4.12 Environmental Justice Impacts

Under Executive Order (E.O.) 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" federal agencies were directed to develop strategies for considering environmental justice in their programs, policies, and activities. Environmental justice is described in the Executive Order as "identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations." In 2004, the Commission issued a Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions (69 FR 52040), which states "The Commission is committed to the general goals set forth in E.O. 12898, and strives to meet those goals as part of its NEPA review process."

Some deviation from the policy was required in the following analysis because some Census geographic units are larger in the sparsely populated areas around the proposed Moore Ranch Project (*e.g.* block groups) and specific populations within a 6.4 km (4 mi) radius around the site could not be determined in accordance with NRC guidance. Block group level data is included in this analysis, but the minority and low income populations within a 6.4 km (4 mi) radius could not be determined using 2000 Census data because the block groups in this portion of Wyoming cover large geographic areas with few people. 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)

The U.S Census 2000 Decennial Population program provides race and poverty characteristics for Census Tracts and Block Groups, which are subdivisions of Census Tracts. The proposed Moore Ranch Project and a 2-mile perimeter are contained within five Census Tracts and one additional Block Group that encompass portions of Campbell, Converse, Johnson, and Natrona Counties.

The State of Wyoming was selected as the geographic area for comparison of demographic data for the affected Census Tract populations. This comparison was made to determine the concentration of minority or low-income populations in the affected Census Tracts relative to the state.

Census Block Group data are available from the 2000 Census. Table 4-5 below shows the percent of people living in poverty and the minority population in the U.S. Wyoming, Campbell, Johnson and Natrona Counties and the block groups closest to the proposed Moore Ranch Project.

The population of Campbell County has been estimated at 40,433 residents. Eleven percent of the Wyoming population is classified as being minority (Table 4-5). The minority population in the census tracts surrounding the proposed Moore Ranch Project ranged from 2.1 to 5.7 percent, approximately 5.3 to 8.9 percent below the state average of 11 percent.

Table 4-5. Percent Living in Poverty and Percent Minority in 2000

Geographic Unit	Percent Living in Poverty	Percent Minority
U.S	13.0	30.9
Wyoming	11.4	11.2
Campbell County	7.6	6.5
Campbell County Project Block Group 1-1	12.4	3.3
Johnson County	10.1	3.8
Johnson County Project Block Group 9551-1	12.5	4.0
Natrona County	11.4	9.1
Natrona County Block Group14.01-2	15.9	5.9

Source: US Census Bureau, 2009

The U.S. population living below the poverty level was identified as 13 percent and 11.4 percent of the population in Wyoming was determined to be living below poverty level. The percentage of people living below the poverty level within the census block groups surrounding the proposed Moore Ranch Project ranged from 10.1 to 15.9 percent. These numbers are well within the 20 percent level of significance compared to the State and county proportion of those living in poverty.

The percentage of minority populations living in the affected block groups are similar to the percentage of minority populations recorded at the state level and well below the national level. No minority populations were identified as residing near the proposed Moore Ranch Project; most of the minority population lives in Gillette and communities along the I-25 corridor to the south. Therefore, there would be no disproportionate high and adverse impact to minority populations from the proposed Moore Ranch Project.

No concentration of people living below the poverty level and no concentrated minority populations are located near the proposed Moore Ranch Project; therefore, there would be no disproportionately high and adverse impact to either minority or low-income populations from the proposed Moore Ranch Project.

4.12.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no change to the demographics of the proposed license area from ISR operations at the proposed Moore Ranch Project since no facility would be licensed by the NRC. There would neither be construction workers nor Uranium One personnel employed. The relative proportion of minority and low-income residents in the vicinity of the proposed Moore Ranch Project would remain unchanged from current conditions. Therefore, there would be no disproportionately high and adverse impact to either minority or low-income populations under the No-Action Alternative.

4.13 Public and Occupational Health and Safety Impacts

Potential radiological and non-radiological impacts from ISR activities at the proposed Moore Ranch Project may occur during all phases of the ISR facility's lifecycle. Such impacts may occur from normal operations or from accidents.

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

4.13.1 Proposed Action (Alternative 1)

4.13.1.1 *Construction Impacts*

Section 4.3.11.1 of the GEIS discussed construction activities at an ISR facility which would include installation of well fields (and associated piping) and construction of surface processing structures, access roads and supporting utilities. Fugitive dust generated from construction and vehicle traffic is expected but would likely be of short duration. The construction phase at the proposed Moore Ranch Project has been estimated to last nine months. Based on radiological environmental monitoring data for the proposed Moore Ranch Project (refer to discussion in Section 6.2), no significantly elevated levels of radioactive materials in soils above natural background levels have been identified (EMC, 2007b). Therefore, inhalation of fugitive dust with these background levels does not pose a radiological dose significantly different than that from natural background exposure (NRC, 2009a).

Construction equipment would likely be diesel powered and would result in diesel exhaust which includes small particles. The impacts and potential human exposures from these emissions would be expected to be SMALL because the releases are usually of short duration and are readily dispersed into the atmosphere (NRC, 2009a).

The staff has not identified any new and significant information during its independent review of the Moore Ranch environmental report, the site visit, or evaluation of other available information. Therefore, the staff has determined that there would be no significant impacts to public and occupational health and safety from construction beyond those discussed in the GEIS. The construction phase of the proposed Moore Ranch Project would be expected to have a SMALL impact on workers and the general public.

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

4.13.1.2 *Operation Impacts*

Section 4.3.11.2 of the GEIS discussed potential occupational radiological impacts from normal operations that could result from (1) exposure to radon gas from the well fields, (2) ion-exchange resin transfer operations, and (3) venting during processing activities. Workers could also be exposed to airborne uranium particulates from dryer operations and maintenance activities. Potential public exposures to radiation could occur from radon releases from the well fields and uranium particulate releases (i.e., from facilities without vacuum dryer technology). Both worker and public radiological exposures are addressed in NRC regulations at 10 CFR Part 20 as noted above, which require licensees to implement an NRC-approved radiation protection program. Measured and calculated doses for workers and the public are commonly only a fraction of regulated limits. For these reasons, the GEIS determined that potential radiological impacts to workers and the public would be SMALL (NRC, 2009a).

Non-radiological worker safety would be expected to be addressed through occupational health and safety regulations and practices.

Radiological accident risks could involve processing equipment failures leading to yellowcake slurry spills, or radon gas or uranium particulate releases. The GEIS stated that the consequences of these accidents to workers and the public would generally be low except for a dryer explosion which could result in a worker dose above NRC limits. The likelihood of such an accident would be expected to be low, due to design considerations and operational monitoring, and therefore the GEIS concluded the risk would also be low.

The potential impact from non-radiological accidents include high consequence chemical release events (e.g., of ammonia) that could expose workers and nearby populations. However, the GEIS stated that the likelihood of such a release would be low based on historical operating experience at NRC-licensed facilities, primarily because operators follow chemical safety and handling protocols. Therefore, the GEIS concluded that radiological and non-radiological impacts from accidents during operations could range from SMALL to MODERATE.

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 materials would be released to the environment during ISR operations. The potential impact for these releases can be evaluated by the MILDOS-AREA computer code, which was developed by Argonne National Laboratory for calculating radiation doses to individuals and populations from releases that occur at uranium recovery facilities. MILDOS uses a multi-pathway analysis for determining external dose, inhalation dose, and dose from ingestion of soil, plants, meat, milk, aquatic foods, and water. The primary radionuclide of interest at an ISR facility is radon-222 ; other key radionuclides that may also be released, which are also in the uranium decay scheme, include uranium, thorium-230, radium-226, and lead-210. MILDOS uses a sector-average Gaussian plume dispersion model to estimate downwind concentrations. This model typically assumes minimal dilution and provides conservative estimates of downwind air concentrations and doses to human receptors.

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 (human receptor) locations range between 0.004 mSv per year (0.4 mrem per year) for the Crow Butte facility located in New Mexico and 0.32 mSv per year (32 mrem per year) for the Irigaray facility located in Campbell County, both well below the 10 CFR Part 20 annual radiation dose limit of 1 mSv (100 mrem per year) (NRC, 2009a).

The GEIS also provides a summary of doses to occupationally exposed workers at ISR facilities. As stated, doses would be expected to be similar regardless of the facility's location and are well within the 10 CFR Part 20 annual occupational dose limit of 0.05 Sv (5 rem) per year. The largest annual average dose to a uranium in-situ mine worker over a 10-year period [1994-2006] was 7 mSv (700 mrem). More recently, the maximum total dose equivalents reported for 2005 and 2006 were 6.75 mSv (675 mrem) and 7.13 mSv (713 mrem), respectively.

The application for the proposed Moore Ranch Project addresses several normal operations activities that have the potential for exposing workers and members of the public to sources of radiation. The primary source of exposure would be associated with the release of radon-222 during the various evolutions, which include extraction of the uranium on the ion exchange columns from the pregnant lixiviant from the well field extraction, the elution of the uranium from the ion exchange columns and subsequent precipitation of uranium, followed by the drying and packaging of the yellowcake for shipment to an offsite facility for further processing.

As described in the GEIS, the drying and packaging of the precipitated uranium would be conducted under vacuum, therefore, there would be minimal release of airborne radioactive materials (uranium and short-lived particulate progeny).

All radioactive and potentially toxic liquid waste from the operations phase would be disposed of via deep well injection. Therefore, there would be no anticipated routine liquid releases or pathways of exposure from routine operations. Leaks and spills are evaluated as abnormal conditions in Section 4.13.1.2.2. No routine releases of radioactive liquids are proposed during operations.

For normal operations, radon-222 would be the only significant radionuclide anticipated to be released; the primary sources would be from well field venting and releases from within the central plant for process operations (predominantly via vent stacks on the ion exchange columns and various tanks).

The potential source term (i.e., atmospheric releases) for normal operations were calculated by the applicant using the NRC approved methodology of Regulatory Guide 3.59 for releases from the production fluids and NUREG-1569 for the processing of resins from satellite facilities. The application of this methodology for Moore Ranch and the resultant source term is discussed in Section 4.12 of the applicant's environmental report (EMC, 2007a). Table 4-6 summarizes releases.

Table 4-6. Estimated Radon-222 Releases (Ci yr^{-1}) from the Proposed Moore Ranch Project

Location	Production	Restoration	Drilling	Resin Transfer	Total
Wellfield 1	85.3	20	0	0	105.3
Wellfield 2	85.3	20	0	0	105.3
Main Plant Stack	230	53	0	5.3	288.3
New well field	0	0	0.43	0	0.43
Total	486	113	0.43	5.3	604.7

Source: EMC, 2007a

Based on this source term, radiation doses at the site boundary in each of the 16 meteorological sectors (e.g., N, NNE, NE, ENE, E) and at nearby residents were calculated using the MILDOS-AREA code (Argonne National Laboratory, 1989). The MILDOS-AREA code was also used to assess radiation dose in the GEIS. The principal exposure pathways modeled include inhalation, ingestion, and direct exposure. The highest dose at the site boundary was 0.008 mSv per year (0.8 mrem per year) TEDE at the northwest property boundary, which is 0.8 percent of the 1 mSv per year (100 mrem per year) dose limit for a member of the public specified in 10 CFR 20.1301. The maximum exposed individual for a resident located 4.5 km (2.8 mi) to the east of the facility is calculated to be 0.007 mSv per year (0.7 mrem per year), also a small fraction of the 1 mSv per year regulatory limit. These doses are consistent with the doses identified for other ISR facilities considered in the GEIS, where the range was from a high of 0.317 mSv per year (31.7 mrem per year) for the Crow Butte facility to 0.004 mSv (0.4 mrem per year) for the Irigaray facility.

The collective dose was also calculated by the applicant using MILDOS-AREA for the population 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 estimated at 0.0009 person-Sv per year (90 person-rem per year).

The applicant also evaluated the deposition of the radon-222 particulate decay products (polonium-210, lead-210, bismuth-214, and lead-210) and the potential exposure to flora and fauna. The calculated soil concentrations were less than 0.01 pCi/g at the surface, which is a small fraction of that normally present in the soil from the natural background levels of uranium and decay products. Therefore, any impact from increased soil radioactivity levels from normal operations would be SMALL.

Based on typical occupational injury and illness rates for the Wyoming mining industry, Uranium One estimated that operations at Moore Ranch could potentially result in 1.9 nonfatal occupational injuries and illnesses per year of operation (EMC, 2007a).

In summary, potential radiation doses to occupationally exposed workers and members of the public from operation of the proposed Moore Ranch Project would be expected to be SMALL.

Calculated radiation doses from the modeling of releases of radioactive materials to the environment are small fractions of the limits of 10 CFR Part 20 that have been established for the protection of the public health and safety. The staff has not identified any new and significant information during its independent review of the Moore Ranch ER, the site visit, the scoping process, 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 could occur with an ISR operation (NRC, 2009a). As discussed, a radiological hazard assessment (Mackin et al., 2001) considered four types of accidents, representing the sources containing the higher levels of radioactivity for all aspect of operation:

- Thickener failure and spill;
- Pregnant lixiviant and loaded resin spills (radon release);
- Yellowcake dryer accident release.

An overview for each of these accident scenarios as evaluated in the GEIS along with a specific application to the proposed Moore Ranch Project is presented below. Table 4-7 summarizes the potential dose to workers and the public from the accident scenarios described 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 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 was selected because it was 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 25 mrem, or 25 percent of the annual public dose limit of 100 mrem y^{-1} with negligible external doses based on sufficient distance between the facility and receptor (NRC, 2009a). Since the nearest resident to the proposed Moore Ranch Project is located 4.5 km (2.8 mi) to the east of the proposed license area the potential dose would be even less.

As discussed in the GEIS, doses to unprotected workers inside the facility have the potential to exceed the annual dose limit of 5 rem y^{-1} if timely corrective measures were not taken for protecting workers and remediating the spill. Typical protection measures, such as monitoring, respiratory protection, and material control, which would be a part of the applicant's Radiation Protection Program, would reduce the worker exposures and the resulting doses to a small fraction of those evaluated.

Pregnant Lixiviant and Loaded Resin Spills. Process equipment (ion exchange columns, drying and packing facilities) would be located on curbed concrete pads as discussed in Section 2.1.1.2 to prevent any liquids from spills or leaks from exiting the building and contaminating the outside environment. Therefore, except for well field leaks, as further evaluated below, the potential for an accidental liquid release with exposure from a liquid pathway was not considered realistic. The primary radiation source for liquid releases within the facility would be the resulting airborne Rn-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 present ^{222}Rn at a high activity level (8×10^5 pCi L^{-1}). For a 30-minute exposure, the dose to a worker located inside the central plant performing light activities without respiratory protection was calculated to be 13 mSv (1300 mrem), which is below the 10 CFR Part 20 occupational annual dose limit. The GEIS did not evaluate public dose; however, since atmospheric transport offsite would reduce the airborne levels by several orders of magnitude, any dose to a member of the public would be less than the 1 mSv (100 mrem) public dose limit of 10 CFR Part 20. Radiation Protection Program controls and monitoring measures would 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. A multiple hearth dryer is capable of releasing yellowcake powder inside the processing building as a result of an explosion and was evaluated in the GEIS as a bounding condition for this type of accidental scenario. The analysis assumes about 4,300 kg (9500 lbs.) of U_3O_8 yellowcake is released within the building area housing the dryer and of this, 1 kg (2.2 lbs) is subsequently released as an airborne effluent to the outside atmosphere as a 100 percent respirable powder. Due to the nature of the material, most of the yellowcake would rapidly fall out of airborne suspension. For the occupationally exposed worker using respiratory protection, which is the normal mode during dryer access and drum filling operations, 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). The amount assumed to remain airborne and to be transported outside the building for atmospheric dispersion to an offsite location would be 1 kg (2.2 lbs) 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 100 mrem.

The Moore Ranch application proposes to use two 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 mostly eliminating the possibility of an explosion, which is the initiating event for the assumed catastrophic failure and significant release of dryer radioactive content. The removal of the driving force for the resuspension of the yellowcake greatly reduces consequences. 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.

Table 4-7. Generic Accident Dose Analysis for ISR Operations		
Accident Scenario	**Maximum Dose to Workers**	**Maximum Dose to Public**
Thickener spill	50 mSv (5000 mrem)	0.25 mSv (25 mrem)
Pregnant lixiviant, resin spill	13 mSv (1300 mrem)	<0.13 mSv (<13 mrem)
Yellowcake dryer release	0.088 Sv (8.8 rem) Generic <0.01 Sv (1 rem) Moore Ranch	<1 mSv (<100 mrem)

Data adapted from GEIS (NRC, 2009a)

Accident Analysis Conclusions. With the addition of a site-specific consideration for the yellowcake dryer accident, the GEIS evaluations appropriately encompass the type of accidents and consequences for the proposed Moore Ranch Project. The NRC Staff has not identified any new and significant information during its independent review of the Moore Ranch ER, the site visit, or evaluation of other available information. Therefore, there would be no significant radiological impacts from potential accidents to the public or occupational exposed workers beyond those considered in the GEIS. The impacts to workers would be SMALL if procedures to deal with accident scenarios were followed; the impacts to the general public would also be SMALL.

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

The GEIS identified the various chemicals, hazardous and non-hazardous, along with typical 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, RCRA, and the Toxic Substances and Control Act.

Listed below are the hazardous chemicals and their associated protective provisions expected to be used at the proposed Moore Ranch Project (EMC, 2007a, EMC, 2007b):

- Anhydrous ammonia (NH_3) – Due to the quantities expected to be used, risk management and emergency response plans would be required, per 40 CFR 68 and 40 CFR 355. The storage tank would be placed outdoors, away from other processing equipment. Spills would be reported in accordance with CERCLA (40 CFR 302.4) requirements. Strict unloading procedures and process safety controls would be in use for handling ammonia. A flow control valve would be installed to ensure flow does not exceed expected levels and positive pressure full face respirators would be stored in the immediate vicinity of ammonia piping and process operations.
- Sulfuric acid (H_2SO_4) – Due to the quantities that would be used, emergency response plans would be required per 40 CFR 355. The storage tank would be located away from other process tanks to preclude accidental mixing with other chemicals.
- Oxygen (O_2) – Oxygen would be stored near, but a safe distance from, the central plant or within well field areas. The oxygen storage facility would be designed to meet industry standards contained in National Fire Protection Association (NFPA) 50 - Standards for Bulk Oxygen Systems at Consumer Sites. Procedures would be developed for spills or fires in the oxygen system.
- Liquid hydrogen peroxide - 50 percent (H_2O_2) – Because the concentration would be < 52 percent, no additional regulatory protective measures would be required.
- Carbon dioxide (CO_2) – Carbon dioxide would be stored adjacent to the central plant. Floor level ventilation and low point carbon dioxide monitors would be installed to preclude a buildup of carbon dioxide in occupied areas.
- Sodium carbonate (Na_2CO_3) and Sodium Chloride (NaCl) – Systems utilizing these chemicals would be designed to industry standards.
- Sodium Sulfide (Na_2S) – Would be stored outside of process areas and separate from hydrogen peroxide and sulfuric acid

The 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 could experience MODERATE impacts if the proper emergency and cleanup procedures and worker training was not available or was inadequate.

In general, the handling and storage of chemicals at the facility would follow standard industrial safety standards and practices. As identified in Section 4.12.1.2.1 of the applicant's environmental report, industrial safety aspects associated with the use of hazardous chemicals at Moore Ranch are regulated by the Wyoming State Mine Inspector (EMC, 2007a). Section 3.2.3 of the applicant's technical report provides an overview of storage practices (EMC, 2007b). Chemical storage facilities would include hazardous and non-hazardous material storage areas. Bulk hazardous materials would be stored outside and segregated from areas where licensed materials are processed and stored to minimize potential impact on radiation safety. Bulk storage of hazardous chemicals would be separated to avoid mixing of incompatible materials; and outside storage areas would be located at a sufficient distance from facilities to minimize hazards to people during an accidental release. Other non-hazardous bulk process chemicals (e.g., sodium carbonate) that do not have the potential to impact radiological safety could be stored within the central plant facilities.

The applicant has proposed an overall chemical safety program that includes:

- Risk Management Planning, as required in 40 CFR Part 68
- Process Safety Management of Highly Hazardous Chemicals standard contained in 29 CFR §1910.119
- Threshold Planning Quantities (TPQs) as contained in 40 CFR Part 355
- Reportable Quantities (RQs) for spills from CERCLA in 40 CFR § 302.4.

In the State of Wyoming, industrial safety at ISR operations is regulated by the Wyoming State Mine Inspector.

The types and quantities of chemicals (hazardous and non-hazardous) for proposed use at Moore Ranch do not differ from those evaluated in the GEIS. Information provided for the Moore Ranch Project does not contain any new or significant information that is either contrary to or varies from the information in the GEIS and the GEIS conclusions regarding potential impacts to the public or occupational health and safety. Therefore, the non-radiological impacts during normal operations at Moore Ranch would 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 than those for other typical industrial applications. In general, these risks are deemed acceptable as long as design and facility's 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.

NUREG-1910, Appendix E, Hazardous Chemicals, provides an accident analysis for the more hazardous chemicals (NRC, 2009a). As discussed in NUREG-1910, chemicals commonly used at ISR facilities can pose a serious safety hazard if not properly handled. NUREG-1910 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 would be expected to lower the likelihood of these severe release events and therefore lower the risk to acceptable levels.

Spills of reportable quantities from chemical bulk storage areas would be reported to the 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 proposed use at Moore Ranch do not differ from that evaluated in the GEIS. Information provided for the proposed Moore Ranch Project does not contain any new or significant information that is either contrary to or varies from the information and conclusions in the GEIS regarding potential non-radiological impacts on public and occupational health and safety from chemical accidents. 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 could experience MODERATE impacts. Based on this finding and the GEIS conclusions, the impacts from potential accidents for both occupationally exposed workers and members of the public would be expected to be SMALL.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions at the proposed Moore Ranch Project are comparable to those described in the GEIS for public and occupational health and safety impacts and incorporates by reference the GEIS's conclusions that the impacts to public and occupational health and safety during operation would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.13.1.3 *Aquifer Restoration Impacts*

Section 4.3.11.3 of the GEIS discussed potential radiological and non-radiological impacts from aquifer restoration. Activities occurring during aquifer restoration would overlap similar activities occurring during operations (e.g., operation of well fields, waste water treatment and disposal). Therefore, the potential impact on public and occupational health and safety would be bound by the operational impacts. The GEIS also stated that the reduction of some operational activities (e.g., yellowcake production and drying, remote ion exchange) as aquifer restoration proceeded would be expected to limit the relative magnitude of potential worker and public health and safety hazards. The GEIS concluded the overall impacts from aquifer restoration would be SMALL.

As discussed in the GEIS, aquifer restoration activities involve activities similar to those during operations (e.g., operation of well fields, waste water treatment and disposal), therefore, the potential impact on public and occupational health and safety would be expected to be similar to the operational impacts. The reduction or elimination of some operational activities (e.g., yellowcake production and drying, remote ion exchange) would further limit the relative magnitude of potential worker and public health and safety hazards. The radiation doses associated with restoration are included in the operations assessment in Section 4.13.1.2.1. Similarly, non-radiological hazards during aquifer restoration are assessed in Section 4.13.1.2.3. Accident consequences would be expected to be smaller than those evaluated in Section 4.13.1.2.2 and 4.13.1.2.4. Therefore, aquifer restoration would be expected to have a very localized SMALL occupational impact to workers (primarily from radon gas) and to the general public for the duration of the aquifer restoration phase which is estimated to last for 3.5 years at Wellfield 1 and 5.25 years at Wellfield 2.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions at the proposed Moore Ranch Project are comparable to those described in the GEIS for public and occupational health and safety impacts and incorporates by reference the GEIS's conclusions that the impacts to public and occupational health and safety during aquifer restoration would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.13.1.4 *Decommissioning Impacts*

Section 4.3.11.4 of the GEIS discussed potential radiological and non-radiological impacts to public and worker health and safety during the decommissioning phase of an ISR facility. Worker and public health and safety would be addressed in a NRC-required and approved decommissioning plan. This plan would be prepared in compliance with 10 CFR Part 20 and discuss implementation of the safety program to ensure worker safety and protection of the public during decommissioning, and compliance with applicable safety regulations. An ISR licensee would conduct decommissioning activities in accordance with the approved plan, and compliance would be enforced through NRC inspections.

The GEIS also assumed that as decommissioning proceeded, the potential environmental impact would be expected to decrease since the hazard would be removed, soils and structures would be decontaminated, and disturbed lands would be reclaimed.

As discussed in the GEIS, the environmental impact from decommissioning an ISR facility would be expected to be SMALL. The degree of potential impact would decrease as the hazards were either reduced or removed, soils and facility structures were decontaminated, and lands were restored to pre-operational conditions. Typically, the initial decommissioning steps would include removal of hazardous chemicals. As such, the majority of safety issues to be addressed during the decommissioning phase would 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 would include details of the radiation safety program that would be implemented during decommissioning to ensure that the workers and public would be adequately protected and that their doses are compliant with 10 CFR Part 20, Subpart C and Subpart D limits. An approved plan would also provide ALARA provisions to further ensure that best safety practices are being use to minimize radiation exposures. Finally, adequate protection of workers and the public during decommissioning is further ensured through NRC plan approval, license conditions, and inspection and enforcement.

The decommissioning of the proposed Moore Ranch Project and any subsequent NRC approval for release of the site for unrestricted access, would have to be in conformance with NRC's radiation protection standards as developed for decommissioning. Therefore, any potential radiation dose to members of the public would also be in conformance with standards established for protecting public health and safety.

Information provided by the applicant does not contain any new or significant information that is either contrary to or varies from the information in and GEIS conclusions regarding the potential impact to public and occupational health and safety. Therefore, the potential impact from and following decommissioning would be expected to be short term and SMALL.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions at the proposed Moore Ranch Project are comparable to those described in the GEIS for public and occupational health and safety impacts and incorporates by reference the GEIS's conclusions that the impacts to public and occupational health and safety during decommissioning would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.13.2 No-Action (Alternative 2)

Under the No-Action Alternative, there would be no occupational exposure. There would be no additional radiological exposures to the general public from project related effluent releases, and there would be no impact on long term environmental radiological conditions. Radiation exposure and risk to the general public would continue to be determined by exposure from natural background, medical-related exposures, consumer products and exposures from existing residual contamination. Under the No-Action Alternative, the existing residual radioactivity would remain in these areas and would not be remediated.

4.14 Waste Management Impacts

Potential environmental impacts from waste management at the proposed Moore Ranch Project could occur during all phases of the ISR facility's lifecycle. 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 of at the proposed Moore Ranch Project are discussed in Section 2.1.1.6 of this SEIS. The primary radiological wastes to be disposed of at the proposed Moore Ranch Project are process-related liquid wastes and process-contaminated structures and soils all of which are classified as 11e.(2) byproduct material. Before operations could begin, NRC requires an ISR facility to have an agreement in place with a licensed disposal facility to accept 11e.(2) byproduct material.

Detailed discussion of the potential environmental impacts from waste management actions during the construction, operation, aquifer restoration, and decommissioning phase of the proposed Moore Ranch are discussed below.

4.14.1 Proposed Action (Alternative 1)

4.14.1.1 *Construction Impacts*

Section 4.3.12.1 of the GEIS concluded that waste management impacts from the construction phase of an ISR facility would be expected to be SMALL because construction activities would be on a relatively small-scale and since the well fields would be developed incrementally a low volume of construction waste would be generated. The primary wastes to be disposed of during this phase of the ISR lifecycle would be expected to be solid (non-radioactive) wastes, such as building materials and piping.

The relatively small scale of construction activities and incremental development of the well fields at ISR facilities generate low volumes of construction waste. No radioactive wastes would be generated during the construction phase at Moore Ranch. Therefore, impact on waste management during the construction phase would be SMALL.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions at the proposed Moore Ranch Project are comparable to those described in the GEIS for waste management and incorporates by reference the GEIS's conclusions that the impacts to waste management during construction are expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.14.1.2 *Operation Impacts*

Section 2.7 of the GEIS indicated that wastes generated during the operations phase would primarily be liquid waste streams consisting of process bleed (1 to 3 percent of the process flow rate) and aquifer restoration water. Wastes would also be generated from well development, flushing of eluant to limit impurities, resin transfer wash, filter washing, uranium precipitation process wastes (brine), and plant washdown water. The method used to handle and process these wastes (water treatment followed by disposal by deep well injection) reduces the waste volume to be disposed of at an approved facility. 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; therefore, the waste management impact would be expected to be SMALL (NRC, 2009a).

At the proposed Moore Ranch Project, wastewater would be decontaminated through the combination of ion exchange and reverse osmosis process and reused in the uranium extraction process. The highly contaminated waste water from this processing classified as 11e.(2) byproduct material would be disposed of via deep well injection which is regulated by WDEQ. The WDEQ permit and approval process would specify the concentrations of hazardous constituents to maintain acceptable safe levels for discharge through deep well injection and to ensure the feasibility of deep well disposal in the selected geologic formations.

The 11e.(2) waste would be disposed of via deep well injection. Proper installation and operating procedures would be used to ensure adequate protection of the public and environmental health and safety. Class I disposal wells are designed to protect all potentially useable underground sources of drinking water and injection of liquid waste would isolate liquid effluent from the accessible environment. By definition, the WDEQ could not issue a permit for Class I injection if a complete exposure pathway existed that could result in public consumption. If deep well disposal is conducted in accordance with applicable UIC regulations, this type of disposal of by-product waste would be protective of human health and the environment. Based on an average flow rate of 643 L (170 gal) over 9 years, approximately 1,015 kg (2,238 lb) of natural uranium and 4.6 Ci of radium-226 would be disposed of in the wells. Radiation doses to the public would be expected to be near zero (due to an incomplete exposure pathway) and well below the public limit of 1 mSv (100 mrem) per year.

As discussed in the GEIS, solid radioactive waste generated during operations would be disposed of at a licensed waste disposal facility. Non-radioactive solid waste would be disposed of at the Midwest, Wyoming-Edgerton facility, located about 39 km (24 mi) from the site. The potential impact would be SMALL since a small volume of material would be disposed.

Radioactive solid waste that could be generated during operations would include maintenance and housekeeping rags/trash, packing materials, replacement components, filters, protective clothing, and solids removed from process pumps and vessels. The applicant has estimated approximately 77 m^3 (100 yd^3) of radioactively contaminated 11e.(2) byproduct waste would be generated per year and be stored on site within a restricted area until sufficient volume was generated for disposal. The applicant has identified the Pathfinders Mines Corp. Shirley Basin site, located approximately 213 km (132 mi) from the proposed Moore Ranch Project, for disposal of 11e.(2) byproduct material. The waste management impact would be expected to be SMALL since preoperational disposal agreements would have been negotiated with the facility.

As discussed in Section 2.1.1.6.3.4, the applicant indicated that it would likely be classified as a Conditionally Exempt Small Quantities Generator (CESQG), defined as a generator that generates less than 100 kg of non-radioactive, hazardous waste per month and would comply with applicable hazardous waste program requirements.

Based on the type and quantity of expected waste generation, the operations phase of the proposed Moore Ranch Project would have a SMALL impact on waste management.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions at the proposed Moore Ranch Project are comparable to those described in the GEIS for waste management and incorporates by reference the GEIS's conclusions that the impacts to waste management during operation would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.14.1.3 *Aquifer Restoration Impacts*

Section 4.3.12.3 of the GEIS discussed waste management activities that would occur during the aquifer restoration phase of an ISR project and noted that the same treatment and disposal options would be implemented as used during operations. Therefore, the waste management impacts would be similar to that during the operations phase of an ISR project. Some increase in waste water volumes could be experienced, but the increase in volume would be offset by the decrease in production capacity. The impact to waste management from aquifer restoration would be expected to be SMALL.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions at the proposed Moore Ranch Project are comparable to those described in the GEIS for waste management and incorporates by reference the GEIS's conclusions that the impacts to waste management during aquifer restoration would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.14.1.4 *Decommissioning Impacts*

Section 4.3.12.4 of the GEIS stated that radioactive waste from decommissioning ISR facilities (including contaminated soil and process equipment) would be disposed of as 11e(2) byproduct material at a licensed facility (NRC, 2009a). A pre-operational agreement with a licensed disposal facility to accept radioactive wastes would ensure that sufficient disposal capacity would be available for byproduct waste generated by decommissioning activities. Safe handling, storage, and disposal of decommissioning wastes would be addressed in a decommissioning plan required for NRC review prior to the initiation of decommissioning. The decommissioning plan would describe how a 10 CFR Part 20 compliant radiation safety program would be implemented to ensure the safety of workers and the public. The GEIS concluded that volumes of radioactive, chemical, and solid wastes generated during decommissioning would be SMALL and the waste management impacts would also be expected to be SMALL (NRC, 2009a).

At the time of decommissioning, the applicant expects that a large fraction of the process equipment and materials would be reusable. Materials would be surveyed for residual radioactivity. Nonradioactively contaminated materials would be removed for reuse or disposal. Contaminated materials could 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.

The applicant has committed to having an agreement for disposal of 11e.(2) byproduct waste materials in-place before construction of the Moore Ranch Project commences. 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.

Given the size of the overall project and the intent to decontaminate and reuse equipment and components, and the applicant's proposed use of well field monitoring instrumentation and well field visual inspection for timely identification and remediation of potential leaks and spills, the potent impact from decommissioning would be expected to be SMALL.

Additionally, after its independent review of the Uranium One license application (EMC, 2007a; EMC, 2007b); the site visit, meeting with federal, state, local, and tribal officials; other stakeholders; and evaluation of other available information, the NRC staff concludes that the site-specific conditions at the proposed Moore Ranch Project are comparable to those described in the GEIS for waste management and incorporates by reference the GEIS's conclusions that the impacts to waste management during decommissioning would be expected to be SMALL. Furthermore, the staff has not identified any new and significant information during its independent review that would change the expected environmental impact beyond those discussed in the GEIS.

4.14.2 No-Action (Alternative 2)

Under the No-Action Alternative no radioactive or nonradioactive liquid or solid waste would be generated because the proposed Moore Ranch Project would not be licensed. No earthmoving activities that could result in the generation of nonhazardous solid waste would occur, no buildings would be constructed, no well fields would be developed, no wastewater would be injected into the subsurface. No arrangements would be made for the management of any wastes.

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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 to 1508) define cumulative effects as "...the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions." Cumulative effects or impacts[2] can result from individually minor but collectively significant actions taking place over a period of time." The proposed project could contribute to cumulative effects when its environmental impacts overlap with those of other past, present, or reasonably foreseeable future actions. For this supplemental environmental impact statement (SEIS), other past, present, and future actions in the area include, but are not limited to, coal mining, oil and gas production, coal bed methane (CBM) operations, other mining (i.e., sand, gravel, bentonite, clinker), in-situ recovery (ISR) operations, conventional uranium mining, and wind farms.

The cumulative impact analysis of the proposed action was based on publicly available information on existing and proposed projects, information from the GEIS (NRC, 2009), general knowledge of the conditions in Wyoming and in the nearby communities, and reasonably foreseeable actions which could occur. The primary activity in the area is a resurgence, within the last few years, of mineral mining and oil and gas development although this interest has not necessarily translated into active projects. Within 8 km (5 mi) of the site and within the proposed license area coal-bed methane operations are occurring. No long-term changes from the proposed action within the projected license area are anticipated because the applicant plans to return the proposed license area to its pre-mining use following restoration and reclamation activities. There are several ISR and conventional uranium projects within the vicinity of the proposed Moore Ranch Project that are either in the pre-licensing stage or decommissioning. There are also oil and gas operations ongoing throughout the area. At distances beyond 8 km (5 mi), it has been assumed that the resurgence in extractive industries would continue along with government and industry support to develop infrastructure.

The GEIS (NRC, 2009) provides an example methodology for conducting a cumulative impacts assessment. The methodology used in this SEIS is provided in Section 5.1.2.

5.1.1 Other Past, Present, and Reasonably Foreseeable Future Actions

The proposed Moore Ranch project which covers an area of approximately 28 km^2 (11 mi^2), is located in the middle of the Powder River Basin, which covers an area of approximately 26,000 km^2 (10,000 mi^2) and spans large portions of northeastern Wyoming and southeast Montana. Therefore, the proposed activities at the Moore Ranch Project would affect less than 0.1 percent of the area within the Powder River Basin. The Powder River Basin contains 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 has been, and continues to be, substantial mining activities throughout the Powder River Basin. 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) issued by the U.S. Bureau of Land Management (BLM) and studies by environmental groups in the Powder River Basin

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[2] For the purposes of this analysis, "cumulative impacts" is deemed to be synonymous with "cumulative effects"

which date 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 proposed Moore Ranch Project are discussed below.

5.1.1.1 *Uranium Recovery Sites*

Along with the proposed Moore Ranch 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. Uranium related exploration operations in the area include the Smith Ranch/Highland Uranium Project; and ISR project operated by Power Resources, Inc. Also in the area is the Irigaray/Christensen Ranch Project, operated by Cogema Mining, Inc. These ISR projects are located approximately 59 km (37 mi) south-southeast and 30 km (19 mi) north-northwest of the proposed Moore Ranch Project, respectively.

NRC staff are aware that several companies are actively investigating the potential for ISR as well as other types of mining in areas near the proposed Moore Ranch Project. These projects are in various stages of development, will be monitored by the NRC and other local government agencies, and will be discussed within the context of cumulative impacts in future SEIS's when information becomes more available.

The current Uranium Recovery Sites in the Powder River Basin pertaining to uranium recovery sites are listed in Table 5-1.

Table 5-1. Uranium Recovery Sites in Wyoming East Uranium Milling Region

Site Name	Company/Owner	Type[2]	County, State	Status[3]
Ruby Ranch	Power Resources Inc.	ISR	Campbell, WY	Potential site
Reno Creek	Strathmore Minerals Corp.	ISR	Campbell, WY	Potential site
Ludeman	Uranium One	ISR	Converse, WY	Potential site
Allemand-Ross	Uranium One	ISR	Johnson, WY	Potential site
Ruby Ranch	Conoco	ISR[1]	Campbell, WY	Not licensed - application withdrawn
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
Peterson Ranch	Arizona Public Service Co. Malapai Resources	ISR[1]	Converse, WY	Not pursued
South Powder River Basin	Kerr-McGee	ISR[1]	Converse, WY	License terminated with approval of Smith Ranch license
Willow Creek	J&P Corp. Western Nuclear	ISR[1]	Johnson, WY	License terminated with approval of Irigaray license

Table 5-1. Uranium Recovery Sites in Wyoming East Uranium Milling Region				
Site Name	**Company/Owner**	**Type[2]**	**County, State**	**Status[3]**
North Platte	Uranium Resources	ISR[1]	Platte, WY	License terminated
Reynolds Ranch	Power Resources Inc.	ISR[2]	Converse, WY	Licensed, but not operational
Reno Creek 2	International Uranium Corp.	ISR[3]	Campbell, WY	Not licensed - application withdrawn
Moore Ranch	Uranium One	ISR[3]	Campbell, WY	Potential site - license application under review by NRC
Highland 1	Exxon Minerals	ISR[3]	Converse, WY	Licensed, but not pursued
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
Leuenberger	Teton Exploration Drilling	ISR[1,3]	Converse, WY	License terminated
Nichols Ranch & Hank	Uranerz Energy Corp.	ISR[2,3]	Campbell & Johnson, WY	Potential site - license application under review by NRC
North Butte & Ruth	Power Resources Inc.	ISR[2,3]	Campbell, WY	Licensed - on standby
Irigaray/ Christensen Ranch	Cogema Malapai Resources	ISR[2,3]	Johnson, WY	Licensed for operations
Shirley Basin South	DOE	Conv.	Carbon, WY	UMTRCA Title II disposal site
Bear Creek	Bear Creek Uranium Co.	Conv.	Converse, WY	Decommisioning
Highlands	Exxon Mobile Corp.	Conv.	Converse, WY	Decommisioning
Spook	Department of Energy	Conv.	Converse, WY	UMTRCA Title I disposal site
Shirley Basin	Pathfinder Mines Corp.	Conv.	Natrona, WY	Decommisioning

[1] Information on potential future uranium recovery applications is based on indication from industry summarized in NRC. "Expected New Uranium Recovery Facility Applications/Restarts/Expansions: Updated 3/11/2009" <http://www.nrc.gov/info-finder/materials/uranium/2008-ur-projects-list-public.pdf> (07 April 2009).

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

[3] Status: 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 in 1990 which allowed leasing to occur in the region on an application basis. Because of decertification, U.S. coal production increased 11 percent from 1,029.1 million tons in 1990 to 1,145.6 million tons in 2007 (BLM, 2009a). 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). Powder River basin coal 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 attributable to coal mines within the Powder River Basin totaled nearly 28,000 ha (70,000 ac). Reasonably foreseeable future development projects contributing to the estimate of the cumulative acreage disturbed range from 47,400 to 50,600 ha (117,000 to 125,000 ac) in the year 2015. Other development related to coal includes railroads, coal-fired power plants, major (230 kV) transmission lines, and coal technology projects. The total land area of other coal-related disturbance in the Powder River Basin in 2003 was nearly 2,000 ha (5,000 ac).

Table 5-2 lists surface coal mines within 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 Mining Projects in Wyoming East Uranium Milling Region[1]

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

Table 5-2. Coal Mining Projects in Wyoming East Uranium Milling Region[1]				
Site Name	**Company/Owner**	**Type**	**County, State**	**Production in 2008 (Tons)**
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
Seminoe #2	Arch Coal, Inc.	Surface	Carbon, WY	Final reclamation in 2006
Medicine Bow	Arch Coal, Inc.	Surface	Carbon, WY	28,212, but 0 in 2005; relatively small operation

[1] As identified by the Wyoming Mining Association (data through 2006). "Wyoming Coal Data." 2008. <http://www.wma-minelife.com/coal/coalfrm/coaldat.htm> (28 October 2009).

5.1.1.3 *Oil and Gas Production*

There are approximately 472 oil and gas production units in the Powder River Basin in various stages of production. These are also evenly dispersed throughout the entire Powder River Basin. The Wyoming Oil and Gas Conservation Commission reported that in 2003, oil and gas wells in the Powder River Basin produced approximately 13 million barrels of oil and 1.1 billion m^3 (40 billion ft^3) of conventional gas (BLM, 2005a, 2005b, 2005c).

Most of Wyoming's current oil production is from old oil fields with declining production and the level of exploration drilling to discover new fields has been low (WSGS, 2002, as cited in BLM, 2008a). 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.

Oil and gas related development include major transportation pipelines and refineries. Cumulative disturbed land area in the Powder River Basin in 2003 from oil and gas, CBM, and related development was nearly 76,100 ha (188,000 ac). The corresponding projection for the year 2015 is 123,000 ha (305,000 ac) (BLM, 2005a, 2005b, 2005c). Depth to gas and oil-bearing strata generally ranges from 1,220 to 4,120 m (4,000 to 13,500 ft), but some wells are as shallow as 76 m (250 ft) (BLM, 2005a, 2005b, 2005c).

5.1.1.4 *Coal Bed Methane Development Projects*

Natural gas production has been increasing in Wyoming. In the Powder River Basin, this is due to the development of shallow CBM resources (BLM, 2005a, 2005b, 2005c). Annual CBM production in the Powder River Basin increased rapidly between 1999 and 2003, with nearly 15,000 producing CBM wells in the Powder River Basin in 2003. Total production in 2003 was 364 billion cubic feet (BLM, 2005a, 2005b, 2005c). CBM production within Campbell County was 166,754 million cubic feet in the year 2007 (BLM, 2009b). The Buffalo Field Office of the BLM has processed approximately 3000 applications for permits to drill since 2003; more than 98 percent of these applications are for CBM recovery (BLM, 2009b).

The recovery of CBM involves the installation of facilities that include access roads, pipelines for gathering gas and produced water, electrical utilities, facilities for measuring and compressing recovered gas, facilities for treating, discharging, disposing of, containing, or injecting produced water, and pipelines to transport gas high-pressure transmission pipelines (EMC, 2007). The wells are collocated on a well pad installed on an (80-ac) spacing pattern (eight pads per square mile). The overall life of each well is approximately 10 years: 7 years of production followed by final reclamation which takes about 2 to 3 years (EMC, 2007).

There are 534 CBM wells within 3.2 km (2-mi) of the boundary of the proposed license area. The largest amounts of CBM are found at depths greater than 60 m (200 ft) below ground surface (bgs). The target formation occurs at depths of between 305 and 366 m (1,000 and 1,200 ft) bgs.

5.1.1.5 *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 1.62 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 the Converse and Campbell Counties portion of the Powder River Basin (BLM, 2005a, 2005b, 2005c).

5.1.1.6 *EISs as Indicators of Past, Present, and Reasonably Foreseeable Actions*

One final indicator of present and reasonably foreseeable future actions is the number of draft and final environmental impact statements (EISs) prepared by federal agencies within a recent time period. Using information in NUREG-1910, *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (GEIS) (NRC, 2009), Section 5.1.1 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 NRC, 2009, 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 by Moore Ranch, 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 lifecycle would have a SMALL impact), the activities at the proposed ISR site would not be expected to provide 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

Cumulative impacts to land use were assessed within the planning area administered by the BLM Buffalo Field Office.

The Powder River Basin encompasses approximately 26,000 km^2 (10,000 mi^2) in land area. Land use within the basin is diversified and cooperative, with CBM and oil and gas extraction activities sharing land with livestock grazing. Although federal grasslands and forests cover approximately 21 percent of the area, most rangeland is privately owned (68 percent) and is primarily used for grazing cattle and sheep as is the case at the proposed Moore Ranch Project.

Land use impacts result from interruption to, reduction or impedance of, livestock grazing areas, open wildlife areas, land access, and limitations placed on natural resource extraction activities. The potential impact on land use from the proposed Moore Ranch Project was expected to be SMALL through all stages of the ISR process as discussed in Section 4.2 of this SEIS. Although the proposed license area encompasses 2,879 ha (7,100 ac), approximately 61 ha (150 ac) of the land area would be used for the operation of the facility, and an even smaller area, approximately 23 ha (57 ac) would be disturbed by earthmoving activities and would be fenced to exclude grazing and other activities as identified above. The impact would be short-term (for the life of the facility) since the applicant has indicated the land would be returned to its pre-mining condition except for one access road.

CBM facilities are active within the proposed license area. If possible, CBM wells are collocated on the same well pad. Wells and well pads are generally installed on an 32 ha (80-ac) spacing (eight pads per square mile) (EMC, 2007).

Given the number of either operating or planned ISR facilities within an 80-km (50-mi) radius of the proposed Moore Ranch Project and the dominant land uses of grazing and development of mineral resources including coal, oil, and CBM extraction, the cumulative impact from the proposed action and other past, present and reasonably foreseeable future actions on land use was estimated to be MODERATE.

5.3 Transportation

Cumulative impacts on transportation were assessed within the immediate vicinity of the proposed Moore Ranch Project since the site is located in a rural setting.

Project related transportation impacts would result from new road construction, more traffic from workers commuting and the associated wear and tear on the road surface, the transport of materials to and from the site, transport of 11e.(2) byproduct material, disposal of waste, and the potential for accidents. During the ISR phases of the proposed Moore Ranch Project, truck traffic was estimated to increase by 0.2 to 0.5 percent and car traffic was estimated to increase from 0.3 to 7.2 percent along SR-387, the main entrance to the proposed facility. Therefore, the transportation impact was estimated to be SMALL as discussed in Section 4.3. Wellfield roads constructed as part of the proposed action would be removed upon decommissioning; the gravel road leading to the central plant from the main access road would remain in place for future use.

As noted in Section 5.1.1, there are other ongoing or planned activities occurring within the Powder River Basin and within the vicinity of the proposed Moore Ranch Project that contribute to the analysis of cumulative impacts. These activities, which include CBM development, oil and gas extraction activities, and large surface mining operations which may have railways to support the transport of coal among others, all have associated transportation impacts. There is approximately 43 km (27 mi) of existing two track, un-graveled road about the width of the wheels on a truck that traverse the proposed Moore Ranch Project which is currently being used by active CBM operators in the area. Furthermore, there are six ISR sites either operating or planned within an 80 km (50 mi) radius of the proposed Moore Ranch Project, each with transportation requirements comparable to that for Moore Ranch. In addition, oil and gas exploration and production and coal mines continue to be developed on both public and private lands throughout the Powder River Basin.

The existing or planned ISR facilities would require the construction of new road surfaces or the improvement of existing roads within the vicinity of the proposed Moore Ranch Project. Therefore, the number of roads and road networks would be expected to grow concurrently with the natural resource exploration and extraction activities with a concomitant increase in traffic and the potential for accidents. The demand for railroads, pipelines, and transmission lines would increase to meet the increased demand for capacity to move coal, oil and gas, and electricity from production locations in the area to markets outside the area.

Therefore, the potential impact on the transportation system to support the proposed Moore Ranch Project would be reclaimed and overall project-related transportation impacts would thus be relatively minor and SMALL. However, when considering the proposed action together with other past, ongoing, and potentialISR projects, CBM projects, oil and gas operations, and surface coal mining facilities, the cumulative impact on the transportation system could be MODERATE.

5.4 Geology and Soils

The cumulative impact to geology and soils was assessed within the immediate vicinity of the proposed license area.

The principal impacts on geology and soils from the proposed Moore Ranch Project would result from earthmoving activities associated with constructing surface facilities, access roads, well fields, and laying pipeline. Earthmoving activities that would impact soils would include clearing the ground surface of topsoil to build the central plant and to develop the well fields which would include preparing a drilling pad to install wells, constructing headerhouses, access roads, and laying pipeline. As discussed in Chapter 4, all phases of the proposed Moore Ranch Project are anticipated to have a SMALL impact on geology and soils.

The other ISR projects either ongoing or planned within the vicinity of the proposed Moore Ranch Project as described in Section 5.1.1 would impact geology and soils at an intensity comparable to what would be seen at Moore Ranch. The past, ongoing, and reasonably foreseeable actions to explore for and extract minerals within the region contribute to the cumulative impact on geology and soils (BLM, 2008b). 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) all contribute to the cumulative impact on soils (BLM, 2008b). The main soil resource concerns within the area administered by the Buffalo Field Office, where the proposed Moore Ranch Project is located, is wind erosion and water erosion that occur where the ground cover has deteriorated (BLM, 2009b).

Long-term and short-term impacts to soils include accelerated wind or water erosion, declining soil quality factors, a decline in microbial populations, fertility, and organic matter, compaction, and the permanent removal of soil (BLM, 2005c). Soil composition can be affect by alkalinity changes from discharge of CBM-produced water.

BLM (2009b) identified soil disturbance from existing actions within the area administered by the BLM Buffalo Field Office 688,259 ha (1.7 million ac) and reported that oil and gas development has the greatest potential impact on soil disturbance (100,000s of ac) within the Buffalo Field Office (BLM, 2009b). Since the proposed Moore Ranch Project would disturb about 61 ha (150 ac), less than 0.0001 percent of the area administered by the Buffalo Field Office and because the disturbance is relatively minor for an ISR project compared to conventional surface coal mining, the potential impact from activities at Moore Ranch are expected to be SMALL. The incremental impact from the proposed Moore Ranch Project would not contribute to a perceptible increase in the MODERATE potential impacts to geology and soils when added to past, present, and reasonably foreseeable future actions occurring in the area administered by the BLM Buffalo Field Office.

5.5 Water Resources

The cumulative impact to surface and groundwater resources was considered with respect to the area administered by the BLM Buffalo Field Office since the proposed Moore Ranch Project is located within this area.

5.5.1 Surface Waters and Wetlands

The proposed Moore Ranch Project is located in the BLM Upper Belle Fourche River watershed. Since no surface water would be discharged as part of the operations of the ISR facility and since the potential impact to onsite washes would be from potential increased surface water runoff primarily during the construction and decommissioning phases of the proposed Moore Ranch Project, the impact from operation of the facility would be expected to be SMALL as discussed in Section 4.5.1 of this SEIS.

However, other activities occurring within the proposed license area as well as within the area administered by the BLM Buffalo Field Office also have the potential to impact surface water both on and within the vicinity of the proposed Moore Ranch Project. The applicant indicated that CBM production has and continues to occur within the proposed license area from the Roland coal formation, which occurs at a depth of approximately 396 m (1,300 ft) below ground surface. CBM-produced water from these operations is discharged through 22 permitted locations, seven of which are located upstream of the proposed Moore Ranch Project, to release water directly to the drainage or small impoundments specifically designed to facilitate infiltration to the groundwater. From 2000 – 2008, approximately 93 million gallons of CBM-produced water was discharged to the surface drainages and impoundments located within the proposed license area (EMC, 2007).

The BLM estimated that 9 to 52 percent of CBM-produced water would contribute to surface water flows and perennial flows would be likely to develop in former ephemeral channels (BLM, 2003). BLM further noted that noticeable changes in water quality would occur in the main channel drainages during periods of low flow and project that the concentrations of suspended sediment in surface water would likely rise above baseline levels from increased flow and surface water runoff from disturbed areas (EMC, 2007).

Nine wetlands, created in response to upstream CBM discharges, have been identified on the proposed Moore Ranch Project.

The operators of the CBM facilities located within the proposed license area have indicated that one of the CBM facilities would likely be at the end of its operational life around the time the applicant would begin construction; a second operator has plans to install new facilities within the proposed license area; however, these locations would not coincide with the Moore Ranch well field locations (EMC, 2007). BLM (2009b) reported 22,543 active permits for CBM operations within Campbell County.

Surface water quality within the area administered by the BLM Buffalo Field Office could also be impacted by conventional oil and gas development, minerals extraction, road maintenance, rangeland grazing, and agriculture (BLM, 2009b).

The proposed action and past, present and reasonably foreseeable future actions within the area administered by the BLM Buffalo Field Office could result in a MODERATE cumulative impact to surface water. However, prudent resource development and use, the proper application of mitigation measures identified in site-specific management or development plans would help to mitigate the impact (BLM, 2009b).

5.5.2 Groundwater

Potential environmental impacts to groundwater resources from the proposed Moore Ranch Project would occur primarily during the operations and aquifer restoration phase of the ISR facility's lifecycle. The analysis of impacts to groundwater resources from operation of the proposed Moore Ranch Project in Section 4.5.2 showed that the potential drawdown in wells outside of the license area from facility operation would be nominal and not affect the well yields. Therefore, the potential impact on groundwater resources from operating the proposed Moore Ranch Project would be expected to be SMALL.

However, within the proposed license area and within the area administered by the BLM Buffalo Field Office, there are either other ongoing or planned activities that would contribute to a cumulative impact on groundwater resources. These include the operation of other ISR facilities (although production may be from a different ore-producing zone) and CBM production.

The BLM estimated that development of CBM in the Powder River Basin through the year 2018 would remove about 3 million acre-feet, less than 0.3 percent of the total recoverable groundwater (nearly 1.4 billion acre-feet) in the Wasatch and Fort Union Formations within the Powder River Basin. An estimated 15 to 33 percent of the removed groundwater would infiltrate the surface and recharge the shallow aquifers above the coals (BLM, 2003). The redistribution of pressure within the coals after water production ended would allow the hydraulic pressure head to recover to within approximately 15 m (50 ft) or less of pre-project levels within 25 years after the project ended. The complete recovery of water levels would take tens to hundreds of years, depending on the specific location. Wells completed in developed coals that are located within the areal extent of 30 m (100-ft) drawdown contour induced by a CBM well could experience drops in water level and possibly encounter methane (BLM, 2003). BLM (2003) noted that the areal extent and magnitude of drawdown effects on coal zone aquifers and overlying or underlying sand units in the Wasatch Formation would be limited by the discontinuous nature of different coal zones within the Fort Union Formation and sandstone layers within the Wasatch Formation.

Within the vicinity of the proposed Moore Ranch Project, the CBM producing unit is the Roland Coal within the Fort Union Formation. The Fort Union Formation is separated from the 70 Sand ore production zone in the Wasatch Formation by greater than 213 m (700 ft) of interbedded clays, siltstone, and discontinuous sands. No hydrologic impacts from CBM production would be expected on the 70 Sand ore production zone and the intervening clay aquitards from ISL operations at the proposed Moore Ranch Project.

However, CBM-produced water was, and continues to be, discharged at the surface in the proposed license area potentially affecting the water quality of the surficial aquifer, the 72 Sand which overlies the 70 Sand ore production zone. The applicant performed an analysis of the surficial aquifer and determined that it would be possible for the surficial aquifer to receive infiltration from CBM-produced water within 1 to 10 years of its surface discharge.

Therefore, the cumulative impact on groundwater resources from the proposed action and past, present, and reasonably foreseeable actions in the vicinity of the proposed Moore Ranch Project was estimated to be MODERATE.

5.6 Ecological Resources

The cumulative impact on ecological resources was considered with respect to the area administered by the BLM Buffalo Field Office and the Powder River Basin since the same types of activities occur throughout these areas.

As noted in Section 4.6 of this SEIS, land disturbance resulting from the construction of the central plant, well fields, and access roads at the proposed Moore Ranch Project would be the primary source of impacts to ecological resources which were estimated to be SMALL if mitigative measures were implemented. Because the total surface disturbance would be limited to approximately 61 ha (150 ac) and most of the habitat disturbance would consist of scattered, confined drill sites for wells that would not result in a large expanses of habitat being dramatically transformed from its original character as in other surface mining operations; no substantial long-term impact would be expected. Furthermore, no federal- and state-listed sensitive plant species, endangered or threatened plant species, or designated critical habitats occur within the proposed license area.

Other earthmoving activities anticipated to occur within the proposed license area include the development of CBM projects which result in localized disturbance of land to build well pads, and within an 80-km (50-mi) radius of the proposed Moore Ranch Project there are six other licensed or planned ISR facilities which would result in land disturbance comparable to that occurring on the proposed Moore Ranch Project. Furthermore, additional CBM projects and oil and gas development projects are occurring within the area administered by the BLM Buffalo Field Office. BLM (2009b) noted that exploration and production of commercially-available mineral materials in this area included moderate to high levels of activity.

The total area of land disturbed from development in the Powder River Basin is projected to increase from 89,347 ha (220,688 ac) to 208,257 ha (514,732 ac) from 2003 to 2020 (BLM, 2005b). Of these disturbed land areas, 45,257 ha (111,786 ac) was reclaimed in 2003 and a total of 151,713 ha (374,732 ac) is estimated to be reclaimed in 2020 (BLM, 2005b).

Land disturbance resulting from the development activities in both the BLM Buffalo Planning Office and within the Powder River Basin would be likely to result in similar ecological impacts as described for the proposed Moore Ranch Project. However, the cumulative impact from land disturbance and alteration of the landscape has likely caused habitat fragmentation, reduced habitat ranges for certain species and an increased susceptibility to invasive species in the affected 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.

The impact on ecological resources from developing the proposed Moore Ranch Project was estimated to be SMALL; however when considering the proposed action with respect to past, present, and reasonably foreseeable actions within the area administered by the BLM Buffalo Field Office and across the Powder River Basin, the cumulative impact on ecological resources would be MODERATE.

5.7 Meteorology, Climatology, and Air Quality

The cumulative impact to air quality from licensing the proposed Moore Ranch Project was considered with respect to the airshed in which the site is located.

Air quality within the area administered by the BLM Buffalo Field Office is considered to be good overall (BLM, 2009b). The area is in compliance with both Wyoming Ambient Air Quality Standards and the National Ambient Air Quality Standards for all criteria pollutants except PM_{10}. PM_{10} violations occur because of vehicle travel over unpaved roads (BLM, 2009). Construction activities at the proposed Moore Ranch Project would generate both fugitive dust and gaseous emissions as discussed in Section 4.7.1 of this SEIS. However, because construction activities would be short term lasting about nine months and because actions would be taken to mitigate the impact, the potential impact on air quality from operation of the proposed Moore Ranch Project was estimated as SMALL.

CBM development and production generates fugitive dust and exhaust from construction activities and air pollutants are emitted during operations. Maximum air pollutant emissions from each well would be temporary and would occur in isolation. Potential impacts could be mitigated by watering disturbed soils and by air pollutant emission limitations imposed by the Wyoming Department of Environmental Quality pre-construction permit that evaluates the source-specific air pollutant emissions (EMC, 2007).

Because of the areally limited air pollution emissions sources, the required mitigative measures, and effective atmospheric dispersion conditions within the BLM Buffalo Field Office planning area, the cumulative impact on air quality considering the proposed action and past, present, and reasonably foreseeable future actions was estimated to be SMALL.

Climate Change

The GEIS (NRC, 2009) did not address human-induced climate change given the imprecise state of the science for making human-induced climate predictions and the relatively short timeframe of the ISR facility lifecycle. Public comments during scoping for the GEIS addressed the potential for ISR facilities to release carbon dioxide (CO_2) and other greenhouse gas emissions, methane (CH_4), water vapor, ozone (O_3), nitrous oxide (N_2O), hydroflurocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). The following discussion discusses this potential relative to other industries that could produce these greenhouse gas emissions.

Sections 3.3.6 of the GEIS provide a discussion of the meteorology, climatology, and air quality within the Wyoming East Uranium Milling Region, where the Moore Ranch Project is located. The entire Wyoming East Uranium Milling Region (including Moore Ranch), is classified as in attainment for all primary pollutants under the National Ambient Air Quality Standards (NAAQS) (NRC, 2009). Other past, present, and reasonably foreseeable activities that may contribute to pollutant emissions and greenhouse gas emissions are identified in Section 5.1.1 of this SEIS.

As discussed in Section 4.7 of this SEIS, air-quality impacts throughout the lifecycle of the proposed Moore Ranch Project would come primarily from fugitive dust and engine exhaust emissions. Fugitive dust would be generated by vehicular traffic, earth-moving activities during construction, and wind erosion of disturbed areas. As discussed, these types of emissions are not expected to be significant as they would be intermittent (temporary), quickly dispersed and would not cause any exceedance of any applicable air quality standards. Additionally, Uranium One may use best management practices (e.g., wetting of dirt roads and cleared land areas) to reduce fugitive dust and emissions.

Additionally, gaseous emissions during ISR operations may come from the release of pressurized vapor from well field pipelines, and during resin transfer or elution. These gases come from two sources: (1) the liquefied gases such as oxygen and carbon dioxide used in the lixiviant that come out of solution and (2) gases in the underground environment that are mobilized. Venting the well pipeline system allows the release of naturally occurring radon gas. Gaseous emission levels from the proposed Moore Ranch facility are expected to comply with applicable regulatory limits and restrictions, and would not be expected to reach levels that result in the Moore Ranch facility being classified as a major source under the operating (Title V) permit process.

Other actions causing a potential cumulative impact in the region that may generate pollutants and emissions are surface coal mining activities. Surface coal mining activities generate fugitive dust particulates, and gaseous emissions from large mining equipment. Activities such as blasting, excavating, loading and hauling of overburden and coal, and wind erosion of disturbed and unreclaimed mining areas produce fugitive dust. Coal crushing, storage, and handling facilities are the most common stationary or point sources associated with surface coal mining and preparation. Particulate matter is the pollutant emitted from coal mine point sources, although small amounts of gaseous pollutants are also emitted from small boilers and off-road vehicles (BLM, 2009). Overburden and coal blasting can produce gaseous clouds that contain nitrogen dioxide (NO_2).

Other air pollutant emission sources potentially having a cumulative impact within the region include carbon monoxide (CO) and nitrogen oxides (NO_X) from internal combustion engines used at natural gas and CBNG pipeline compressor stations; CO, NO_X, particulates (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), and volatile organic compounds (VOCs) from gasoline and diesel vehicle tailpipe emissions; particulate matter (dust) generated by vehicle travel traffic on unpaved roads, agricultural activities, and application of sand to paved roads in winter; NO_2 and PM_{10} emissions from railroad locomotives; SO_2 and NO_X from other power plants; and air pollutants transported from emission sources located outside the Powder River Basin (BLM, 2009).

The Center for Climate Strategies (CCS) estimates that activities in Wyoming will account for approximately 60.3 million metric tons (tonnes) of gross CO_2 equivalent emissions in Year 2010 and 69.4 million tonnes in Year 2020 (CCS, 2007). Using those projections, the Year 2007 emissions from the three applicant coal mines reviewed by the staff total represents 2.22 percent of the Year 2010 statewide emissions. With the addition of the expected six new coal mines, the estimated total emissions at the three applicant mines would represent 3.61 percent of the projected Year 2020 state-wide emissions (BLM, 2009).

The proposed Moore Ranch ISR facility is not expected to be a major contributor of greenhouse gases due to the size of the facility, small construction and decommissioning workforce, and relative short term of operation. Additionally, it is expected that greenhouse gas emissions associated with the proposed Moore Ranch Project would be much lower than other actions in the Power River Basin region associated with natural resource-based extraction facilities (i.e., surface coal mining) and would not be expected to contribute a perceptible increase to greenhouse gas emissions in the Power River Basin region and the State of Wyoming.

5.8 Noise

Cumulative impacts from noise were assessed within an 8-km (5-mi) radius of the proposed Moore Ranch Project since noise dissipates quickly from the source.

The GEIS noted that noise would not be discernible to an offsite person at distances of greater than 300 m (1,000 ft) (NRC, 2009). Section 4.8 of this SEIS evaluated potential noise impacts to the nearest resident who lives 4.5 km (2.8 mi) east of the boundary of the proposed license area. Because this person lives beyond 300 m (1,000 ft) of the proposed license area, there would be no noise impact above background levels.

Past, present, and reasonably foreseeable future noise-generating activities in the vicinity of the proposed Moore Ranch Project would primarily be from traffic noise, oil and gas operations, CBM operations, and uranium mining/milling operations. The Final EIS for the Powder River Basin Oil and Gas Project noted that sound levels from CBM operations would be expected to be unnoticeable at distances of 490 m (1,600 ft) and beyond and the EIS concluded there would be no cumulative noise impact on the surrounding area (BLM, 2003). CBM operations are active within the proposed license area.

Although noise-related impacts are generally constrained to within a 610 m (2,000 ft) radius of activities associated with oil and gas development (e.g., drilling, operation of compressor stations) the level of energy-related development both on and around the proposed Moore Ranch Project has been increasing and is anticipated to continue to grow (BLM, 2003).

The licensing of the proposed Moore Ranch Project would have a SMALL impact on noise generated in the area as discussed in Section 4.8. Although other noise generating activities (i.e., CBM operations) occur within an 8-km (5-mi) radius of the Moore Ranch ISR project, they do not overlap the proposed Moore Ranch Project. Because the noise generated from either the proposed Moore Ranch Project or from CBM operations would be a background levels at distances ranging from 300 m (1,000 ft) to 610 m (2,000 ft) as discussed above and because the nearest resident is located 4.5 km (2.8 mi) east of the proposed license area, the cumulative impact from noise would be SMALL. Furthermore, noise levels would be mitigated by the use of administrative and engineering controls to maintain noise levels in work areas below Occupational Safety and Health Administration (OSHA) regulatory limits.

5.9 Historic and Cultural Resources

The assessment of the cumulative impact on historic and cultural resources was defined with respect to activities occurring within the Powder River Basin.

The potential impact on cultural resources from implementing the proposed Moore Ranch Project was estimated to be SMALL since the ISR lifecycle was not expected to directly impact specific archaeological sites determined to be eligible for listing on the National Register of Historic Places as discussed in Section 4.9 of this SEIS.

BLM (2009b) identified various actions which would have the greatest potential for cumulative effects on cultural resources within the Powder River Basin. These actions included coal extraction, oil and gas operations, utility transmission and distribution actions, other mining/milling actions including uranium, wind power activities, reservoir development, various non-energy related developments including transportation, and county-level economic development actions.

As previously noted, six other ISR facilities located within 80-km (50-mi) of the proposed Moore Ranch Project are either operating or planned. CBM activities are occurring and are planned to occur within the proposed license area, and oil and gas development within the planning area of the BLM Buffalo Field Office is expected to continue.

The potential impact to historic and cultural resources would likely be minimized for projects occurring on federal or state lands or which are funded in part by the government since these projects would be subject to the *National Historic Preservation Act* (NHPA), Section 106 consultation process, and applicable statutes. The Fortification Creek Area Draft Resource Management Plan Amendment/Environmental Assessment (BLM, 2008b) concluded 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 potential impact on historic and cultural resources from licensing the proposed Moore Ranch Project would result in a SMALL impact on cultural and historic resources; however, when considering the other past, present, and future actions in the Powder River Basin, the cumulative impact would be MODERATE. The Section 106 consultation process for either actions on federal lands or that would require a federal permit requires consideration of historic and cultural resources.

5.10 Visual and Scenic Resources

The cumulative impact on visual and scenic resources was considered within the area administered by the BLM Buffalo Field Office.

The development of the proposed Moore Ranch Project was expected to have a SMALL impact on visual and scenic resources because the facility would be located in a BLM visual resource management (VRM) Class IV area, which allows an activity to contrast with the basic elements of the characteristic landscape to a much larger degree.

However, within the area administered by the BLM Buffalo Field Office and within the Powder River Basin region, energy development is expected to grow over the next 15 to 20 years and would involve constructing railroads, coal-fired power plants, major (230 kV) transmission lines, coal technology projects, oil and gas transportation pipelines and refineries, and CBM processing plants. Within the BLM Buffalo Field Office planning area, there are other either ongoing or planned uranium recover projects, oil and gas developments, and CBM projects all which have an impact on visual and scenic resources.

Therefore, although the impact on visual and scenic resources from licensing the proposed Moore Ranch Project would be SMALL, the impact from past, present and reasonably foreseeable future actions would result in a MODERATE impact on visual and scenic resources within the area administered by the BLM Buffalo Field Office.

5.11 Socioeconomics

The cumulative socioeconomic impact was considered within the Powder River Basin, since mineral extraction dominates activities within this area.

Socioeconomic impacts from the proposed Moore Ranch Project would be expected to range from SMALL to MODERATE depending on the phase of the ISR lifecycle and the particular socioeconomic characteristic (e.g., finance, demographics, etc.) as discussed in Section 4.11 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 consider the current recession, climate change legislation (including cap and trade components) and future technological changes (e.g., clean coal initiatives). Within the Powder River Basin, employment is expected to increase from 2,300 to 11,563 jobs by 2010 from the increases in coal mining operations and in oil and gas development. Most of this incremental gain is expected to occur in Campbell County (BLM, 2009a). While Campbell County and the entire Powder River Basin have been characterized as being able to adapt to, respond to, and accommodate growth, periods of rapid growth can stress communities and their social structures, housing resources, and public infrastructure and service systems (BLM, 2005a, 2005b, 2005c). Socioeconomic projections in the South Gillette Draft EIS indicated a strong demand for housing resources within the Powder River Basin through the year 2020 which would exert substantial pressure on housing markets, prices, and the real estate development and construction industries at a time when the overall demand for labor and other resources would be high. Short-term school capacity shortages and public services limitations have also been anticipated in response to the population increase in population.

The cumulative impact on the socioeconomics of the region could be more severe if the growth of extractive industries and power production increased above average historic levels. A cumulative negative impact could result if the housing supply and real estate market could not meet the labor demands in the extractive industries. There could be a long-term impact on local schools, health care facilities, fire and police services, and infrastructure, including waste management facilities, if large industrial projects created a demand for labor in the Powder River Basin.

If the population size were to remain stable or grow at a rate that the area could manage (approximately 2 percent per year based on past experience), the local economy could be positively affected by multiple mining operations occurring simultaneously that would generate local and state economic revenue.

Therefore, the past, present, and reasonably foreseeable future actions occurring within the Powder River could result in a MODERATE impact on the socioeconomic conditions within the vicinity of the proposed Moore Ranch Project.

5.12 Environmental Justice

The analysis of environmental justice compared the occurrence of minority and low-income populations in the vicinity of the proposed Moore Ranch Project with those populations in the State of Wyoming. There are no concentrations of minority and people of low-income living near the proposed Moore Ranch Project; therefore, there would be no disproportionately high and adverse impacts as discussed in Section 4.12 of this SEIS.

Within the area administered by the BLM Buffalo Field Office, the economic base is largely ranching and resource extraction; low-income segments of the population are dispersed throughout this area. People living below poverty level could reside within this area. However, the number of people living below poverty level does not represent a disproportionate segment of the population.

5.13 Public and Occupational Health and Safety

The cumulative impact on public and occupational health and safety was considered within an 80-km (50-mi) radius of the proposed Moore Ranch Project.

The public and occupational health and safety impacts from the proposed Moore Ranch Project would be expected to be SMALL under normal operations since the potential radiological exposure would be consistent with background. Under accident conditions, the potential exposure could be MODERATE as discussed in Section 4.13 of this SEIS. The annual dose to the population located within 80 km (50 mi) of the proposed Moore Ranch Project would be far below applicable NRC regulations. If an accident were to occur, the potential impact could be MODERATE if the appropriate mitigation measures and other procedures that ensure worker safety were not followed.

The proposed Moore Ranch Project site is located within the GEIS Wyoming East Uranium Milling Region which contains 21 previous, current, or potential uranium handling sites (NRC, 2009). The GEIS (NRC, 2009) identified eight draft or final EISs submitted from January 2005 to February 2008 for projects that could contribute to a cumulative impact on public and occupational health and safety within the Wyoming East Uranium Milling Region. In addition, the GEIS identified ten programmatic EISs affecting the entire State of Wyoming. No additional projects initiated since February 2008 were identified that would contribute to the cumulative impact on radiological public health and safety. As noted above, the proposed Moore Ranch Project would have a SMALL impact on public health and safety consistent with background radioactivity under normal operations. Because the identified projects within an 80-km (50-mi) radius of the proposed Moore Ranch Project would not significantly contribute to the cumulative public and occupational health and safety effects from the identified projects, the cumulative impact would be SMALL.

The maximum expected exposure to any member of the public from the proposed Moore Ranch Project, as with other operating ISR facilities in the U.S., would be expected to be less than 10 mrem per year at the site boundary (NRC, 2009). This exposure, combined with exposures from other facilities, is expected to remain far below the regulatory public limit of 100 mrem/year and have a negligible contribution to the 620 mrem average yearly dose received by a member of the public from all sources. Therefore, the cumulative impact on public health and safety from past, present and reasonably foreseeable actions in the vicinity of the proposed Moore Ranch Project would be expected to be SMALL.

5.14 Waste Management

The cumulative impact on waste management was considered within an 80-km (50-mi) radius of the proposed Moore Ranch Project. Waste management impacts from the proposed Moore Ranch Project would be expected to be SMALL as discussed in Section 4.14 of this SEIS.

Past, present, and reasonably foreseeable future activities in the vicinity of the proposed Moore Ranch Project site that could generate solid, hazardous or radioactive wastes include uranium mining/milling activities, CBM activities, and oil and gas exploration. Each of these facilities would be required to comply with applicable regulations and site-specific license agreements that manage any generated wastes. Because hazardous and radioactive wastes are closely monitored throughout the United States, the potential impact from these activities would be expected to be SMALL.

Within an 80-km (50-mi) radius of the proposed Moore Ranch Project there are at least six either operating or planned ISR facilities that would generate waste volumes consistent with that projected for Moore Ranch. The incremental impact from waste management activities at the proposed Moore Ranch Project when added to past, present, and reasonably foreseeable actions that would contribute to a SMALL potential cumulative impact on either waste management or disposal capacity.

5.15 References

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6 ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

6.1 Introduction

As discussed in the GEIS (Section 8.0), 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 (NRC, 2009). Monitoring programs provide data on operational and environmental conditions so that prompt corrective actions can be implemented if an adverse condition is detected. In this regard, these programs help to limit the potential environmental impacts at ISR facilities and the surrounding areas.

Required monitoring programs can be modified to address unique site-specific characteristics by the addition of license conditions based on NRC's site-specific safety and environmental reviews.

The discussion of the proposed monitoring programs for the Moore Ranch 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 Uranium One's proposed radiological monitoring program as described in its license application (EMC, 2007a; EMC 2007b) and subsequent responses to NRC's request for additional information (Uranium One, 2009). 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 and workers (NRC, 2003).

In accordance with NRC regulations contained in 10 CFR Part 40, Appendix A, Criterion 7, a preoperational monitoring program is required to establish the 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 the environmental impact of an ISR facility under operational conditions. Although not a requirement, NRC Regulatory Guide 4.14 (NRC, 1980) provides guidance for implementing monitoring programs that are acceptable to the NRC staff for uranium mills, including ISR facilities.

The results of Uranium One's baseline monitoring program are presented in Section 3.12.1 of this SEIS. The following sections provide a brief description of the applicant's proposed operational monitoring program.

6.2.1 Airborne Radiation Monitoring

Uranium One proposes to implement an airborne radiation monitoring program to detect radon and air particulate releases from the central plant processes. Figure 6-1 shows the air sampling locations proposed by Uranium One, which, based on the recommendations in Regulatory

Guide 4.14, include a minimum of three air monitoring stations at or near the site boundaries, one station at or close to the nearest structure within 10 km (6.2 mi) of the site, and one station at a control or background location. These operational monitoring locations would be the same as those used to perform the baseline analysis described in Section 3.12.1.

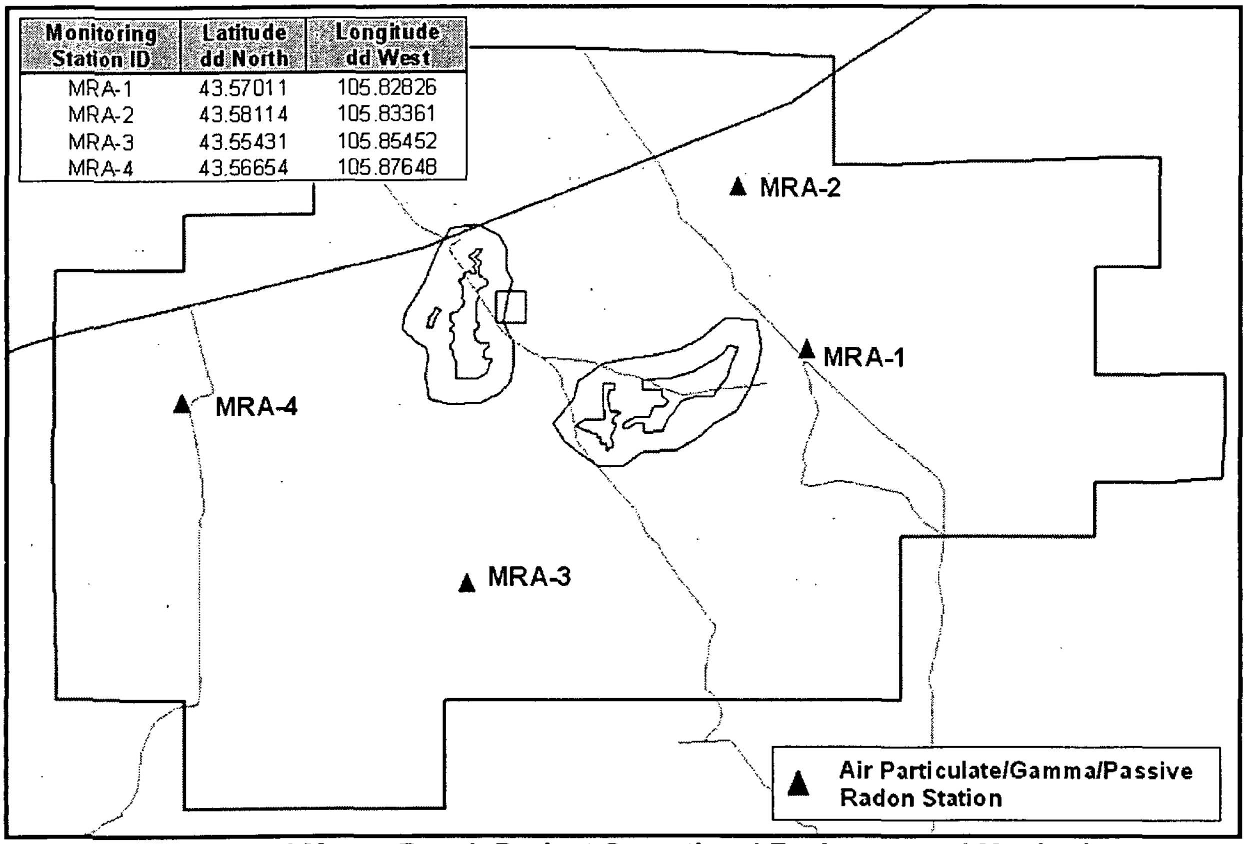

Figure 6-1. Proposed Moore Ranch Project Operational Environmental Monitoring Locations

Air particulate monitoring would be performed using low volume samplers. Filters would be collected weekly to help prevent dust loading and would be composited on an approximately quarterly basis and analyzed for average Ra-226, U-234, U-235, U-238, Th-230, and Pb-210 concentrations and detection levels. Results of the operational air particulate monitoring program would be reported in the semi-annual effluent reports to the NRC, as required by 10 CFR 40.65. Radon sampling would be conducted at the air particulate sampling locations using Track-Etch radon cups which would be exchanged semiannually and analyzed to determine radon concentrations (in pCi/L). In addition to the environmental monitoring, Uranium One would estimate the release of radon from process operations using MILDOS-AREA modeling and would report results in the semi-annual effluent reports required by 10 CFR 40.65.

6.2.2 Soils and Sediment Monitoring

During operations, Uranium One would conduct soil sampling on an annual basis. Samples would be collected to a depth of 5 cm for consistency with the baseline soil sampling surveys described in Section 3.12.1. Following Regulatory Guide 4.14, discrete grab samples of surface soils would be collected at the four air particulate sampling locations shown in Figure 6-1 and would be analyzed for U-234, U-235, U-238, Ra-226, and Pb-210. Prior to decommissioning, following the conclusion of operations, subsurface soil samples would be taken to compare the results with subsurface soil samples collected as part of the pre-operational monitoring program.

6.2.3 Vegetation, Food, and Fish Monitoring

As described in Section 3.12.1, Uranium One conducted pre-operational vegetation sampling in 2007 at various locations on the Moore Ranch site. Uranium One evaluated the ingestion pathway to individuals from vegetation using the MILDOS-Area model and concluded that the ingestion pathway is not significant. Following Regulatory Guide 4.14, Uranium One does not intend to conduct vegetation, food, or fish sampling because the predicted dose to an individual from these pathways would be less than five percent of the applicable radiation protection standard.

6.2.4 Surface Water Monitoring

The proposed license area contains only intermittent streams and natural runoff occurs during heavy rainfall and snowmelt events. Current CBM operations contribute surface water discharge, which maintains some ponding at select locations across the proposed license area for portions of the year. Surface water samples would be collected on a quarterly basis at the same locations sampled for the pre-operational baseline if surface water is present as shown in Figure 3.4.2-4 of the applicant's Technical Report (EMC, 2007b).

Surface water samples would be collected in appropriate containers and field measurements for pH and conductivity would be documented. A preservative (acid) would be added to the surface water sample immediately after collection and filtration, if required. The sampling volume, preservative, and holding times for the proposed analytes are summarized in Uranium One (2008). The samples would be analyzed for Pb-210; Ra-226; Th-230; U-234, U-235, U-238 and Po-210. Surface water monitoring results would be submitted to the NRC in the semi-annual environmental and effluent monitoring reports.

6.2.5 Groundwater Monitoring

Groundwater monitoring of wells located outside of the proposed license area would be conducted to monitor the potential for contaminated groundwater to migrate offsite. The proposed Moore Ranch Project would monitor all private wells located within one kilometer of the boundary of the well fields. These wells would be sampled quarterly, and analyzed for natural uranium and radium-226 with the landowner's consent, to identify potential impacts from the ISR operation. The sampling would be conducted in accordance with a standard operating procedure reviewed by the NRC staff. Furthermore, the water levels in private wells would be measured by the applicant every three months during operations (EMC, 2007a)

6.3 Physiochemical Monitoring

The ISR process directly affects groundwater and has the potential to contaminate it. Monitoring programs help to prevent and limit potential environmental impacts. Physiochemical monitoring provides data on operational and environmental conditions so that prompt corrective actions can be taken if an adverse condition is detected. The physiochemical monitoring program at the proposed Moore Ranch Project includes groundwater monitoring and well field and pipeline flow and pressure monitoring.

6.3.1 Well Field Groundwater Monitoring

Section 8.3 of the GEIS discussed the potential for ISR production processes to affect groundwater in and near the operating well field. Hence, groundwater conditions are extensively monitored both before and during operations, and after restoration. The proposed pre-operational and baseline groundwater monitoring that would occur at the Moore Ranch Project is discussed below in Section 6.3.1.1. The groundwater quality monitoring that would occur during operation and restoration is discussed in Section 6.3.1.2.

6.3.1.1 *Pre-Operational Groundwater Sampling*

Section 8.3.1.1 of the GEIS discussed how a baseline groundwater quality program would be established prior to uranium production (NRC, 2009). The purpose of this program is to characterize water quality in monitoring wells used to detect lixiviant excursions from the production zone, to remediate excursions, and to establish Restoration Target Values (RTVs) for aquifer restoration after the operations phase is complete.

Groundwater monitoring wells were installed at Moore Ranch to evaluate pre-operational water quality as part of the site characterization discussed in Section 3.5.2 of this SEIS. Four well groups, each with a well in the 70 Sand production zone aquifer, the overlying 72 Sand aquifer, and the underlying 68 Sand aquifer were installed across the proposed license area. Three wells were also completed in the 60 Sand aquifer. Four additional wells completed in the 70 Sand aquifer, installed in the 1980s by Conoco, and existing stock water wells completed in either the production aquifer or the underlying and/or overlying aquifers were also sampled for the WDEQ LQD Guideline 8 groundwater quality parameters to establish the WDEQ class of use as described in Section 3.5.2 of this SEIS.

This sampling program in combination with groundwater sampling data from the 1980 Conoco project, provided a preliminary baseline of groundwater quality. The purpose of the preoperational analysis is to evaluate the overall groundwater quality in the proposed license area under normal pre-operational conditions. It is not used to establish the baseline water quality which forms the basis for establishing restoration criteria for the individual well fields.

To establish baseline water quality at the proposed Moore Ranch Project before operations began, monitoring wells would be installed in the 70 Sand production zone at a density of one well per 1.2 ha (3 ac) of the two planned well fields. Each monitoring well would be analyzed for all WDEQ LQD Guideline 8, Appendix 1, parts III and IV parameters shown in Table 5.7-1 of the applicant's Technical Report (EMC, 2007b). The third and fourth sampling events would be analyzed for a reduced list of parameters defined by the previous sample results. If certain constituents were not detected during the first and second sampling events, then they would not be analyzed for again during the third and fourth sample events. Data for each water quality parameter would be averaged. If the collected well field data indicated that waters of different underground water classes coexist (WDEQ-WQD Rules and Regulations, Chapter VIII), then the data would not be averaged but rather treated as sub-zones. Sub-zone specific data would also be averaged. A sub-zone boundary would be delineated half-way between the sampled well sets as appropriate.

Once the baseline water quality is established for each well field, it would be used to determine the appropriate restoration target values to assess the effectiveness of ground water restoration on a well field-specific basis. The restoration target values are a combination of the average and range of baseline values for specific constituents in wells completed in the 70 Sand production zone. The WDEQ would review and approve the baseline water quality assessment and restoration target values for each well field; NRC would also review and approve the restoration target values for specific constituents.

Monitoring wells would be installed in a ring around each well field in the 70 Sand production zone and in the overlying 72 Sand and underlying 68 and 60 Sand aquifers prior to the start of operations. The wells would be sampled to determine baseline water quality data to establish upper concentration limits (UCL) for operational excursion monitoring. The wells would be sampled four times, at least two weeks apart. The first sample would be analyzed for the full set of constituents required by the WDEQ; subsequent samples would only be analyzed for the UCL parameters (see Section 6.3.1.2).

The applicant's Technical Report provides detailed procedures for sampling and analysis, including methods for measuring water levels, well purging and sampling protocols, sample preservation and documentation, analytical methods, and quality assurance/quality control (QA/QC) requirements (EMC, 2007b).

6.3.1.2 *Groundwater Quality Monitoring*

Section 8.3.1.2 of the GEIS discussed the placement of monitoring wells around the perimeter of the well fields, in the aquifers overlying and underlying the ore-bearing production aquifers, and within the well fields to provide early detection of potential horizontal and vertical lixiviant excursions during production operations. Monitoring well placement is based on a number of factors including the nature and extent of the confining layer and the occurrence 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 aquifer thickness being monitored, the distance between the monitoring wells and the well field, the distance between adjacent monitoring wells, the frequency of groundwater sampling, and the magnitude of changes in lixiviant migration indicator parameters. Therefore, the spacing, distribution, and number of monitoring wells are site specific and established by license conditions.

The groundwater monitoring program at the proposed Moore Ranch Project would be designed to detect excursions of lixiviant outside the well field under production and into the overlying and/or underlying water bearing strata. The groundwater monitoring is divided into four phases: pre-operational, baseline, production and restoration monitoring. Section 5.7.8 of the applicant's Technical Report documents the groundwater monitoring program that would be implemented at the proposed Moore Ranch Project (EMC, 2007b). Monitoring wells completed in the 70 Sand production zone would be installed around the perimeter of each well field. Approximately 24 groundwater wells would monitor the perimeter of Wellfield 1 and approximately 27 groundwater wells would be used to monitor the perimeter of Wellfield 2. Within the pattern area wells completed in the overlying 72 Sand aquifer and in the underlying 68 Sand aquifer would be spaced at one well per every 6.4 ha (4 ac) of pattern area resulting in approximately 6 monitor wells completed in the overlying and underlying aquifers in Wellfield 1 and about 9 monitor wells completed in overlying and underlying aquifers in Wellfield 2 since it covers a larger area. In the Wellfield 2 area where the 68 and 70 Sands coalesce, the sands would be treated as one aquifer and the underlying aquifer would be the 60 Sand. Additional monitoring wells would be placed in the 68 Sand in this area detect potential impacts. Wells would also be completed in the underlying 60 Sand in the area where the 68 and 70 Sands coalesce in Wellfield 2. The final number of such wells would be determined during final well field planning and submitted to the WDEQ-LQD and NRC for review and approval.

The distance between the perimeter monitoring wells surrounding the production wells would be no more than 152 m (500 ft) and the distance between the perimeter monitoring wells and the production pattern would also be approximately 152 m (500 ft) base on the output from a groundwater flow model and the estimated hydraulic properties within the production area. Model simulations were also used to demonstrate that if an excursion occurred, the perimeter monitoring ring would be able to detect an excursion in a timely manner. Appendix B-4 of the Technical Report presents the groundwater model and an analysis of the model results (EMC, 2007b).

At the proposed Moore Ranch Project, the constituents selected as lixiviant migration indicators for which UCLs would be established are chloride, conductivity, and total alkalinity. Chloride was selected because it has a low background concentration in native groundwater and because it would be introduced into the lixiviant from the ion exchange process. Chloride is also very mobile in groundwater. Conductivity was selected because it is an indicator of overall groundwater quality. Total alkalinity was selected because bicarbonate is the major constituent added to the lixiviant during production; therefore, elevated concentrations of total alkalinity could be indicative of an excursion.

The applicant must provide a field demonstration of the hydraulic interconnection between the monitoring wells and production pattern using pump tests before operations can be initiated. Because of the unconfined nature of the groundwater aquifer in the 70 Sand at the proposed Moore Ranch Project, the typical pump tests used for a confined aquifer are ineffective. The applicant therefore used the numerical groundwater model presented in Appendix B-4 of the Technical Report to develop a pump test strategy that could demonstrate the hydraulic connections between the monitoring wells and production pattern in the 70 Sand unconfined aquifer (EMC, 2007b). This pump test strategy would be implemented after the required monitoring and production wells were completed but prior to operations.

A Wellfield Hydrologic Data Package would be prepared by the licensee following the installation of the production pattern and monitoring well network in a well field. This package would provide the monitoring well locations, the pump test results, baseline water quality for all wells, and RTVs for each well field production zone. The applicant's Safety and Environmental Review Panel, responsible for monitoring any proposed change in the facility or process, would review the data package to ensure that the hydrologic testing results and planned ISR activities would be consistent with technical requirements and did not conflict with NRC regulatory requirements. The Wellfield Hydrologic Data Package would be submitted to the WDEQ and NRC for review and approval to ensure the acceptability of the baseline data and the RTVs. WDEQ and NRC would also review the monitoring well locations and the well field-specific monitoring program to ensure they would provide timely detection and correction of potential horizontal or vertical excursions.

After operations were completed, the well fields would be restored. During restoration, lixiviant injection would be suspended; thereby reducing the potential for an excursion. The applicant has therefore proposed a reduced groundwater monitoring program. During the aquifer restoration phase, wells located in the perimeter monitoring ring and completed in the overlying and underlying aquifers would be sampled every sixty days for chloride, alkalinity and conductivity excursion parameters. An excursion would be defined in the same manner as during operations and subject to the same correction requirements.

6.3.2 Well Field and Pipeline Flow and Pressure Monitoring

Section 8.3.2 of the GEIS discussed operator monitoring of injection and production well flow rates to manage the entire well field water balance. The pressure of each production well and the production trunk line in each well field header house would also be monitored. Unexpected pressure loss could indicate equipment failure, a leak, or well integrity problems.

The proposed Moore Ranch Project would have an extensive program of well field and pipeline flow and pressure monitoring as described in Section 3.1.3 of the applicant's Technical Report (EMC, 2007b). Injection well and production well flow rates and pressures would be monitored at each header house to balance injection and production in each pattern and throughout the well field. The production and injection flow rate in each well would be continuously individually monitored by electronic flow meters in each well field header house. The pressure of each production and injection well trunk line would also be monitored at the header house with electronic pressure gauges. Both flow meter and pressure gauges would tie into the header house control panel that would tie into the central plant control room. High and low pressure flow alarms would alert well field and plant operators if specified ranges were exceeded. Automatic shutoff valves would stop the flow in the event of significant changes in volume or pressure. This monitoring would alert the operators to detect malfunctions that could lead to either well field infrastructure or pipeline failures, thus minimizing the potential to impact groundwater.

6.3.3 Surface Water Monitoring

Uranium One does not plan on conducting any physiochemical monitoring of surface water since there would be no surface water discharges associated with the ISR process at the proposed Moore Ranch Project. To ensure the protection of surface water, each injection and production well would have a monitoring device that sounds an alarm in the event of a change in flow pressure that might indicate a leak or rupture in the system. If a leak were to occur, the system would be shut down and remediation conducted as appropriate.

6.3.4 Meteorological Monitoring

Uranium One 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, Uranium One used meteorological data from the Antelope Coal Mine meteorological station located approximately 40 km (25 mi) southeast of the proposed Moore Ranch Project. The Antelope coal mine site has similar topographic features to the proposed Moore Ranch Project and is characterized by mildly rolling hills covered with grass and sparse shrubs (Uranium One, 2008).

6.4 Ecological Monitoring

6.4.1 Vegetation Monitoring

As discussed previously in Section 6.2.3, Uranium One concluded from its pre-operational vegetation sampling program and through modeling that the ingestion pathway for radiological dose is not significant. Therefore, Uranium One does not intend to conduct vegetation, food, or fish sampling because the predicted dose to an individual from these pathways would be less than five percent of the applicable radiation protection standard.

6.4.2 Wildlife Monitoring

Furthermore, large game animals such as deer or pronghorn have extensive ranges and are not confined to the site. The potential for bioaccumulation of radionuclides in these animals would be limited as they would likely derive only a small fraction of total sustenance from the site. No fish species are found within the proposed license area since all of the water bodies are intermittent in nature and do not contain sufficient water to support aquatic species.

Wildlife studies on the proposed Moore Ranch Project would include an annual raptor survey (Uranium One, 2009). An annual raptor nest survey would be conducted in late April or early May to identify new nests and to assess whether known nests are being utilized. The survey would cover all areas of planned activity for the life of the mine (i.e., well fields and the central plant) and a one-mile area around the activity primarily to protect against unforeseen conditions such as the construction of a new nest in an area where it could be affected by the operation of the ISR project (Uranium One, 2009).

6.5 References

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Uranium One, 2008. "Additional Information Requested for the Moore Ranch In Situ Uranium Recovery Project License Application (TAC JU011), First Set of Responses." ADAMS Accession No. ML082060527. July 11, 2008.

7 COST-BENEFIT ANALYSIS

This chapter summarizes benefits and costs associated with the proposed action and the No-Action alternative. Chapter 4 of this Supplemental Environmental Impact Statement (SEIS) discusses the potential socioeconomic impacts of the construction, operation, aquifer restoration, and decommissioning of the proposed Moore Ranch Project by Uranium One.

The implementation of the proposed action primarily would generate regional and local benefits and costs. The regional benefits of constructing and operating the proposed Moore Ranch ISR Project would be increased employment, economic activity, and tax revenues in the region around the proposed site. Some of these regional benefits, such as tax revenues, would be expected to accrue specifically to Campbell County, Wyoming, where the proposed ISR facility would be located, and the town of Wright, located approximately 40 km (25 mi) from the proposed project site. Other benefits may extend to the neighboring Wyoming counties of Johnson and Natrona. Costs associated with the proposed Moore Ranch Project are, for the most part, limited to the area surrounding the site. Examples of these environmental impacts would include changes to current land use and increased road traffic.

7.1 No-Action Alternative

Under the No-Action alternative, the NRC would not approve the license application for the proposed Moore Ranch Project. The No-Action alternative would result in Uranium One not constructing, operating, restoring the aquifer, or decommissioning the proposed Moore Ranch Project. No facilities, road, or wellfields would be built; no pipeline would be laid as described in Section 2.1.1.2. No uranium would be recovered from the subsurface orebody; therefore, injection, production, and monitoring wells would not be installed to operate the facility. No lixiviant would be introduced in the subsurface and no buildings would be constructed to process extracted uranium or store chemicals involved in that process. Because no uranium would be recovered, neither aquifer restoration nor decommissioning activities would occur. No liquid or solid effluents would be generated. As a result, the proposed site would not be disturbed by the proposed project activities, and ecological, natural, and socioeconomic resources would remain unaffected. All potential environmental impacts from the proposed action would be avoided. Similarly, all project-specific socioeconomic impacts (e.g., related to employment, economic activity, population, housing, local finance) would be avoided.

7.2 Benefits from Proposed Action in Campbell County

Under the proposed action, Uranium One would construct, operate, and decommission and conduct aquifer restoration at the proposed Moore Ranch Project site in Campbell County, Wyoming. The central processing plant, access roads, and initial development of the first of two wellfields for the proposed Moore Ranch Project would take place over a nine month period, with the development of the second well field anticipated within the following 2-year period. Operation of the central plant for uranium recovery and processing would be expected to occur over 12 years, with approximately 3.25 years of uranium recovery in each of the wellfields. Aquifer restoration activities and associated stability monitoring following restoration is expected to occur over a 4.5- to 6.5-year period. Uranium One expects to conduct final well field and site decommissioning within one year.

The principal socioeconomic impact or benefit from the proposed Moore Ranch Project would be an increase in the jobs in Campbell County, Wyoming. Uranium One expects to employ 40-

60 workers during construction, and approximately the same number of workers during operations, aquifer restoration, and decommissioning. As discussed in Chapter 4, it is expected that workers involved in construction and decommissioning activities would most likely not relocate due to the short period over which these activities are expected to take place.

However, during the 12-year period of operations and aquifer restoration, it is expected that workers are more likely to relocate to be nearer the facility. If the majority of operational requirements is filled by a workforce from outside the region, assuming a multiplier of about 0.7[1], there could be an influx of 28 to 42 jobs (i.e., 40 jobs x 0.7 = 28 jobs and 60 jobs x 0.7 = 42 jobs).

The closest town to the proposed site is the town of Wright with an estimated population of 1,462 (U.S. Census Bureau, 2008). However, operational employees may prefer larger communities (NRC, 2009) and therefore may choose to reside in larger towns, such as the towns of Gillette and Casper. Thus the influx of these jobs along with the reduction of unemployment is expected to have a MODERATE benefit to the businesses in the town of Wright and a SMALL to MODERATE impact in the businesses of the larger towns that are within commuting distance from the proposed project site.

In addition to job creation, the project's operations and its employees would contribute to local, regional, and state revenues through the purchase of goods and services and through the taxes levied on such goods and services. Additionally, severance taxes associated with uranium mining in Campbell County are levied by the State of Wyoming, Mineral Tax Division of the Department of Revenue has a 4% uranium severance tax of taxable market value coming from mining operations (Wyoming Department of Revenue, 2009). Current Uranium One resource estimates for the proposed Moore Ranch Project are 5.8 million lbs of U_3O_8. If Uranium One is able to fully recover this resource and sell it at a nominal market price of $45 per pound of U_3O_8, the severance tax would yield approximately $10,440,000 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 Moore Ranch Project.

7.2.1 Benefits from Potential Production

Both the employment generated and the taxes paid by Uranium One would depend on the production of yellowcake. The amount of yellowcake produced would depend on the market price for yellowcake (as U_3O_8) and the cost of production. Since 2007, the spot-market price for U_3O_8 has fluctuated significantly, from a high of over $130 in 2007 to as low as $40 in 2009. As of September 8, 2009, the price was $46 per pound.

The project's potential benefits to the local community depend on Uranium One's operating costs being lower than the future price of U_3O_8. If the price of U_3O_8 is less than the costs of operation, then operations may be suspended and/or discontinued.

[1] The Economic Multiplier is used to summarize the total impact that can be expected from a change in a given economic activity. It is the ratio of total change to initial change. The multiplier of 0.7 was used as a typical employment multiplier for the milling/mining industry (Economic Policy Institute, 2003).

7.2.2 Costs to the Local Communities

Table 7-1 identifies the towns within 40 km (25 mi) and towns within commuting distance from the proposed project site. The table also presents the towns' population and distance from the project site.

Table 7-1. Towns Near to the Proposed Moore Ranch Project

Town	Population *	Distance from Project Site (km) [mi]
Towns within 40 km (25 mi) from the project site		
Edgerton	176	38 [24]
Wright	1,462	40 [25]
Midwest	435	40 [25]
Towns greater than 40 km (25 mi) from the project site		
Kaycee	290	64 [40]
Gillette	26,871	80 [50]
Buffalo	4,832	100 [62]
Casper	54,047	100 [62]

*U.S. Census Bureau, 2008

As stated in Section 7.2, the proposed project is expected to employ 40 to 60 workers during the period of operations, and if the majority of these workers came from outside the region, there could be an influx of 28 to 42 jobs (using an economic multiplier of 0.7). Given the expectation that workers during operations would tend to relocate closer to the site, these new jobs potentially could involve an influx of 69 to 104 people, based on 2.48 persons per household for the State of Wyoming (U.S. Census Bureau, 2000).

Chapter 4 of this SEIS states that because of the small relative size of the ISR workforce, the overall potential impacts to socioeconomics would be expected to be SMALL to MODERATE. As stated previously, operational employees may prefer larger communities (NRC, 2009) and therefore may choose to reside in larger towns. Thus, for the relatively smaller town of Wright the influx of these jobs is expected to have a MODERATE impact in housing and jobs demand, MODERATE impact in education infrastructure, SMALL increase demand for health and social services, and SMALL impact on emergencies from vehicle-related accidents. For the larger towns of Gillette and Casper, the influx of these jobs is expected to have a SMALL to MODERATE impact in housing and jobs demand, SMALL impact in education infrastructure, SMALL increase demand for health and social services, and no significant costs on emergencies from vehicle-related accidents.

7.3 Evaluation Findings of the Proposed Moore Ranch Project

Implementation of the proposed action would have a SMALL to MODERATE overall economic impact on the region of influence. The implementation of the proposed action would generate primarily regional and local benefits and costs. The regional benefits of building the proposed Moore Ranch ISR Project would be increased employment, economic activity, and tax revenues in the region around the site. Some of these regional benefits, such as tax revenues, would be expected to accrue specifically to Campbell County. Other benefits may extend to neighboring counties in the State of Wyoming. Costs associated with the proposed Moore Ranch ISR Project are, for the most part, limited to the area surrounding the site and the communities within commuting distance. Table 7-2 summarizes the costs and benefits.

Table 7-2. Summary of Costs and Benefits of the Proposed Moore Ranch Project	
Cost-Benefit Category	**Proposed Action**
BENEFITS	
Capacity Produced	5.8 million pounds of U3O8
Other Monetary	$10.44 million (estimated)
Non-Monetary (50% of jobs will be from Campbell County)	40-60 jobs—during construction, operation aquifer restoration, and decommissioning 28-42 jobs—local jobs from economic multiplier during operation and aquifer restoration
COSTS	
Education Infrastructure	SMALL to MODERATE
Health and Social Services	SMALL to MODERATE
Housing Demand	SMALL to MODERATE
Emergency Response	SMALL

7.4 References

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8 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

This chapter summarizes the potential environmental impacts and consequences of the proposed action and No-Action alternative if the decision were made to license the proposed Moore Ranch Project. In doing so, the potential impacts and consequences of the proposed action 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 for the 13 resource areas and discussed by stage of the proposed Moore Ranch Project's lifecycle (i.e., construction, operation, aquifer restoration and decommissioning). These impacts are described in the table 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

Table 8-1 summarizes the environmental consequences for the proposed action. Under the No-Action alternative there would be no unavoidable adverse impacts because no licensing action would be taken. Likewise, there would be no irreversible and irretrievable commitment of resources since no materials would either be committed or consumed under the No-Action alternative. Similarly, since no action would be taken there would be short- or long-term impacts under the No-Action alternative. The proposed action is briefly described below and the environmental impacts of the No-Action alternative are provided for comparison to the proposed action.

8.1 Proposed Action (Alternative 1)

Under the Proposed Action, the NRC would issue a license for the construction, operation, aquifer restoration, and decommissioning of the proposed Moore Ranch Project. During the construction phase of the action, expected to last about nine months, buildings, access roads, well fields, pipelines, and injection wells to be used for liquid effluent disposal would be constructed. These actions would disturb approximately 61 ha (150 ac) of the 2879 ha (7100 ac) proposed license area. During the operations phase, expected to last about 12 years, although the well fields themselves would only be operational 3.25 years, injection wells would be used to inject lixiviant (recovery) solutions into the ore body to recover uranium, production wells would be used to recover the dissolved uranium which then would be processed through the central plant, and finally monitoring wells would be installed to monitor the performance of the well field and to mitigate potential excursions from the production zone. Initially, approximately 2 to 3 million pounds of U_3O_8 would be produced per year. Following the operations phase, aquifer restoration would be initiated to ensure that water quality and groundwater use from surrounding aquifers was not impacted by the proposed action. The process of aquifer restoration, expected to last about 3.5 years in Wellfield1 and 5.25 years in Wellfield 2, would involve transferring contaminated groundwater from one well field to the next, "sweeping" groundwater (i.e., replacing contaminated groundwater with cleaner baseline water through pumping action), and finally treating the groundwater to minimize the groundwater volume consumed during the restoration phase. Finally, during the decommissioning phase of the proposed action, expected to last about one year, the lands that had been disturbed would be returned to their pre-mining use. The wells in the well fields would be plugged and abandoned and the land surface would be reclaimed.

8.2 No-Action (Alternative 2)

Under the No-Action alternative, the NRC would not issue a license to Uranium One for the construction, operation, aquifer restoration, and decommissioning of the proposed Moore Ranch Project. No buildings, roads, well fields and the supporting infrastructure would be built, no uranium would be recovered from the subsurface orebody; therefore, the aquifer would be unaffected by activities at the proposed Moore Ranch Project and there would be no need for restoring the aquifer or for decommissioning. The decision to not license the proposed Moore Ranch Project would leave a large resource unavailable for energy production supplies to fuel power generation facilities.

Under the No-Action alternative, there would be no impact to land use because the facility would not be constructed; there would neither be earthmoving activities to disturb the land nor restrictions put on the land for grazing or ranching. The existing land use would continue and the property would be available for other uses. There would be no impact on the local transportation system. The current volume and existing traffic patterns would continue as described in the affected environment. Since the land surface would not be disturbed under the No-Action alternative, there would be no impact to soils. Natural phenomena such as wind and water erosion (during storms and severe weather events) would remain the most significant variable associated with geology and soils at the site. The subsurface geology at the site would be unaffected by the injection of fluids.

The occurrence of surface water and associated wetlands at the site would continue to occur intermittently in response to snowmelts, large precipitation events or from the discharge of surface water from upstream coal-bed methane operations. Under the No-Action alternative, groundwater would be unaffected by the proposed ISR operation. The groundwater quality in the aquifer and the water levels in wells surrounding the proposed license area would remain unaffected. Because there would be neither be earthmoving nor grazing restriction activities under the No-Action alternative, the existing vegetation and wildlife communities would be undisturbed. There would be no impact to air quality since there would be no activities to generate either fugitive dust or gaseous emissions nor would there be any noise-generating activities.

No historic or cultural resources would be disturbed under the No-Action alternative nor would there be any proposed activities that could affect the viewscape. The viewscape would consist of existing activities in the area, such as coal-bed methane extraction and oil and gas development. There would be no additional radiological exposure to the general public other than that from background radiation levels. No additional waste streams or materials such as sanitary waste or 11e.(2) byproduct material would be generated.

Under the No-Action alternative, there would be no impact on the socioeconomics of the area. No new jobs would be created, no additional revenue would accrue to the tax base, there would be no impact on the availability of housing or public services. There would be no disproportionately high and adverse impact on minority and low-income populations.

Table 8-1. Summary of Environmental Consequences

The Proposed Action (Alternative 1)				
Impact Category *(as applicable)*	**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	There would be a SMALL impact to land during the construction and decommissioning phases of the proposed Moore Ranch Project. During construction, approximately 60 ha (150 ac) of land would be disturbed by earthmoving activities to construct the central plant, well fields and their infrastructure, and to build the access roads. This area is less than 2 percent of the proposed license area. During decommissioning, the land would also be impacted by earthmoving activities to reclaim and reseed the area.	No impact. There would be no irreversible and irretrievable commitment of land resources from implementing the proposed action. The duration of the proposed action would last approximately 12 years after which time the land would be available for other uses.	There would be short-term impact to land use from implementing the proposed action. Approximately 66 acres of the proposed license area would be unavailable for other uses such as rangeland for grazing or potentially for CBM or oil and gas exploration which would be limited over the life of the project, approximately 12 years. The impact would be SMALL.	There would be no long-term impact on land resources from implementing the proposed action. The land would be available for other uses at the end of the license period.

Table 8-1. Summary of Environmental Consequences

The Proposed Action (Alternative 1)

Impact Category *(as applicable)*	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Transportation 4.3.1	There would be a SMALL impact on transporation. Increased truck and vehicle traffic along SR-387 would result in small changes in the current use of this local road.	No impact.	There would be a SMALL potential impact. Small increases in the numbers of traffic accidents resulting in injuries or fatalities, and small increases in vehicle emissions that should not degrade local air quality. The risk from transporting yellowcake, ion exchange resin, and 11e.(2) byproduct material, and hazardous chemicals was determined to be small (NRC, 2009).	There would be no transportation impacts attributable to the proposed Moore Ranch Project following license termination.
Geology and Soil 4.4.1	There would be a SMALL impact on geology and soils. The construction and decommissioning phases of the proposed action would disturb surface soils to build the central plant, develop the well fields, lay pipeline, and build new access roads. These impacts would be temporary and at the end of the decommissioning phase topsoil would be replaced.	Topsoil salvaged during the construction phase of the project would be replaced during the reclamation and reseeding processes.	There would be a SMALL impact to geology and soils. No significant matrix compression or ground subsidence would be expected since the net withdrawal of fluid from the 70 Sand production zone would be about one percent or less. Earthmoving activities would disturb about 60 ha (150 ac) of soil.	There would be not long-term impacts to geology and soils following license termination. Groundwater levels would return to near original conditions under a natural gradient

Table 8-1. Summary of Environmental Consequences

The Proposed Action (Alternative 1)

Impact Category *(as applicable)*	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
Water Resources (Surface Water) 4.5	There would be a SMALL impact to surface water from the construction of the central plant and the two well fields that could potentially increase the sediment yield in the disturbed areas. A small (< 2 acre) wetland area in Wellfield #2 could be disturbed by constructing wells near the drainage area. The implementation of best management practices such as the use of silt fencing and diverting surface water runoff from undisturbed areas would help to mitigate the impact.	There would be no irreversible and irretrievable commitment of surface water from implementing the proposed action. No drainage or body of water would be significantly altered during operations. The impact to wetlands would be minimal since the stream flow is intermittent and the potential disturbance would be of short duration.	Normal construction activities within the well fields, at the central plant, along pipelines and access roads have the potential to result in increased sediment yield in surface water runoff. However, given the absence of perennial streams, the small area to be affected, potential impacts to surface water during construction and decommissioning would primarily be limited to uncommon precipitation or runoff events. These impacts would be further mitigated by implementing best management practices.	There would be no long-term impact to surface water following license termination.

Table 8-1. Summary of Environmental Consequences				
The Proposed Action (Alternative 1)				
Impact Category *(as applicable)*	**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**
Water Resources (Groundwater) 4.5	There would be a SMALL impact on groundwater. Groundwater would be impacted from ISR mining by consumption of groundwater and degradation of water quality in the 70 Sand production zone.	About 99 percent of the groundwater used during the ISR mining process would be treated and re-injected into the subsurface; however, one about one percent of the groundwater use in the the process would be consumed.	Short-term impacts to groundwater would include degradation of water quality within the 70 Sand production zone during operations and the potential drawdown in private wells completed in the same aquifer as the production zone. This potential drawdown was shown to be nominal so that the operation of private wells would not be impaired, and monitoring of private wells would help t o mitigate the potential impact.	Both the State of Wyoming and the NRC require restoration of affected groundwater following operations. The groundwater quality would be restored to ensure that adjacent aquifers would not be affected in the future.

Table 8-1. Summary of Environmental Consequences

The Proposed Action (Alternative 1)				
Impact Category *(as applicable)*	**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**
Ecology 4.6.1	There would be a SMALL impact. Construction and decommissioning of the proposed Moore Ranch Project would result in the short-term loss of vegetation covering approximately 23 ha (57 ac) and could stimulate the introduction and spread of undesirable and invasive, non-native species.	Vegetative communities directly impacted by earthmoving activities and wildlife injuries and mortalities would be irreversible. However, the implementation of mitigative measures such as the use of fences to limit wildlife movement and enforcing speed limits would reduce potential impacts to wildlife. Furthermore, areas impacted by earthmoving activities would be reclaimed and reseeded.	During any of the ISR phases direct impacts to ecological resources include injuries and mortalities caused by either collisions with project-related traffic or habitat removal actions such as the removal of topsoil. Most of the habitat disruption would consist of scattered, confined drill sites for wells and would not result in large transformation of the existing habitat. Wildlife could be displaced from increased noise and traffic.	Some of the vegetative communities that exist within the proposed Moore Ranch Project could be difficult to reestablish through artificial plantings and natural seeding could take many years. Species associated with those communities could be reduced in number or replaced by generalist species.

Table 8-1. Summary of Environmental Consequences				
The Proposed Action (Alternative 1)				
Impact Category *(as applicable)*	**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**
Meteorology, Climatology, and Air Quality 4.7.1	There would be a SMALL impact. During implementation of the proposed action there would be increased amounts of dust (particulates) from the earthmoving activities to build the central plant, drill wells and develop the well fields, lay pipeline, and build access roads to the well fields, from vehicular traffic on unpaved roads, and from diesel emissions from construction equipment.	There would be no irreversible or irretrievable commitment of air resources from implementing the proposed action.	There would be a temporary, short-term impact on air quality primarily during the construction and decommissioning phases from earthmoving activities and from vehicle emissions. The effect would be highly localized, temporary, and use of mitigative measure such as applying water to unpaved roads would limit fugitive dust emissions.	No impact. There would be no long-term effect on air quality either from implementing the proposed action or following license termination.
Noise 4.8.1	There would be a SMALL impact. The nearest resident is located about 4.5 km (2.8 mi). east of the proposed Moore Ranch boundary and the site is in a remote location.	No impact.	No impact.	No impact. There would be no noise impact from implementing the proposed action following license termination.

Table 8-1. Summary of Environmental Consequences

Impact Category *(as applicable)*	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 Proposed Action (Alternative 1)				
Historic and Cultural 4.9.1	There would be a SMALL impact. There would be no impact to historical and cultural resources recommended eligible for listing on the National Register of Historic Places.	No impact.	No short-term impact to historic or cultural resources would be expected. If any unidentified historic or cultural resources were encountered during the operation of the ISR facility it would be evaluated following procedures in an Unanticipated Discovery Plan. Therefore, the potential impact to cultural resources during operation of the facility would be SMALL.	No impact. There would be no impact to historic or cultural resources from the proposed action following license termination.
Visual and Scenic 4.10.1	Implementing the proposed action would result in a SMALL impact on the visual landscape. The area surrounding the proposed Moore Ranch Project contains well fields, pipelines, and utility lines associated with CBM development.	No impact.	There would be a SMALL short-term impact to the visual landscape from implementing the proposed action. The activities would be consistent with the BLM visual resource classification of the area and the existing natural resource extraction activities.	No impact. There would be no impact to the visual landscape from the proposed action following license termination.

Table 8-1. Summary of Environmental Consequences

The Proposed Action (Alternative 1)				
Impact Category *(as applicable)*	**Unavoidable Adverse Environmental Impacts**	**Irreversible and Irretrievable Commitment of Resources**	**Short-term Impacts and Uses of the Environment**	**Long-Term Impacts and the Maintenance and Enhancement of Productivity**
Socioeconomic 4.11.1	During construction and operation, increased demand for housing may increase housing costs in the local area and would result in a SMALL to MODERATE impact. During all phases, there would be an increased demand for health and social services could put a strain on these resources and would result in a SMALL to MODERATE impact.	Not applicable.	Implementing the proposed action could have SMALL to MODERATE impacts on the local communities. Although jobs would be created and the purchase of goods and services would contribute to the Campbell County tax base, this could affect housing availability and overtax the existing infrastructure supporting education and health and social services.	Following license termination, individuals who supported activities at the proposed Moore Ranch Project would need to find other employment and there would be a loss of revenue to Campbell County.
Environmental Justice 4.12.1	Not applicable. Section 4.12.1 of this SEIS concluded that there are no disproportionately high and adverse impacts to minority or low-income populations from the proposed Moore Ranch Project	Not applicable	Not applicable. Section 4.12.1 of this SEIS concluded that there are no disproportionately high and adverse impacts to minority or low-income populations from the proposed Moore Ranch Project	None.

Table 8-1. Summary of Environmental Consequences

The Proposed Action (Alternative 1)

Impact Category *(as applicable)*	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
Public and Occupational Health and Safety 4.13.1	There would be a SMALL impact on public and occupational health from implementing the proposed action. The construction and decommissioning would generate fugitive dust emissions that could result in a dose comparable to that from natural background exposure.	Not applicable.	There would be a small impact from radiological exposure comparable to that from natural background. The radiological impacts from accidents would be SMALL for workers if procedures to deal with accident scenarios were followed, and SMALL for the public because of the facility's remote location. The non-radiological public and occupational health impacts from normal operations and accident to chemical exposures would be SMALL if handling and storage procedures were followed.	No impact. There would be no long-term impact to public and occupational health following license termination.

Table 8-1. Summary of Environmental Consequences				
The Proposed Action (Alternative 1)				
Impact Category *(as applicable)*	**Unavoidable Adverse Environmental Impacts**	**Irreversible and Irretrievable Commitment of Resources**	**Short-term Impacts and Uses of the Environment**	**Long-Term Impacts and the Maintenance and Enhancement of Productivity**
Waste Management 4.14.1	There would be a SMALL impact on waste management from all ISR phases by the generation of small waste volumes. Construction wastes would be mostly solids, operations wastes would include solids and liquids (brine, plant washdown water, and others), and decommissioning wastes would include solid and radioactive wastes.	The energy consumed during the ISR phases and the space used to properly handle and dispose of all waste types would represent an irretrievable commitment of resources resulting in a SMALL impact.	During all phases, hazards associated with handling and transport of wastes would represent a short-term and SMALL impact	During all phases, permanent disposal or storage of wastes would represent a long-term and SMALL impact.

8.3 References

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

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Casper, WY

Pam Viviano
Ranchers & Neighbors Protecting Our Water
Sheridan, WY

APPENDIX A

Consultation Correspondence

A.1. Consultation Correspondence

The Endangered Species Act of 1973, as amended, and the National Historic Preservation Act of 1966 require that Federal agencies consult with applicable state and federal agencies and groups prior to taking action that may affect threatened and endangered species, essential fish habitat, or historic and archaeological resources, respectively. This appendix contains consultation documentation related to these federal acts.

Chronology of Consultation Correspondence

Author	Recipient	Date of Letter
U.S. Nuclear Regulatory Commission (G. Suber)	Wyoming State Historic Preservation Office (M. Hopkins)	April 9, 2008
U.S. Nuclear Regulatory Commission (G. Suber)	U.S. Fish and Wildlife Service (B. Kelly)	April 9, 2008
U.S. Fish and Wildlife Service (B. Kelly)	U.S. Nuclear Regulatory Commission (G. Suber)	May 7, 2008
Wyoming State Parks and Cultural Resources (R. Currit)	U.S. Nuclear Regulatory Commission (G. Suber)	June 5, 2008
U.S. Nuclear Regulatory Commission (A. Kock)	Shoshone Business Council (Ivan Posey)	February 23, 2009
U.S. Nuclear Regulatory Commission (I. Yu, B. Shroff, and A. Bjornsen)	U.S. Nuclear Regulatory Commission (A. Kock)	March 2, 2009
U.S. Nuclear Regulatory Commission (A. Kock)	Wyoming Game and Fish Department (T. Christiansen)	August 5, 2009
Wyoming Game and Fish Department (T. Christiansen)	U.S. Nuclear Regulatory Commission (A. Kock)	September 3, 2009
U.S. Nuclear Regulatory Commission (A. Kock)	Wyoming State Historic Preservation Office (R. Currit)	October 22, 2009

April 9, 2008

Ms. Mary Hopkins
State Historic Preservation Officer
Wyoming State Historic Preservation Office
Department of State Parks
& Cultural Resources
2301 Central Avenue, Barrett Building
3rd Floor
Cheyenne, Wyoming 82002

SUBJECT: INITIATION OF SECTION 106 PROCESS FOR ENERGY METALS CORPORATION'S MOORE RANCH URANIUM RECOVERY PROJECT LICENSE REQUEST (Docket 40-9073)

Dear Ms. Hopkins:

The U.S. Nuclear Regulatory Commission (NRC) has received an application from Energy Metals Corporation for a new radioactive source materials license to develop and operate the Moore Ranch Uranium Recovery Project (an in-situ uranium recovery operation) located in Campbell County, WY. The proposed project will consist of injection/production wellfields, a central plant with ion exchange, resin unloading, elution, precipitation, and yellowcake drying capabilities, and deep injection disposal wells. The Moore Ranch Uranium Recovery Project is located in Township 42 North, Range 75 West, Sections 26, 27, 33, 34, 35, and 36, and Township 41 North, Range 75 West, Sections 1, 2, 3, and 4, and Township 42 North, Range 74 West, Section 31. Maps showing the boundaries of the Moore Ranch Uranium Recovery Project area are enclosed.

In-situ leach mining involves injecting a carbonate/bicarbonate leaching solution and oxidant into a subsurface uranium ore body to release the uranium and then pumping the uranium bearing solution to the surface for further processing to remove and concentrate the uranium.

Surface-disturbing activities associated with the proposed mining in the Moore Ranch Uranium Recovery Project area would involve, at a minimum (1) construction of a 11 acre central processing plant facility, (2) the laying of about 8000 linear feet of pipeline five feet below the ground surface to transport the leaching solution and the uranium-bearing solution; (3) drilling of multiple injection, production, and monitoring wells; and (4) construction of access roads as needed. The proposed total wellfield area to be used for injection and recovery of solution over the ten-year life of the project is approximately 150 acres.

As established in Title 10 Code of Federal Regulations Part 51 (10 CFR 51), the NRC regulation that implements the National Environmental Policy Act of 1969, as amended, the NRC is preparing an environmental assessment (EA) for the proposed action that will tier off a Generic Environmental Impact Statement currently under development. In accordance with Section 106 of the National Historic Preservation Act, the EA will include an analysis of potential impacts to historic and cultural resources. To support the environmental review, the NRC is requesting information from the State Historical Preservation Officer to facilitate the identification of historic and cultural resources that may be affected by the Moore Ranch Uranium Recovery Project

1

M. Hopkins 2

license application. Any information you provide will be used to document effects in accordance with 36 CFR 800.8(c). After reviewing all the information collected, the NRC will follow up with your office regarding compliance with the National Historic Preservation Act of 1966, as amended, and the Section 106 consultation process.

The Moore Ranch Uranium Recovery Project license application is publicly available in the NRC Public Document Room (PDR) located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agency wide Documents Access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams.html. The accession number for the application is ML072851222.

Please submit any comments concerning this environmental review by mail to the NRC Commission Attn: Mr. Gregory Suber, Mail Stop T-8F05, Washington, DC 20555 within 30 days of the receipt of this letter. If you have any questions, please contact Mr. Behram Shroff of my staff by telephone at 301-415-0666 or by email at bps2@nrc.gov. Thank you for your assistance.

Sincerely,

/RA, by Allen Fetter for/

Gregory F. Suber, Branch Chief
Environmental Review Branch
Environmental Protection
and Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Enclosure: Maps of Moore Ranch
Uranium Recovery Project

Docket No.: 40-9073

April 9, 2008

Brian T. Kelly, Field Supervisor
U.S. Fish and Wildlife Service
Mountain-Prairie Region
Wyoming Field Office
5353 Yellowstone Road
Cheyenne, WY 82009

SUBJECT: REQUEST FOR INFORMATION REGARDING ENDANGERED OR THREATENED SPECIES AND CRITICAL HABITAT FOR THE PROPOSED LICENSE APPLICATION FOR ENERGY METALS CORPORATION'S MOORE RANCH URANIUM RECOVERY PROJECT (Docket 40-9073)

Dear Mr. Kelly:

The U.S. Nuclear Regulatory Commission (NRC) has received an application from Energy Metals Corporation for a new radioactive source materials license to develop and operate the Moore Ranch Uranium Recovery Project (an in-situ recovery operation) located in Campbell County, WY. The proposed project will consist of injection/production wellfields, a central plant with ion exchange; resin unloading, elution, precipitation, and yellowcake drying capabilities, and deep injection disposal wells. The Moore Ranch Uranium Recovery Project is located in Township 42 North, Range 75 West, Sections 26, 27, 33, 34, 35, and 36, and Township 41 North, Range 75 West, Sections 1, 2, 3, and 4, and Township 42 North, Range 74 West, Section 31. Maps showing the boundaries of the area are enclosed.

As established in Title 10 *Code of Federal Regulations* Part 51 (10 CFR 51), the NRC regulation that implements the National Environmental Policy Act of 1969, as amended, the agency is preparing an environmental assessment (EA) for the proposed action that will tier off a Generic Environmental Impact Statement currently under development. In accordance with Section 7 of the Endangered Species Act, the EA will include an analysis of potential impacts to endangered or threatened species or critical habitat in the action area. To support the environmental review, the NRC is requesting information from the U.S. Fish and Wildlife Service to facilitate the identification of endangered or threatened species or critical habitat that may be affected by the proposed project. Any information you provide will be used to enhance the scope and quality of our review in accordance with 10 CFR 51 and 50 CFR 402. After assessing the information provided by you, the NRC will determine what additional actions are necessary to comply with Section 7 of the Endangered Species Act.

The Energy Metals Moore Ranch Recovery Project license application is publicly available in the NRC Public Document Room (PDR) located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agency wide Documents Access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams.html. The accession number for the application is ML072851222.

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B. Kelly 2

Please submit any comments/information that you have regarding this environmental review to me at the U. S. Nuclear Regulatory Commission, Attention: Mr. Gregory Suber, Mail Stop T8F05, Washington, DC 20555 within 30 days of the receipt of this letter. If you have any questions, please contact Mr. Behram Shroff of my staff by telephone at 301-415-0666 or by email at bps2@nrc.gov. Thank you for your assistance.

Sincerely,

/RA, by Allen Fetter for/

Gregory F. Suber, Branch Chief
Environmental Review Branch
Environmental Protection
and Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Enclosure: Map of Moore Ranch
Uranium Recovery Project

Docket No.: 40-9073

1

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
5353 Yellowstone Road – Suite 308
Cheyenne, Wyoming 82009

In Reply Refer To:

ES/61411/W.26 /WY08SL0166

MAY - 7 2008

Gregory F. Suber, Branch Chief
Environmental Review Branch
Office of Federal and State Materials and
Environmental Management Programs
U.S. Nuclear Regulatory Commission
Mail Stop T8F05
Washington, D.C. 20555-0001

Dear Mr. Suber:

Thank you for your letter of April 9, 2008, received in our office on April 14, regarding the permit application by Energy Metals Corporation for a uranium in-situ recovery facility in Campbell County, Wyoming. The proposed Moore Ranch Uranium Recovery Project will consist of injection/production wellfields, a central plant with ion exchange; resin unloading, elution, precipitation, and yellowcake drying capabilities; and deep injection disposal wells. Your letter requested that we provide information concerning endangered or threatened species or critical habitat that may be affected by the proposed project.

In response to your letter, the U.S. Fish and Wildlife Service (Service) is providing you with information on (1) federally listed species, (2) migratory birds, (3) wetland and riparian areas, and (4) sensitive species. The Service provides recommendations for protective measures for federally listed species in accordance with the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Protective measures for migratory birds are provided in accordance with the Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703 and the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668. Wetlands are afforded protection under Executive Orders 11990 (wetland protection) and 11988 (floodplain management), as well as section 404 of the Clean Water Act. Other fish and wildlife resources are considered under the Fish and Wildlife Coordination Act and the Fish and Wildlife Act (FWCA) of 1956, as amended, 70 Stat. 1119, 16 U.S.C. 742a-742j.

Threatened and Endangered Species

The following threatened and endangered species may occur in Campbell County, and could also occur on or near this project site. If you determine that the proposed project may affect any of the following listed species, please contact our office to discuss consultation requirements under the Act.

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Species	Status	Habitat
Black-footed ferret (*Mustela nigripes*)	Endangered	Prairie dog towns
Ute ladies'-tresses (*Spiranthes diluvialis*)	Threatened	Moist soils and wet meadows of drainages below 7000 feet

Black-footed ferret: Black-footed ferrets may be affected if prairie dog towns are impacted. Please be aware that black-footed ferret surveys are no longer recommended in black-tailed prairie dog towns statewide. However, we encourage you to protect all prairie dog towns for their value to the prairie ecosystem and the myriad of species that rely on them. If a field check indicates that prairie dog towns may be affected, you should contact this office for guidance on ferret surveys.

Ute ladies'-tresses: Ute ladies'-tresses is a perennial, terrestrial orchid, 8 to 20 inches tall, with white or ivory flowers clustered into a spike arrangement at the top of the stem. *S. diluvialis* typically blooms from late July through August; however, depending on location and climatic conditions, it may bloom in early July or still be in flower as late as early October. *S. diluvialis* is endemic to moist soils near wetland meadows, springs, lakes, and perennial streams where it colonizes early successional point bars or sandy edges. The elevation range of known occurrences is 4,200 to 7,000 feet (although no known populations in Wyoming occur above 5,500 feet) in alluvial substrates along riparian edges, gravel bars, old oxbows, and moist to wet meadows. Soils where *S. diluvialis* have been found typically include fine silt/sand, gravels and cobbles, and highly organic, peaty soil types. *S. diluvialis* is not found in heavy or tight clay soils or in extremely saline or alkaline soils. *S. diluvialis* seems intolerant of shade and small scattered groups are found primarily in areas where vegetation is relatively open. Surveys should be conducted by knowledgeable botanists trained in conducting rare plant surveys. *S. diluvialis* is difficult to survey for primarily due to its unpredictability of emergence of flowering parts and subsequent rapid desiccation of specimens.

Migratory Birds

Please recognize that consultation on listed species may not remove your obligation to protect the many species of migratory birds, including eagles and other raptors, protected under the MBTA and BGEPA. Of particular focus are the species identified in the Service's *Birds of Conservation Concern 2002*. In accordance with the FWCA (16 USC 2912 (a)(3)), this report identifies "species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing" under the Act. This report is intended to stimulate coordinated and proactive conservation actions among Federal, State, and private partners and is available at http://www.fws.gov/migratorybirds/reports/bcc2002.pdf.

The MBTA, enacted in 1918, prohibits the taking of any migratory birds, their parts, nests, or eggs except as permitted by regulations and does not require intent to be proven. Section 703 of the MBTA states, "Unless and except as permitted by regulations ... it shall be unlawful at any time, by any means or in any manner, to ... take, capture, kill, attempt to take, capture, or kill, or possess ... any migratory bird, any part, nest, or eggs of any such bird..." The BGEPA, prohibits knowingly taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagles or their body parts, nests, or eggs, which includes collection, molestation, disturbance, or killing.

In order to promote the conservation of migratory bird populations and their habitats, the Service recommends that your agency implement those strategies outlined within the Memorandum of Understanding directed by the President of the U.S. under the Executive Order 13186, where possible. Work that could lead to the take of a migratory bird or eagle, their young, eggs, or nests (for example, if you are going to erect new roads, or power lines in the vicinity of a nest), should be coordinated with our office before any actions are taken.

***In situ* Uranium Mining**

High selenium concentrations can occur in wastewater from in situ mining of uranium ore as uranium-bearing formations are usually associated with seleniferous strata (Boon 1989). The disposal of this wastewater can expose migratory birds to selenium which is known to cause impaired reproduction and mortality in sensitive species of birds such as waterfowl.

The in situ mining wastewater is typically disposed of through deep-well injection or discharge into large evaporation ponds. One mining operation in Converse County disposes of the wastewater through land application using center-pivot irrigation after treatment for removal of uranium and radium.

In 1998, the Service conducted a study of a grassland irrigated with wastewater from an *in situ* uranium mine and found that selenium was mobilized into the food chain and bioaccumulated by grasshoppers and songbirds (Ramirez and Rogers 2002). Disposal of the *in situ* wastewater through irrigation is not recommended by the Service due to the potential for selenium bioaccumulation in the food chain and adverse effects to migratory birds. Additionally, land application may result in the contamination of groundwater and eventually seep out and reach surface waters. Additionally, the selenium-contaminated groundwater could seep into low areas or basins in upland sites and create wetlands which would attract migratory birds and other wildlife.

The Service is also concerned with the potential for elevated selenium in evaporation ponds receiving *in situ* wastewater. Waterborne selenium concentrations ≥ 2 µg/L are considered hazardous to the health and long-term survival of fish and wildlife (Lemly 1996). Additionally, water with more than 20 µg/L is considered hazardous to aquatic birds (Skorupa and Ohlendorf 1991). Chronic effects of selenium manifest themselves in immune suppression to birds (Fairbrother et al. 1994) which can make affected birds more susceptible to disease and predation. Selenium toxicity will also cause embryonic deformities and mortality (See et al. 1992, Skorupa and Ohlendorf 1991, Ohlendorf 2002)

If submerged aquatic vegetation and/or aquatic invertebrates are present in evaporation ponds with high waterborne selenium concentrations, extremely high dietary levels of this contaminant can be available to aquatic migratory birds. Ramirez and Rogers (2000) documented selenium concentrations ranging from 434 to 508 µg/g in pondweed (*Potamogeton vaginatus*) collected from a uranium mine wastewater storage reservoir that had waterborne selenium concentrations ranging from 260 to 350 µg/L.

Wetlands/Riparian Areas

The proposed project area includes tributaries to Ninemile Creek. Wetlands perform significant ecological functions, which include: (1) providing habitat for aquatic and terrestrial wildlife species, (2) aiding in the dispersal of floods, (3) improving water quality through retention and assimilation of pollutants from storm water runoff, and (4) recharging the aquifer. Wetlands also possess aesthetic and recreational values. The Service recommends measures be taken to avoid and minimize wetland losses in accordance with Section 404 of the Clean Water Act, and Executive Order 11988 (floodplain management) as well as the goal of "no net loss of wetlands." If wetlands may be destroyed or degraded by the proposed action, those wetlands in the project area should be inventoried and fully described in terms of their functions and values. Acreage of wetlands, by type, should be disclosed and specific actions should be outlined to avoid, minimize, and compensate for all unavoidable wetland impacts.

Riparian or streamside areas are a valuable natural resource and impacts to these areas should be avoided whenever possible. Riparian areas are the single most productive wildlife habitat type in North America. They support a greater variety of wildlife than any other habitat. Riparian vegetation plays an important role in protecting streams, reducing erosion and sedimentation as well as improving water quality, maintaining the water table, controlling flooding, and providing shade and cover. In view of their importance and relative scarcity, impacts to riparian areas should be avoided. Any potential, unavoidable encroachment into these areas should be further avoided and minimized. Unavoidable impacts to streams should be assessed in terms of their functions and values, linear feet and vegetation type lost, potential effects on wildlife, and potential effects on bank stability and water quality. Measures to compensate for unavoidable losses of riparian areas should be developed and implemented as part of the project.

Plans for mitigating unavoidable impacts to wetland and riparian areas should include mitigation goals and objectives, methodologies, time frames for implementation, success criteria, and monitoring to determine if the mitigation is successful. The mitigation plan should also include a contingency plan to be implemented should the mitigation not be successful. In addition, wetland restoration, creation, enhancement, and/or preservation does not compensate for loss of stream habitat; streams and wetlands have different functions and provide different habitat values for fish and wildlife resources.

Best Management Practices (BMPs) should be implemented within the project area wherever possible. BMPs include, but are not limited to, the following: installation of sediment and erosion control devices (e.g., silt fences, hay bales, temporary sediment control basins, erosion control matting); adequate and continued maintenance of sediment and erosion control devices to insure their effectiveness; minimization of the construction disturbance area to further avoid streams, wetlands, and riparian areas; location of equipment staging, fueling, and maintenance areas outside of wetlands, streams, riparian areas, and floodplains; and re-seeding and re-planting of riparian vegetation native to Wyoming in order to stabilize shorelines and stream banks.

Sensitive Species

Mountain Plover: Although the Service has withdrawn the proposal to list the mountain plover (*Charadrius montanus*) and we will no longer be reviewing project impacts to this species under the Act, we continue to encourage conservation of this species as it remains protected under the MBTA. Measures to protect the mountain plover from further decline may include (1) avoidance of suitable habitat during the plover nesting season (April 10 through July 10), (2) prohibition of ground disturbing activities in prairie dog towns, and (3) prohibition of any permanent above ground structures that may provide perches for avian predators or deter plovers from using preferred habitat. Suitable habitat for nesting mountain plovers includes grasslands, mixed grassland areas and short-grass prairie, shrub-steppe, plains, alkali flats, agricultural lands, cultivated lands, sod farms, and prairie dog towns. We strongly encourage the development of protective measures with an assurance of implementation should mountain plovers be found within the project area.

Greater Sage-grouse: The Service is currently conducting a review to determine if the greater sage-grouse (*Centrocercus urophasianus*) warrants listing. Greater sage-grouse are dependent on sagebrush habitats year-round. Habitat loss and degradation, as well as loss of population connectivity have been identified as important factors contributing to the decline of greater sage-grouse populations rangewide (Braun 1998, Wisdom *et al.* 2002). Therefore, any activities that result in loss or degradation of sagebrush habitats that are important to this species should be closely evaluated for their impacts to sage-grouse. If important breeding habitat (leks, nesting, or brood rearing habitat) is present in the project area, the Service recommends no project-related disturbance March 1 through June 30, annually. Minimization of disturbance during lek activity, nesting, and brood rearing is critical to sage-grouse persistence within these areas. Likewise, if important winter habitats are present (Doherty *et al.* 2008), we recommend no project-related disturbance November 15 through March 14, annually.

We recommend you contact the Wyoming Game and Fish Department to identify important greater sage-grouse habitats within the project area, and appropriate mitigative measures to minimize potential impacts from the proposed project. The Service recommends surveys and mapping of important greater sage-grouse habitats where local information is not available. The results of these surveys should be used in project planning, to minimize potential impacts to this species. No project activities that may exacerbate habitat loss or degradation should be permitted in important habitats. Additionally, unless site-specific information is available, greater sage-grouse habitat should be managed following the guidelines by Connelly *et al.* 2000 (also known as the WAFWA guidelines).

We appreciate your efforts to ensure the conservation of Wyoming's fish and wildlife resources. If you have questions regarding this letter or your responsibilities under the Act, MBTA or BGEPA, please contact Pedro 'Pete' Ramirez at the letterhead address or phone (307) 772-2374, extension 236.

Sincerely,

Scott Hicks

for Brian T. Kelly
Field Supervisor
Wyoming Field Office

cc: WGFD, Non-game Coordinator, Lander, WY (B. Oakleaf)
WGFD, Statewide Habitat Protection Coordinator, Cheyenne, WY (V. Stelter)

Literature Cited

Boon, D.Y. 1989. Potential selenium problems in Great Plains soils. In L.W. Jacobs, ed. Selenium in agriculture and the environment. American Society of Agronomy, Inc, and Soil Science Society of America. SSSA Special Pub. No. 23. Madison, WI. pp: 107-121.

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Ramirez, P. Jr. and B.P. Rogers. 2002. Selenium in a Wyoming grassland community receiving wastewater from an *in situ* uranium mine. Arch. Environ. Contam. Toxicol. 42:431-436.

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ARTS. PARKS. HISTORY.
Wyoming State Parks & Cultural Resources

State Historic Preservation Office
Barrett Building, 3rd Floor
2301 Central Avenue
Cheyenne, WY 82002
Phone: (307) 777-7697
Fax: (307) 777-6421
http://wyoshpo.state.wy.us

June 5, 2008

Gregory F. Suber, Branch Chief
Nuclear Regulatory Commission
Mail Stop T-8F05
Washington, DC 20555

re: Energy Metals Corporation, Initiation of Section 106 Process for the Moore Ranch Uranium Recovery Project License Request (Docket 40-9073) (SHPO File # 0608RLC007)

Dear Mr. Suber:

Thank you for consulting with the Wyoming State Historic Preservation Office (SHPO) regarding the above referenced project.

A search of our records shows that a cultural resource survey has not been conducted for the entire area of potential effect (APE). However, previous surveys of portions of the APE have been completed and have identified numerous historic properties. The proposed project has the potential to adversely affect these properties. Following 36 CFR Part 800, and prior to any ground disturbing activities, we recommend the Nuclear Regulatory Commission carry out appropriate efforts necessary for identification of historic properties, which may include a file search, background research, consultation, consideration of visual effects, sample field investigations or field survey. The identification efforts must be conducted by a consultant meeting the Secretary of the Interior's Professional Qualification Standards (48 FR 22716, Sept. 1983). A report detailing the results of these efforts must be provided to SHPO staff for our review and comment.

We have enclosed a copy of a cultural resource consultants list for your use. Please refer to SHPO project control number #0608RLC007 on any future correspondence dealing with this project. If you have any questions, please contact me at 307-777-5497 or by email at rcurri@state.wy.us.

Sincerely,

Richard L. Currit
Senior Archaeologist

Dave Freudenthal, Governor
Milward Simpson, Director

1

February 23, 2009

Mr. Ivan Posey
Chairman
Shoshone Business Council
P.O. Box 538
Fort Washakie, WY 82514

SUBJECT: REQUEST FOR INFORMATION REGARDING TRIBAL HISTORIC AND CULTURAL RESOURCES POTENTIALLY AFFECTED BY THE PROPOSED LICENSE APPLICATION FOR URANIUM 1 INC'S MOORE RANCH URANIUM RECOVERY PROJECT IN CAMPBELL COUNTY, WYOMING (Docket No. 040-09073)

Dear Mr. Posey:

The U.S. Nuclear Regulatory Commission (NRC) has received an application from Uranium 1 Inc. for a new radioactive source materials license to construct and operate the Moore Ranch Uranium Recovery Project (an *in-situ* recovery operation) located in Campbell County, WY. The proposed project will consist of injection/production wellfields, a central plant with ion exchange: resin unloading, elution, precipitation, and yellowcake drying capabilities, and deep injection disposal wells. The Moore Ranch Uranium Recovery Project is located in Township 42 North, Range 75 West, Sections 26, 27, 33, 34, 35, and 36, and Township 41 North, Range 75 West, Sections 1, 2, 3, and 4, and Township 42 North, Range 74 West, Section 31. Maps showing the boundaries of the area are enclosed.

As established in Title 10 Code of Federal Regulations Part 51 (10 CFR 51), the NRC regulation that implements the National Environmental Policy Act of 1969, as amended, the NRC is preparing an Environmental Assessment (EA) for the proposed action that will tier off a Generic Environmental Impact Statement currently under development. The NRC's EA process includes an opportunity for public and inter-governmental participation in the development of the EA. In accordance with Section 106 of the National Historic Preservation Act, the EA will include an analysis of potential impacts to historic and cultural properties. To support the environmental review, the NRC is requesting information to facilitate the identification of tribal historic sites or cultural resources that may be affected by the proposed Moore Ranch Uranium Recovery Project. Specifically, the NRC is interested in learning of any sites that you believe have traditional religious or cultural significance. Any input you provide will be used to enhance the scope and quality of our review in accordance with 10 CFR 51 and 36 CFR 800. After reviewing all of the information collected, the NRC will prepare a draft EA and provide your office with an opportunity to comment.

Uranium 1 Inc.'s Moore Ranch Uranium Recovery Project license application is publicly available in the NRC Public Document Room located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agencywide Documents Access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams.html. The accession number for the application is ML072851222.

I. Posey - 2 -

Please submit any comments/information that you may have regarding this environmental review within 30 days of the receipt of this letter to the U.S. Nuclear Regulatory Commission Attn: Ms. Andrea Kock, Mail Stop T-8F05, Washington, DC 20555. If you have any questions, please contact Mr. Behram Shroff of my staff by telephone at 301-415-0666 or by email at Behram.Shroff@nrc.gov. Thank you for your assistance.

Sincerely,

/RA/

Andrea Kock, Branch Chief
Environmental Review Branch
Environmental Protection
and Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Enclosures:
1. Map of Moore Ranch Uranium Project
2. Regional Map of Moore Ranch Uranium Project

cc w/enclosures: See next page

March 2, 2009

MEMORANDUM TO: Andrea Kock, Chief
Environmental Review Branch
EPPAD/DWMEP/FSME

FROM: Irene W. Yu, Project Manager /RA/
Environmental Review Branch
EPPAD/DWMEP/FSME

Behram Shroff, Project Manager /RA/
Environmental Review Branch
EPPAD/DWMEP/FSME

Alan Bjornsen, Project Manager /RA/
Environmental Review Branch
EPPAD/DWMEP/FSME

SUBJECT: INFORMAL MEETINGS WITH LOCAL, STATE, AND FEDERAL AGENCIES IN WYOMING REGARDING THE ENVIRONMENTAL REVIEWS BEING CONDUCTED ON THE MOORE RANCH, NICHOLS RANCH, AND LOST CREEK IN-SITU LEACH APPLICATIONS FOR SOURCE MATERIAL LICENSES (DOCKET NOS. 040-09073, 040-09067, 040-09068, RESPECTIVELY)

During the week of January 12, 2008, the U.S. Nuclear Regulatory Commission (NRC) staff and their contractor staff informally met with various local, state, and federal agencies in Wyoming regarding the environmental reviews being conducted on the Moore Ranch, Nichols Ranch, and Lost Creek In-Situ Leach (ISL) applications for Source Material Licenses. The purpose of these meetings was to discuss any comments or concerns they may have on these projects and to better understand the agency's procedures and regulations and how they fit in with NRC's obligations under the National Environmental Policy Act (NEPA). The following is a summary of each meeting and a list of participants.

CONTACT: Irene Yu, DWMEP/FSME
(301) 415-1951

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State Historic Preservation Office (SHPO), Cheyenne, Wyoming – January 12, 2009

Meeting Summary

Regarding the Nichols Ranch Project, we discussed the proximity to the Pumpkin Buttes, which is designated as a Traditional Cultural Property, and the tribal interest in the Pumpkin Buttes. The SHPO is currently working on a programmatic agreement (PA) with the Bureau of Land Management (BLM) pertaining to the Pumpkin Buttes. We discussed potential best management practices (BMPs) and mitigation strategies to be included in the PA such as painting the buildings a certain color to mitigate the visual effect, keeping the buildings a low profile, and adding a public education component. Regarding the Lost Creek Project, we discussed the presence of tribal artifacts with cultural significance in the nearby town of Bairoil. We also discussed the potential presence of paleontological artifacts in the Great Divide Basin because it was at one time covered with water. The mitigation strategies discussed included data recovery (where a discovery plan would be needed) and a public education component. No tribal concerns were discussed for the Moore Ranch Project. For all three projects, we discussed cumulative impacts and the importance of assessing the impacts of ISL in addition to those for coal-bed methane (CBM), oil and gas (O&G), wind, and/or coal, which are all actively underway in Wyoming. We also discussed the Section 106 process and verified NRC's responsibilities and process to submit the cultural resources information to the SHPO.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
Richard Currit, SHPO

Follow-up Items

NRC to talk to BLM about how they want to comment when BLM lands are involved in the Section 106 process. NRC spoke to BLM following the trip about how they want to comment when BLM lands are involved in the Section 106 process. NRC will provide BLM with a copy of the complete cultural resources section of the application for discussion and concurrence prior to submitting the information to the SHPO.

State Engineer's Office (SEO), Cheyenne, Wyoming – January 12, 2009

Meeting Summary

We discussed the importance of the ISL wells being constructed well to prevent cross-contamination between aquifers and that the applicant's provide adequate means for the closure of these wells once the facilities are decommissioned so as not to leave a conduit for cross-contamination. We discussed the differences in the roles and responsibilities of the SEO (focused on water quantity) and of the Department of Environmental Quality (DEQ, focused on water quality). The SEO is responsible for well permitting, which is typically done in permit blocks which allow for a certain number of wells to be constructed within a certain tract of acres. The SEO also issues permits for stormwater management impoundments.

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Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
John Harju, SEO
Harry Labonde, SEO

Follow-up Items

None

Bureau of Land Management State Office, Cheyenne, Wyoming – January 12, 2009

Meeting Summary

NRC staff provided an overview of how and why the draft Memorandum of Understanding (MOU) between NRC headquarters and BLM headquarters was developed and the current status of the draft MOU. Having not reviewed the draft MOU, BLM staff expressed their interest in reviewing the MOU and having the MOU signed at the state level instead of at the headquarter level. BLM has an MOU in place with the DEQ and briefly explained how the MOU specifies the roles and responsibilities of each agency and the points of contact. BLM staff provided NRC staff with a copy of their MOU with DEQ and a copy of the new Department of Interior regulations on implementing NEPA to help NRC in their development of an MOU with BLM. BLM staff also stressed the importance of increased communication between them and the NRC. We discussed both BLM and NRC's NEPA responsibilities for the three ISL projects and whether an environmental assessment (EA) or an environmental impact statement (EIS) is more appropriate. BLM staff sees the main issues with ISL to be related to groundwater quality and cumulative impacts. Specifically, they raised the concern of the possible conflict between the reducing nature of CBM and the oxidizing nature of ISL.

Meeting Participants

Patrice Bubar, NRC (via phone)
Irene Yu, NRC
Nancy Barker, VHB
Larry Claypool, BLM
Ed Heffern, BLM
Larry Jensen, BLM
Bob Janssen, BLM
Janet Kurman, BLM
Pam Stiles, BLM

Follow-up Items

NRC to continue to pursue an MOU with BLM.

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Department of Environmental Quality, Cheyenne, Wyoming – January 12, 2009

Meeting Summary

DEQ staff stressed the importance of increased communication between them and the NRC and requested the development of an MOU with the NRC. Since the DEQ issues the permits for the underground injection wells and the aquifer exemption related to ISL, we discussed in great detail DEQ's requirements from the applicant and the issues they have seen thus far in their review of the three project applications. DEQ Land Quality Division staff will coordinate the comments from all other DEQ divisions for their review of NRC's environmental documents. DEQ Water Quality Division staff provided background on the stormwater and groundwater concerns. Specifically, we discussed the different classes of injection wells and which ones apply to ISL facilities, the construction of wells and how important the construction is to minimizing cross-contamination between aquifers, the viability of ISL in an unconfined aquifer, and groundwater restoration. DEQ Air Quality Division staff provided information on air quality issues in the state. DEQ Industrial Siting Division staff provided information related to the sage grouse core areas and provided NRC with a map showing those areas. DEQ Solid and Hazardous Waste Division staff provided background on radioactive/hazardous waste disposal in the state. Regarding the Lost Creek Project, we discussed the need for increased federal and state agency interaction because the site consists primarily of federal lands. Also, DEQ staff raised some wildlife concerns as the Lost Creek Project site is located near a sage grouse core area.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
Carl Anderson, DEQ Solid & Hazardous Waste Division
Mark Conrad, DEQ Water Quality Division
John Corra, DEQ Administration Division
Kevin Frederick, DEQ Water Quality Division
Andrew Keyfaurer, DEQ Air Quality Division
Brian Lovett, DEQ Water Quality Division
Don McKenzie, DEQ Land Quality Division
Darla Potter, DEQ Air Quality Division
Barb Sahl, DEQ Water Quality Division
Chad Schlichtemeier, DEQ Air Quality Division
Tom Schroeder, DEQ Industrial Siting Division
Paige Smith, DEQ Air Quality Division
Lowell Spackman, DEQ Land Quality Division
Ed Heffern, BLM

Follow-up Items

NRC to discuss internally on possible MOU with DEQ. Internal discussions have been held and a call is scheduled with DEQ to discuss this request.

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Governor's Planning Office (GPO), Cheyenne, Wyoming – January 13, 2009

Meeting Summary

GPO staff provided an overview of their assistance to several BLM field offices in updating their Resource Management Plans. In addition, we discussed the location of sage grouse core areas and sage grouse conservation initiatives that are being developed or are already underway.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
Tom Blickensderfer, GPO

Follow-up Items

None

Bureau of Land Management Field Office, Rawlins, Wyoming – January 13, 2009

Meeting Summary

The status of the Draft Generic EIS for environmental reviews for ISL facilities (GEIS) and the MOU were discussed. It was explained that the NRC would be the lead agency because of their regulation over milling (not mining) operations. The BLM inquired whether the DEQ should be a cooperating agency. The BLM indicated the state has created an MOU format for federal agencies. Typically, an MOU is made with the state and separate agencies are assigned, as applicable. Shirley Basin & Red Desert, where the Lost Creek site is located, has been extensively explored. The effects of ISLs on freshwater aquifers are critical and applicants need to show that leaching will not occur between aquifers. The Cheyenne Office of the DEQ (Steve Engle-hydrologist) will scrutinize the Lost Creek EA for groundwater issues. The Battle Springs aquifer is a major aquifer in the area. ISLs operate under BLM mining laws and these laws address land use issues. A Plan of Operations will be required by BLM for the Lost Creek site. Currently, they are functioning (exploring) under a Notice (<5 acres of disturbance). An issue of concern is fencing. If fencing of the site is proposed, there are public access issues and wild horse routes that may be impacted. In addition, applicants (ISL operators) need to address effects of their ISL operation on grazing leases. The U.S. Fish & Wildlife Service (FWS) recommends that standard BMPs be used. Their principal concerns are for cattle and raptors. Netting would be required over waste ponds, and over mud pits. The BLM plans on meeting with UR-Energy (applicant) on January 27th on the Lost Creek site.

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Mark Newman, BLM
Clare Miller, BLM
Patrick Madigan, BLM
Travis Sanderson, FWS

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Follow-up Items

NRC to keep BLM Field Offices up to date on status of MOU; BLM to send Environet a copy of the Land Status Map for Wyoming.

Bureau of Land Management Casper Field Office, Casper, Wyoming – January 13, 2009

Meeting Summary

Topics discussed included cumulative impacts, existing coal-related analyses, and hydrology at ISL sites. Specifically, with regards to cumulative impacts, BLM, U.S. Environmental Protection Agency (EPA), and DEQ cooperated on a study of the effects of coal, O&G, CBM, uranium, and wind development in the Powder River Basin. There are several existing coal-related analyses: five coal-related EISs either final or in progress (West Antelope, Wright, and three physical groupings: North, Middle, and South Pods). Chapter 4 in these EISs was recommended as a good resource for NRC's cumulative impacts analysis. Another EIS with good information on cumulative impacts was for Pacific Corporation/Rocky Mountain Corporation's Wind Farm in the northeastern part of the state. BLM's concerns with respect to ISL impacts were about the cross-contamination of groundwater between CBM and ISL and whether NRC was going to require groundwater monitoring. BLM is working on a reliable groundwater model for ISL projects.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Patrick Moore, BLM
Tom Foertsch, BLM
Mike Karbs, BLM

Follow-up Items

None

Sweetwater County (SC), Green River, Wyoming – January 13, 2009

Meeting Summary

Safety and emergency issues were the top concerns raised by Sweetwater County (SC). Site access, particularly on the narrow county roads, was of concern with the Bairoil representatives (trucks, dust, noise, etc.). The proposed routes were of concern, along with road improvements, maintenance, and signage. Of special interest was the amount of radiation that could be expected from trucks carrying product from the facility to the next processing facility. The Sweetwater County Fire Department (SCFD) and emergency personnel were concerned with radiation and potential exposure, construction of the facility, access, materials and waste storage, and emergency plans that the applicant would prepare. The SCFD specifically requested that plans of the facility be available to them in case of an actual emergency. Waste

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disposal was an issue of great importance: what types of waste would be generated; how much would be generated; where would the waste be disposed; and what routes would be used to get there. There is also a limited workforce that is available in the SC area. Even unskilled workers are hard to come by. Other issues that were raised included: impacts to Bairoil's municipal water supply well, potential storm water discharges, waste water ponds, utilities, and air quality (dust).

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
John Radosevich, SC
Steve Horton, SC
John Barton, SC
Dennis Washam, SC
Wayne Silvers, SC
Judy Valentine, SC
Dennis Claman, SC
Robert Robinson, SC
Tony Riga, Bairoil
Sue Ann Riganco, Bairoil

Follow-up Items

NRC to find out what roads are being proposed for access to the facility. NRC to find out the levels of radiation at various locations throughout the facility, as well as during transportation. NRC to inform applicant that the SCFD would like a hazardous materials inventory.

Fremont County Planning Department, Fremont County, Wyoming – January 13, 2009

Meeting Summary

The county has no zoning laws in effect. Reviews are performed for residential subdivisions. Regarding solid waste disposal, the county operates a transfer station and landfill in Riverton. Regarding highway maintenance in the vicinity of Lost Creek (SC), the county only maintains about ten miles of the Crooks Gap-Wamsutter Road south of Jeffrey City. Beyond that point, the road is poorly maintained.

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Ray Price, Fremont County Planning Department

Follow-up Items

None

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Casper Planning Department, Casper, Wyoming – January 13, 2009

Meeting Summary

The main points drawn from this discussion were that rental housing is very scarce, especially affordable housing, and that less expensive housing would be available to ISL workers and families in Glenrock, Douglas, and Wright. However, those cities also have a shortage of affordable housing. Also, the Powder River Basin has good roads and the school capacity and retail establishments are sufficient for the present. Fire and police departments are adequately staffed. Medical and hospital facilities are able to provide good service. Additionally, the industry boom-bust cycles are typical, making it hard to maintain available and affordable housing. The population of Casper is about 53,000 (75,000 including suburbs) and the current economic downturn will likely make housing more affordable. Developers are currently building housing for both upper and lower income families.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Craig Collins, Casper Planning Department
Robin Mundell, Casper Planning Department

Follow-up Items

None

Wyoming Community Development Authority (WCDA), Casper, Wyoming – January 13, 2009

Meeting Summary

Discussions centered around the impact of resource extraction, including ISL, on housing. The WCDA was able to provide extensive data on existing housing statewide, and future projections. The main points raised were that rental housing is scarce in the Powder River Basin and Great Divide Basin; single family housing tends to be out of the affordable range; those seeking to move to Wyoming from economically hard-hit areas have a difficult time selling their homes; and the Wyoming economy is doing very well compared to the nation as a whole. Most Moore Ranch and Nichols Ranch workers are expected to live in Casper, Gillette, and other smaller communities such as Wright. The level of healthcare, education, and commercial facilities is generally good. Rawlins would likely be the main base for Lost Creek employees (possibly Wamsutter). There is no office of state planning.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
David Haney, WCDA
Cheryl Gillam, WCDA

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Follow-up Items

None

Lander Chamber of Commerce, Lander, Wyoming – January 13, 2009

Meeting Summary

Inquiries were made regarding housing and workforce. There is some limited housing available in Fremont County (Lander Area), but it's pricey. Jeffrey City may be a better bet as there are still houses there from the oil boom in the late 80s/early 90s. The thought was that there would be sufficient skilled labor available due to the slowdown in the oil industry.

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Chamber of Commerce Director
Chamber of Commerce Receptionist

Follow-up Items

None

Bureau of Land Management Field Office, Buffalo, Wyoming – January 14, 2009

Meeting Summary

BLM staff explained their responsibilities under NEPA and their review and approval process of Plans of Operations submitted by ISL applicants. BLM staff also provided details on the update to the Buffalo Resource Management Plan, in which they just completed the scoping process. Since no BLM lands are present on the Moore Ranch Project site, BLM staff is not likely to review that application. Regarding the Nichols Ranch Project, BLM staff will provide comments on NRC's environmental documents and request frequent communication with the NRC throughout the environmental review process. BLM staff sees the main issues for the Nichols Ranch Project to be related to cultural resources and tribal concerns since the Pumpkin Buttes was designated a Traditional Cultural Property (TCP) in June 2007. The BLM is in the process of developing a PA for the TCP. BLM staff emphasized the importance of good construction of injection wells and did not seem concerned with CBM operations and ISL operations occurring simultaneously in the same area because of the large distances between CBM wells. BLM has prepared Plan of Development (POD) EISs and a 2003 EIS on CBM and natural gas, which have solid cumulative impacts analyses for the Powder River Basin. FWS staff discussed the locations of sage grouse core areas in the Powder River Basin, the possible need for avoidance of these areas, and the candidate conservation assurances program. FWS staff stated that additional information on sage grouse is present in the Northeast Wyoming Management Plan. FWS staff raised a concern over migratory birds, specifically related to the electrocution of raptors on power poles and they recommended buried power lines or aboveground lines conforming to the requirements set by the Avian Power Line Interaction Committee.

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Meeting Participants

Behram Shroff, NRC
Irene Yu, NRC
Nancy Barker, VHB
Tracy Hamm, VHB
Stewart Bland, Chesapeake Nuclear
Brian Kuehl, Clark Group
Lori VanBuggenum, Clark Group
Buck Dumone, BLM
Jerry Queen, BLM
Clint Crago, BLM
Tom Bills, BLM
Paul Beels, BLM
Brad Rogers, FWS
Pete Ramirez, FWS

Follow-up Items

NRC to review BLM's POD EISs and 2003 EIS on CBM and natural gas to see if the cumulative impacts analyses can be incorporated into the NRC documents. NRC to also review the Northeast Wyoming Management Plan for sage grouse.

<u>Department of Environmental Quality District 3 Office, Sheridan, Wyoming – January 14, 2009</u>

Meeting Summary

DEQ staff explained their two tier review process of applications, which consists first of a completeness review and then a technical review (150 days to complete). Both the Moore Ranch and Nichols Ranch ISL applications have been through the completeness review and are undergoing the technical review with Moore Ranch to be completed first. DEQ staff's initial assessment of both applications is that additional information is necessary from the applicant and inconsistencies arise in both applications. DEQ staff's main concerns with both projects are cumulative impacts (whether ISL, CBM, and O&G can all occur simultaneously), groundwater quality resulting from unconfined aquifer conditions (effects on drawdown, ability to limit excursions, restoration), and underground injection well viability (which formation to drill into).

Meeting Participants

Behram Shroff, NRC
Irene Yu, NRC
Nancy Barker, VHB
Tracy Hamm, VHB
Stewart Bland, Chesapeake Nuclear
Brian Kuehl, Clark Group
Lori VanBuggenum, Clark Group
Mark Rogaczewski, DEQ Land Quality Division District 3
Don Fischer, DEQ Water Quality Division
Glenn Mooney, DEQ Land Quality Division District 3

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Follow-up Items

None

Department of Environmental Quality District Office, Lander, Wyoming – January 14, 2009

Meeting Summary

A brief update was presented on the status of the GEIS and the EA for Lost Creek. The topic of requests for additional information (RAIs) was discussed. It was found that the DEQ, in addition to the list of RAIs submitted last summer on UR-Energy's application, was currently preparing a much larger list (200 in addition to the initial 45). The DEQ's primary concern is groundwater impact. The Water Quality Division (WQD) determines the class of use of an aquifer, but the EPA determines the exemption boundary. For deep well injection of wastes, the contact at the WQD identified was John Passehl. The DEQ is the agency that issues the actual mining permit, with the BLM concurring. DEQ, however, is also concerned with surface disturbance. If the total amount of disturbance is less than 5 acres, the DEQ issues a Drilling Notification (similar to the BLM's Notice). If the disturbance exceeds 5 acres, a License to Explore is issued (similar to the BLM's Plan of Operation). Bonding is also required by the DEQ and, in fact, the DEQ is the bond holder, even when BLM land is involved. For bond release, 2 years of successive growing seasons must occur after reclamation. Issues, besides groundwater that were raised during the meeting included the need to address solid waste disposal. This includes a complete characterization of the various waste streams, the disposal facilities intended to be used, and if there is to be any hazardous waste generated. The U.S. Department of Game & Fish (DGF) is concerned with the potential impacts to sage grouse. In particular, there appears to be a lek within the boundary of the Lost Creek site. There is a 1/4-mi exclusion area, as well as a 2-mi limited activity area surrounding each lek. The DGF also has an issue with the installation of overhead utility lines (as roosts for raptors). In addition to groundwater quality, groundwater drawdown is an issue. DEQ is asking the applicant to address potential drawdown outside the boundary of the site (up to 3 mi), and to identify users. The DEQ is also concerned with the fault running through the site, and if the potentiometric surface differs either side of it. Regional (outside the permit boundary) well data is also being asked of the applicant by the DEQ. The DEQ questions the need for such a large permit boundary if the ore body only occupies a portion of the site. A new requirement of the DEQ is the need for the applicant to submit data (including well, and GW data) for the first mine unit to operate at an ISL. This seems to be problematic, in that this information is not normally available until after the NRC issues its license. The DEQ is also requesting the applicant to submit additional cross-sections for the Lost Creek site. DEQ is also requesting a more detailed description of the hydrogeology of the site: thicknesses of the confining units, the multiple sands within the primary production zone in the Battle Spring Formation HJ unit, and deep well injection. Stability monitoring is required after uranium recovery is complete (quarterly monitoring for 12 months, then annually, thereafter).

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Amy Boyle, DEQ
Melissa Bautz, DEQ

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Carrie Dobey, DGF

Follow-up Items

DEQ WQD to determine the class of aquifer for the HJ unit, as well as the appropriate monitoring well distribution.

Bureau of Indian Affairs (BIA) Wind River Agency, Fort Washakie, Wyoming – January 15, 2009

Meeting Summary

NRC provided a status of the GEIS, the environmental review process the NRC is undertaking, and proposed ISLs in Wyoming. There was more concern over legacy sites than the proposed new uranium recovery facilities in Wyoming. In particular, the conventional mill near Riverton was discussed because of the groundwater plume. While there are no ISL facilities proposed for the Wind River Reservation, it was told us that anytime a new facility is proposed, all the tribes in Wyoming should be notified. The names of two cultural resource contacts were given to us: Amanda White (Northern Arapaho) and Reed Tidzump (Eastern Shoshone). The counties within the state generally send letters to the tribes for concurrence on cultural matters. It was suggested that when cultural resource studies are performed, tribal elders be contacted so that items other than physical features (e.g., spiritual/sacred views) may be identified. The Wind River Reservation has its own environmental commissions (air, water, etc.).

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Ray Nation, BIA
Tony Pingree, BIA
Kelly Ferris, BIA
Trisha Cachelin, BIA
John Enos, Shoshone
Steve Babbitts, BIA
Kassel Weeks, WREQC
Don Aragon, WREQC

Follow-up Items

NRC to send copies of draft GEIS (CD) to BIA and Wind River Agency. NRC to send letters to Northern Arapaho and Eastern Shoshone tribes regarding the licensing of the Lost Creek project. The CD and letters were sent in February 2009.

Bureau of Land Management Field Office, Casper, Wyoming – January 15, 2009

Meeting Summary

NRC gave a status of the GEIS and BLM MOU. BLM explained the difference in the types of BLM land. Leasable land, also known as acquired land, is land that the US has bought back the mineral rights. This represents only a small portion of BLM lands. Locatable land is land that

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was originally federal-owned, and represents most of BLM lands. BLM was concerned that the GEIS does not distinguish between the two types of land. BLM was pleased to hear that there is progress being made on the MOU, but has a concern about how field office personnel working jointly on a NEPA document with the NRC would be reimbursed for their effort. BLM was also questioning whether the state or field office would participate in the development of the MOU.

Meeting Participants

Alan Bjornsen, NRC
Stephanie Davis, Environet
Tom Foertsch, BLM
Patrick Moore, BLM

Follow-up Items

NRC to send copies of the proposed ISL Wyoming site map to the Casper Field Office and the State BLM Office. NRC sent the copies of the map in February 2009.

Buffalo Chamber of Commerce (COC), Buffalo, Wyoming – January 15, 2009

Meeting Summary

The COC Board raised the issues of impacts to wildlife (specifically to sage grouse) and socioeconomics (specifically housing capacity) in regards to the potential Nichols Ranch Project. The COC Board stated that Kaycee does not have the housing capacity and services that Buffalo has. The COC Board stated that the County school system has the capacity to handle additional students. RV parks and motels still have ample space in the county for workers who choose not to permanently relocate into the County. The COC Board emphasized that like most of the state, the county's population fluctuates with the industry cycles of booms and busts.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
Margaret Dunfee, COC
Various members from the COC Board

Follow-up Items

None

Johnson County Commissioners, Buffalo, Wyoming – January 15, 2009

Meeting Summary

The County Commissioners raised the issues of impacts to socioeconomics, both positive and negative, in regards to the potential Nichols Ranch Project. Specifically, the County

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Commissioners mentioned the shortage of housing in Kaycee, the shortage of housing for low-moderate income families in the County, and the poor conditions of Trabing Road (also known as Iragary Road), which is a likely commuter path from Buffalo and Kaycee to the Nichols Ranch Project site. Trabing Road has been heavily utilized by CBM operators and although it is a county-maintained road, the County does not have enough funding currently to upgrade the road. The County Commissioners requested that the path of transport for the yellowcake be described in the NRC's environmental document. We also discussed positive economic impacts from new ISL projects such as the creation of new jobs and the addition to tax base. The County Commissioners stated that emergency response services needed for the Nichols Ranch Project would come from either Buffalo or Kaycee. The County Planner stated that the only local permitting required of the applicant would be for a septic system leach field up to 2,000 gallons in size.

Meeting Participants

Irene Yu, NRC
Nancy Barker, VHB
Smokey Wildeman, Commissioner
Gerald Fink, Chairman
Rob Yingling, County Planner

Follow-up Items

None

<u>Campbell County Economic Development Corporation (CCEDC), Gillette, Wyoming – January 15, 2009</u>

Meeting Summary

The discussion focused on the impact of resource extraction, including ISL, on housing, schools and other community facilities, and socioeconomics. The vacancy rate for rental housing has been close to zero for the last four years; 850 rental units in Gillette have recently been built and fully occupied. The local economy is mineral-based and has gone through boom and bust cycles which have discouraged investment in housing. Local government has extended water and sewer lines well beyond city limits to encourage development. Land is being annexed aggressively by the city as a spur to foster residential development. Two new elementary schools have been built and two more are planned.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Michael Surface, CCEDC
Susan Yerke, CCEDC
Brandi Beecher, CCEDC

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Follow-up Items

None

Town of Wright, Wright, Wyoming – January 15, 2009

Meeting Summary

A new power plant is being built nearby. O&G extraction and coal mining are active in the vicinity. Almost 200 single family houses have just been built and the town has purchased 113 acres, some of which will be for housing; the land includes water service. It is hard to get developers to come out to a small town of under 5,000 people, although tax credits exist for rural development. There are several private apartments in the community and many employers are building motels and renting rooms to their workers. A new shopping center has been built and the town has one medical clinic. The junior and senior high schools have been combined and capacity is adequate.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Lyle Murdock, Wright Building Official

Follow-up Items

None

Converse County Planning Department Douglas, Wyoming – January 15, 2009

Meeting Summary

In discussing where workers from the Powder River Basin may live, Converse County Planning Department Douglas, Wyoming staff thought that the cities of Glenrock and Douglas would likely home bases for workers for the Nichols Ranch and Moore Ranch projects; Midwest and Wright were also mention as possibilities. Some trailer parks might have vacancies but rental apartments are scarce and expensive. There is the potential for new hotels/motels to be built. There are 130 zoned and platted lots for housing but they are without services. The state has a loan program for first-time home buyers. The current population is about 6,000 people, but the city could accommodate a total of 10,000. Schools are close to capacity in Douglas but Glenrock may have some room.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Forrest Neuerberg, CCPD
Paul Musselman, CCPD

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Follow-up Items

None

Converse Area New Development Organization (CANDO) – January 15, 2009

Meeting Summary

CANDO deals primarily with workforce concerns, local economic development, business recruitment and training, and housing. Ranchers are seeking information about energy companies looking for leases on their property. There is a shortage of workers with uranium mining experience. Locally, there is limited housing and Nichols Ranch and Moore Ranch workers would likely face a 1.5 hour commute, which is typical for the area.

Meeting Participants

Behram Shroff, NRC
Stewart Bland, Chesapeake Nuclear
Tracy Hamm, VHB
Joe Coyne, CANDO
Ed Werner, Consultant to CANDO

Follow-up Items

None

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August 5, 2009

Tom Christiansen
Sage Grouse Coordinator
Wyoming Game and Fish Department
Green River Field Office
351 Astle Avenue
Green River, WY 82935

SUBJECT: REQUEST FOR INFORMATION REGARDING SAGE GROUSE HABITATS FOR THE PROPOSED LICENSE APPLICATION FOR URANIUM ONE INCORPORATED'S MOORE RANCH URANIUM RECOVERY PROJECT (Docket 040-09073)

Dear Mr. Christiansen:

The U.S. Nuclear Regulatory Commission (NRC) has received an application from Uranium One Inc. for a new radioactive source materials license to develop and operate the Moore Ranch Uranium Recovery Project (an *in-situ* recovery operation) located in Campbell County WY. The proposed project will consist of the following area located in Township 42 North, Range 75 West, Sections 26, 27, 33, 34, 35, and 36 and Township 41 North, Range 75 West, Range 75 West, Sections 1, 2, 3, and 4, and Township 42 North, Range 74 West, Section 31.

The location of the Moore Ranch project is close to two currently licensed *in-situ* recovery projects, the AREVA (COGEMA) Christensen Ranch Project and the Power Resources Inc. North Butte License Area. Maps showing the proposed project location are enclosed.

As established in Title 10 *Code of Federal Regulations* Part 51 (10 CFR 51), the NRC regulation that implements the National Environmental Policy Act of 1969, as amended, the agency is preparing a Supplemental Environmental Impact Statement (SEIS) for the proposed action that will tier off a Generic Environmental Impact Statement published in June 2009 (NUREG-1910). In accordance with Section 7 of the Endangered Species Act, the SEIS will include an analysis of potential impacts to endangered or threatened species or critical habitat in the proposed project area.

To support the environmental review, the NRC requested information from the U.S. Fish and Wildlife Service (FWS) to facilitate the identification of endangered or threatened species or critical habitat that may be affected by the proposed project. According to a letter sent to the NRC from the FWS dated May 7, 2008, the FWS indicated that they are currently conducting a review to determine if the greater sage-grouse warrants listing and that you may have more information on the greater sage-grouse habitats within the project area and appropriate mitigative measures to minimize potential impacts to the species. Any information you provide will be used to enhance the scope and quality of our review in accordance with 10 CFR 51 and 50 CFR 402. After assessing the information provided by you, the NRC will determine what additional actions are necessary to comply with Section 7 of the Endangered Species Act.

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The Uranium One Inc.'s Moore Ranch Uranium Recovery Project license application is publicly available in the NRC Public Document Room located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852, or from the NRC's Agency Wide Documents Access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams.html. The accession number for the application is ML072851229.

Please submit any comments/information that you may have regarding this environmental review within 30 days of the receipt of this letter to the U.S. Nuclear Regulatory Commission, Attention: Mr. Andrea L. Kock, Mail Stop T8F05, Washington, DC 20555. If you have any questions, please contact Mr. Behram Shroff of my staff by telephone at 301-415-0666 or by email at Behram.Shroff@nrc.gov. Thank you for your assistance.

Sincerely,

/RA/

Andrea L. Kock, Branch Chief
Environmental Review Branch
Environmental Protection
and Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 040-09073

Enclosure: Moore Ranch location maps

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WYOMING GAME AND FISH DEPARTMENT

5400 Bishop Blvd. Cheyenne. WY 82006

Phone: (307) 777-4600 Fax: (307) 777-4610

Web site: http://gf.state.wy.us

September 3, 2009

WER 329
Nuclear Regulatory Commission
Request for Information Regarding Sage Grouse Habitats
for the Proposed License Application for Uranium One Inc.
Moore Ranch Uranium Recovery Project
Docket No. 040-09073

U. S. Nuclear Regulatory Commission
Attention: Ms. Andrea L. Kock
Mail Stop T8F05
Washington, DC 20555

Dear Ms. Kock:

The staff of the Wyoming Game and Fish Department has reviewed the request for information regarding Sage Grouse Habitats for the proposed license application for Uranium One Incorporated's Moore Ranch Uranium Recovery Project. We offer the following comments for your consideration.

Terrestrial Considerations:

The proposed project area lies within the Pumpkin Buttes and North Converse Pronghorn Herd Units, as well as the and Pumpkin Buttes and North Converse Mule Deer Herd Units. Pronghorn use the areas in question for yearlong and winter/year-long habitat. No crucial winter range for pronghorn is contained within the project area. Mule deer in the region also utilize local habitats as yearlong habitat. Any removal of sagebrush habitats will reduce overall forage for both pronghorn and deer. If sagebrush habitats are disturbed during the uranium extraction process, restoration projects that strive to restore sagebrush and associated native plant species are recommended.

The area also provides winter, breeding, nesting, and brood-rearing habitat for sage grouse, sharp-tailed grouse, and a variety of other sage-dependent non-game birds and small mammals. The project area does not lie a sage grouse Core Area. Currently there are no known leks within the proposed project area. WGFD encourages Uranium One, Inc. to conduct annual sage grouse lek surveys to identify any unkown leks that may occur. Should sage grouse leks be discovered within the project area, WGFD recommends proper steps be taken to avoid disturbance within a

Mr. Andrea L. Kock
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2-mile buffer of any active breeding areas (leks) used by sage grouse from March 15 to July 1. In addition, permanent structures should not be placed within ¼ mile of a sage grouse lek.

We recommend that additional wildlife surveys be performed to detect the presence of sensitive or threatened species prior to mining activities that disturb new areas. A winter bald eagle survey should be conducted to document any local roost locations. Surveys should also be conducted to document active nests of other raptor species present on the mine. Listed below are recommended dates that raptor nest sites should be free of disturbance. A 1/2 mile buffer around each nest should be maintained. Exceptions may be granted based on topography or other site-specific factors.

Osprey: April 15-August 1
Bald Eagle: February 15-August 15
Northern Harrier: April 1-July 31
Sharp shinned hawk: May 1 -August 31
Cooper's hawk: April 15 -August 15
Northern goshawk: April 1-August 15
Swainson's hawk: May 1-August 31
Red tailed hawk: March 15-July 31
Ferruginous hawk: April 1- July 31
Golden eagle: February 1-July 31
American kestrel: April 1-August 15
Merlin: April 1-August 15
Peregrine falcon: March 15-August 15
Prairie falcon: March 1-August 15

We recommend contacting and coordinating with the Bureau of Land Management and/or the U.S. Fish and Wildlife Service regarding locations of active raptor nest sites they may be aware of within the project area.

The WGFD recommends that all topsoil be saved and spread over disturbed areas as soon as possible after disturbance to accelerate reclamation. Native plants suitable for wildlife most dependent upon the disturbed site should be planted.

Finally, we encourage the Moore Ranch and Uranium One, Inc. to allow access to properties for the purpose of hunting big game species. Allowing such access would contribute greatly to the successful management of both deer and pronghorn to meet population objectives.

Aquatic Considerations:

This project will not have direct impacts to the aquatic resources of Ninemile Creek. However, we are concerned with the indirect and cumulative impacts to aquatic resources associated with this project. The construction of roads and pads will change how water will run off the landscape. This change will affect the infiltration rate of water, increase the velocity and quantity of water running across the landscape, and potentially could increase erosion and sediment deposition into nearby waterways. Roads have the potential for having the most

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September 3, 2009
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profound impact on hydrology. Changes in hydrology across the landscape will then be reflected in changes in the geomorphology of perennial streams downstream of the project area. Ultimately, changes in geomorphology will directly influence aquatic habitat which may impact fish populations.

Currently, we do not have information regarding the effects this in-situ mining on aquatic habitats. Much is known, however, about the effects of increased sediment in streams. Stream channels respond to increased sediment supply by adjusting their pattern (sinuosity) and dimensions. These changes may result in decreased pool depths, decreased riffle area, less diversity in channel substrate and increased lateral instability marked by eroding banks. These changes along with direct effects from increased sediment loading can affect macroinvertebrate populations and diversity and decrease fish habitat. A common impact is a decrease in gravel and cobble used by spawning fish.

Additional information is needed regarding the effects of this project on aquatic habitat. It is recommended the monitoring of cumulative impacts from culverts and roads with 5% slope or greater be conducted.

The following is a protocol that we have developed for the monitoring of culverts and roads with 5% slope or greater. We are more than willing to work Uranium One, Inc. to discuss this protocol and adapt the protocol if needed.

Culverts

The purpose of monitoring culverts is to determine the cumulative impacts of changing the upland surface hydrology, erosion and deposition, and to ensure that they are functioning as designed and they are being maintained.

All culverts installed as part of this project will be monitored by a minimum of the following practices:

- Collect GPS coordinates for each culvert site
- Collect pre-construction photographs of the culvert site: upstream and downstream
- We recommend that several preconstruction photographs be taken overtime/ to record the relative change pre-construction. We recommend that photographs be taken three times between April and November.
- Collect post-construction photographs of the culvert site: upstream and downstream.
- Place a graduated fence post upstream and downstream of each culvert. The posts should have visible markings every 2" to provide a visual reference within each photograph. Fence posts should be placed within 50 feet of the culvert openings. Posts should be placed outside of the mainflow channel so they are not directly affected by storm flow events. Each fence post location will be referenced by GPS.
- GPS the site where photographs will be taken for the upstream and downstream view.
- Culverts and accompanying fence posts will be monitored/photographed three times a year (spring after snow melt, summer, and fall) and after rainfall events accumulating

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Mr. Andrea L. Kock
September 3, 2009
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greater than ½ inch of precipitation as measured at the nearest National Weather Service Monitoring point (if within 10 miles of the site) or at the Facility operations and maintenance building. The summer monitoring period can include a thunderstorm event as long as the monitoring occurs within seven days after the thunderstorm.

- Photographs will be provided to WGFD for review within 45 days. We recommend that a website or ftp site be developed.

If the photographs reveal observable changes from erosion or deposition, consultation between WGFD and industry will occur.

Roads with 5% or greater slope

The purpose of monitoring roads with 5% or greater slope is to determine the cumulative impacts of changing the upland surface hydrology, erosion and deposition, and to ensure that the long-term BMPs that were installed are still functioning and are being maintained.

- Place a graduated fence post midway down the slope and at the bottom of the slope. If a drainage ditch occurs on both sides of the road, post will also needs to be placed on both sides of the road. The posts should have visible markings every 2" to provide a visual reference within each photograph. Posts should be placed outside of the mainflow channel so they are not directly affected by storm flow events.
- Each fence post location will be referenced by GPS.
- GPS the site where photographs will be taken.
- Fence posts will be monitored/photographed three times a year (spring after snow melt, summer, and fall) and after rainfall events accumulating greater than ½ inch of precipitation as measured at the nearest National Weather Service Monitoring point (if within 10 miles of the site) or at the Facility operations and maintenance building. The summer monitoring period can include a thunderstorm event as long as the monitoring occurs within seven days after the thunderstorm.
- Photographs will be provided to WGFD for review within 45 days. We recommend that a website or ftp site be developed.

If the photographs reveal observable changes from erosion or deposition, consultation between WGFD and industry will occur.

If you have any questions or concerns, please contact Mr. Rick Huber, Staff Aquatic Biologist, at 307-777-4558.

Thank you for the opportunity to comment. If you have any questions or concerns, please contact Heather Obrien, Wildlife Biologist at 307-682-1579.

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Mr. Andrea L. Kock
September 3, 2009
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Sincerely,

John Emmerich
Deputy Director

JE: MF: gfb

cc: USFWS
H. Obrien. L. Jahnke- WGFD. Sheridan
Paul Mavrakis. Sheridan Region Fisheries Supervisor

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October 22, 2009

Mr. Richard L. Currit
Senior Archaeologist
Wyoming State Historic
Preservation Office
2301 Central Avenue
Barrett Building, Third Floor
Cheyenne, WY 82002

SUBJECT: URANIUM ONE INC. MOORE RANCH IN-SITU URANIUM RECOVERY PROJECT – SECTION 106 CONSULTATION

Dear Mr. Currit:

In accordance with the provisions in 10 CFR Part 51, the U.S.Nuclear Regulatory Commission (NRC) regulations that implement the National Environmental Policy Act of 1969 and 36 CFR 800.8(c) of the National Historic Preservation Act, NRC is developing a Supplemental Environmental Impact Statement for Uranium One Inc.'s (previously Energy Metals Corporation) request to construct and operate the Moore Ranch In-Situ Recovery (ISR) facility in Campbell County, Wyoming. The facility includes a central processing plant, support buildings, wellfields, and access roads.

By letter dated April 9, 2008, the NRC staff initiated the Section 106 consultation process with the Wyoming State Historic Preservation Office (SHPO) concerning the proposed Moore Ranch ISR. In your office's response of June 5, 2008, it was stated that records showed that a cultural resources survey had not been conducted for the entire Area of Potential Effect (APE). On August 8, 2008, Uranium One provided your office with a Class I literature search, Class II Inventory, and Class III cultural resource survey for the APE, with the intent of completing the Section 106 consultation process. Your office notified Uranium One that the federal agency which issues the license, NRC, was responsible for this process.

On October 1, 2009, Behram Shroff of my staff verified, via an email to you, that your office was in possession of Uranium One's cultural resources surveys and related documentation. By way of this letter, supported by documentation in the SHPO's possession, NRC is seeking to continue and complete the Section 106 consultation process and seeks your concurrence with a finding of no effect.

As discussed in the Class II Inventory, site investigation identified seven sites, 48CA6691-48CA6697, and 25 Isolate Resources/Artifacts, including artifacts from the Paleo-Indian, Middle Archaic, and Late Archaic and Historic periods. Two sites, 48CA6694 and 48CA6696, are considered eligible for nomination to the National Register of Historic Places (NRHP). However, only two sites, 48CA965 and 48CA966, which are listed as not eligible for nomination to the NRHP, are at or near any proposed development areas for the ISR project.

R.L. Currit 2

NRC staff has also corresponded with several Native American tribes concerning the cultural resources in the vicinity of the proposed project. To date, no response has been received.

NRC requests your comments and recommendations within 30 days of receipt of this letter, including the issue of which cultural resources are deemed eligible/ineligible for the NRHP. The agency also seeks your position on the effect of the proposed project on the cultural resources identified. If you have any questions or require additional information, please contact the Environmental Project Manager, Mr. Behram Shroff at (301) 415-0006, or at Behram.Shroff@nrc.gov.

Sincerely

/RA/ Formatted: Font: Bold

Andrea L. Kock, Chief
Environmental Review Branch
Environmental Protection
and Performance Assessment Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No.: 40-9073

cc: D. McKenzie, DEQ, Cheyenne
G. Mooney, DEQ, Sheridan
C. Crago, BLM, Buffalo
P. Beels, BLM, Buffalo
M. Griffin, Uranium One
C. Fisher, Northern Cheyenne THPO

NRC FORM 335 (9-2004) NRCMD 3.7

U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

(See instructions on the reverse)

1. REPORT NUMBER (Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.)

NUREG-1910
Supplement 1

2. TITLE AND SUBTITLE

Environmental Impact Statement for the Moore Ranch ISR Project in Campbell County, Wyoming
Supplement to the Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities
Draft Report for Comment

3. DATE REPORT PUBLISHED

MONTH	YEAR
December	2009

4. FIN OR GRANT NUMBER

5. AUTHOR(S)

6. TYPE OF REPORT

Technical

7. PERIOD COVERED *(Inclusive Dates)*

8. PERFORMING ORGANIZATION - NAME AND ADDRESS *(If NRC, provide Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)*

Division of Waste Management and Environmental Protection
Office of Federal and State Materials and Environmental Programs
U.S. Nuclear Regulatory Commission
Washington, D.C 20555-0001

9. SPONSORING ORGANIZATION - NAME AND ADDRESS *(If NRC, type "Same as above"; if contractor, provide NRC Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address.)*

10. SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*

By letter dated October 2, 2007, Energy Metals Corporation, a wholly-owned subsidiary of Uranium One (Uranium One) submitted a source material license application to the U.S. Nuclear Regulatory Commission (NRC) for the Moore Ranch in-situ uranium recovery (ISR) project. Uranium One is proposing to construct, operate, conduct aquifer restoration, and decommission an ISR facility at the proposed Moore Ranch Project, located in Campbell County, Wyoming. In this draft Supplemental EIS (Draft SEIS), the NRC staff evaluates the potential environmental impacts from the proposed action and reasonable alternatives, describes the environment potentially affected by Uranium One's proposed site activities, and describes Uranium One's environmental monitoring program and proposed mitigation measures.

In preparing this Draft SEIS, the NRC staff evaluated site-specific data and information to determine whether the applicant's proposed site activities and site characteristics were consistent with that evaluated in NUREG-1910, "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities" (GEIS). The NRC staff then determined findings and conclusions in the GEIS and relevant sections of the GEIS that could be incorporated by reference in this Draft SEIS, and performed site-specific analyses as appropriate.

The Draft SEIS was prepared in accordance with the National Environmental Policy Act of 1969 and NRC implementing regulations found at Title 10, "Energy," of the Code of Federal Regulations (CFR), Part 51 (10 CFR Part 51).

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*

Uranium Recovery
In-Situ Leach Process
Uranium
Environmental Impact Statement

13. AVAILABILITY STATEMENT

unlimited

14. SECURITY CLASSIFICATION

(This Page)
unclassified

(This Report)
unclassified

15. NUMBER OF PAGES

16. PRICE