ENVIRONMENTAL ASSESSMENT
FOR THE
ADDITION OF THE REYNOLDS RANCH MINING AREA
TO
POWER RESOURCES, INC'S
SMITH RANCH / HIGHLANDS URANIUM PROJECT
CONVERSE COUNTY, WYOMING

SOURCE MATERIAL LICENSE NO. SUA-1548
DOCKET NO. 40-8964

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U.S. Nuclear Regulatory Commission
Office of Federal and State Materials and Environmental Management Programs
Division of Waste Management and Environmental Protection
Environmental Review Section

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1.0 INTRODUCTION

By letter dated January 14, 2005, Power Resources, Inc. (PRI) submitted a request to amend its U.S. Nuclear Regulatory Commission (NRC) Source Material License SUA-1548 for the Smith Ranch-Highland Uranium Project (SR-HUP), located in Converse County, Wyoming (PRI, 2005a). PRI requested that the SR-HUP permit area be modified to include the Reynolds Ranch area, which encompasses approximately 8700 acres (3521 hectares) and is contiguous with the current northern boundary of the SR-HUP permit area. PRI desires to conduct in-situ leach uranium mining in the Reynolds Ranch area. In response to NRC requests for additional information (USNRC, 2005a, 2005e), PRI supplemented and modified its amendment application by letters dated April 7, and July 19, 2005 and March 15, and September 19, 2006 (PRI, 2005c; PRI, 2005d; PRI, 2006a; PRI, 2006b).

1.1 Background

Power Resources, Inc.'s (PRI's) Smith Ranch-Highland Uranium Project (SR-HUP) is a commercial in-situ leach (ISL) uranium mining facility located in the South Powder River Basin, Converse County, Wyoming. The main office and Central Processing Plant complex is located at Smith Ranch, about 17 air miles (22 road miles) (27 air / 35 road kilometers) northeast of Glenrock, Wyoming, and 23 air miles (25 road miles) (37 air / 40 road km) northwest of Douglas, Wyoming (see the location map provided in Appendix A). NRC renewed PRI's NRC license for the SR-HUP (Source Material License SUA-1548) on August 18, 2003, as part of a license renewal process (USNRC, 2003a). With the renewal of SUA-1548, PRI's current and anticipated ISL operations at its Smith Ranch, Highland, Gas Hills, Ruth, and North Butte properties were consolidated into a single NRC license. At present, commercial ISL production of uranium is occurring at both the Smith Ranch and Highland sites, while the Gas Hills, Ruth, and North Butte sites are planned for future production. Commercial ISL uranium production began at the Highland site in January 1988 and at the Smith Ranch site in June 1997. NRC most recently amended SUA-1548 in August 2005 (USNRC, 2005b).

Under SUA-1548, PRI is authorized, through its ISL process, to produce up to 5.5 million pounds (2.5 million kilograms) per year of tri-uranium octoxide (U_3O_8), also known as "yellowcake." PRI's current annual production is less than half of this limit.

1.2 Purpose and Need for the Proposed Action

PRI currently conducts commercial-scale ISL uranium mining at the SR-HUP permit area. PRI is proposing to expand its mining operations and to conduct ISL mining in the Reynolds Ranch area. This would enable PRI to continue to meet the current and future needs of its customers for U_3O_8, a product that will eventually become used in fuel for commercially-operated nuclear power reactors.

1.3 Review Scope

The NRC staff is reviewing PRI's request in accordance with the NRC's environmental protection regulations in 10 CFR Part 51. Those regulations implement section 102(2) of the National Environmental Policy Act of 1969, as amended. This document provides the results of the NRC staff's environmental review; the staff's radiation safety review of PRI's request is documented separately in a Safety Evaluation Report (USNRC, 2006a).

The NRC staff has prepared this Environmental Assessment (EA) in accordance with NRC requirements in 10 CFR 51.21 and 51.30, and with the associated guidance in NRC report NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs" (NRC, 2003b). In 40 CFR 1508.9, the Council on Environmental Quality defines an EA as a concise public document that briefly provides sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact (FONSI).

This review will address the environmental impacts of the currently-approved mining operations at the SR-HUP only insofar as such operations would be modified by the proposed mining at the Reynolds Ranch area.

1.4 Previous Environmental Assessments and Supporting Documents

The NRC first authorized Kerr-McGee Corporation (KMC) to conduct research and development (R&D) ISL operations at the Smith Ranch site in June 1981 under Source Material License SUA-1387, with a corresponding Environmental Impact Assessment (EIA) issued at that time (46 FR 30924). In February 1984, SUA-1387 was amended to reflect that Sequoyah Fuels Corporation (SFC), a wholly owned subsidiary of KMC, was the NRC licensee for the Smith Ranch R&D operations (USNRC, 1984). The NRC renewed SFC's NRC license for continued R&D operations by letter dated January 29, 1988 (USNRC, 1988). In suport of the license renewal, the NRC staff published a FONSI in the *Federal Register* on January 7, 1988 (53 FR 459).

Rio Algom Mining Corp. (RAMC) acquired the Smith Ranch ISL site in December 1988 (Quivira Mining Corp., 1988). On March 12, 1992, the NRC issued Source Material License SUA-1548 to RAMC, which authorized expansion of the Smith Ranch R&D operations into commercial-scale production (USNRC, 1992). An EA/FONSI documenting the staff's environmental review was published in the *Federal Register* on January 10, 1992 (57 FR 306). SUA-1548 was renewed on May 8, 2001 (USNRC, 2001), and the FONSI published in the *Federal Register* on May 4, 2001 (66 FR 22620).

In 1987, the NRC authorized Everest Minerals Corp. to conduct commercial-scale ISL operations at the Highland site under Source Materials License SUA-1511 (USNRC, 1987). The staff's environmental review was documented in an EA/FONSI issued on July 2, 1987 (52 FR 25094). Everest Minerals Corp. changed its name to Power Resources, Inc. in 1989 (Everest Minerals Corp., 1989). In 1995, the NRC renewed SUA-1511 for PRI's Highland site, with the EA/FONSI published in the *Federal* Register on August 18, 1995 (60 FR 44367).

PRI acquired the Smith Ranch site in July 2002, and by letter dated August 18, 2003, the NRC approved the integration of the Highland license into the Smith Ranch license (USNRC, 2003a). With that integration, operations at the combined Smith Ranch-Highland Uranium Project were authorized under Source Materials License SUA-1548. The NRC staff did not prepare an EA/FONSI as this action was considered administrative and organizational in nature.

The proposed action under consideration by the NRC in this EA is the modification of the SR-HUP permit boundary to include the Reynolds Ranch area, so that PRI could pursue ISL operations in the Reynolds Ranch area.

2.0 THE PROPOSED ACTION

PRI is proposing to modify its permit area boundary to include the Reynolds Ranch area, and to conduct ISL operations within that area (PRI, 2005a). As part of such operations, PRI would construct eight wellfields and a satellite ion-exchange facility for the recovery of uranium and for wellfield restoration following mining operations, and also a deep disposal well for the disposal of liquid wastes. The ore deposits in the SR-HUP and Reynolds Ranch area generally occur at depths of 450 feet (137 meters) to 1000 feet (305 m) below the surface in long narrow trends varying from a few hundred to several thousand feet long and 20 to 300 feet (6 to 91 m) wide. The depth depends on the local topography, the dip of the formation, and the stratigraphic horizon. At the Reynolds Ranch area, the shallower ore deposits are contained within the U/S-Sand, with the mineable ore in this sand occurring at approximate depths of 380 to 525 feet (116 to 160 m). Most of the remaining uranium mineralization at the Smith Ranch and Reynolds Ranch areas occurs in the O-sand formation at a depth of 700 to 900 feet (213 to 274 m).

Following uranium recovery in each mining unit, PRI would restore ground-water conditions in the wellfield. Restoration would involve ground-water sweep, clean water injection, and geochemical stabilization of the aquifer with a reductant. The goal of ground water restoration is to return the aquifer to the baseline conditions that existed prior to the start of uranium recovery; or, if approved, to a secondary standard of pre-mining “class of use.”

2.1 Location

PRI’s Smith Ranch-Highland Uranium Project (SR-HUP) is located in the South Powder River Basin, in Converse County, Wyoming. The main office and Central Processing Plant complex is located at Smith Ranch, about 17 air miles (22 road miles) (27 air / 35 road km) northeast of Glenrock, Wyoming, and 23 air miles (25 road miles) (37 air / 40 road km) northwest of Douglas, Wyoming. The Reynolds Ranch area is located in the Little Cheyenne River drainage of the South Powder River Basin, directly north of and contiguous with the current SR-HUP permit area.

2.2 Description of the In-Situ Leach Process

Numerous facilities have used in-situ leach methods of uranium recovery for research and development and commercial use since 1975. For the most part, these ventures have shown that uranium can be recovered economically and that ground water quality can be restored to pre-mining “baseline” conditions or to the pre-mining class-of-use standards.

During in-situ leaching, an oxidant-charged solution, or lixiviant, is injected into the production zone aquifer through injection wells. By license condition 10.1.4 of SUA-1548, PRI is authorized to use native ground water, carbon dioxide, and sodium carbonate/bicarbonate as the mining solution, 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 where it is pumped to the surface, and then transferred to a processing facility. At the processing facility, the uranium is extracted from the solution. The leaching solution is then recharged with the oxidant and reinjected to recover more uranium from the wellfield.

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 in the Reynolds Ranch area would be designed in a five-spot or seven-spot pattern, with each recovery (*i.e.*, production) well being located inside a ring of injection wells. Monitor wells surround the wellfield pattern area, being located in the production zone aquifer as well as in the overlying and underlying aquifers. These monitor wells are screened in appropriate stratigraphic horizons to detect lixiviant in case it migrates out of the production zone.

2.3 Planned Activities

2.3.1 Wellfield Design and Construction

PRI plans to open eight wellfields in the Reynolds Ranch area. When the project is fully operational, approximately five uranium recovery units would be in production at a time. Well field installation and testing for each unit would take up to a year and a half. Based on PRI's estimated schedule, uranium recovery in each unit would generally last approximately five years, followed by approximately four years of ground water restoration and a year and a half of decommissioning. PRI expects to conduct ISL operations in the Reynolds Ranch area over a 15-year period (PRI, 2005a). PRI would adjust the locations and boundaries at each wellfield as more detailed stratigraphic and ore-occurrence data are collected during wellfield construction. PRI may alter well patterns to fit the size, shape, and boundaries of individual ore bodies.

Each well would be connected to the respective injection or production manifold in a nearby header house. The manifolds route solution to the pipelines to and from the recovery plant. Meters and control valves in individual well lines would monitor and control flow rates and pressures for each well. The wellfield piping would be high-density polyethylene pipe, PVC, and/or steel. Individual well lines and trunk lines to the recovery plant would be buried to prevent freezing of the transferred solutions.

Well Completion

Injection, production, and monitor wells would be constructed using the same techniques. First, a pilot hole for the well would be drilled to the top of the target depth with a small rotary drilling unit using native mud and a small amount of commercial drilling fluid additive for viscosity control. The hole then would be logged and reamed, and the casing set and cemented to isolate the completion interval from all other aquifers. The cement would be placed by pumping it down the casing and forcing it out the bottom of the casing and back up the casing-drill hole annulus. The purpose of the cement is to stabilize and strengthen the casing and to plug the annulus of the hole to prevent vertical migration of mining solutions.

After the well is cemented to the surface and the cement has set, the well would be drilled out and completed either as an open hole or fitted with a screen assembly (slotted liner), which may have a sand filter pack installed between the screen and the underreammed formation. The well would then be air lifted for about 30 minutes to remove any remaining drilling mud and/or cuttings. A small submersible pump is frequently run in the well for final clean-up and sampling.

Well Integrity Testing

PRI performs a mechanical integrity test (MIT) on each well prior to its use in the wellfield. The purpose of the MIT program is to ensure that fluids injected and recovered during mining are not lost from the well due to casing failure. In the integrity test, the bottom of the casing adjacent to or below the overlying confining stratigraphic layer is sealed with a plug, downhole packer, or other suitable device. The top of the casing is then sealed in a similar manner or with a threaded cap, and a pressure gauge is installed to monitor the pressure inside the casing. By license condition 10.1.3 of SUA-1548, PRI is required to pressurize the well to 125 percent of the maximum operating wellhead casing pressure. The well must maintain 90% of this pressure for 10 minutes to pass the test. Wells not passing the MIT are reworked and tested again. PRI would abandon the well upon repeated failure of the MIT.

In accordance with Wyoming Department of Environmental Quality (WDEQ) and U.S. Environmental Protection Agency requirements, PRI would repeat MITs once every five years for all wells used for injection of lixiviant, or injection of fluids for restoration operations (PRI, 2005a). Additionally, a MIT would be conducted whenever a downhole drill bit or underreaming tool is used to repair an injection well. PRI would perform a new MIT for any injection well with evidence of suspected subsurface damage prior to the well being returned to service (PRI, 2005a).

Satellite Building

PRI plans to construct a satellite building in the Reynolds Ranch area. The satellite building would house the ion exchange (IX) columns, water treatment equipment, resin transfer facilities, pumps for injection of the lixiviant, a small laboratory, and an employee break room. The building would occupy approximately 13,000 ft^2 (1,208 m^2) and would serve the eight wellfields planned for the Reynolds Ranch area. It would be designed to operate with a maximum through-flow of 4,500 gallons per minute (gpm) (17,034 liters per minute) during production operations. Bulk carbon dioxide and oxygen would be stored in compressed form adjacent to the building or in the wellfield. Gaseous carbon dioxide is added to the lixiviant as the fluid leaves the satellite building for the wellfield and header houses.

Under PRI's proposed action, construction of the satellite facility and wellfield delineation drilling is anticipated to begin in 2006, and construction of the first wellfield is anticipated to begin in 2007. PRI anticipates beginning production at this wellfield in 2008 (PRI, 2005a).

2.3.2 Wellfield Operation

Once wellfield operations begin, uranium-rich solution would be routed from the wellfields to the planned satellite plant. In the satellite building, the solution would be pumped into a series of IX columns where the uranium (as uranyl carbonate complexes) would be adsorbed onto resin beads in the columns. The resulting uranium-poor (*i.e.*, "barren") lixiviant (which contains normally less than 2 parts per million of uranium) would then exit the IX columns, be recharged with additional oxidizing and complexing agents, and then be reinjected in the wellfields.

Once the majority of the ion exchange sites on the IX column resin are filled with uranium, the column would be taken offline to begin the elution/precipitation circuit to recover the uranium. At this point in the process, the uranium-loaded resin would be transferred from the satellite plant IX columns to a truck for transport to the Smith Ranch Central Processing Plant (CPP) for further processing. At the CPP, the uranium would be stripped (*i.e.*, eluted) from the resin beads with a concentrated solution of sodium chloride. The stripped resin beads would then be returned by truck to the satellite plant where they would be loaded back onto the IX columns.

Operational monitoring of the wellfields and environment are discussed in section 6 of this EA.

2.3.3 Wellfield Restoration

Prior to conducting uranium recovery operations in a mine unit, PRI is required by license condition 10.1.9 of SUA-1548 to collect baseline ground water quality data from the wells completed in the planned production zone, and from these data, to determine and set post-mining restoration criteria. The ground water restoration criteria are set on a parameter-by-parameter basis, with the restoration values for each parameter calculated as the average and range of the pre-mining sample values (PRI, 2005a). The list of parameters for which PRI sets restoration criteria is provided in Table 1.

Table 1. Baseline parameters analyzed in each ground-water monitor well, Smith Ranch-Highlands Uranium Project, Converse County, Wyoming. (PRI, 2005a)

Common Constituents (in milligrams per liter)	
Bicarbonate	Magnesium
Calcium	Potassium
Carbonate	Sodium
Chloride	Sulfate
Fluoride	Nitrate (as nitrogen)
Ammonia	
Trace and Minor Elements (in milligrams per liter)	
Aluminum	Radium-226 (in picocuries per liter)
Arsenic	Manganese
Barium	Mercury
Boron	Molybdenum
Cadmium	Nickel
Chromium	Selenium
Copper	Uranium
Iron	Vanadium
Lead	Zinc
Physical Parameters	
Total dissolved solids (in mg/l)	Specific Conductivity - μmhos @25°C
Temperature (°F)	pH - units

Under license condition 10.1.9, the primary goal of the PRI restoration is to return the ground water quality, on a mining unit average, to pre-mining baseline conditions. During uranium recovery, the wellfield waters will be enriched with uranium as well as several other metals that are also associated with the bedrock minerals. Data from the R&D project and commercial operations indicate that, to a lesser extent, other trace metals such as arsenic, selenium, vanadium, iron and manganese are mobilized during the leaching process with the uranium. As evidenced in the R&D restoration demonstration (see Table B-1), baseline levels for all ground water parameters cannot always be reasonably met. Therefore, by license condition 10.1.9, a secondary ground water restoration goal is to restore the ground water to a quality consistent with the use, or uses, for which the water was suitable prior to ISL mining activities. In order to apply these secondary standards, PRI must demonstrate that baseline conditions are not achievable after the application of Best Practicable Technology. Upon the completion of restoration of each mining unit, PRI is required to submit a wellfield completion report for NRC review and approval.

To restore wellfield ground water to acceptable levels, PRI employs a series of techniques that include ground water transfer, ground water sweep, and permeate injection (Chapter 6 of PRI, 2005a).

Ground water transfer involves the movement of ground water between the wellfield entering restoration and another wellfield in which uranium recovery is commencing, or alternately, within the same wellfield, if one area is in a more advanced state of restoration than another. The purpose of this technique is to displace mining-affected waters in the restoration wellfield with baseline quality waters from the wellfield commencing mining. As a result, the ground water in the two wellfields becomes blended until the waters are similar in conductivity. An advantage to ground water transfer is the reduction in waste waters to be disposed during restoration.

Ground water sweep involves pumping ground water from a wellfield without injection. This draws baseline quality ground water from the perimeter of the mining unit toward the center of the mining unit. In this way, waters unaffected by mining “sweep” the mining-affected portion of the aquifer, resulting in a lowering of parameter concentrations. The water produced during ground water sweep is disposed in an approved manner (*e.g.*, via a deep disposal well).

In association with or following ground-water sweep, PRI may conduct ground water treatment. In this process, water recovered from the wellfield is processed by ion exchange to remove remnant amounts of uranium, and then electrodialysis or reverse osmosis (edr/ro) treatment is used to remove other dissolved solids. The resulting purified water (i.e., the permeate), or other clean water, can then be injected into the wellfield. Brine solutions from edr/ro treatment would be routed to a deep disposal well. If required, this flushing process would be used in conjunction with the injection of a biological or chemical reductant. The reductant is intended to re-establish reducing conditions in the aquifer, thereby immobilizing metals like arsenic, molybdenum, selenium, uranium, and vanadium. Finally, clean water could again be circulated through the aquifer to reduce the dissolved solids introduced during the reductant phase.

The success of restoration is determined following the completion of a stability monitoring period. At the end of that period, restoration is achieved by meeting the approved standards, either the primary standard (return to pre-mining background values) or if authorized, the secondary standard (class-of-use).

Previous experiences at SR-HUP with ground water restoration are discussed in section 5 of this EA.

2.3.4 Wellfield Reclamation

Under license condition 9.11 of SUA-1548, PRI is required to submit for NRC review and approval a final detailed decommissioning plan at least 12 months prior to the planned commencement of decommissioning of a wellfield. Activities associated with such decommissioning would involve plugging and abandonment of the wells and reclamation of the surface areas disturbed by operations. Surface disturbance associated with the satellite plant, the field header houses, and access roads to and through the wellfield would be for the life of those buildings and roads. As a result, final decommissioning of those structures and roads could await the end of operations in that mining area.

Well Plugging and Abandonment

Following the completion of restoration, PRI would plug and abandon all production, injection, and monitoring wells in the wellfield, in accordance with WDEQ rules and regulations. Such practices could include (1) removal of all pumps and tubing; (2) plugging of the well with an appropriately formulated abandonment gel or slurry; (3) cutting the well casing below the ground surface; (4) placing a cement plug to seal the well; and (5) backfilling, smoothing, and leveling the area to blend in with the surrounding terrain.

In addition, buried wellfield lines and pipelines would be removed and the affected surface areas appropriately reclaimed. Affected areas would be leveled and re-seeded with a WDEQ-approved seed mixture of native wheatgrasses, fescues, and clovers.

Surface Reclamation

PRI has stated (PRI, 2005a) that its goal is to return all lands disturbed by the mining project to their pre-mining land use of livestock grazing and wildlife habitat unless an alternate use is approved by the State and the landowner (*e.g.*, a rancher who wishes to retain access roads and/or buildings). In addition, PRI's objective is to return the disturbed lands to a production capacity equal to or better than that existing prior to mining (PRI, 2005a).

PRI plans to keep soil disturbances caused by the mining operation to a minimum.
In accordance with WDEQ requirements, topsoil would be salvaged from building sites (*e.g.*, the satellite building), permanent storage areas, main access roads, and chemical storage sites. The salvaged topsoil would be stockpiled, seeded to minimize erosion, and later reapplied as needed. PRI estimates that a maximum of 250 acres (101 ha) of topsoil would be so treated throughout the lifetime of the SR-HUP and Reynolds Ranch operations (PRI, 2005a).

For areas where only limited disturbance had occurred, such as at well sites and along pipeline routes, topsoil would have been separated from the subsoil using a backhoe and then reapplied once the well work was completed or the pipeline ditch backfilled. These areas would then have been seeded to minimize wind and water erosion.

PRI's revegetation practices are conducted in accordance with WDEQ-LQD regulations and PRI's WDEQ mine permit. Following topsoiling for final reclamation, an area would normally be seeded with oats to establish a stubble crop, and then re-seeded with grasses during the next growing season (PRI, 2005a). If the area in question is to be disturbed again prior to final decommissioning, PRI may apply a long-term temporary seed mix of one or more native wheatgrasses (*i.e.*, Western Wheatgrass, Thickspike Wheatgrass) at a seeding rate of

12-14 lbs. of pure live seed per acre. A permanent seeding mixture would typically contain native wheatgrasses, fescues, and clovers, with typical seeding rates of 12-14 lbs. of pure live seed per acre.

2.3.5 Final Wellfield Decommissioning

Decommissioning and Disposal

As part of the reclamation following the end of mining operations in the Reynolds Ranch area, the satellite facility would need to be decommissioned. In doing so, process equipment could either be dismantled and sold to another licensed facility or decontaminated in accordance with the applicable NRC guidance. Materials that could not be decontaminated to acceptable levels would be disposed in a licensed disposal facility. Decontaminated materials having no resale value, such as building foundations, may be buried on-site.

Radiation Surveys

After the equipment, buildings, foundations, piping, and associated support facilities are removed, gamma radiation surveys would be conducted over the areas. In the wellfields themselves, gamma surveys would also be conducted during the decommissioning of each mining unit. Material with contamination levels requiring disposal in a licensed facility would be removed, packaged as needed, and shipped to a licensed disposal facility.

Re-contouring

After decommissioning and decontamination have been completed, surface areas disturbed by project operations would be re-contoured so that these areas would blend in with the natural terrain and be consistent with the post-mining land use.

2.3.6 Operational Wastes

Liquid wastes generated at the proposed Reynolds Ranch satellite facility would be disposed through a deep injection well. These wastes would include the production bleed stream, wash down water, and ground water restoration waste water (*i.e.*, from ground water sweep and ground water treatment activities). The planned deep injection well would be similar in design and depth to current deep injection wells at Smith Ranch and located near the Reynolds Ranch area. This deep injection well would be permitted through the WDEQ and operated according to permit requirements.

Disposal of liquid wastes via deep well injection would comply with license condition 10.1.8 of SUA-1548. This condition requires PRI to dispose of all liquid effluents stemming from mining units, process buildings, and process waste streams (with the exception of sanitary wastes) in an approved manner, including deep well injection.

Sanitary wastes from the restrooms and lunchroom at the satellite plant would be disposed of in an approved septic system. PRI's septic system is subject to continued approval by the State of Wyoming.

Solid wastes generated at the site would include both contaminated and non-contaminated wastes. Contaminated wastes would include rags, trash, packing material, worn or replaced parts from equipment, piping, and sediments removed from process pumps and vessels. Radioactive solid wastes with contamination levels requiring disposal at a licensed facility would be isolated in drums or other suitable containers prior to offsite disposal. Under license condition 10.1.7 of SUA-1548, PRI is required to maintain an area within the restricted area boundary for the storage of contaminated materials prior to their disposal. PRI would dispose of non-contaminated wastes in the SR-HUP site disposal landfill in accordance with the permit issued by the WDEQ.

3.0 ALTERNATIVES TO THE PROPOSED ACTION

3.1 The No-Action Alternative

Under the provisions of the National Environmental Policy Act, one alternative that must be considered in each environmental review is the no-action alternative. In this case, the no-action alternative would mean that the NRC would not approve the addition of the Reynolds Ranch area to the existing SR-HUP permit area. In-situ leach uranium mining would not occur in the Reynolds Ranch area and the associated environmental impacts also would not occur. In-situ leach mining would continue to occur within the currently approved SR-HUP permit area.

3.2 Open Pit Mining / Underground Mining

In the southern Powder River Basin, where the SR-HUP facility is located, uranium ore has been mined via open pits in the past. This activity occurred from 1970 to 1984 at the Exxon Highland facility, which is adjacent to the eastern edge of the SR-HUP permit area, and from the mid-1970s to 1986 at Union Pacific Resources' Bear Creek site, which is approximately 15 miles (24 km) northeast of the SR-HUP permit area.

Underground mining of uranium ore also has occurred in the region around the SR-HUP permit area. This mining process involves the sinking of shafts and tunnels to gain access to the ore, followed by the extraction of the ore for later processing. Ore was obtained via underground mining at the adjacent Exxon Highland site, in addition to the open pit method.

Processing of ore obtained in both of these methods requires a mill to crush and grind the rock as well as solvent extraction and settling tanks to liberate the uranium from the powdered ore. The milling process generates a significant amount of waste relative to the amount of ore processed (roughly 95% of the ore is disposed as waste (PRI, 2005a; p. 8-1 to 8-2)). Extensive mill tailings ponds are needed for the disposal of these wastes.

The environmental impacts associated with open pit and underground mining are generally recognized as being considerably greater than those associated with in-situ leach mining. Therefore, although both open pit and underground mining of uranium have occurred near the Reynolds Ranch area, these alternatives will not be considered further in this analysis.

4.0 THE AFFECTED ENVIRONMENT

4.1 Land Use

The proposed facility and associated wellfields would be located in east-central Wyoming. There are no occupied homes in the Reynolds Ranch area, and the nearest resident is located 5.6 miles (9 km) north-northeast of the area. The land has been used mainly for sheep and cattle grazing. In the past, homesteaders settled some areas for dry farming, but most of these farms are now abandoned.

The proposed Reynolds Ranch area would add approximately 8704 acres (3522 ha) to the current SR-HUP permit area of approximately 30,760 acres (12,448 ha). The Reynolds Ranch area contains approximately 720 acres (291 ha) of U.S. Government ownership (administered by the U.S. Bureau of Land Management), 640 acres (259 ha) of State of Wyoming ownership, 240 acres (97 ha) directly owned by PRI, and 7135 acres (2887 ha) of other private ownership. The names and addresses of the surface and mineral owners of record within and around the proposed Reynolds Ranch area are found in Appendix A of PRI’s application (PRI, 2005a). Of the 8704 acres (3522 ha), PRI estimates that a maximum of 325 acres (131 ha) would be excluded from livestock use and used for uranium mining and mining-related activities (*e.g.*, access road construction, pipelines, satellite facility construction). Of the 325 acres (131 ha) potentially affected, less than half would be lands administered by the Federal or State government. After mining activities are completed, the land would be returned to its pre-mining use for livestock grazing and wildlife use.

Coal beds within the Fort Union Formation produce methane gas from numerous wells and fields in the Powder River Basin. The federal Duck Creek Project is located about nine miles northeast of the Reynolds Ranch area, with about 45 wells permitted in the project area. Additional wells have been permitted or drilled to the west of the Duck Creek Project and to the west of the Reynolds Ranch area.

4.2 Demography

Within 50 miles (80 km) of the SR-HUP main office, the population is centered in the Wyoming communities of Casper, Douglas, and Glenrock. These cities are the major locations for public services (*e.g.*, schools, churches, medical care facilities) and for cultural and scenic attractions for the residents of Natrona and Converse Counties. Populations of these cities have fluctuated with the rise and fall of the price and demand for oil and uranium. In the Year 2000 census, Casper had a population of 49,644, Douglas 5,288, and Glenrock 2,231.

4.3 Climatology and Meteorology

The project permit area is located in eastern-central Wyoming, where climate can generally be classified as semiarid and cool. The climate in the area is rather dry due to the effective barrier to moisture from the Pacific Ocean offered by the Cascades, Sierra Nevada, and the Rocky Mountains when winds are from the west and northwest. The mountain ranges in the west-central portion of the state, which are oriented in a general north-south direction, are perpendicular to the prevailing winds. These ranges also tend to restrict the passage of storms and thus restrict precipitation in the eastern part of Wyoming.

The official weather station closest to the Reynolds Ranch area is located at the Natrona County International Airport near Casper, Wyoming. Meteorological data (wind speed and direction, temperature, and precipitation) for this weather station are available through the Western Regional Climate Center website, http://www.wrcc.dri.edu. Unless otherwise specified, the data presented here are for the period from August 1948 to March 2005.

The average temperature is 68°F (20°C) in the summer and 25°F (-4°C) in the winter. Extreme temperatures in these respective seasons have reached as high as 104°F (40°C) and as low as -41°F (-41°C).

The average annual precipitation for the area is approximately 12 inches (30.5 cm), with the bulk of the annual precipitation associated with moisture-laden easterly winds, particularly during the spring months. Most of this precipitation is in the form of rain although occasional heavy wet snowfalls in spring months are not uncommon, but these snows are short-lived. Summer precipitation is almost exclusively from thundershower activity and under normal conditions provides sufficient moisture to maintain growth or rangeland grasses. Annual snowfall averages about 78 inches (198 cm), but the water content of winter snow is low owing to the cold temperatures at which it usually occurs. The very dry strong west and southwest winds following these winter snows tend to clear the snow from the rangelands thereby permitting winter grazing of livestock. Winter days are generally bright with considerable sunshine.

Wind speed data taken from the Casper Mountain station, just outside Casper, Wyoming, for the period from August 1992 to September 2005 indicate that winds are predominantly from the southwest, ranging from light to moderate breezes (from 1.3 to 19 miles per hour) (2.1 to 30.6 km per hour) under the Beaufort Scale. The mean annual wind speed at this station during this period of time was 7.7 mph (12.4 kph). A maximum observed wind speed maintained for longer than one minute of 81 mph (130 kph) was recorded at the Natrona County International Airport outside Casper in March 1956.

4.4 Geology

4.4.1 Regional Geology

The Reynolds Ranch area is located in northern Converse County, Wyoming near the southern extent of the Powder River Basin. It is located adjacent to the northern boundary of the SR-HUP permit area. The Powder River Basin is a late Cretaceous to early Tertiary structural and topographic basin with a regional dip in a northwesterly direction at a rate of approximately one foot per 100 feet (0.3 m per 30.5 m).

The Eocene-aged Wasatch Formation outcrops in the area. Beneath the Wasatch, the Paleocene-aged Fort Union Formation comprises the strata to a depth of at least 3280 feet (1000 m). The Lance Formation of the Cretaceous age underlies the Fort Union Formation. Most of the economic uranium mineralization occurs within the upper 500 feet (152 m) of the Fort Union Formation.

4.4.2 Site Geology

The bedrock unit across the Reynolds Ranch area is the Wasatch Formation. It varies in thickness from less than 200 feet (61 m) to over 400 feet (122 m) and overlies the Fort Union Formation. The contact between these two formations is unconformable where seen at the surface, but it is not readily identifiable in the subsurface by any characteristic marker (PRI, 2005a).

The Fort Union Formation consists of alternating and discontinuous mudstones and siltstones with lens-shaped beds of coarser arkosic sandstones (*i.e.*, sandstones with a considerable amount of the mineral feldspar). Additionally, disconnected drainage systems led to swampy environments that resulted in the coal seams commonly found throughout the Fort Union Formation. The sources of uranium in the region are considered to be the large accumulations of sediment from volcanic sources that entered the basin.

Unconsolidated materials in the area consist mainly of locally-derived colluvium (loose and incoherent deposits) on hill slopes and alluvial (stream) deposits along water courses. The thickness of these deposits ranges from 0 to 10 feet (0 to 3 m) or more. Playa deposits (*e.g.*, clays, sands, and silts) present in closed depressions are derived from local bedrock, but they also contain alkaline evaporite mineralization.

4.4.3 Stratigraphic Setting

Figure A-2 in Appendix A shows a schematic stratigraphic cross-section from the Reynolds Ranch area to the nearby Smith Ranch and Highland Project Areas. This section illustrates the correlation of the various sand zones and the nomenclature used for them at each project area. The sands in which PRI has mined, or will be mining, are designated. Currently, the uppermost sand that is mined at the Highland project - the "50 sand" (designated the "O3 sand" at Smith Ranch and Reynolds Ranch) - is the deepest anticipated target zone at the Reynolds Ranch Project. As shown in the figure, the O3 sand is part of the larger "O-sand Formation."

In the figure, the "R" shale is the upper confining layer for the "Q" sand and the lower confining layer for the "U/S" sand. The "R" shale is similar in composition to the "P" shale and, where the "Q" sand is absent, the "P" and "R" shales combine with a thickness of up to 150 feet (46 m).

The primary uranium-mineralized sands within the Reynolds Ranch area are the "S" and "U" sands. These sands individually range in thickness from 0 to 70 feet (0 to 21 m) thick, but in many places, where significant channel sand deposition had occurred, they form one sand unit of up to 150 feet (46 m) in thickness. In much of the project area, these two sands are referred to jointly as the "U/S" sand.

The upper confining layer for the "U/S" sand is the "V" shale, which is composed of siltstones and bentonitic claystones (*i.e.*, containing clays formed from chemically-altered volcanic ash). The "V" shale ranges in thickness from 20 to 70 feet (6 to 21 m) throughout the SR-HUP permit area.

4.4.4 Ore Occurrence

Uranium deposits that occur in most of the region are of the "roll front" type. Roll fronts occur in areas where ground water had infiltrated from the surface or migrated through an aquifer composed of sediment containing minerals with slight amounts of uranium. Near the surface, oxidizing conditions result in the weathering of minerals (such as feldspar) and volcanic ash and the mobilization of minute concentrations of uranium in solution. As ground water continued to migrate, it encountered reducing conditions where the uranium was no longer stable in solution. (The reducing environment may be a result of hydrogen sulfide (H_2S), pyrite, or organic material existing in the aquifer.) As a result, the uranium precipitated from the ground water and formed coatings of minerals such as uraninite (UO_2) or coffinite ($USiO_4$) on the sediment grains in the formation. Roll fronts extend farther in the middle of an aquifer. Therefore, uranium minerals occur concentrated in the direction of flow, resulting in typically distorted C-shaped deposits. Individual fronts can range in thickness from 2 feet (0.6 m) to more than 25 feet (7.6 m). Mineral ore may exist laterally along a front hundreds of feet long, and fronts may coalesce to form ore bodies miles in length. Thin mineralized trails and more finely disseminated minerals are found branching off the main front and are located between fronts. In general, uranium ore deposits in eastern Wyoming average about 0.20 percent uranium oxide.

The physical shape of the ore deposit is dependent on the local permeability of the sandstone matrix, its continuity and distribution in the geologic unit, as well as the former oxidation/reduction front in the aquifer. The recoverable ore is located in portions of the Wasatch and Fort Union Formations extending from depths of 400 to 1000 feet (122 to 305 m) below the surface.

For in-situ leach mining to be successful, the ore deposit must (1) be located in a saturated zone, (2) be bounded above and below by suitable confining layers, (3) have adequate permeability, and (4) be amenable to chemical leaching.

4.5 Water Resources

4.5.1 Surface Water

The Reynolds Ranch area is located in the Duck Creek, Willow Creek, and Brown Springs Creek drainages, all part of the Dry Fork drainage of the Little Cheyenne River. The Little Cheyenne River is part of the Cheyenne River drainage system in the southern part of the Powder River Basin. The only natural surface water in the permit area is ephemeral runoff in response to intermittent precipitation and seepage into small basins at low points in the Duck Creek, Willow Creek, and Brown Springs Creek drainages. Surface runoff is limited (PRI, 2005a).

The SR-HUP permit area and Reynolds Ranch area have several known stock ponds consisting of small earthen dams across dry stream channels that collect the small quantities of runoff. Two of these ponds are supplemented by ground water pumped from a well by a windmill. Some water also accumulates in small excavations or natural depressions at low points in the Sage Creek and Duck Creek drainage. No other significant waterbodies are present in the SR-HUP permit area. During underground mining, a local rancher constructed a small reservoir to collect water discharged from the Bill Smith Mine and used the water for irrigating approximately 160 acres of alfalfa and native grass. However, with the absence of pumping from the mine after it was reclaimed and abandoned, the reservoir is dry most of the time but is still used as a stock pond when there is runoff.

4.5.2 Ground Water

Alluvium

Consisting of thin, unconsolidated, and poorly stratified clays, silts, sands, and gravels, the alluvium in the Reynolds Ranch area is estimated to range from less than 1 foot to 30 feet (less than 0.3 m to 9 m) in thickness. Small amounts of precipitation infiltrate the alluvium during part of the year, and intermittent flows across the alluvium may provide some recharge of the underlying aquifers. However, the water table is typically more than 100 feet (30.5 m) below the land surface throughout most of the area. The potential for future development of alluvial ground water supplies in the Reynolds Ranch area is considered very poor (PRI, 2005a).

Wasatch Formation

The Wasatch Formation typically is composed of lens-shaped, fine- to coarse-grained sandstones with interbedded claystones and siltstones. This formation underlies all except the southwestern and extreme western sectors of the SR-HUP permit area and ranges in thickness from 0 to approximately 500 feet (0 to approximately 152 m). The Wasatch Formation contains some of the more important shallow aquifers in the Powder River Basin (PRI, 2005a). Properly constructed wells penetrating the Wasatch aquifer in the vicinity of the SR-HUP permit area generally yield from 5 to 15 gpm (19 to 57 lpm). For the most part, ground water in the Wasatch aquifer occurs under water table (unconfined) conditions, and its primary use in the permit area is low-yielding wells used for watering livestock. Artesian (confined) zones near the base of the formation are separated from near-surface deposits and from each other by impermeable shale layers.

Fort Union Formation

The Fort Union Formation underlies the Wasatch Formation in the SR-HUP permit area. The top of the Fort Union is exposed at the surface in the southwestern and western portions of the area, but may be at depths of 500 feet (152 m) or more in the eastern and northeastern part of the permit area. Typically, the Fort Union is comprised of lenticular, fine- to coarse-grained sandstones with interbedded claystones, siltstones, and coal. The formation is as much as 3000 feet (914 m) thick beneath the permit area.

The Fort Union Formation contains important aquifers in the Powder River Basin and the principal production zones for the Reynolds Ranch Project (PRI, 2005a). While most of the solution mining wells are designated for limited yields (5 to 30 gpm of water), wells completed in the Fort Union Formation can produce substantial volumes of ground water over extended periods, as demonstrated by the various past mining operations in the southern Powder River Basin.

Coal beds within the Fort Union Formation produce methane gas from numerous wells and fields in the Powder River Basin. Typically, the coal beds are de-watered before the methane gas is extracted. The de-watering process depends on the number of producing wells in an area, but it can take several months, or in some cases, several years.

Water Quality

Solution Mining Corporation (SMC) collected water quality data for the Reynolds Ranch area in 1980-1981 and in 1989-1990 (PRI, 2005a). Data collected by SMC and provided by PRI in its application included that from the O-sand and the U/S-sand, as well as from shallow wells and surface watercourses. Water quality, based on U.S. Environmental Protection Agency (EPA) drinking water standards (EPA, 2005), is relatively good in both aquifers. Only radium-226, which is a daughter product of the uranium decay chain, naturally exists in concentrations above EPA primary drinking water standards. The EPA standard for radium is 5 picocuries per liter (pCi/l), and baseline radium levels in the O-sand ranged from 0.3 to 2598 pCi/l, while the levels in the U/S-sand ranged from 3.3 to 375 pCi/l. The calculated averages were 296 pCi/l and 86 pCi/l for the O-sand and the U/S-sand, respectively. Both aquifers contain calcium-sulfate type water with total dissolved solids (TDS) ranging from 234 to 952 milligrams per liter (mg/l). Sulfate and TDS routinely are found in O-sand samples to exceed EPA's secondary standards. In addition, various metals are intermittently found to exceed standards. However, these conditions vary with location and sampling period.

Aquifer Testing

In 1989, In-Situ Incorporated (ISI) and Solution Mining Corporation (SMC) conducted aquifer testing in the Reynolds Ranch area (PRI, 2005a). This testing involved two multiple-well constant-pumping tests of the O- and U/S sands, with each test encompassing both a 72-hour pumping phase and a 215- to 271-hour recovery phase after the cessation of pumping. ISI and SMC analyzed the data to determine transmissivity, storage coefficient, directional transmissivity, and leakage. The data demonstrated that the O- and U/S sands have acceptable transmissivity and permeability for in-situ leach mining and that the confining shale members were shown to be effective aquitards to the vertical movement of leaching solutions (PRI, 2005a).

PRI conducts further hydrologic testing of a mine unit prior to conducting mining operations in that unit (PRI, 2005a). This testing addresses (1) the hydrologic characteristics of the production zone aquifer; (2) the presence/absence of hydrologic boundaries within the production zone aquifer; (3) the degree of hydrologic communication between the production zone aquifer and overlying and underlying aquifers, as well as between the production zone aquifer and the surrounding monitor well ring; and (4) the vertical permeability of the overlying and underlying confining units that have not already been tested.

PRI reviews and evaluates the field data from this additional hydrologic testing to ensure that the testing results and the planned mining activities are consistent with the appropriate technical requirements and are in compliance with the requirements of the site's NRC license. PRI's written evaluation of its review is retained onsite for review by the NRC or WDEQ.

4.5.3 Ground water Uses

Most of the wells in the vicinity of the current SR-HUP permit area are associated with windmills used for livestock watering. As such, these wells are usually shallow, less than 180 feet in depth. Only four wells in the current SR-HUP permit area, Reynolds Ranch area, and on adjacent lands are known to be used for domestic water supply. Of these, three are located outside the Reynolds Ranch area (two of which are in the SR-HUP permit area and the other just outside the permit area boundary). The remaining well, the domestic-use well for the Mason House (unoccupied), is near the proposed location for the Reynolds Ranch Satellite Facility. Plate 1 in PRI's application (PRI, 2005a) shows the locations for all four of these dwellings. Water wells at the SR-HUP satellite buildings, the Highland Central Plant, and the Smith Ranch Main Office/CPP site only supply water for plant operations and washing purposes. These water supplies are not used for drinking as bottled water is supplied for this purpose.

Existing permitted well locations in the Reynolds Ranch area and surrounding areas are accessible through the "Water Rights Database" at the Wyoming State Engineer's Office website at http://seo.state.wy.us/. The majority of the wells within the Reynolds Ranch area were installed by Solution Mining Corp., Rio Algom Mining Corp., and PRI for the purpose of collecting ground water quality data and to determine ground water aquifer characteristics as part of preparations for potential ISL activities. A list of domestic, stock, and non-ISL monitoring wells in the Reynolds Ranch area and neighboring township/range sections is provided in Appendix B.

Coal bed methane wells of the federal Duck Creek Project are located about nine miles northeast of the Reynolds Ranch area in T38N, R72W. Typically, these wells are used to de-water the coal bed prior to producing methane gas. About 45 wells have been permitted by the U.S. Bureau of Land Management (Casper Field Office) in the project area, 8 of which are drilled and currently producing water but no gas. The Duck Creek Project wells are producing from the Upper and Lower Pawnee Coals of the Fort Union Formation from about 1800 to 200 feet below ground. An additional 19 coal bed methane wells have been permitted or drilled in T38N, R73W, west of the Duck Creek area. Several other wells have been drilled in T36N, R75W, west of the Reynolds Ranch area.

4.6 Ecology

BKS Environmental Associates, Inc. conducted a vegetation study of the Reynolds Ranch area in 1997 for Rio Algom Mining Corporation (RAMC). The vegetation was determined to be predominantly grassland and sagebrush/grassland (PRI, 2005a). The grassland was found in well-drained upland areas on ridge tops and flat areas, with blue grama *(Bouteloua gracilis),* threadleaf sedge *(Carexfilifolia),* and needle-and-thread *(Stipa comata)* as the dominant perennial grasses. The sagebrush/grassland was found on sloped areas and drainages. Shrub cover varies with big sagebrush *(Artemisia tridentata)* on sloped areas to silversagebrush *(Artemisia cana)* in drainages and on toeslopes. Dominant perennial grasses include blue grama, threadleaf sedge, and needle-and-thread.

None of the plants identified through this survey was federally-listed as either endangered or threatened or listed as state-sensitive.

Hayden-Wing Associates conducted baseline wildlife studies of the Reynolds Ranch area in 1997 and 1998 under contract to RAMC (PRI, 2005a). These studies involved surveys of big game species, raptors, sage grouse, and other local wildlife. Depending on the species, these surveys were conducted either by air alone or alternately by air and on the ground.

Numerous pronghorn antelopes (*Antilocapra americana*) and mule deer (*Odocoileus hemionus*) were sighted during these surveys, along with white-tail deer (*Odocoileus virginianus*), red fox (*Vulpes vulpes*), coyote (*Canis latrans*), and cottontail rabbits (*Sylvilagus floridanus*). Of the raptors surveyed, ferruginous hawks *(Buteo regalis),* red-tailed hawks *(Buteo jamaicensis)*, golden eagles *(Aquila chrysaetos),* and a great horned owl *(Bubo virginianus)* were found to nest in the area. The surveys did not locate any sage grouse *(Centrocercus urophasianus)* leks (*i.e.*, breeding areas), although sage grouse were observed in the area. The lack of leks indicates that the sage grouse do not use the area for breeding or nesting (PRI, 2005a).

In a January 1998 survey, a bald eagle (*Haliaeetus leucocephalus*) was observed feeding on a deer carcass. Bald eagles are known to spend the winter along the North Platte River approximately 11 miles (17.7 km) south of the SR-HUP permit area and regularly range inland to scavenge winter-killed big game carcasses (PRI, 2005a). Bald eagles are listed as a threatened species under Section 7 of the Endangered Species Act.

In accordance with WDEQ-LQD requirements, PRI conducts a raptor survey in late April or early May of each year to identify any new nests and to assess whether known nests are being used

(PRI, 2005a). The survey covers all areas of planned activity for the life of the project and a one-mile area around the activity. The survey program is primarily intended to protect against unforeseen conditions, such as the construction of a new nest in an area where operations may take place. In the event that it would be necessary for PRI to disturb a raptor nest, PRI will obtain a permit for a mitigation plan from the U.S. Fish and Wildlife Service. Surveys since 1992 have shown that known nest sites are used by redtailed hawks, Swainson's hawks (*Buteo swainsoni*), and great horned owls on a seasonal basis. To date, the only golden eagles observed nesting have nested approximately two miles from any project activity (PRI, 2005a).

4.7 Transportation

The SR-HUP facility and the Reynolds Ranch area are accessed via Ross Road (Converse County Road 31). Ross Road begins at the junction of State Routes 93 and 95 in south-central Converse County, and it extends generally to the northwest where it ends at the intersection with State Route 387 in Campbell County, WY. The posted speed limit on Ross Road is 55 mph (88.5 kph).

The State of Wyoming Department of Transportation (WDOT) has taken traffic counts at Milepost 0 along Ross Road (*i.e.*, the intersection of State Routes 93 and 95) in both 1998 and 2004 (WDOT, 2005a, 2005b). In 1998, a total of 646 vehicles (including motorcycles, cars, pickups, buses, delivery trucks, and single- and multi-trailer trucks) were recorded. In 2004, the number of vehicles recorded was 897, an increase of approximately 39% since 1998. The majority of the vehicles recorded (85% for both years) were cars and pickup trucks/vans, as classified under the Federal Highway Administration scheme F vehicle classification system (WDOT, 2005a, 2005b).

The WDOT also provided data on accidents along the Ross Road from Year 2000 to July 2005 (WDOT, 2005c). This data covered accidents that had occurred between Mileposts 0 and 25 on Ross Road, as well as for the first two miles along County Road 34, which intersects with Ross Road at approximately Milepost 24. A total of eight crashes were recorded, seven of which were on Ross Road and the eighth on County Road 34. Three involved property damage only, five involved injuries, and none were fatal.

The proposed satellite facility for the Reynolds Ranch area would be located just off Ross Road, between Mileposts 14 and 15. Two accidents have occurred just north of the proposed satellite facility site, between Mileposts 16 and 17, where the road bends. Both of these accidents resulted in overturned vehicles, due to unsafe speed in the case of a tractor/trailer accident and to an inattentive driver in the case of a passenger car accident. The entrance to the access road for the SR-HUP Central Processing Plant is located between Mileposts 7 and 8 on Ross Road. A passenger car hit a deer in May 2000 at Milepost 8, resulting in property damage to the vehicle. The remaining four accidents along Ross Road occurred several miles to the north or south of the proposed satellite facility site or SR-HUP CPP, respectively.

4.8 Cultural and Historical Resources

Documentation of the staff's consultation with the State of Wyoming's Historic Preservation Office in accordance with Section 106 of National Historic Preservation Act is provided in section 7 of this EA.

4.8.1 Cultural Resources Site Survey

In September 1997, Pronghorn Archaeological Services of Mills, WY completed a Class III Cultural Resource Inventory for the majority of the proposed Reynolds Ranch area. The survey addressed those areas on Plate 1 of PRI's amendment application (PRI, 2005a) where PRI has delineated its proposed mine units, but the southern-most and southeastern-most portions of the proposed permit area, where mining is not proposed, were not included in the survey. From this survey, thirteen sites were located: six historic and seven prehistoric. In addition, eighteen isolated artifacts were recorded. All of the sites were considered not eligible for inclusion to the National Register of Historic Places, and no further work was recommended for any of the sites.

4.8.2 Historical Resources Site Survey

Rosenberg Historical Consultants of Cheyenne, WY conducted an assessment of the potential impacts to the Bozeman Trail and other historical sites within the Reynolds Ranch area in August and September 1997. As with the cultural resource survey, this assessment covered those portions of the Reynolds Ranch area where PRI indicates it plans to mine. The assessment included a 3.3-mile long segment of the Bozeman Trail known as the Holdup Hollow Segment (T36N, R74W, Sec.15, 10, and 3), as well as 2.5 miles (4.0 km) of trail just north of the Reynolds Ranch area. The Holdup Hollow Segment is listed in the National Register of Historic Places (see http://wyshs.org/wynr-cou.htm).

It was recommended in the assessment that no ground disturbing activity of any kind associated with in-situ leach mining should occur within the recognized boundaries of the Holdup Hollow Segment, as well as no exploratory drilling. As a result of this recommendation, PRI did not include the sections of land in which the Holdup Hollow Segment is located in the proposed permit area for Reynolds Ranch. Therefore, no ground disturbing activities, in-situ mining activities, or exploratory drilling would occur in the Holdup Hollow area (PRI, 2005a).

The Bozeman Trail segment located just north of the Reynolds Ranch area was considered non-contributing. A No Effect determination was recommended and no further historical work was believed necessary. A cultural clearance was recommended for this area with no stipulations (PRI, 2005a).

In addition to the Bozeman Trail, the survey recorded and evaluated three historic period dry land homesteads. All of these sites are considered to be ineligible to the National Register of Historic Places and a determination of No Effect is recommended. A cultural clearance was recommended for this area with no stipulations.

Should mining operations expose any cultural or significant paleontological evidence during site operations, PRI has committed to delaying such activities until the appropriate state office has been notified and a qualified person has examined the evidence (PRI, 2005a).

4.9 Background Radiological Characteristics

A background radiological survey of a portion of the Reynolds Ranch area was conducted previously by Solution Mining Company (SMC) in 1989-1990 as part of its efforts to develop a mine permit application for the area (which SMC referred to as the Blizzard Heights Project) (PRI, 2005a). SMC's radiological assessment was conducted over approximately 890 acres (360 ha) of the Reynolds Ranch area, with radiation surveys undertaken of the entire 640 acres

(259 ha) in T37N, R74W Section 36, and of 175 acres (71 ha) of relatively flat land in T37N, R74W, Sections 25 and 26. Background radiological surveys conducted for SMC included surface gamma radiation survey, soil radionuclide analysis, ground water and surface water radionuclide analysis in locations in the vicinity of the proposed Reynolds Ranch satellite plant and some of the anticipated wellfield areas. Surface gamma levels determined during the SMC survey are consistent with surface gamma surveys conducted for the SR-HUP, and therefore, PRI considers the results of the SMC survey to be representative of the entire Reynolds Ranch area (PRI, 2005a).

PRI has collected background gamma and radon-222 data at the Reynolds Ranch area since April 2004 using a gamma ball and radon cup placed near the proposed location of the Reynolds Ranch satellite plant. PRI compared these data with data from a background air monitoring location for the SR-HUP and found the two data sets to be consistent with each other. For the second quarter of 2004, the mean ambient dose equivalent for gamma was 33 millirem (mrem) for the Reynolds Ranch site and 35 mrem for the SR-HUP site, while the radon measurements were 1.6pCi/L and 1.7 pCi/L for the Reynolds Ranch site and SR-HUP site, respectively (PRI, 2005b).

5.0 ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION AND ALTERNATIVES

5.1 Introduction

In-situ leaching of uranium is an established technology. The major potential environmental impacts associated with this technique of uranium recovery are impacts to ground water quality, radiological impacts, and impacts from waste disposal. Other potential impacts may affect land use, wildlife, and transportation.

As discussed in section 1.4 of this EA, the potential environmental impacts from commercial ISL uranium mining operations in the current SR-HUP permit area have been evaluated previously. Therefore, this section will address only the potential environmental impacts associated with ISL uranium mining operations in the Reynolds Ranch area.

If approved, ISL activities at the Reynolds Ranch area would involve (1) the addition of approximately 8700 acres (3521 ha) to the SR-HUP permit area; (2) the disturbance of about 325 acres (131 ha) of the approximately 8700 acres (3521 ha) due to ISL operations; (3) the net withdrawal of ground water of approximately 50 gpm during wellfield operations (from a maximum throughput of 4500 gpm at the proposed satellite facility); (4) the temporary contamination of monitored ground water aquifers; (5) the transport of resin beads from the Reynolds Ranch satellite facility to the Smith Ranch central processing plant (CPP) and back; and (6) the processing of the uranium derived from the Reynolds Ranch satellite facility at the Smith Ranch CPP.

5.2 Land Use Impacts

The primary impact on land use would be the fencing of the restricted areas within the permit area boundary to exclude livestock from approximately 325 acres (131 ha) until the completion of ground water restoration and surface reclamation. These effects would be limited, temporary, and reversible through returning the land to its former grazing use following completion of post-recovery surface reclamation.

Since 2001, PRI and the previous site operator, Rio Algom Mining Corp., have reported 24 spills of mining-related solutions. The size of these spills has ranged from a 50- to 100-gallon (189 to 378-liter) spill in February of 2004 to a 62,400-gallon (236,210-liter) spill in October of 2001. The largest recent spill was one of 20,700 gallons (78,358 liters) in May 2005. The spills generally have involved injection fluids (0.5 to 3.0 mg/l uranium), although spills of production fluids (10.0 to 15.5 mg/l uranium) also have occurred. Predominantly, the cause for these spills has been the failure of joints, flanges, and unions of pipelines and at wellheads. PRI's immediate response actions have included shutting down the affected well or pipeline, recovering as much of the spilled fluid as possible, and collecting samples of the affected soil and from a nearby background site to be analyzed for uranium, radium-228, and selenium. As required by license condition 12.1 of SUA-1548, PRI and RAMC reported each of these spills to the NRC and the WDEQ within 48 hours, followed within 30 days by a report to the NRC describing the conditions leading to the spill, the corrective actions taken, and the results achieved.

Under license condition 12.1, PRI also is required to maintain documentation of all spills of source or 11e.(2) byproduct materials (including mining solutions) and of process chemicals until license termination. This documentation would include: the date and volume of the spill; the total activity of each radionuclide released; results of radiological surveys and soil samples; the corrective actions performed; and a map showing the spill location and the affected areas. This information would be used during radiological surveying as part of wellfield and final site decommissioning activities. Any soils with contamination levels requiring disposal in a licensed facility would be removed, packaged (if needed), and shipped to an approved facility for disposal.

5.3 Air Quality Impacts

5.3.1 Construction-Related

Construction activities in the Reynolds Ranch area would include: preparation and construction of the proposed satellite facility and header houses; construction and vehicle traffic along unpaved access roads to the satellite building and in the wellfields; pipeline laying; and well drilling. Air quality would be impacted by the release of diesel emissions from drilling and construction equipment and from fugitive dust from construction activities and vehicle traffic. Diesel emissions would be minor and of short duration, and would be readily dispersed in the atmosphere. Fugitive dust generated from construction and drilling activity, as well as vehicle traffic on unpaved roads, would be localized and of short duration. Localized areas affected by the laying of pipelines and drilling of wells would be reclaimed, topsoiled, and re-seeded. PRI has committed additionally to re-seeding disturbed surface areas to minimize erosion from wind and water. Vegetation normally would be reestablished within two years of disturbance (PRI, 2005a). Reclaimed building sites and access roads would be re-contoured, covered with topsoil, and re-seeded to minimize long-term impacts to air quality.

5.3.2 Operations-Related

Dissolved radon gas, generated by its dissolution from processing solutions, may escape to the atmosphere and potentially adversely impact air quality in the wellfields and immediate vicinity of processing buildings. Radon can be vented to the atmosphere from the wellfields at each wellhead or from the process equipment in the proposed satellite facility. PRI would use pressurized downflow ion exchange (IX) columns, and therefore radon releases would occur only when individual IX columns are disconnected from the circuit and opened to remove the resin for elution. The radiological impacts of operations are discussed in section 5.8 of this EA.

Uranium recovered at Reynolds Ranch would be processed at the Smith Ranch central processing plant (CPP). The main non-radiologic gaseous effluents that would be released from the operation of processing equipment in the CPP include gases such as CO_2 and hydrogen chloride. At the CPP, these gases are vented directly to the atmosphere where they are readily dispersed.

5.4 Water Impacts

5.4.1 Impact to Surface Water and Ephemeral Drainages

As discussed in section 4.6 of this EA, within the Reynolds Ranch area, surface precipitation and snowmelt collect in small basins at low points in the Duck Creek, Willow Creek, and Brown Springs Creek drainages. Surface runoff is limited, and surface flow is ephemeral as a result.

Mining activities may impact ephemeral drainages as a result of road construction and travel and in the course of wellfield construction and operations. To the extent possible, existing travel roads would be utilized when traveling within the Reynolds Ranch area; however, PRI has stated that it would need to construct new roads through the area (PRI, 2005a). In instances where ephemeral drainages may be impacted by mining operations, whether by road or wellfield operations, PRI would take appropriate protection measures to minimize impact to the drainage, including prevention of erosion. These measures could include: contouring and re-vegetation to stabilize soils; placement of hay bales, engineered sedimentation breaks and traps, and water contour bars; and the use of diversion ditches, engineered culverts, and energy dissipaters to prevent excessive erosion and to control runoff.

When designing and constructing new roads, PRI would consider weather, elevation contours, land rights, and drainages. When constructing new roads, PRI would make efforts to cross ephemeral drainages or channels at right angles to enhance erosion protection measures. However, as it may not always be feasible or warranted to construct roads or crossings at right angles or along elevation contours, PRI would consider and implement erosion measures appropriate for the situation (PRI, 2005a).

In steep grade areas, in addition to the previously noted erosion protection measures, the disturbed areas would be re-seeded as soon as possible after construction is completed. PRI would begin seeding, weather permitting, at the appropriate time for optimum growth, whether the next spring or fall planting.

In areas where wells may be constructed in ephemeral drainage areas, impacts would be minimized through the use of necessary erosion protection structures including but not limited to: placement of hay bales; construction of water contour bars; installing engineered culverts; flow diversion structures; grading and contouring; application of rip rap; and designated traffic routes. Traffic within the drainage bottoms would be limited to work activities necessary to construct and service the wells. Wells that are constructed in significant drainages where runoff has a likely potential to impact the wellhead would have added wellhead protection. This protection would vary depending on the drainage and its potential for runoff. Protection measures may include barriers surrounding the wellhead, protective steel casing, cement blocks or other means to protect the wellhead from damage that may be caused by runoff (PRI, 2005a).

The physical presence of the surface facilities (*e.g.*, wellfields and header houses, the proposed satellite IX building) are not expected to significantly change peak surface water flows because of the relatively flat topography of the drainages at the sites, the low regional precipitation, the absorptive capacity of the soils, and the small area of disturbance relative to the large drainage area within and adjacent to the Reynolds Ranch area. In areas where these structures may affect surface water drainage patterns, PRI would use diversion ditches and engineered culverts to prevent excessive erosion and control runoff. In areas where runoff is concentrated, PRI would utilize energy dissipaters to slow the flow of runoff to minimize erosion and sediment loading in the runoff (PRI, 2005a).

5.4.2 Ground Water Impacts

Ground water quality

While it is common to dramatically degrade the water quality within the mineralized zone during uranium recovery activities, this impact is localized and temporary (*i.e.*, extending over the life of mining operations). Following mining, PRI is required to restore the affected ground water to its pre-mining quality or if approved, to its pre-mining class-of-use. PRI submits the results of its restoration activities to the NRC and the WDEQ for final approval, prior to the termination of such activities.

Ground water restoration activities at the SR-HUP site have been approved previously for the R&D operations and for the A-Wellfield during commercial operations. In August 1987, the NRC amended the R&D license to confirm successful restoration of the Q-sand project. Although one well in the field exhibited uranium and nitrate levels above the target restoration goals, the wellfield averages on a whole were below the targets. The approved restoration criteria for the R&D license was based upon returning the affected ground water to a category of use standard rather than to the average plus range of the baseline values. The results of the Q-sand project restoration is provided in Table 2.

Table 2. Baseline ground-water conditions, aquifer restoration goals, and actual final restoration values approved by NRC for the Q-Sand pilot well field (from Sequoyah Fuels Corporation, 1988. All values in mg/l, unless specified otherwise. n/a - not applicable nd - non-detectible)

Parameter	Range	Mean	Restoration Goal	Actual Restoration
Arsenic	0.001-.0013	0.004	0.05	0.008
Boron	0.002 - 0.70	0.15	0.54	0.14
Calcium	24 - 171	72	120	78
Iron	0 .01 - 0.27	0.025	0.3	0.24
Magnesium	3 - 22	16	0.092	0.06

Parameter	Range	Mean	Restoration Goal	Actual Restoration
Manganese	0.01 - 0.077	0.023	n/a	0.1
Selenium	0.001 - 0.024	0.004	0.029	0.003
Uranium	0.001 - 3.1	0.28	3.7	1.45
Chloride	4 - 65	18	250	15
Bicarbonate (HCO_3)	129 - 245	199	294	254
Carbonate (CO_3)	nd - 75	18	15	nd
Nitrate	0.1 - 1.0	0.4	n/a	0.13
Potassium	7 - 34	12	23	8
Sodium	19 - 87	28	41	38
Sulfate	100 - 200	124	250	128
TDS	155 - 673	388	571	443
Specific Conductivity (μmhos/cm)	518 - 689	582	827	642
pH (standard units)	7.5 - 9.4	8.0	6.5 - 8.6	7.0
Radium-226 (pCi/l)	6 - 1132	340	923	477
Thorium-230 (pCi/l)	0.027 - 4.65	1.03	5.62	3.4

On June 29, 2004, the NRC concurred with the State of Wyoming, Department of Environmental Quality's (WDEQ's) determination that the A-wellfield had been restored in accordance with the applicable regulatory requirements (NRC, 2004). PRI had pumped more than 15 pore volumes of water through the wellfield using ground water sweep, reverse osmosis, and reductant recirculation, with the result that the restoration parameters had reached baseline or had become asymptotic. Not all of the parameters were returned to baseline conditions, but the ground water quality was consistent with the pre-mining class of use standard (*i.e.,* Class IV(A), suitable for industry due to elevated background concentrations of radium). The WDEQ determined, and the NRC concurred, that PRI had employed "Best Practicable Technology" in its restoration efforts for the A-wellfield. In addition, the NRC endorsed the WDEQ's decision to require PRI to conduct long-term monitoring of the A-wellfield to assure that the "natural attenuation" model proposed by PRI was validated.

PRI also would withdraw millions of gallons of water from the subsurface during ISL mining operations at the Reynolds Ranch area. If the satellite facility planned for Reynolds Ranch were assumed to operate at its peak flow of 4500 gpm, over the entirety of a 15-year period of operations, at a nominal 1% overproduction (*i.e.*, “bleed”), approximately 4450 gpm of the 4500 gpm would be returned to the wellfields to be reinjected, with the remaining approximately 50 gpm used in the ion exchange columns or discharged to an authorized deep disposal well following treatment (PRI, 2005a; Figure 4-1). The amount of water used in the IX columns or discharged to an authorized deep disposal well under these assumptions equates to approximately 1200 acre-feet of water over the course of a 15-year period.

Excursions

Migration of lixiviant-fortified ground water beyond the expected confines (horizontal or vertical) of a wellfield could occur. These “excursions” could occur due to a variety of circumstances, including: (1) an improper balance between injection and recovery rates; (2) undetected high permeability strata or geologic faults; (3) improperly abandoned exploration drill holes; (4) discontinuity and unsuitability of the confining units that allow movement of the lixiviant out of the ore zone; (5) poor well integrity; or (6) hydrofracturing of the ore zone or surrounding units. Appropriate characterization of the geologic and hydrogeologic setting and adequate construction, testing, and abandonment of wells would address the majority of these circumstances. These aspects of PRI’s operations are discussed in section 2 of this EA.

PRI would control the potential for horizontal excursions (*i.e.*, within the production zone aquifer) primarily through wellfield bleed (*i.e.*, minor wellfield overproduction relative to injection) (PRI, 2005a). Should overproduction fail, lixiviant-fortified ground water could move to a monitor well. If such an event were to take place, the excursion would be reversed typically by increasing the overproduction rate, thereby drawing the lixiviant back into the extraction zone. PRI’s program for excursion monitoring is addressed in section 6 of this EA.

Since 2001, PRI and the previous site operator, RAMC, have reported only one excursion. PRI reported this horizontal excursion in September 2004, which occurred in Mine Unit 4 in the SR-HUP permit area, after PRI determined that the upper control limits (UCLs) for chloride and conductivity were exceeded at a single monitor well. PRI increased sampling and commenced corrective actions to address the situation. In a September 23, 2004, letter to NRC, PRI reported that its corrective actions were successful in bringing the chloride and conductivity levels back below their respective UCLs (PRI, 2004).

Impacts to Local Wells

PRI’s operations in the Reynolds Ranch area are not expected to affect local stock and domestic wells as these wells are completed in stratigraphic horizons above the zones planned for ISL mining. Pre-mining aquifer testing by PRI would ensure that confining layers are present to restrict the vertical movement of ISL leaching solutions and to restrict the influence of pumping in the deeper mining zones on water levels in the stratigraphically higher non-mining aquifers.

As discussed in section 4.5.3 of this EA, there is only one well in the Reynolds Ranch area and contiguous township/range sections that is used for domestic purposes. This well, the Mason House well near the planned location of the satellite building, is 118 ft deep, a depth stratigraphically above the zones planned for ISL mining. PRI is not planning to mine at that depth since there is no uranium mineralization of economic significance in that zone. Since the Mason House well is vertically separated from the ore zones by at least 300 to 400 ft (91 to

122 m) of alternating layers of shale, siltstone, and sandstone, it is not likely that the well will be affected by mining-related activities. In addition, during operations, PRI monitors aquifers overlying the mining horizon to detect any problems prior to any shallower non-mining wells being adversely affected.

The cumulative impacts associated with the recovery of coal bed methane gas is addressed under section 5.10 of this EA.

5.5 Impacts to Ecological Systems

Impacts to soils and vegetation from PRI's operations at the Reynolds Ranch area would result primarily from well drilling activities and from the construction of wellfield houses, pipelines, access roads, and the planned satellite facility. These impacts would be confined for the most part to the satellite facility site and the wellfields, and would involve the clearing of top soils, trench digging and refilling, ground clearing and surface preparation for the roads and the satellite facility and associated structures. Areas affected by well drilling activities, pipeline laying, and access road construction would be re-seeded as soon as possible following the activities. Final reclamation and re-seeding of the wellfields and satellite facility site would occur after the cessation of mining operations.

Soils and vegetation also would be affected by spills of injection and production fluids during operations. As discussed in section 5.2 of this EA, since 2001, 24 spills have occurred within the SR-HUP permit area. Impacts from spills in the Reynolds Ranch area would be limited in area as PRI would take immediate actions to stop the leak and to contain and recover as much as possible of the spilled fluid. PRI's spill documentation, as required under its NRC license, would be used during decommissioning of the affected wellfield to identify contaminated soils requiring offsite disposal at a licensed facility. As part of PRI's decommissioning activities, affected areas would be re-seeded using a WDEQ-approved seed mixture.

5.6 Impacts to Wildlife

The NRC previously evaluated impacts to local wildlife from ISL mining operations at the SR-HUP permit area and determined that such impacts would not be significant (USNRC, 2001).

As discussed in section 4.7 of this EA, no federally-listed endangered or threatened species or critical species habitat are found within the Reynolds Ranch area. The sighting of a bald eagle in 1998 appears to be an isolated event; annual surveys of raptor nests have not identified any bald eagle nests in the site vicinity. No effect on endangered or threatened species or critical habitat is expected from the proposed ISL mining operations at Reynolds Ranch.

As discussed in Section 4.6, PRI conducts an annual raptor survey, in accordance with WDEQ-LQD requirements, to identify any new nests, to assess whether known nests are being used, and to protect against unforeseen conditions, such as the construction of a new nest in an area where ISL operations may take place (PRI, 2005a). The survey covers all areas of planned activity for the life of the project and a one-mile area around the activity. In the event that it would be necessary for PRI to disturb a raptor nest, PRI will obtain a permit for a mitigation plan from the U.S. Fish and Wildlife Service.

5.7 Transportation Impacts

Operation of the planned satellite facility for the Reynolds Ranch area would involve the transportation of uranium-charged resin beads from the satellite facility to the Smith Ranch central processing plant (CPP), and the transportation of the stripped resin beads back to the satellite facility. This would involve approximately two to four round-trip shipments a week between the satellite facility and the CPP, a distance of about 14 miles (22.5 km) round-trip along Ross Road. The addition of these trucks would not significantly increase the current traffic load on Ross Road.

It is not expected that the additional traffic would result an increased accident rate for the stretch of Ross Road between the Reynolds Ranch satellite facility and the Smith Ranch CPP. However, in the case of an accident involving a shipment of uranium-loaded resin, the environmental impacts would be expected to be small. Overturning of a tanker truck carrying the loaded resin could result in the release of some resin and residual water. The resin beads, which would be deposited on the ground a short distance from the truck, would retain the uranium, absent a strong brine to strip the resin. PRI would collect the resin and any contaminated soils and dispose of them appropriately (*e.g.*, in a licensed facility). All disturbed areas would then be reclaimed in accordance with the applicable NRC and State regulations. Airborne release of uranium would not occur since the uranium would remain fixed to the beads.

5.8 Radiological Impacts

5.8.1 <u>Introduction</u>

The primary source of radiological impact to the environment from site operations is gaseous radon-222, which is released from the satellite facility and from the wellfields. This section provides the radiological impacts to the environment from ISL mining operations at the Reynolds Ranch area.

For final yellowcake processing at the Smith Ranch facility, PRI employs a vacuum dryer that collects in a liquid condenser the dust and gas generated from drying (PRI, 2005a). As a result, no particulates will be released to the environment.

5.8.2 <u>Occupational Doses</u>

PRI is required to meet the annual occupational dose limits in 10 CFR Part 20 (10 CFR 20.1201). PRI has established written Standard Operating Procedures (SOPs) for all operational activities involving radioactive materials that are handled, processed, stored, or transported by its employees. PRI also has established procedures for in-plant and environmental monitoring, bioassay analysis, and instrument calibration for activities involving radiation safety (PRI, 2005a). All permanent employees receive new-hire training in topics such as the basic principles of radiation safety, radiation safety procedures, responses to emergencies or accident involving radioactive materials. In addition, these employees also attend quarterly safety meetings and receive annual refresher training that includes a review of any new radiation safety regulations, site safety experience, and radiation exposure trends (PRI, 2005a).

PRI would conduct quarterly gamma surveys at specified locations (*e.g.*, the IX columns) throughout the planned satellite facility to assure that areas requiring posting as "Radiation

Areas" are identified, posed and monitored to assess external radiation conditions. PRI also would conduct routine visual and instrument surveys of the planned satellite facility to determine any obvious signs of contamination and the total alpha contamination (PRI, 2005a).

5.8.3 Doses to the General Public

PRI modeled the effects of radon gas release from the wellfields and satellite facility proposed for the Reynolds Ranch area (PRI, 2005a). PRI used MILDOS-Area, a dispersion model approved by the NRC, to estimate the potential radiological impacts from air emissions of radon-222. The results of the modeling can be compared with the effluent concentration limits and the dose limits for the general public in 10 CFR Part 20.

In looking at its anticipated mining plan for 15 years of operations at Reynolds Ranch, PRI noted that the maximum release of radon-222 (and therefore, the highest expected doses to the public) would occur in the eighth year of operations (PRI, 2005a). In that year, PRI plans to have one wellfield in the pre-mining drilling phase, four wellfields in production, and the remaining three wellfields in restoration. Radon-222 releases and the related doses to the public would be less in the other years of operation, because fewer wellfields would be in the drilling, production, and/or restoration phases. PRI used the purge water rate for restoration, rather than that for production, to maximize the calculated radon-222 releases (PRI, 2005a).

As discussed in section 4.2 of this EA, the major population areas within 50 miles (80 km) of the Reynolds Ranch satellite facility are the towns of Glenrock (population of approximately 2,200; located about 17 miles (27 km) SSW), Douglas (population of approximately 5,300; located about 23 miles (37 km) SE), and Casper (population of approximately 49,500; located about 36 miles (59.6 km) WSW). The population within 50 miles (80 km) of the Reynolds Ranch area is approximately 76,000 persons.

The highest annual population dose computed by MILDOS-Area (Year 8 of planned operations at Reynolds Ranch) was a dose of 2.0 person-rem/yr to persons living within 50 miles (80 km) of the site.

PRI also assessed potential doses to a series of nearby receptors, which included nearby dwellings and ranches, both occupied and unoccupied. The nearest residence, the Mason House, which is only occasionally occupied during the summer months, is located approximately 0.34 miles (0.55 km) SW of the planned satellite facility. The nearest downwind resident is located at the Reynolds Ranch, 5.6 miles (9 km) NNE of the planned satellite facility.

The highest radon-222 concentration was 1.1E-03 working level at a distance of 0.9 mi (1.5 km) ENE of the proposed satellite facility. This concentration is 4% of the 100 mrem/yr effluent concentration limit in 10 CFR Part 20. The total annual effective dose was 27 mrem/yr at the unoccupied Mason House, and 4 mrem/yr at the Reynolds Ranch. Both of these dose values are well below the 10 CFR Part 20 limit of 100 mrem/yr to members of the public. All of the concentrations and doses presented here are from the mining operations anticipated during Year 8 at the Reynolds Ranch area.

5.9 Waste Disposal Impacts

Under NRC regulations (10 CFR Part 40, Appendix A, Criterion 2), to avoid the proliferation of waste disposal sites, byproduct material from uranium ISL operations must be disposed at existing uranium mill tailings disposal sites, unless such offsite disposal is shown to be impracticable or the benefits of onsite disposal clearly outweigh those of reducing the number of waste disposal sites. PRI is required under license condition 9.6 of SUA-1548 to dispose of 11e.(2) byproduct materials generated by project operations at a licensed byproduct waste disposal site. Currently, PRI disposes of its radioactively-contaminated wastes at Pathfinder Mine Corp.'s Shirley Basin uranium mill site in eastern Wyoming.

To ensure that it retains control of all contaminated wastes while such wastes are onsite, PRI is required by license condition 10.1.7 of SUA-1548 to maintain an area within the restricted area boundary for the storage of contaminated materials prior to their disposal. PRI has specially designated and placarded containers at the SR-HUP central processing plant and at each of the satellite facilities for the storage of such materials. These containers are set off from containers for non-contaminated materials, and a re-attachable tarp is used as a cover to prevent the inadvertent dispersal of the stored wastes.

PRI also is required by license condition 10.1.7 to dispose of all contaminated wastes at a licensed radioactive waste disposal site. PRI will survey all equipment, buildings, and other items for radioactive contamination, prior to their release from the site for unrestricted use (PRI, 2005a). Finally, transportation of all material to the byproduct disposal facility would be handled in accordance with U.S. Department of Transportation and NRC regulations (49 CFR 173.389 and 10 CFR Part 71, respectively).

5.10 Cumulative Impacts

The Duck Creek Project to extract methane gas from coal beds in the Fort Union Formation (the same formation that PRI will be mining for uranium) is located approximately nine miles northeast of the Reynolds Ranch area. Additional drilling for coal bed methane gas is occurring to the west of Reynolds Ranch area and to the west of the Duck Creek Project. Given the distance between these drilling projects and the Reynolds Ranch area and that the Dry Fork Cheyenne River is located between the Duck Creek and Reynolds Ranch areas, drawdown from current methane gas drilling should not have an effect on the Reynolds Ranch project. However, depending on the success of coal bed methane gas extraction around the Reynolds Ranch area, there is a potential for such activity to occur closer to the SR-HUP permit area. Drawdown in the Fort Union Formation, and possibly regionally, may need to be considered at that time. It is likely that PRI would keep abreast of the local methane gas drilling and be in contact with the appropriate Federal and State agencies involved with permitting such drilling.

As discussed in section 3.2 of this EA, open pit and underground mining for uranium has occurred in the past, just to the west of PRI's Highland operations. Reclamation activities from those activities have been completed, and no further impacts from such activities are expected.

6.0 MONITORING AND MITIGATION

PRI would monitor all effluent streams and the various environmental pathways that could be affected (*e.g.*, air, surface water, and ground water) by ISL mining operations at the Reynolds Ranch area. PRI is required to submit the results of this monitoring, along with injection rates, recovery rates, and injection manifold pressures, to the NRC on a semiannual basis, in accordance with 10 CFR 40.65.

6.1 Monitoring of Wellfield Flow and Pressures

PRI would monitor injection well and production well flow rates and pressures so that injection and production can be balanced for each pattern and the entire wellfield (PRI, 2005a). The flow rate of each production and injection well would be determined by monitoring individual flow meters in each wellfield header house. PRI would determine production well flow rates on a daily basis and injection well flow rates at least every three days. Additionally, through operating experience and the fact that injection pressures remain relatively constant, PRI has found that monitoring injection well flow rates at least every three days has been more than adequate to ensure that wellfield patterns are adequately balanced (PRI, 2005a).

On a daily basis, PRI would determine the pressure of each production well and the production trunk line in each wellfield header house. The pressure of the injection trunk line would also be determined daily in each wellfield header house. The surface injection pressures would not exceed the maximum surface pressures posted in each header house (PRI, 2005a).

PRI would maintain on-site the data records for these monitoring activities.

6.2 Pipeline Monitoring

PRI would monitor pressure and flow indicators on the main pipelines to and from the planned satellite facility to ensure that the pressures and flows are maintained within the safe working limits of the pipeline (PRI, 2005a).

6.3 Ground Water Monitoring

Ground water is monitored prior to, during, and after mining. Prior to well-field installation, ground water data will be collected to determine water quality and define aquifer properties. This data is built upon during wellfield development when mine unit-specific data is collected to establish upper control limits for operational monitoring and post-mining criteria for restoration. During and following mining and restoration, additional ground-water monitoring is performed to verify the effect, if any, on the aquifer. Pre-mining sampling and restoration stability monitoring are addressed in section 2.3.3 of this EA.

6.3.1 <u>Operational Water Quality Monitoring</u>

As part of wellfield development in the Reynolds Ranch area, PRI would install monitor wells within the production zone aquifer outside and around the pattern area (i.e., as a monitor well ring) and also within overlying and underlying aquifers to ensure that the lixiviant and production fluids do not leave the defined production zone. Monitor wells in the production zone aquifer would encircle the various mining units with wells completed in the mineralized formations at a distance of 250 to 600 feet (76 to 183 m) from the production patterns and between 300 to 800 feet (91 to 244 m) from each other. Monitor wells for the overlying and underlying aquifers would be installed at a density of one for each four acres of wellfield area (PRI, 2005a). The distance between these monitor wells would not exceed 1000 feet (305 m), and all such wells would be installed within the confines of the wellfield area.

Under license condition 11.5 of SUA-1548, PRI is required to sample all monitor wells twice per month. In its application (PRI, 2005a), PRI states that the samples would be taken no less than 10 days apart. The samples are analyzed for the excursion indicators (chloride, conductivity, and alkalinity) and the results compared to the upper control limits (UCLs) for the sampled well. If two excursion indicators (*i.e.*, two UCLs) for the monitor well are exceeded, PRI is required to take a confirmatory sample within 24 hours. If the confirmatory sample indicates that UCLs have been exceeded, then the well in question is placed on excursion status, and the sampling frequency is increased to weekly in the affected well. PRI would sample at this increased frequency until it controls the excursion (*i.e.*, returns the concentrations of the excursion parameters to below the respective UCLs).

If corrective actions are not effective within 60 days since the first excursion verification, PRI has committed to suspending injection of lixiviant into the mining zone adjacent to the excursion until the problem is resolved (PRI, 2005a).

PRI's Radiation Safety Officer must maintain quality assurance (QA) programs. All QA programs would be conducted according to the Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment." Standard QA procedures would be maintained throughout the project life.

6.4 Environmental Monitoring

PRI would conduct a radiological monitoring program in accordance with the requirements of its application and NRC source materials license. An outline of PRI's environmental monitoring program is discussed in Section 5 of its amendment application (PRI, 2005a). PRI's program includes monitoring surface water, soils and sediments, direct radiation, radon, and ground water at multiple sites. PRI is required under license conditions 11.6 and 12.2 of SUA-1548 to monitor the various environs and to provide in an annual report to the NRC a copy of one of the semiannual effluent and environmental monitoring reports required under 10 CFR 40.65.

As discussed in sections 4.6 and 5.6 of this EA, PRI also conducts annual raptor surveys with the primary intent of protecting against unforeseen conditions, such as the construction of a new nest in an area where operations may take place.

7.0 AGENCIES AND PERSONS CONSULTED

7.1 U.S. Fish and Wildlife Service, Mountain-Prairie Region

By letter dated August 29, 2005, the NRC staff requested information regarding endangered or threatened species or critical habitat in the Reynolds Ranch area from the U.S. Fish and Wildlife Service, Mountain-Prairie Region (USFWS/MPR) (USNRC, 2005d). By return letter dated September 28, 2005, the USFWS/MPR provided a list of endangered and threatened species, as well as comments on migratory birds and wetlands and associated riparian areas (USFWS, 2005). In its letter, the USFWS/MPR identified the black-footed ferret as an endangered species and the bald eagle and Ute ladies-tresses (*Spiranthes diluvialis*) as threatened species that may be present in the project area.

Based on the NRC staff's review, there are no endangered or threatened species, either plant or animal, nor is there critical habitat, in the Reynolds Ranch area. There is not expected to be an effect on any endangered or threatened species or critical habitat.

7.2 U.S. Bureau of Land Management

Federal land occurs within the proposed mining area and, consequently, involves U.S. Bureau of Land Management (USBLM) jurisdiction as it pertains to federal surface and minerals and to split estate lands when there is no surface agreement with the land owner in the permit area. USBLM concerns are limited to (1) undue and unnecessary degradation of this land; (2) threatened and endangered species under the Endangered Species Act of 1973, as amended by public law 97-304 of 1982; and (3) cultural and historic resources that qualify for the National Historic Register of Historic Places as outlined under 36 CFR Part 800 and the implementing regulations for Section 106 of the National Historic Preservation Act of 1966.

By letter dated April 10, 2006, the NRC staff provided a draft copy of this EA to the USBLM for its review and comment (USNRC, 2006b). By electronic mail on April 24, 2006 (USBLM, 2006a, 2006b) and July 5, 2006 (USBLM, 2006c), the USBLM provided comments on the draft EA.

In its comments, the USBLM focused on land use and hydrology issues. With regards to land use, the USBLM requested (1) clarification on the total acreage to be disturbed by the proposed activities; (2) clarification on the extent of the proposed activities taking place on public lands; (3) an expanded discussion of the impacts of process fluid spills; and (4) a description of the recommended seed mixture to be used during reclamation. The NRC staff has revised the EA to address the USBLM's land use issues.

In its hydrology comments, the USBLM requested that (1) a list of water wells in the area be provided; (2) "best management practices" be referenced (*e.g.*, for road construction, surface disturbance); (3) cumulative impacts be addressed with respect to previous mining operations and to current and foreseeable drilling for coal bed methane gas; and (4) the potential drawdown impacts from the proposed ISL mining activities on local water wells be addressed. The NRC staff has revised the EA to address these hydrology issues.

The USBLM further questioned the restoration goals for arsenic, iron, selenium, chloride, and uranium, referencing Table 2 in section 5.4.2. As discussed in section 2.3.3 of the EA, the goal of ground water restoration is to restore the affected ground water to its pre-mining quality or if approved, to its pre-mining class-of-use. The restoration values provided in Table 2 were for the Q-sand R&D project and reflected returning the affected ground water to a category of use standard rather than to the pre-mining average plus range of the baseline value. No modification to the EA was deemed necessary on this issue.

7.3 Wyoming State Historic Preservation Office

By letter dated August 11, 2005, the NRC staff requested information from the Wyoming State Historic Preservation Office (WSHPO) regarding cultural and historic properties that may be affected the proposed addition of the Reynolds Ranch area to the SR-HUP operational area (USNRC, 2005c). By return letter dated August 24, 2005, the WSHPO provided its concurrence that no historic properties would be adversely affected by the proposed action (WSHPO, 2005).

7.4 State of Wyoming, Department of Environmental Quality (WDEQ)

The WDEQ administers and implements the State rules and regulations concerning protection of the environment while supporting responsible stewardship of the State's resources. WDEQ has granted PRI a mining permit, a National Pollutant Discharge Elimination System (NPDES) permit, and a Surface Water Protection Plan for PRI's commercial operations at the SR-HUP. Prior to ISL operations in the Reynolds Ranch area, PRI would need to have these permits and plan amended to include the Reynolds Ranch area. PRI also has permits from the WDEQ for its SR-HUP deep disposal wells and will need a permit for the deep disposal well planned for the Reynolds Ranch area.

By letter dated April 10, 2006, the NRC staff provided a draft copy of this EA to the WDEQ for its review and comment (USNRC, 2006c). By phone conversation on August 15, 2006, the WDEQ provided its comments on the draft EA. The WDEQ requested clarification of the post-mining ground water restoration standards and of the ground water transfer restoration process and provided some editorial comments. The NRC staff has revised the EA to address the WDEQ's comments.

7.5 State of Wyoming Department of Transportation

On November 22, 2005, the NRC staff contacted the State of Wyoming Department of Transportation (WYDOT) to obtain information on traffic flow and accidents along County 31, Ross Road. The SR-HUP facility and the Reynolds Ranch area are accessed primarily via Ross Road. By electronic mail, on November 22, 2005, Mr. Sherman Wiseman of the WYDOT provided tables of traffic counts taken along Ross Road in 1998 and 2004 (WYDOT, 2005a). The following day, also by electronic mail and in response to questions from the NRC staff (USNRC, 2005g), Mr. Wiseman provided clarifying remarks about the information in the traffic count tables (WYDOT, 2005b).

By letter dated November 25, 2005, Mr. Thomas Carpenter of the WYDOT provided accident data and analyses for the portion of Ross Road that passes the SR-HUP facility and the Reynolds Ranch area (WYDOT, 2005c). The data and analyses covered the period from 2000 to 2005. This information was provided in response to an NRC staff telephone request made on November 22, 2005 (USNRC, 2005f).

8.0 CONCLUSION

The NRC staff concludes that PRI's proposed action to amend the SR-HUP permit boundary to include the Reynolds Ranch area and to conduct in-situ leach uranium mining in that area would not result in a significant impact to the environment. Impacts to ground water resources would be small, in that following the completion of mining operations in a wellfield, PRI would restore the ground water quality in the mine unit to its pre-mining conditions, or alternately, if approved, to its pre-mining class-of-use standard. Radiological doses to workers and to the general public would be below the regulatory limits in 10 CFR Part 20. PRI would dispose of any radioactive wastes generated by its operations in the Reynolds Ranch area via approved methods (*i.e.*, in a deep disposal well or at a licensed disposal facility).

Impacts to land use would be temporary and limited, because out of the Reynolds Ranch area's 8704 acres (3521 ha), only 325 acres (131 ha) would be fenced off to exclude livestock during mining operations. Following reclamation, the land would be returned to its pre-mining grazing use.

The NRC has reviewed the environmental impacts of the proposed action in accordance with the requirements of 10 CFR Part 51. The NRC staff has determined that the addition of the Reynolds Ranch area to the SR-HUP operational area for the purpose of constructing and operating in-situ leach uranium mining units and supporting infrastructure, would not significantly affect the quality of the human environment. Therefore, an environmental impact statement is not warranted for the proposed action, and pursuant to 10 CFR 51.31, a Finding of No Significant Impact (FONSI) is appropriate.

The documents related to this proposed action are available for public inspection and copying at NRC's Public Document Room, One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852. Additionally, most of these documents are available for public review through the NRC's electronic reading room, at: http://www.nrc.gov/reading-rm/adams.html.

9.0 LIST OF PREPARERS

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10.0 LIST OF REFERENCES

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APPENDIX A

FIGURES

Figure A-1 Reynolds Ranch Area
(approximately 56 km NE of Casper, Wyoming)

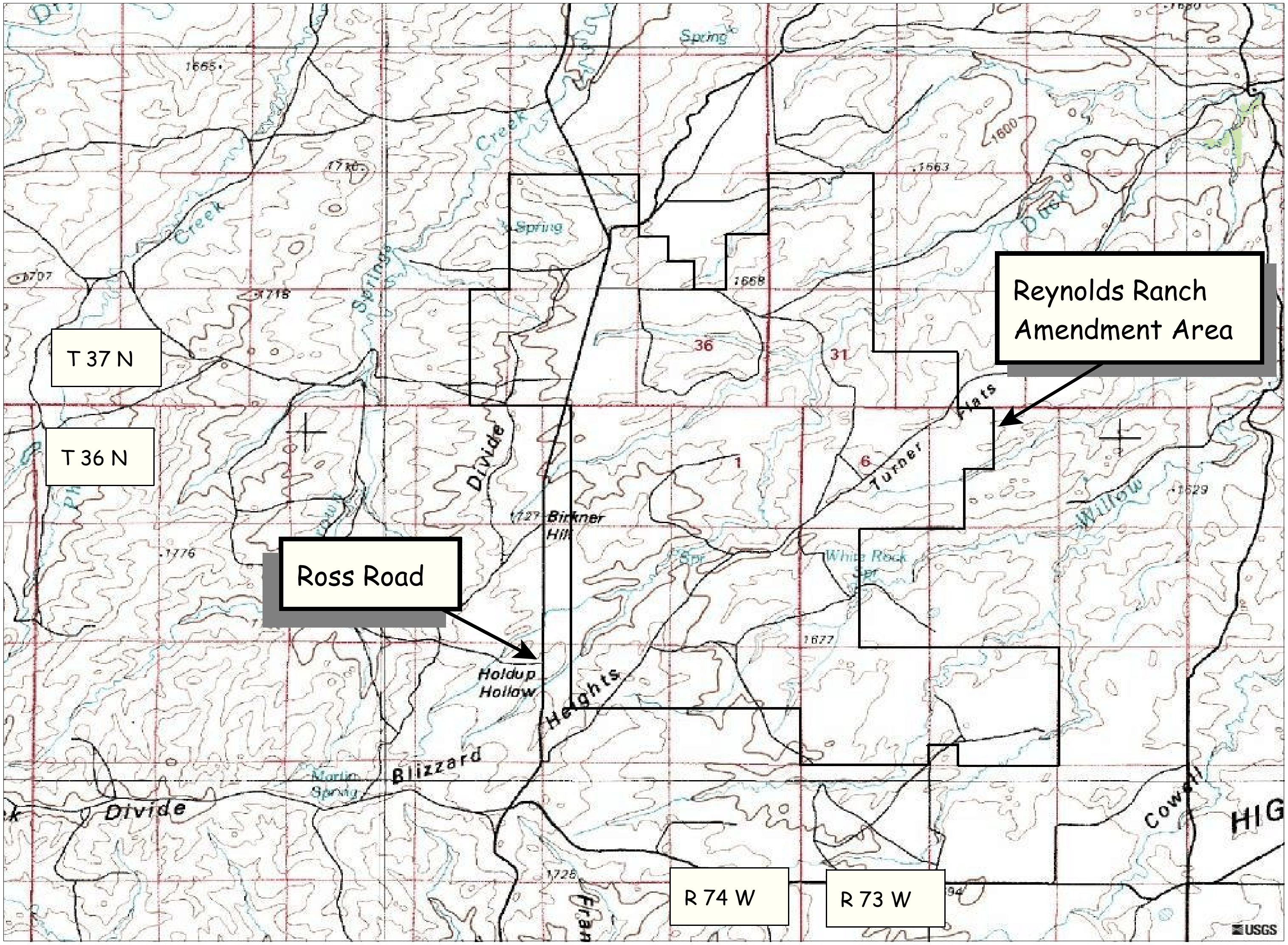
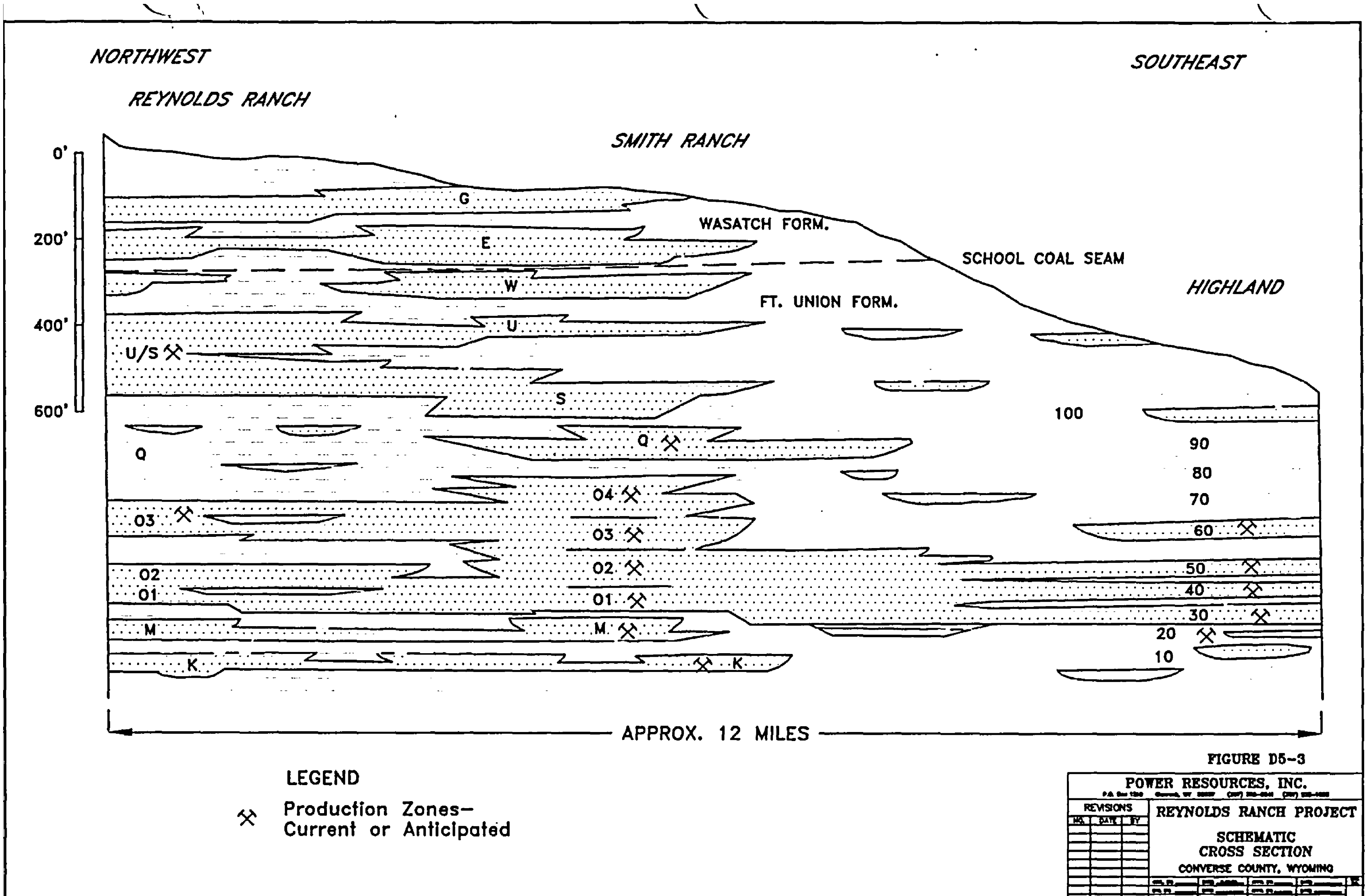


Figure A-2 Reynolds Ranch Project - Schematic Cross Section (PRI, 2005a)



APPENDIX B

Domestic, Stock, and Non-ISL Monitoring Wells in the Reynolds Ranch Area

Domestic, Stock, and Non-ISL Monitoring Wells in the Reynolds Ranch Area

Appropriation	Section	Permit Uses	Permit Facility Name	Permit Applicant	Static Well Depth / Well Depth
			T 36 N R 73 W		
P9155P	3	STOCK	REYNOLDS #3	DUCK CREEK RANCHES INC.	42 / 180
P163616W	5	STOCK	MANGY COYOTE S5-1	DUCK CREEK RANCHES INC.	6 / 6
P56681W	9	MONITORING	MWR #9	ALTA GOLD CO.**WALT RENOLDS	401 / 640
P153488W	17	STOCK	DUCK CREEK #17-2	DUCK CREEK RANCHES INC.	
P163615W	17	STOCK	DUCK CREEK S17-1	DUCK CREEK RANCHES INC.	7 / 7
P77858W	17	STOCK	DUCK CREEK #17	DUCK CREEK RANCHES INC.	102 / 255
P27911W	19	STOCK	ADAMS #1	WILLIAM R. & ALICE L. VOLLMAN	100 / 300
P306S	19	STOCK	Domsalla #1 Stock Reservoir	F. W. DOMSALLA	
P9161P	20	STOCK	REYNOLDS #20	DUCK CREEK RANCHES INC.	26 / 47
P160753W	21	STOCK	REYNOLDS #21-3	DUCK CREEK RANCHES INC.	
P2498W	21	INDUSTRIAL,DOMESTIC	HIGHLAND #8	HUMBLE OIL & REFINING COMPANY	
P6986P	21	STOCK	VOLLMAN #4	VOLLMAN WILLIAM R.	127 / 200
			T 36 N R 74 W		
P9154P	1	STOCK	REYNOLDS #1	DUCK CREEK RANCHES INC.	4 / 11
CR1/269A	12	STOCK	Silver Spoon Reservoir	Joseph W. Reynolds	
P163613W	12	STOCK	SILVER SPOON SPRING S12-1	DUCK CREEK RANCHES INC.	
P5393R	12	STOCK	Silver Spoon Reservoir	JOE REYNOLDS	
P9158P	13	STOCK	REYNOLDS #13	DUCK CREEK RANCHES INC.	150 / 195
P88428W	15	STOCK	EAST NORTH PASTURE #63	SMITH SHEEP CO.	-7 / 500
P5006P	23	STOCK	SMITH #33	SMITH SHEEP CO.	60 / 175
P5007P	24	STOCK	SMITH #34	SMITH SHEEP CO.	110 / 145

Domestic, Stock, and Non-ISL Monitoring Wells in the Reynolds Ranch Area (continued)

Appropriation	Section	Permit Uses	Permit Facility Name	Permit Applicant	Static Well Depth / Well Depth
			T 37 N R 73 W		
P19965P	19	STOCK	HORNBUCKLE WELL #4	HORNBUCKLE RANCH	90 / 130
23/4/199W	30				
P94859W	30	STOCK	DUCK CREEK #30	DUCK CREEK RANCHES INC.	
P28416W	31	STOCK	DUCK CREEK #1	DUCK CREEK RANCHES INC.	40 / 440
P96420W	31	STOCK	DUCK CREEK #31	DUCK CREEK RANCHES INC.	125 /170
C72/269A	32	IRRIGATION	Shed Ditch No. 1	Roy A. Johnson, Ruth L. Johnson, and Grace O. Johnson	
P9167P	32	STOCK	REYNOLDS #32	DUCK CREEK RANCHES INC.	130 / 175
P94860W	32	STOCK	DUCK CREEK #32	DUCK CREEK RANCHES INC.	240 / 320
Appropriation	**Section**	**Permit Uses**	**Permit Facility Name**	**Permit Applicant**	**Static Well Depth / Well Depth**
			T 37 N R 74 W		
P7719P	23	STOCK	HENRY #3	WILLIAM M. HENRY	23 / 235
P19971P	24	STOCK	HORNBUCKLE WELL #10	HORNBUCKLE RANCH	90 / 140
CR8/763A	33	STOCK	Brown Springs No. 1 Stock Reservoir	State Board of Land Commissioners and Hornbuckle Ranch	
P17330D	33	IRRIGATION	Judson No. 2 Ditch	CARL J. JUDSON	
P8097S	33	STOCK	Brown Springs No. 1 Stock Reservoir	HORNBUCKLE RANCH**WYO BOARD OF LAND COMMISSIONERS	
P8098S	33	STOCK	Brown Springs No. 2 Stock Reservoir	HORNBUCKLE RANCH**WYO BOARD OF LAND COMMISSIONERS	
P17314P	34	STOCK	MASON #2	WILLIAM H. MASON	120 / 255
P17313P	35	DOMESTIC	MASON #1	WILLIAM H. MASON	75 / 118

Domestic, Stock, and Non-ISL Monitoring Wells in the Reynolds Ranch Area (continued)					
Appropriation	**Section**	**Permit Uses**	**Permit Facility Name**	**Permit Applicant**	**Static Well Depth / Well Depth**
			T 37 N R 74 W (cont'd)		
P38165W	35	DOMESTIC,STOCK	MASON #3	WILLIAM H. MASON	180 / 310
P52446W	36	MONITORING	50 WYO OBSERVATION	AMERICAN NUCLEAR CORPORATION	335 / 834
P78281W	36	MONITORING	SMC1070S	WILLIAM F. HERBST FAMILY TRUST	-7 / 24
P9169P	36	STOCK	REYNOLDS #36 (DEEPENED)	GAME & FISH COMM., STATE OF WYOMING** DUCK CREEK RANCHES INC.	58 / 180