7.0 ENVIRONMENTAL EFFECTS

7.1 SITE PREPARATION AND CONSTRUCTION

The environmental impacts of site preparation and construction for the Nichols Ranch ISR Project will be minimal. Even though the project boundaries (permit boundaries) will encompass a total of approximately 3,370 acres, disturbance and impacts will be limited to an area of approximately 300 acres or less. Local soils and vegetation will be impacted during the construction of the processing facilities and during the lifetime operation of the project. Wellfield activities such as drilling of wells and installation of pipelines will result in temporary disturbance to the soils and vegetation in those areas that the activities are taking place. The impact by the wellfield activities and processing facilities is small as demonstrated by existing ISR operations in the Powder River Basin of Wyoming and the southern portion of Texas. Since the Nichols Ranch ISR Project is located in a remote part of Wyoming, on private land, no impacts to any public services or public activities will result from the operation.

Construction and site preparation of the processing facilities located at both the Nichols Ranch and Hank Units will be limited to an area of approximately 2-4 acres at each site. During the construction of the facilities, all topsoil will be removed and stockpiled in a designated area where it will remain for the life of the project. During reclamation of the processing facilities, the original topsoil will be replaced in its original location where it will then be re-seeded to return the area back into its original land use of livestock grazing and wildlife habitat.

Access roads to the wellfield and processing facilities will also result in surface impact to the local soils and vegetation. The impacts caused from the access roads will be for the life of the project. The land where the Nichols Ranch ISR Project is located on has specific road construction practices that will be implemented if access roads have to be constructed. The details for road construction can be found in Addendum 6A in Chapter 6.0 of this license application. When the access roads are no longer needed for the operation of the project, those access roads that the landowner does not want will be re-contoured, topsoiled, and re-seeded.

With the construction and site preparation activities of the access roads and processing facilities, livestock grazing and wildlife habitat will be excluded in these areas. An estimated 60-80 acres will be fenced off to grazing activities at any given time during the life of the operation. Because the areas that will be affected by the surface disturbance of the access roads and processing facilities will be reclaimed and restored to the pre-mining use, no long-term surface impacts will result from the project.

Surface disturbance associated with the drilling of wells and pipelines result in temporary disturbance of the soils and vegetation in the areas of these activities. The impact that results from these activities is minimal in that when an area is being drilled and pipelines constructed the disturbance results from the digging of mud pits or from the trenching of the pipeline. When the mud pits or trenches are excavated, the topsoil from the area of the mud pit or trench is removed and placed in a separate location. The subsoil is then removed and placed next to the excavation site. As soon as the mud pit is no longer needed or the trench has the pipeline in place, the subsoil is immediately put back into the excavation followed by the replacement of the topsoil. Re-seeding then follows as soon as possible. Depending on the time of year of the completion of construction and weather conditions re-seeding will take place in late spring or early fall.

The Nichols Ranch ISR Project will not result in any subsidence to the project area or surrounding areas. The proposed in situ recovery process does not remove any physical structures underground that would cause a void to occur and subside. The in situ process removes only the uranium mineral that is present on the surface of the host sandstone formation. The physical structure of the host sandstone is unaffected. Because the host sandstone formation is not affected subsidence will not result from the in situ process; therefore, no subsidence mitigation or control plans have been developed or included in this application.

7.2 EFFECTS OF OPERATION

The Nichols Ranch ISR Project is anticipated to minimally affect the areas in and adjacent to the project areas since the in situ recovery process will be used to recover the uranium. The in situ recovery process has demonstrated that its impacts to air, surface water, groundwater, land, land use, and ecological systems are minor and temporary as seen by the past and current in situ recovery operations that are located in the areas near the proposed project and in currently operating facilities in Wyoming, Nebraska, and Texas.

7.2.1 Surface Water Impacts

Surface water impacts that result from the Nichols Ranch ISR Project are considered to be nonexistent to minimal. Any impacts that might arise to surface water from the Nichols Ranch ISR Project will be temporary.

Surface water for the Nichols Ranch ISR Project is limited to four identified jurisdictional wetlands located on the Nichols Ranch Unit. These wetlands are in such locations that they will not be disturbed by the mining activities. In the event that any disturbance would occur in a jurisdictional wetland, consultation with the Corp of Engineers would be initiated to establish mitigation and control plans. The attached Appendix D10 provides more information regarding the wetlands.

The potential for erosion and potential movement of sediments into drainages may occur during construction and reclamation activities associated with processing facilities and wellfield. Berms and contouring when and where possible will be utilized to minimize potential erosion and sediment movement. Re-seeding with native seed mixture or cover crops will also occur upon completion and reclamation of the project area. Re-seeding of an area will take place during the appropriate growing seasons, either spring or fall, whichever comes first.

Surface water runoff should not be affected by the presence of any surface facilities including the wellfields and associated structures, access roads, office and maintenance buildings, pipelines, and processing facilities (both main and satellite facilities). In the event that surface runoff flows are impeded by any facilities, culverts and diversion ditches will be implemented to control the runoff and prevent excessive erosion. If the surface runoff is concentrated in an area, measures such as energy dissipaters will be used to slow the flow of the runoff so that erosion and sediment transport are minimized. Figure 2-15 of Chapter 2.0 provides a map of the surface drainage areas for the Nichols Ranch ISR Project.

7.2.2 Ephemeral Drainages Impacts

The Nichols Ranch ISR Project area contains three main drainages, one at the Nichols Ranch Unit, and two at the Hank Unit. In the Nichols Ranch Unit, drainage from surface precipitation and snowmelt is to the southwest to Cottonwood Creek via small ephemeral moderately to deeply incised channels (1 to 30 ft high banks) that range from 1 to 15 ft wide. Cottonwood Creek has been altered with a system of irrigation ditches and spreader dikes that have been constructed in the past to supply water to the area for past hay production. Drainage in the Hank Unit generally is to the northwest and west off North Middle and South Middle Buttes via Dry Willow Creek and Willow Creek. Channel widths generally range from 1 to 2 ft in the headwater areas and increase to 20 to 30 ft wide where the drainages leave the western edge of the Hank Unit. In general, the drainages are deeply incised with 10 to 50 ft high banks in the southern and northeastern portions of the Hank Unit and less incised in the other parts of the unit.

All flows within both units are ephemeral with no perennial or intermittent stream flows. The volume of flow from these ephemeral drainages is seasonal and directly related to local climatic conditions. The climate is semi-arid with an annual precipitation varying from 10 to 14 inches. Most of the precipitation occurs during May through June with snowfall contributing slight amounts to the overall total.

Impacts to ephemeral drainages may occur with some of the production activities such as wellfield operations or the construction of access roads. To avoid impacts to the drainages, existing roads within the project area will be used. If an ephemeral drainage may be impacted by the roads or wellfield operations, appropriate measures will be taken to minimize the impact to the ephemeral drainage including the prevention of erosion and sediment transport into the drainage.

Access road construction will be minimized by using existing roads within the project area. When new roads are needed, design and construction practices will incorporate such parameters as drainages, elevation contours, location with regard to weather conditions, and land rights to ensure the least amount of impact. If a new road has to cross an ephemeral drainage, efforts will be made to cross the drainage at right angles to minimize erosion with the appropriate sized culverts installed. In the event that a drainage has to be crossed, but cannot be crossed at a right angle or along elevation contours, appropriate measures for erosion control will be examined and implemented.

Wellfield construction activities will result in some short term or temporary effects on erosion. The ongoing drilling, well development, pipeline construction, header house construction, lateral pipeline placement, and access road construction activities will incorporate erosion protection measures based on the conditions where construction activities are taking place. Protection measures that may be used are: grading and contouring, placement of hay bales, culvert installation, sedimentation breaks, or placement of water contour bars.

In areas where steep grades are encountered during construction activities, re-seeding of the disturbed area will take place along with the erosion protection measures mentioned in the previous paragraph. The re-seeding will take place in the spring or fall, whichever comes first after the construction activity takes place.

Wells that are constructed in any ephemeral drainage will use the appropriate erosion protection controls to minimize the impact to the drainage. Protection controls that could be used, but not limited to, are: grading and contouring, placement of hay bales, culvert installation, placement of water contour bars, and designated traffic routes. The drainage bottoms will be restricted to the work activities that are needed to construct and maintain the wells. If the wells are placed in a location in the drainage where runoff has the potential to impact the well, measures will be taken to protect the well and wellhead. Barriers surrounding the well such as cement blocks, protective steel casing around the well heads, or other measures to protect the wells from damage will be utilized.

7.2.3 Groundwater Impacts

In situ recovery impacts to the groundwater are minimal. During the uranium recovery process, the groundwater will be impacted by the elevated concentration of certain constituents that are present in the groundwater in the ore zone. These impacts are temporary as the groundwater will be returned to pre-mining condition or class of use as defined by the Wyoming Department of Environmental Quality when the mining of the ore zone is completed.

One other impact to the groundwater will be the removal of water from the ore zone aquifers during the life of the Nichols Ranch ISR Project from the wellfield bleed. The water that is removed from the ore zone aquifers will result in a net loss of water from the ore zone aquifer, but the water that is lost will be replaced over time by the recharging of the aquifer. Water that is removed from ore zone aquifers will be sent to a deep disposal well.

The bleed rate from the ISR operation at Nichols Ranch Unit will cause a steady stress on the A Sand aquifer. For production of 3,500 gpm and a 1% bleed rate. The bleed rate will average 35 gpm. This stress for a three year operation at Nichols Ranch Unit was simulated with the aquifer properties of 350 gal/day/ft for transmissivity and a storage coefficient of 1.8E-4. Figure 7-1 (see map pocket) presents the results of these drawdowns. These drawdowns were calculated from three different stress locations. Pumping wells were placed in the southeastern portion of the wellfield, north central and southwestern portion; each for one year pumping period. One pumping location in the center of the wellfields would produce very similar drawdown. These predictions show that 30 ft of the drawdown will extend 7,000 ft outward from the center of the wellfields. The 5 ft contour is projected to extend out 22,500 ft or approximately 4 mi from the Nichols Ranch ISR Project area. Table 7A.1-1 in Addendum 7A presents the WELFLO model printout of the simulated drawdown.

The flowing wells that are inside the 10 ft contours and produce the majority of its water from the A Sand are likely to cease flowing. Most of the flowing wells in the area only have a few PSI pressure when they are shut in. Brown 20-9 flowing well is completed in the A Sand and will very likely cease flowing during the ISR operation. Impacts to any wells that could be affected by consumptive use in the "A" Sand by Uranerz are addressed in surface use agreements between Uranerz and the surface owner of the land where the Nichols Ranch ISR Project is located. Although the details of the surface use agreement are confidential, Uranerz has agreed to work with the landowners if a well is affected by the "A" Sand drawdown. Potential actions could include installing pumps in artesian/flowing wells that stop flowing or drilling a new well for the landowner.

The analysis of the potential predicted drawdowns in the F Sand from the Hank Unit ISR operation were calculated with average aquifer properties of transmissivity (400 gal/day/ft) and storage value of 0.05 and 3 years of operation. For a production rate of 2,500 gpm and a 3% bleed rate, the predicted drawdowns are presented in Figure 7-2 (see map pocket). Twelve stresses were used to simulate these drawdowns. Six stresses for a total of 75 gpm for 1.5 years was located on the northern wellfield and a second set of six stresses for the following 1.5 years was located in the southern wellfield. This figure shows that for the 10 ft contour extends only near the area of the southern wellfield while the 5 ft unit contour extends out approximately 900 ft from the edge of the wellfields. Table 7A.2-1 in Addendum 7A presents the output from the WELFLO program for the Hank simulation.

No flowing wells exist in the F Sand in this area and therefore the limited drawdowns are not likely to significantly affect any existing water users.

7.2.4 Air Quality

The Nichols Ranch ISR Project will result in minimal and temporary impacts to air quality in the region of the project. By using the in situ recovery method for the extraction of the uranium, minimal emissions are created. The principal emission will be fugitive dust generated from vehicle traffic to and from the project site and from wellfield activities since the majority of the roads in the project are unpaved. Negligible amounts of fugitive dust will be associated with disturbance of the soils during well development.

The gaseous pollutants produced from the diesel and gas vehicles used for the Nichols Ranch ISR Project are considered a non-stationary source which results in negligible impacts to the project area. Equipment used for development of the wellfields and construction activities will be used intermittently. Other vehicles associated with the Nichols Ranch ISR Project will be equipped with required pollution control devices to minimize combustion products derived from gasoline and diesel fuel.

Fugitive dust emissions associated with wind erosion are considered to be negligible. Measures such as re-seeding and prompt reclamation of disturbed areas such as wellfields will be utilized to minimize the dust emissions. These measures will also be used for additional areas such as topsoil stockpiles.

Emissions from the processing facilities associated with the Nichols Ranch ISR Project are limited to airborne effluents from process tanks and other vessels. The amounts of emissions that are released from the processing facility are considered to be very minimal to negligible. Table 7-1 identifies the emission sources from the processing facilities and their estimated emission quantities.

Radon will be generated during processing and restoration stages. When uranium-bearing solution is brought to the surface from the ore zone aquifer, radon, if not contained within the pressurized system, will off gas at the first opportunity due to changes in pressure and temperature. The pressurized down flow system described in the Application will ensure that radon emissions will be greatly reduced. The pressurized, closed-loop down flow–system will keep the radon gas in solution by keeping it under a constant pressure. However, caution and proper safety measures must and will be taken when loading and unloading ion exchange columns and vessels. Radon gas emissions will occur for short periods of time when ion exchange columns are taken off line and opened to the atmosphere. Short-term emissions will also occur in association with certain maintenance activities that involve cleaning or repairing the process/restoration system. Caution and proper safety measure must also be taken in the wellfield where radon gas will be vented from wellheads.

Table 7-1 Emissions Inventory.

Emission	Estimated Emission (tons/yr)
CO_2	353.70
HCL	0.017
H_2O_2	0.003
NaOH	0.0003
Fugitive Dust	135.9

The yellowcake dryer that will be located at the Nichols Ranch Unit could potentially release minute airborne particulate emissions such as uranium and radon daughters to the atmosphere. Dryer particulate emissions are held to near zero by employing a condenser circuit in combination with high efficiency filters (capture rating in excess of 99.99%), and by maintaining a vacuum in the system. By keeping the closed-loop dryer under a constant vacuum, any particulates that are generated in the drying process are captured in the dryer, the filters and the condenser system. Any potential radiological impacts of particulate emissions that might leave the dryer on the local populations are detailed by the use of the MILDOS computer model developed by the NRC. Section 7.3 provides a detailed discussion of this model.

7.2.5 Wildlife Impacts

A wildlife survey/study was conducted for the Nichols Ranch ISR Project. The wildlife study area includes the Nichols Ranch ISR Project area and a 2.0-mile buffer (see Exhibits D9-1 through D9-4 of the attached Appendix D9). The entire wildlife survey area (project area plus the 2.0-mi survey area) encompasses approximately 62.0 mi^2 (39,659.6 acres).

7.2.5.1 Endangered Species

There are no known endangered species or endangered species habitat within the Nichols Ranch ISR Project area. Impact to endangered species is therefore non-existent and no mitigation factors are needed.

7.2.5.2 Wildlife

Mining activities within the proposed Nichols Ranch ISR Project area will result in limited short-term loss of approximately 300 acres of wildlife habitat over the approximate 10-year life of the mine. Short-term habitat losses will occur in those areas that are temporarily disturbed during drilling operations and during the construction of the ancillary facilities. The losses in wildlife habitat will be limited to small areas (less than 60-80 acres/year) and will be short-term in nature. The loss of wildlife habitat will be mitigated with the completion of reclamation activities.

All wildlife habitat disturbed during the life of the mine will be revegetated following the completion of mining operations (refer to the Reclamation Plan). Reclamation will be directed toward the restoration of the site primarily for livestock grazing and wildlife habitat.

7.2.5.2.1 Big Game

The entire project area lies within winter/yearlong pronghorn antelope and mule deer range of the Pumpkin Buttes Herd Units (WGFD 2005a). Direct impacts to big game as a result of project activities will include the disturbance of a portion of winter/yearlong range, loss of forage, increased potential for poaching, vehicular collision accidents, and the displacement of big game into surrounding areas. An estimated 300 acres will be incrementally mined or otherwise disturbed during the approximate 10-year life of the mine. As a result of these habitat disturbances, the winter/yearlong range carrying capacity for big game will be reduced during the life of the mine and for several years following mining until vegetative growth on the revegetated areas become productive enough to support big game. Since only 60-80 acres will be withdrawn from use as wildlife habitat at any given time, the Nichols Ranch ISR Project is not expected to have any adverse impacts on pronghorn antelope or mule deer. No significant increase in the potential for vehicle collision with big game is expected because of the short distances and low speeds required on the access roads. Also, levels of vehicular traffic associated with mine development and use of the roads are not expected to increase above current levels.

The number of employees and the nature and intensity of mining activities will be comparable to those already taking place on this site, and no increase in the potential for poaching and general harassment of big game is anticipated. Mitigation plans such as speed limits and fencing will aid in the reduction of big game conflicts associated with the Nichols Ranch ISR Project.

7.2.5.2.2 Upland Game Birds

Ten greater sage-grouse leks occur within the wildlife study area (refer to Exhibit D9-3 of the attached Appendix D9). All of the leks were active in 2006. Direct impacts to greater sage-grouse from project activities would include habitat loss and fragmentation from mine, road, pipeline, and power line construction; alteration of plant and animal communities; increased human activity that could cause the birds to avoid an area; increased noise that could cause the birds to avoid an area or reduce breeding efficiency; increased motorized access by the public leading to legal and illegal harvest; direct mortality from increased vehicular traffic; and an increase in mortality from raptors if power poles are placed in occupied greater sage-grouse habitat.

To minimize impacts to breeding greater sage-grouse, project activities and vehicular traffic would be minimized in areas within 0.25 mi of an active lek between the hours of 8:00 pm and 8:00 am during the greater sage-grouse strutting period (March 1-May 15), and project activities (i.e., drilling and construction) would be reduced in areas adjacent to an active lek between March 15 and July 15. To reduce raptor predation on greater sage-grouse, the construction of overhead power lines, permanent high-profiled structures such as storage tanks, and other perch sites would not be constructed within 0.25 mi of an active lek. To minimize impacts to greater sage-grouse and other upland bird species (i.e., Hungarian partridge), removal and disturbance of vegetation will be kept to a minimum through the use of existing roads for travel and for the placement of pipelines. All lands disturbed by project activities will be revegetated as soon as practical following the project disturbing activities following practices outlined in the Reclamation Plan.

7.2.5.2.3 Waterfowl and Shorebirds

During the 2006 field season, waterfowl were seldom observed on the project area. This minimal use is probably due to the fact that aquatic habitats on the project area are generally seasonal in nature and higher-quality waterfowl habitat is located outside the project area.

Therefore, the Nichols Ranch ISR Project is not expected to have any adverse impacts on waterfowl or shorebirds. No mitigation efforts are needed.

7.2.5.2.4 Mammalian Predators

The use of the project area by mammalian predators will be temporarily reduced due to mining activities at the Nichols Ranch ISR Project. In addition, the recent outbreak of Tularemia may have an effect on the prey base (i.e., rabbits) for mammalian predators, which may have already resulted in a shift of predators to other areas to seek prey. Therefore, the Nichols Ranch ISR Project is not expected to have any adverse long-term impacts on mammalian predators. No mitigation efforts are also needed.

7.2.5.2.5 Lagomorphs

Rabbits were abundant within the project area and wildlife study area. Direct impacts to lagomorphs as a result of the project may include vehicular collision accidents, loss of habitat, increased motorized access by the public leading to legal and illegal harvest, and the displacement of lagomorphs into surrounding areas due to human activity and project related noise. The natural outbreak of Tularemia has caused noticeable mortality to the rabbits in the area. Since lagomorphs are relatively abundant in the project area, and the fact that they show an affinity to disturbed areas with existing facilities such as culverts and well pads, the Nichols Ranch ISR Project is expected to have a negligible short-term adverse impacts on lagomorph populations. No adverse long-term impacts are likely to occur.

7.2.5.2.6 Small Mammals

Some small mammals may be displaced by the mining activities over the life of the mine. Prairie dog habitat (i.e., towns) occurs on the project area. Prairie dog towns would not be avoided during mining activities; however, steps will be taken to minimize disturbance in their habitat. However, due to the low frequency of small mammal occurrence in the project area, the Nichols

Ranch ISR Project is expected to have a negligible short-term adverse impact on small mammal populations. No adverse long-term impacts are likely to occur.

7.2.5.2.7 Raptors

Forty raptor nests occur within the wildlife study area, of which 14 were determined to be active. Twelve of the 14 active nests were located in the Hank Unit and two of the active nests were located in the Nichols Ranch Unit. Two active red-tailed hawk, two long-eared owl, one great-horned owl, and two prairie falcon nests were observed in the Hank Unit. Based on the proposed permit boundaries, those trees with nests will not be removed during project activities. The principal impact to these nests from project activities and associated increased human access is potential disturbance during nesting, which could result in nest abandonment and decreased reproduction success. Potential conflicts between active nest sites and project-related activities will be mitigated by annual raptor monitoring and mitigation plans such avoiding areas, when possible, where raptor nest sites are located, and limiting the constructing of overhead power lines so that raptors will not come in contact with them or use them as perches for viewing prey such as sage-grouse.

The temporary disturbance of approximately 300 acres of raptor prey species habitats is unlikely to result in a reduction in the raptor population in the area because only 60-80 acres will be disturbed at any time. Additionally, this reduction is expected to be short-term and negligible. Therefore, the Nichols Ranch ISR Project is not expected to have any adverse long-term impacts on raptor populations.

7.2.5.2.8 Nongame/Migratory Birds

The temporary disturbance of approximately 300 acres of habitat will result is some reduction in the carrying capacity for nongame/migratory birds within the project area. Birds may be displaced by the mining activities and the temporary disturbance of wildlife habitat; however, the amount of habitat lost will be minimal in relation to the amount of comparable habitats that are available in the general area. Therefore, the Nichols Ranch ISR Project is not expected to have any adverse long-term impact on any passerine bird populations.

7.2.5.2.9 Reptiles and Amphibians

The two species of reptiles that were documented in or near the project area during fieldwork are common in Wyoming. The mining activities and temporary disturbance may result in some reduction in the population levels of reptile and amphibian species in the area; however, these impacts are expected to be short-term and negligible. Therefore, the Nichols Ranch ISR Project is not expected to have any adverse long-term impacts on any reptiles or amphibian populations.

7.2.5.2.10 Threatened, Endangered, Proposed, and Candidate Species and Special Status Species

Based on state and federal wildlife agencies and habitat preference, two TEPC animal species and 17 BLM SS species have the potential to occur in the project area (refer to Tables D9-3 and D9-4 of the attached Appendix D9). Bald eagle was the only protected species observed within the wildlife study area and may use the area for foraging during the winter months and migration; however, no nests or communal roosts occur within the Nichols Ranch ISR Project wildlife survey area. Project lands disturbed as a result of mining will be unavailable for foraging bald eagles until these areas are reclaimed and prey species return. The area has been block-cleared for the black-footed ferret (refer to Addendum D9A of the attached Appendix D9; therefore, the mine will have no affect on black-footed ferrets. Two BLM SS species, the swift fox and Brewer's sparrow, were observed within or adjacent to the project area. Since only 60-80 acres will be withdrawn from use as wildlife habitat at any given time, the Nichols Ranch ISR Project is not expected to have any adverse impacts on TEPC species or SS. No special mitigation plans for TEPC species or SS are planned at this time.

7.3 RADIOLOGICAL EFFECTS

This section provides an evaluation of the radiological effects of the Nichols Ranch ISR Project. The evaluation considers potential exposure pathways to humans from operation of the Nichols Ranch and Hank Unit facilities.

The evaluation described in this section is based on the description of the sites and operations provided in Chapter 3.0 of this report. Otherwise, pertinent inputs and assumptions are included here.

7.3.1 Exposure Pathways

The potential exposure pathways considered here are water, air, and external. The water and external pathways are not quantitatively evaluated since there are no liquid effluents to surface water and no particulate effluents to air. The air pathway is quantitatively addressed but the scope is limited to radon since there are no particulate emissions.

7.3.1.1 Exposures from Water Pathways

The extraction solutions in the ore zone will be monitored and controlled to detect and prevent migration from the production zone. The monitoring and controls are described in Section 5.7.8 of this report.

The method of liquid waste disposal at the facility will be by deep disposal well. The deep disposal well(s) will be completed at depths significantly deeper than zones planned for mining and current CBM operations and will be isolated geologically from underground sources of drinking water. The deep disposal well(s) are described in Sections 3.2.6 of this report.

The uranium ion exchange, precipitation, drying and packaging facilities will be located on curbed, re-inforced concrete pads to prevent liquids from entering the environment. Solutions collected on these pads, including water used to wash down equipment, and accidental spills drain to a sump collection network and are either pumped back into the process circuit or to the disposal well.

No liquid effluents will be discharged to surface water. There are no surface waters on either site. Thus no definable water related pathways exist for routine operations.

7.3.1.2 Exposures from Air Pathways

Release rates of airborne radioactivity were estimated for the Nichols Ranch ISR Project. Dose commitments received by individuals and the general population within an 80 km radius of the site were estimated from atmospheric dispersal of such radioactivity with respect to regional meteorological data. Only airborne releases of radon are considered. Particulate emissions are not considered since such releases are not expected under normal operating conditions for vacuum dryers.

The computer code MILDOS-Area (MILDOS) was used to calculate both the release rates (source terms) and the dose commitments. The dose commitments include contribution from each of the Nichols Ranch and Hank Unit sites. Extra-regional population doses are also estimated as a result of transport of radon. The results are provided as total effective dose equivalent per year.

Two MILDOS-Area models were run for the Nichols Ranch ISR Project. The first MILDOS model used joint frequency data for wind speed, direction, and stability that was collected from Gillette, Wyoming from 1996 to 2005. This MILDOS model is presented in Addendum 7B. The second MILDOS-Area model, contained in Addendum 7C, used joint frequency distribution data for wind speed, direction, and stability that was collected from the Antelope Coal Company (ACC) site from 1987 to 2006. Each MILDOS model was used because the original model containing the Gillette data did not fully represent the conditions at the Nichols Ranch ISR Project site. The wind at the Nichols Ranch ISR Project site is primarily out of the south/southwest. The wind direction at Gillette is primarily from the north/northwest. To be consistent with the conditions at the Nichols Ranch ISR Project site, the second MILDOS model run used the ACC site since the wind direction at this site is the same and the Nichols Ranch ISR Project. Even with the two different runs using two different wind directions, the results for each model were very similar. The data contained in the tables in this section report the numbers that were produced from the second MILDOS model run using the ACC site.

7.3.1.2.1 Site Description

The physical description of the sites is provided in Chapter 3.0 of this report. The location of the sites is described in Figure 7-3 (see map pocket). The dose estimates are provided for intervals, directions, and elevations relative to the drying/packaging location at the Nichols Ranch facility; this location is subsequently referred to as the Nichols Ranch Central Processing Plant (mill center).

7.3.1.2.2 Population Distribution

The population distribution within 80 km of the mill center is provided in Table 7-2. Figure 7-4 (see map pocket) shows the locations of the cities within 80 km of the mill center.

Table 7-2 Population Distribution Within 80 km of Nichols Ranch Central Processing Plant.

Cities Within 80 km of Mill Center	Population	Distance from Mill Center (km)	Direction from Mill Center
Gillette	19,646	74	NE
Kaycee	249	56	W
Midwest	408	40	SW
Edgerton	169	37	SW
Wright	1,347	35	E

The population dose beyond 80 km is estimated using the code's predetermined population dose for year 1978. The population dose is adjusted for population growth by the ratio of estimated United States population for year 2000 of 268 million to the estimated United States population for year 1980 of 228 million, or 1.2.

7.3.1.2.3 Individual Receptor Locations

The locations of the nearest residents to the Nichols Ranch Central Processing Plant are provided in Table 7-3. Locations of site boundaries to the Nichols Ranch CPP are provided in Table 7-4. Figure 7-3 (see map pocket) shows the locations of the nearest residents to the mill center.

Table 7-3 Nearest Residents to Nichols Ranch Central Processing Plant.

Nearest Residence	Number of Inhabitants	Distance from mill center km		Elevation from mill center z m
		x(E)	y(N)	
T-Chair (Rolling Pin) Ranch	5	3.7	-2.2	-7
Dry Fork Ranch	3	-2.7	-1.1	-58
Christensen Ranch	1	1.8	-7.8	-1
Pfister Ranch	3	7.8	7.4	78
Pumpkin Butte Ranch	2	11.1	3.6	218
Van Buggenum Ranch	0	15.4	5.3	130
Ruby Ranch	2	19.0	2.9	101
Hank Satellite Plant	0	7.9	3.5	121

Table 7-4 Center of Site Boundary from Nichols Ranch Central Processing Plant.

Location	Distance from mill center x(E), y(N) km		Elevation from mill center z m
Nichols Ranch – north central	-0.4	1.3	57
– east central	0.6	0.2	-2
– south central	-0.3	-1.1	-18
– west central	-1.4	0.5	12
Hank – north central	7.9	6.6	86
– east central	8.8	3.3	160
– south central	7.9	1.3	139
– west central	7.1	4.2	102

7.3.1.2.4 Time Parameters

The dose commitments were completed for development, production, and restoration of wellfields for the operating years 2011 through 2019. The respective schedule is provided in Table 7-5.

The time parameters were input as:

- Beginning Year: 2011.
- Number of Time Steps: 9.
- Time Increment: 1 year.
- Population Adjustment: 1.2 (see "Population Distribution")
- Source Adjustment: varied per source to reflect development, production, and restoration schedule of Table 7-5.

7.3.1.2.5 Food Pathway Parameters

The MILDOS code requires four inputs to describe the feeding habits of livestock near the sites. The inputs used to describe the fraction of total annual livestock feed requirements are:

- Pasture Grass/Individual: 0.5 (default)
- Pasture Grass/Population: 0.5 (default)
- Hay/Individual: 0.5 (default)
- Hay/Population: 0.5 (default)

The MILDOS code also requires input of the areal food-production rate per unit area around the facility. The inputs used are:

- Vegetables: 3120 kg/y-m^2
- Meat: 345 kg/y-m^2
- Milk: 134 kg/y-m^2

Table 7-5 Development, Production, and Restoration Schedule.

<table>
<tr><td>Year</td><td colspan="4">2010</td><td colspan="4">2011</td><td colspan="4">2012</td><td colspan="4">2013</td><td colspan="4">2014</td><td colspan="4">2015</td><td colspan="4">2016</td><td colspan="4">2017</td><td colspan="4">2018</td><td colspan="4">2019</td></tr>
<tr><td>Quarter</td><td>Q1</td><td>Q2</td><td>Q3</td><td>Q4</td><td>Q1</td><td>Q2</td><td>Q3</td><td>Q4</td><td>Q1</td><td>Q2</td><td>Q3</td><td>Q4</td><td>Q1</td><td>Q2</td><td>Q3</td><td>Q4</td><td>Q1</td><td>Q2</td><td>Q3</td><td>Q4</td><td>Q1</td><td>Q2</td><td>Q3</td><td>Q4</td><td>Q1</td><td>Q2</td><td>Q3</td><td>Q4</td><td>Q1</td><td>Q2</td><td>Q3</td><td>Q4</td><td>Q1</td><td>Q2</td><td>Q3</td><td>Q4</td><td>Q1</td><td>Q2</td><td>Q3</td><td>Q4</td></tr>
<tr><td>Nichols Ranch Area #1</td><td colspan="3">Devel.</td><td colspan="10">Production</td><td colspan="12">Restoration</td><td colspan="15"></td></tr>
<tr><td>Nichols Ranch Area #2</td><td colspan="10"></td><td colspan="3">Devel.</td><td colspan="5">Production</td><td colspan="7"></td><td colspan="4">Restore</td><td colspan="11"></td></tr>
<tr><td>Hank Area #1</td><td colspan="2"></td><td colspan="3">Devel.</td><td colspan="10">Production</td><td colspan="20">Restoration</td><td colspan="5"></td></tr>
<tr><td>Hank Area #2</td><td colspan="12"></td><td colspan="3">Devel.</td><td colspan="8">Production</td><td colspan="12"></td><td colspan="4">Restore</td><td colspan="1"></td></tr>
</table>

7.3.1.2.6 Meteorological Parameters

The meteorological parameters for the MILDOS code were input as:

- The annual average morning and afternoon mixing heights each as the code default of 100 m
- The Briggs height cutoff vertical dispersion coefficient as the code default of 50 m
- The fractional joint frequency distribution of wind speed, direction and stability for Antelope Mine, Wright Wyoming for years 1987 through 2006.

7.3.1.2.7 Source Terms

The parameters and values used to develop the source terms and the resulting annual releases are listed in Tables 7-6 and 7-7 for Nichols Ranch and Hank Units, respectively. The respective source terms determined by MILDOS are included in these tables.

The fraction of radon attributable to the site was input as one for Casper, Wyoming.

A source term for release of particulates from drying and packaging activities was not developed since no particulate emissions are expected under normal operating conditions for vacuum dryers.

7.3.1.2.8 Results

Dose modeling was completed as described above for the primary years of operation of the Nichols Ranch ISR Project, Nichols Ranch and Hank sites. The operations modeled included wellfield development, production, and wellfield restoration. The source terms were adjusted to reflect actual periods of activity per year. The results of the dose modeling are summarized below with respect to the nearest residents, site boundaries, and the surrounding population. The 40 CFR 190 doses are zero because does from radon is excluded from the scope of the standard. The report of the MILDOS code execution is provided as Addendum 7B.

Table 7-6 MILDOS Input Parameters - Nichols Ranch Unit.

	(values in gray are calculated by MILDOS)*		
	Common Parameters (each wellfield)	Units	
Location	X (location relative to the plant which is considered (0,0,0)	-0.9	km
	Y (location relative to the plant which is considered (0,0,0)	0.4	km
	Z (location relative to the plant which is considered (0,0,0)	6	m
	area of active drilling (ore zone)	228644	m^2
	emanation fraction	0.2	
	Ra concentration in ore	311	pCi/g
	thickness	2.2	m
	density	1.9	g/cm3
	porosity	0.3	
	fraction of Rn	0.75	
	rate of Rn venting	0.01	/d
	volume in circulation	149068 519	L
	New Wellfield Source Parameters (each wellfield)		
Mud pits	storage time in pit	30	d
	ore material into pit	136534	g/y
	number of mud pits	966	
	Total amount of Rn-222 released from drilling activities	0.045	Ci/yr
	Production Wellfield Source Parameters (each wellfield)		
Ore zone	Rn-222 source	1.1 E+13	pCi/d
Process water	treated water purge rate	190779	L/d
	Rn-222 release from purge water	20	Ci/yr
	Rn-222 release from well venting	150	Ci/yr
Ion exchange columns	column volume	14158	L
	column unloading rate	2	/d
	porosity of resin	0.4	
	Rn-222 release from ion exchange column	1.2	Ci/yr
	Total amount of Rn-222 released from production activities	170	Ci/yr
	Restoration Wellfield Source Parameters (each wellfield)		
Ore zone	Rn-222 source	1.1 E+13	pCi/d
Process water	treated water purge rate	310698	L/d
	operating days	360	d/yr
	Rn-222 release from purge water	31	Ci/yr
	Rn-222 release from well venting	150	Ci/yr
	Total Rn-222 released from restoration activities	180	Ci/yr

* Values may not sum within table due to rounding.

Table 7-7 MILDOS Input Parameters – Hank Unit.

	(values in gray are calculated by MILDOS)*		
	Common Parameters (each wellfield)		Units
Location	X (location relative to the plant which is considered (0,0,0)	8.2	km
	Y (location relative to the plant which is considered (0,0,0)	3.5	km
	Z (location relative to the plant which is considered (0,0,0)	142	m
	area of active drilling (ore zone)	313627	m^2
	emanation fraction	0.2	
	Ra concentration in ore	277	pCi/g
	thickness	2.6	m
	density	1.9	g/cm3
	porosity	0.3	
	fraction of Rn	0.75	
	rate of Rn venting	0.01	/d
	volume in circulation	245770913	L
	New Wellfield Source Parameters (each wellfield)		
Mud pits	storage time in pit	30	d
	ore material into pit	160949	g/y
	number of mud pits	776	
	Total amount of Rn-222 released from drilling activities	0.038	Ci/yr
	Production Wellfield Source Parameters (each wellfield)		
Ore zone	Rn-222 source	1.6 E+13	pCi/d
Process water	treated water purge rate	408813	L/d
	Rn-222 release from purge water	37	Ci/yr
	Rn-222 release from well venting	220	Ci/yr
Ion exchange columns	column volume	14158	L
	column unloading rate	2	/d
	porosity of resin	0.4	
	Rn-222 release from ion exchange column	1.0	Ci/yr
	Total amount of Rn-222 released from production activities	260	Ci/yr
	Restoration Wellfield Source Parameters (each wellfield)		
Ore zone	Rn-222 source	1.6 E+13	pCi/d
Process water	treated water purge rate	119918	L/d
	operating days	360	d/yr
	Rn-222 release from purge water	11	Ci/yr
	Rn-222 release from well venting	220	Ci/yr
	Total Rn-222 released from restoration activities	230	Ci/yr

* Values may not sum within table due to rounding.

7.3.1.2.8.1 Individual Receptor Dose

Estimated annual doses at individual receptor locations are shown in Table 7-8. The estimated doses result exclusively from radon daughters, since there are no particulate releases from the facility. The total effective dose equivalent (TEDE) is at least 100 times less than the dose limit to individual members of the public in 10 CFR 20 of 100 mrem/y.

Estimated annual doses at site boundary locations are shown in Table 7-9. The estimated doses result exclusively from radon daughters, since there are no particulate releases from the facility. The total effective dose equivalent (TEDE) is substantially less than the dose limit to individual members of the public in 10 CFR 20 of 100 mrem/y.

Table 7-8 Summary of Total Effective Dose Equivalent to Individual Receptors, mrem/year.

	Year								
Receptor	2011	2012	2013	2014	2015	2016	2017	2018	2019
T-Chair Ranch	0.1	0.2	0.2	0.2	0.2	0.2	0.06	0.03	0.02
Dry Fork Ranch	0.04	0.04	0.06	0.07	0.05	0.04	0.02	0.01	0.01
Christensen Ranch	0.07	0.09	0.1	0.2	0.1	0.08	0.06	0.05	0.04
Pfister Ranch	0.1	0.1	0.2	0.3	0.2	0.1	0.1	0.1	0.07
Pumpkin Butte Ranch	0.5	0.7	0.8	1	1	0.6	0.6	0.5	0.4
Van Buggenum Ranch	0.1	0.2	0.2	0.3	0.3	0.2	0.1	0.1	0.1
Ruby Ranch	0.1	0.1	0.1	0.3	0.2	0.1	0.1	0.1	0.07

Table 7-9 Summary of Total Effective Dose Equivalent Site Boundary, mrem/year.

	Year								
Boundary Location	2011	2012	2013	2014	2015	2016	2017	2018	2019
Nichols Ranch									
– north central	0.7	0.7	1	1	0.7	0.7	0.2	0.03	0.3
– east central	1	1	2	2	1	1	0.3	0.03	0.02
– south central	0.2	0.2	0.4	0.4	0.3	0.2	0.08	0.02	0.02
– west central	3	3	4	4	3	3	0.7	0.03	0.02
Hank									
– north central	0.2	0.2	0.2	0.4	0.4	0.2	0.1	0.1	0.1
– east central	4	6	7	11	9	5	5	5	4
– south central	0.3	0.3	0.4	0.5	0.4	0.3	0.2	0.2	0.1
– west central	0.6	0.8	1	1	1	0.7	0.7	0.6	0.5

7.3.1.2.8.2 Population Dose

Estimated annual doses populations are shown in Table 7-10. The estimated doses result exclusively from radon daughters, since there are no particulate releases from the facility. There is no regulatory limit for population dose. The TEDE for the population within 80 km of the mill center (0.04 to 0.2 person-rem/y) is about 162,500 to 32,500 times less than the dose to this population attributable to natural background radon of 300 mrem/y (21,819 persons x 0.3 rem/y = 6500 person-rem/y).

Table 7-10 Summary of Total Effective Dose Equivalent to Populations, person-rem/year.

	Year								
Receptor	2011	2012	2013	2014	2015	2016	2017	2018	2019
Population within 80 km	0.07	0.08	0.1	0.2	0.1	0.08	0.06	0.05	0.04
Population beyond 80 km	4	4	6	7	6	4	3	2	2
All populations	4	4	6	8	6	4	3	2	2

7.3.1.3 Exposures from External Radiation

The drying and packaging operations are conducted under vacuum such that there are no particulate emissions. The drying and packaging controls are described in Section 4.1.2 of this report. Therefore, there is no potential for deposition and concentration of source material in surface soils from routine site operations.

Certain process areas at either site will routinely exhibit exposure rates well above background. However, these areas include controls to prevent unintended or unmonitored access of the general public. These process areas are of such a distance from any site boundary that natural attenuation in air reduces the exposure rate to background levels.

There is no source created by operations to establish a concern for external exposure. Also, no definable external exposure pathways exist for routine operations.

Figure 7.3a – Exposure Pathways Diagram (see map pocket) depicts the pathways for potential exposures from an ISR operation.

7.3.1.4 Total Human Exposures

The dose estimates described above for the air pathway represent the maximum annual dose that could be received via all pathways by an individual at the nearest residence (i.e. the individual likely to receive the highest dose from the licensed operation). These estimates were effectively executed by the MILDOS-Area code as described in Section 7.3.1.2 given the absence of the water and external exposure pathways. The results satisfy the regulatory requirements of 10 CFR 20.1301(a)(1) and 1302(b).

The public dose limits of 40 CFR 190 and the constraint requirement of 10 CFR20.1101 are not applicable because the scope of each excludes radon.

The Nichols Ranch ISR Project (Project) does not impose a significant dose on any individual member of the public. The Project does not appreciably contribute to total population dose.

7.3.1.5 Exposure to Flora and Fauna

The project will not have any significant impact on flora and fauna as a result of planned or accidental air emissions or fluid discharges. As noted above, the primary emission associated with ISR is Rn-222 and its daughters since there are no particulate emissions or fluid discharges. Any fluid discharge would be the result of an accidental spill from a pipeline break or leak. Spills of this nature would most likely occur within the restricted wellfield areas and between the wellfields and the process facility. Spills occurring on the process facility pad are far less likely to contact soil and vegetation. The reason for this is that the pad is engineered to contain a spill from a pipe rupture or leaking fluid vessel.

The engineering controls and operational monitoring program that will be in place combine to provide strong assurance that spills will be quickly detected and minimized. In addition to these measures, any contamination that might result from an accidental spill will be reconciled through corrective action protocol. Corrective action involves identifying the area affected by the spill, conducting radiological surveys and removing contaminated soil and vegetation. Corrective action also includes documenting the event. Extensive experience has shown that single-event spills arising from a pipeline leak or break do not cause significant contamination of soil and vegetation.

With regard to fauna, there is no opportunity for animals (domestic or wildlife) to consume contaminated vegetation or seeds. As just noted above, other than limited accidental spills which would be immediately assessed and undergo remediation, the operation will not significantly impact food (vegetation/seeds) sources that wildlife and domestic animals depend upon.

Although this is in fact the case, the operation's potential radiological impact on human health and the environment was assessed through MILDOS radiological modeling.

Briefly, MILDOS is an air dispersion model which provides an estimate of radiation dose commitment to the public from all sources associated with the operation. To do this, the model requires certain input parameters such as: (1) local meteorological dispersion characteristics; (2) radiation source term location, type (e.g., gaseous/particulate/fluid), particle size, strength, volume and duration; (3) population distribution within 80 km of the process site; (4) location of the nearest residences; and (5) food chain pathways (crop production/consumption and contributions from consuming meat and milk from grazing animals).

Given the various input parameters, the model generates dose commitments to the population as a whole and to certain organs such as bone, lung, liver, kidney, bronchi and whole-body. Exposure pathways include inhalation, ground, emersion in cloud, and the consumption of vegetation, meat and milk. As can be seen from this description, the MILDOS model provides a comprehensive assessment of potential exposure from a number of sources.

Referring back to the conclusions of the MILDOS radiological assessment given in Section 7.3.1.4, it was noted that dose estimates are well within the regulatory limits given in 10 CFR 20.1301(a)(1) and 1302(b). If fact, dose estimates are many times lower than the 10 mrem standard set for members of the public. It is understood that the dose standards set for humans are also protective of animals and wildlife.

7.4 NONRADIOLOGICAL EFFECTS

7.4.1 Nonradioactive Airborne Effluents

Nonradioactive airborne effluents that are released from the Nichols Ranch ISR Project will not have a significant environmental impact. Fugitive dust from vehicular travel on access roads and wellfield development, and emissions such as CO_2, NaOH, and HCl consist of the majority of the non-radioactive airborne effluents. Because of the minimal amounts of these non-radioactive airborne effluents, no air quality permits are anticipated to be required from the Wyoming Department of Environmental Quality. The nonradioactive airborne effluents and their estimated emissions quantity are detailed in Table 7-1.

Measures will be taken to minimize impacts from non-radioactive airborne effluents. Dust suppressant may be used to reduce fugitive dust when conditions are such that the use of the suppressant is warranted. Gaseous effluents will be vented to the atmosphere to quickly dissipate the effluent so that it will not impact the surrounding area.

7.4.2 Nonradioactive Liquid Effluents

Nonradioactive effluents will not be discharged to the environment during the operation of the Nichols Ranch ISR Project. The processing plants will be zero discharge facilities as all nonradioactive effluents will be sent to the deep disposal well.

7.5 EFFECTS OF ACCIDENTS

The NRC completed analyses of accidents at ISR uranium extraction facilities that consider the likelihood of occurrence and/or consequence. [NRC 2001, NRC 1980] These analyses demonstrate that consequences are minor in the presence of effective emergency procedures and properly trained personnel. The facility design, site features, and operating assumptions of the Nichols Ranch ISR Project are consistent with those of the NRC analyses. Therefore, independent accident analyses will not be conducted for the Nichols Ranch ISR Project. However, assessments are provided of applicable accident types and scenarios to include site specific conditions. More specifically, discussion is provided with respect to coal bed methane recovery, which is unique to the region.

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7.5.1 Transportation Incidents

Materials transportation to and from the Hank and Nichols Ranch Units can be classified into four categories:

1) Shipment of refined yellowcake from the Nichols Ranch Central Processing Plant to a uranium conversion facility.
2) Shipment of loaded resin from the Hank Unit to the Nichols Ranch Central Processing Plant.
3) Shipment of process chemicals from suppliers to the Hank and Nichols Ranch Units.
4) Shipments of 11(e)2 by-product material to a NRC licensed facility for disposal.

One other transportation classification is the transporting of employees to and from the plant site.

7.5.1.1 Shipment of Refined Yellowcake

Refined Yellowcake produced at the Nichols Ranch Central Processing Plant will not differ from the refined yellowcake produced at conventional mills. The NRC evaluated transportation accidents associated with yellowcake shipments from conventional mills and published the results in a generic environmental impact statement, NUREG-0706, NRC, 1980. The following information on transportation accidents is based on the analysis on the earlier NRC study.

Refined yellowcake produced at the Nichols Ranch Central Processing Plant will be packaged in 55-gallon steel drums. Yellowcake will be shipped approximately 1,200 mi to a uranium conversion facility. This conversion facility is the first manufacturing step in converting the yellowcake into reactor fuel. An average truck shipment contains approximately 40 drums, or up to 19 tons of yellowcake. Based on the initially projected annual production rate of 800,000 pounds of yellowcake per year, approximately 21 shipments of 40 drums each would be required annually for the Nichols Ranch ISR Project. By increasing the annual production rate to 2.0 million pounds per year per the vacuum dryer designed throughput, approximately 53 shipments would be required annually.

According to NUREG-0706, published accident statistics predict the probability of a truck accident under three different scenarios: 1) on interstate highways in rural areas, 2) on interstate highways in urban areas, and 3) on two-lane roads typical of those in the vicinity of the proposed project. The overall average probability of a truck accident for the Nichols Ranch ISR Project based on the NUREG-0706 data is 2.2×10^{-6}/mile. This takes into account that most of the shipping of yellowcake will be on interstates in both rural and urban areas.

The truck accident statistics also include three categories of events: collisions, noncollisions, and other events. Collisions are considered to be between the trucks and other vehicles or any other object, whether moving or stationary. Noncollisions are accidents involving only the truck that result in accidents such as the truck leaving the road and rolling over. Other events include personal injuries that are suffered from someone on the truck, someone falling from or being thrown against the truck, cases of stolen trucks, and fires occurring on a standing truck. The probability of a truck being involved in any of the accidents types during a one year period is approximately 10 percent.

A generalized accident-risk evaluation conducted by the NRC classified accidents into eight categories, depending on the combined stresses of impact, puncture, crush, and fire. Using this classification scheme as a basis, conditional accident probability was developed for eight severity levels. Two radioactive material release models were then developed to calculate the amount of yellowcake that could be released based up what severity of accident occurs. Model I is hypothetical assuming a complete loss of yellowcake drum contents when an accident occurs. Model II is based on actual tests assuming a partial loss of yellowcake drum contents. The quantity of the release for Model I and Model II in the event of an accident is 17,000 pounds and

1,200 pounds respectively, (NUREG 0706, NRC, 1980). Most of the yellowcake that is released from the container would be directly deposited on the ground in the immediate vicinity of the accident location. Some fraction of the released material would be dispersed to the atmosphere. The following expression was utilized by the NRC to estimate the amount of released material dispersed to the atmosphere:

$$F = 0.001/4.6x10^{-4} (1-e^{-0.15ut}) u^{1.78}$$

Where:

F = the fractional airborne release
u = the wind speed at 50 ft expressed in m/s
t = the duration of the release (hours)

In this expression, the first term represents the initial "puff" that is immediately airborne when the yellowcake drum fails in an accident. Assuming a wind speed of 10 mph (5 m/s) and a release time of 24 hours, the environmental release fraction would be $9x10^{-3}$. Since the conversion facility is located in the eastern United States, a population density of 160 people per square mile was used to calculate the 50 year dose commitments to the lungs of the general public. The calculated 50 year dose commitments are two man-Sv (200 man-rem) and 0.14 man-Sv (14 man-rem) for Model I and Model II. The integrated dose estimate would be lower for the more sparsely populated areas.

Any accident that results during the shipment of yellowcake product could result in some yellowcake being spilled. In the unlikely event that such an accident does occur, all yellowcake and contaminated soil would be removed, processed through a uranium mill, or disposed of in a licensed NRC disposal facility. All areas that are disturbed by the accident would then be reclaimed in accordance to all applicable NRC and State regulations.

The risk of an accident involving the transporting of yellowcake resulting in a yellowcake spill will be kept to a minimum by the use of exclusive use shipments. If an accident were to occur, impact to the environment would be further reduced by following instruction outlined in the Uranerz Energy Corporation Incident Response Guide. This guide will be included with every shipment of yellowcake that leaves the Nichols Ranch Central Processing Plant. The carrier will also be required to maintain accident response capability to specifically include spill response.

With the shipment of yellowcake product to a conversion facility located approximately 1,200 mi away, all risks associated with the transportation of the product cannot be eliminated. However, the potential impacts to the environment in the event of an accident can be minimized by having proper procedures in place to ensure that any yellowcake that is spilled is contained as soon as possible and the area affected by the spill is secured and cleaned up to avoid contact with unauthorized personnel.

7.5.1.2 Shipments of Loaded Resin

The Hank Unit of the Nichols Ranch ISR Project is designed as a satellite ion-exchange (IX) facility. This IX satellite operation will require the shipping of resin loaded with uranium to the Nichols Ranch CPP located approximately 6 mi away. The uranium that is loaded on the resin will then be processed, dried, and packaged at the Nichols Ranch CPP. The route for moving the resin from the Hank Unit to the Nichols Ranch Unit is shown on Figure D1-2 of Appendix D1. No public roadways will be utilized during the shipping of resin for the Hank Unit to the Nichols Ranch CPP.

The uranium that is loaded onto the resin will remain attached to the resin until it is removed by a strong brine solution. When the loaded resin is transferred to a truck, it is moved using barren lixiviant. The barren lixiviant can have uranium concentrations of approximately 1-3 mg/L U_3O_8. The loaded resin is transferred to specially designed tanker trailers that will hold approximately 500 ft^3 of loaded resin. Most of the barren lixiviant is removed prior to shipping to minimize that amount of water weight in the tanker trailer. Because of the size of the trucks hauling the resin being consistent with a standard tractor-trailer combination, the trucks hauling the loaded resin should withstand the impact of most collisions.

If an accident were to occur with a loaded resin truck, a rupture to the tanker trailer carrying the loaded resin could happen. The ruptured tank could result in a portion of the loaded resin to be spilled on the ground. The uranium that is attached to the loaded resin would remain attached to the resin, but any residual barren lixiviant contained in the tank could spill to the ground carrying the resin a short distance from the accident scene. The environmental impact that would result would be minimal. The uranium on the resin would stay attached to the resin as would the uranium contained in any barren lixiviant that might spill. No airborne release of uranium would result from the spill. The spilled resin and lixiviant will typically collect in the low areas surrounding the accident scene trapping the resin for cleanup. The loaded resin and contaminated soil from the barren lixiviant would be removed and processed at a uranium mill or disposed of in a NRC licensed facility. The disturbed areas would then be reclaimed in accordance with all applicable NRC and State regulations.

7.5.1.3 Shipment of Process Chemicals

Truck shipments of process chemicals to the Nichols Ranch ISR Project site could result in local environmental impacts if the trucks are involved in an accident. Any spills would be removed with the affected area cleaned up and reclaimed. The process chemicals used at an ISR facility in truck load quantities are common to many industries and present no abnormal risk. Table 7-11 lists the process chemicals that may be utilized at the Nichols Ranch ISR Project. Since most of the material would be recovered or could be removed, no significant long-term environmental impacts would result from an accident involving the process chemicals.

Uranerz Energy Corporation may use anhydrous ammonia in the precipitation circuit at the Nichols Ranch CPP. A significant environmental impact could result if a truck carrying the anhydrous ammonia was involved in an accident. The ammonia "cloud" that could develop from a release during an accident could pose an environmental hazard if it were to occur in a populated area.

Table 7-11 Bulk Chemicals Required at the Nichols Ranch ISR Project.

Shipped As Dry Bulk Solids		Shipped as Liquids or Gases	
Salt	NaCl	Hydrochloric Acid	HCL
Sodium Bicarbonate	$NaHCO_3$	Hydrogen Peroxide	H_2O_2
Sodium Carbonate	Na_2CO_3	Carbon Dioxide	CO_2
Sodium Hydroxide	NaOH	Oxygen	O_2
		Diesel	
		Gasoline	
		Bottled Gases	
		Ammonia	NH_3

The anhydrous ammonia will be trucked to the Nichols Ranch ISR Project in bulk shipments of approximately 7,500 gallons. The frequency of shipments will be approximately 10-12 trucks per year. The trucks will originate from Casper and travel to the project site. The distance to be covered is approximately 85 road mi. Using the accident rate of $4.8x10^{-7}$ accidents/mi from the Generic Environmental Impact Statement for Uranium Mills, (NUREG-0706, NRC, 1980), the chance of a traffic accident involving these trucks is very low.

7.5.1.4 Shipment of 11e(2) By-product Material for Disposal

All 11e(2) by-products generated at the Nichols Ranch ISR Project site will be transported to an off-site NRC licensed disposal facility. The risk involved in shipping the material to a disposal facility is inherently lower that the risk involved in shipping yellowcake to a conversion facility since the distance between the disposal facility and the Nichols Ranch ISR Project site is considerably less than the distance between the conversion facility and the Nichols Ranch ISR Project site.

In the event that an accident would occur while transporting 11e(2) by-product material, the impact to the environment would be minimal. Any waste that is spilled on the ground and any contaminated soil would be removed and sent to the disposal facility. Because the 11e(2) by-products could contain some uranium, an airborne release could occur, but would not be any greater than the amount of released determined in Section 7.5.1.1 using the Model I criteria.

The risk of an accident involving the transporting of 11e(2) byproduct material and resulting in a spill will be kept to a minimum by the use of proper packaging and exclusive use shipments. If an accident were to occur, impact to the environment would be further reduced by following instruction outlined in the Uranerz Energy Corporation Incident Response Guide. This guide will be included with every shipment of 11e(2) byproduct material that leaves the Nichols Ranch Central Processing Plant. The carrier will also be required to maintain accident response capability to specifically include spill response.

7.5.1.5 Transporting Employees To and From Project Site

The Nichols Ranch ISR Project site is in a remote location in Wyoming. Employees that work at the Nichols Ranch ISR Project site will more than likely have to commute to the project site from areas such as Gillette, Wright, or Casper, Wyoming. The distances involved could be from 22 mi away to as far as 61 miles away from the project site. Transportation to and from the project site will either be from personal vehicles or company provided transportation.

Potential risks to employees coming to and from the Nichols Ranch ISR Project site include fatigue, animals, and adverse weather conditions. Fatigue and animal risks can be minimized by taking precautions such as resting and defensive driving, but adverse weather conditions can be more involved. If weather conditions exist such that roads leading into and out of the Nichols Ranch ISR Project are impassible or closed, then measures will be taken so that employees, contractors, vendors, and visitors will have a place to take shelter and be provided meals and a place to stay until the roads are passable.

The likelihood of an accident occurring while going to and from the Nichols Ranch ISR Project is estimated at 2.2×10^{-6}/mi based on NUREG 0780, NRC, 1980. All travel will be on either two lane rural highways with some rural interstate travel depending if employees come from Casper.

Work schedules will be developed with the goal of trying to minimize the amount of time that employees are traveling to and from the project site to help in reducing the risks of commuting to the project site.

7.5.2 Tank Failure

Process fluids will be contained in process vessels and pipes during the operation of the Nichols Ranch CPP and the Hank Satellite. Process instrumentation, controls, and alarms will monitor the flows and levels of tanks to maintain proper levels in the vessels. If a tank or process vessel were to have an unlikely failure such as a rupture in the process building, all fluid would be contained in the process building. The fluid would be collected in the plants sumps and then pumped to either other process vessels or to the deep disposal well. After the fluids have been removed, the area then would be washed down with plant water. The water would be collected in the plant sump system and pumped to either process vessels or the deep disposal well eliminating any environmental impact for the tank failure.

A process vessel or tank that fails outside of the process plants could result in spill of a process chemical such as HCL or H_2O_2. In the unlikely event that such a failure were to occur, the process chemical would be contained in the containment basin surrounding the vessel. The process chemical would then be either pumped to another tank or into a tanker truck to be properly disposed of in accordance with State requirements. If any soil is contaminated from the failure, then it will be removed and disposed of according to the requirements of the State. The environmental impact of such an incident would be minimal with no long-term impact.

An additional measure that will be put forth to mitigate any potential tank failures is in designing of the plant concrete floors. The concrete floors will be designed to support the full weight of any vessel, including contents, plus a safety factor so that tanks will not collapse or rupture as a result of a flooring failure. With that, tanks will either be constructed on reinforced concrete floors or reinforced concrete pads that will be designed by registered civil engineers and meet all building codes and standards.

7.5.3 Pipeline Failure

7.5.3.1 Process Pipelines

The failure of a process pipeline could result in the discharge of pregnant or barren lixiviant to the surface if the failure were to occur in the pipelines located in the wellfield. Measures such as high and low pressure alarms/shutdowns and flowmeters will be utilized on the piping leading to and from the wellfield to the CPP and satellite plant to minimize the amount of process fluid that is lost if a failure were to occur. If the amount and/or concentration of the process fluid lost in a pipeline failure constitute an environmental concern, the affected area would have the contaminated soil surveyed and removed for disposal according to NRC and State regulations. The probability of a failure to a process pipeline located in the wellfield is considered small since most pipelines will be buried approximately two to five feet below the surface and made out of corrosion free high density polyethylene. The pipelines will also be inspected and tested prior to burial to ensure that the pipelines are sound. Pressure test results will be documented.

The worst case scenario for a pipeline failure would involve a major pipeline rupture releasing barren or pregnant lixiviant for an hour at full operating capacity. If this were to occur, 210,000 gallons of barren or pregnant lixiviant would be released to the environment surrounding the area of the incident at the Nichols Ranch CPP. The pipeline would have to suffer a complete line break with no operators or plant personnel detecting the failure in a timely manner. The likelihood of this happening is considered very low since most industry experience has been that major pipeline ruptures are not complete line breaks, but smaller openings such as cracks, small punctures, or other types of partial line breaks. This was detailed in the NRC staff Hydro Resources Inc. Final Environmental Impact Statement for the Crownpoint Uranium Solution Mining Project (NUREG-1508, 1997). The Crownpoint FEIS also stated that the experience for pipeline ruptures shows less than 25% of the volume of the lixiviant contained in the pipeline is spilled in the worst case scenario, and in actuality, most leaks and spills occur through minor cracks or disconnection on smaller pipes.

7.5.3.2 Coal Bed Methane Gas Pipeline Failure

With the coal bed methane production in the Hank and Nichols Ranch Units, a rupture of a methane pipeline could occur resulting in the escape of the flammable and explosive methane gas. If such an event were to occur, the area surrounding the rupture would have to be evacuated with all equipment being shutdown and if necessary, a total plant shutdown and evacuation if the rupture was located near the CPP or satellite plant. The area in the vicinity of the methane pipeline rupture would remain sealed off until such time that the methane gas is turned off and the pipeline repaired. The environmental impact of such a failure would be minimal as the methane would be released to the atmosphere where it would quickly dissipate. The probability of such an event occurring is low since the methane pipelines that would be located in the Hank and Nichols Ranch Units would be buried approximately 6 ft under the surface and clearly identified with signage.

The worst case scenario for a methane pipeline would involve a major pipeline rupture as a result of a drilling rig drilling into the pipeline. This event could potentially result in an explosion of the methane gas, which could result in significant property loss and fatalities. The probability of this happening is low given that coal bed methane pipelines located in the Hank and Nichols Ranch Units will be clearly identified with signage. In addition to the signage, procedures will be developed on steps to be taken when drilling near methane pipelines. Measures such as verifying the location of the pipeline, flagging off the pipeline corridor, and maintaining a set distance from the methane pipeline when drilling wells will be implemented. Most of the methane pipelines will be in place before the Nichols Ranch ISR Project begins. Communication with the coal bed methane producers and Uranerz Energy Corporation has taken place and will continue so that any potential incidents involving methane pipelines are minimized.

7.5.4 Fires and Explosions

Fire and explosion hazards for the Nichols Ranch CPP and Hank satellite will be low since neither of the two plants uses flammable liquids or products in the yellowcake process. Propane will be utilized for the heating of oil for the vacuum dryer located at the Nichols Ranch CPP. The propane would be the primary source for a potential fire at the CPP. Building heat at Hank and Nichols Ranch Units will be supplied by electric heaters. If an explosion were to occur at the CPP, the uranium present in the plant would not appreciably disperse to the environment. The uranium will be kept in solution, adsorbed on ion exchange resin, as wet yellowcake slurry, or as dried yellowcake product contained in sealed 55-gallon drums. Any spilled fluids or slurries as a result of an explosion would be contained in the process building or in their containment area. The Dryer section of the Nichols Ranch CPP would contain the dried yellowcake product, sealed in 55-gallon drums or contained in the vacuum dryer, where any potential release from an explosion would occur and be contained.

Potential fire and explosions for the wellfields would be from an accumulation of gaseous oxygen in a "header house." Injection and recovery well piping systems are brought into manifolds in the wellfields for operational control. Piping manifolds, pump motor starters/controllers, and gaseous oxygen delivery systems are situated in the header houses. The header houses are designed to be an all-weather building equipped with electric heaters to keep piping from freezing during the cold months. If a gaseous oxygen accumulation were to occur in the header house and then ignited through some ignition source, an explosion could occur. The explosion could result in the rupture of pipelines containing mining solutions within the header houses and a spill to the area surrounding the header house.

To minimize the risk of an explosion in a header house caused by an accumulation of gaseous oxygen, each header house is equipped with a continuously operating exhaust fan. Additionally, the gaseous oxygen and primary mining solution lines entering the header houses are equipped with automatic low pressure shut off valves that will minimize any release of the oxygen or solution if the lines were ruptured.

7.5.5 Tornados

The Nichols Ranch ISR Project is located in Campbell and Johnson Counties, Wyoming. Both counties have experienced tornado activity. Johnson County has reported 17 tornados from the years 1950-2003. Campbell County has seen 69 tornados from the 1950-2003 time period (Wyoming Climate Atlas, 2004). The tornados occurring in Johnson County have been on the order of F0 (40-72 mph wind speed), and F1 (73-112 mph wind speed) as rated on the Fujita Scale. The majority of the Campbell County tornados are also F0 and F1 tornados, but Campbell County has also experienced several F2 (113-157 mph wind speed) tornados. The most recent F2 tornado struck the town of Wright, Wyoming on August 12, 2005 resulting in the death of two people, numerous injuries, and forty plus homes destroyed. Wright, Wyoming lies approximately 22 air mi to the east of the project area.

The probability of occurrence of a tornado in the area that the Nichols Ranch ISR Project is located in is approximately 3.2×10^{-4} per year (NUREG-0706, Section 7.1.6.3.1, Table 7-5). The region is classified as a Region III tornado intensity area with typical tornados having winds speeds of 240 miles per hour comprising of rotational wind speeds of 190 miles per hour and transitional wind speeds of 50 miles per hour. The design of the plant structures are not designed to withstand a tornado of this intensity.

With the nature of ISR operations, there is little that can be done to secure the facilities with advance warning than without it. Since most of the uranium is in the form of wet slurry or contained as a dry powder, the potential environmental effects resulting from a tornado encounter would be minimal. The strongest recorded tornado in Johnson and Campbell Counties was a F2 tornado in Campbell County. Using the Fujita Scale for F2 tornado, the typical damaged resulting from a F2 tornado is roof damage, unsecured mobile homes being removed from their foundations, and light structures severely damaged or destroyed. With most of the dried yellowcake product being stored in 55-gallon drums or in the vacuum dryer, both located in an engineered steel building, the dried yellowcake should not be released in the air by a tornado. However, if a tornado does cause damage to the building housing the vacuum dryer and the stored yellowcake to the point that the building collapses, then a possibility exists that some of the dried yellowcake could be released to the environment from damaged 55-gallon drums or from a damaged vacuum dryer.

The NRC in NUREG-0706, Generic Environmental Statement for Uranium Milling, performed a conservative dispersion model for uranium released to the environment by a tornado incident. The NRC staff assumed 25,100 pounds of dry yellowcake, or approximately 26 55-gallon drums of dried yellowcake, were picked up by a tornado. The model then calculated the maximum radiation exposure to the public due to the accident at three distances. At a distance of 2.5 mi away from the facility, the estimated 50 year does commitment to the lungs of an individual was estimated at $8.3x10^{-7}$ rem. From the facility to the model facility fenceline approximately 1,600 ft away, the 50 year dose commitment to the lungs of an individual was estimated to be $2.2x10^{-7}$ rem. For the nearest resident to the model site, 6,500 ft away, the 50 dose commitment was estimated at $2.4x10^{-7}$ rem.

7.5.6 Well Casing Failure

The failure of an injection well casing would have the potential for the most significant environmental impact since this failure could introduce lixiviant into a United States Drinking Water (USDW) aquifer that is not exempted from the process. This type of incident has the possibility to last for several days before being detected by the monitoring well system that will be in place. If such a failure were to occur, the defective well would either be immediately repaired, or plugged and abandoned in accordance to State of Wyoming regulations. If contamination of an aquifer other than the ore zone aquifer was determined, wells would be drilled into the contaminated aquifer then pumped until concentrations of the lixiviant constituents were reduced to acceptable levels. With proper well construction procedures and well testing procedures, including verifying the integrity of the well casing, and proper cementing of the wells, the probability of such a failure is minimal.

To minimize the risk of a casing failure significantly impacting the environment, monitor wells are completed in the aquifers above and below the ore zone. The monitor wells are routinely sampled during the extraction process to check the fluid levels and quality of water. By doing such routine monitoring for fluid levels and water quality, any excursions of the lixiviant to these aquifers can be observed if such an incident were to occur. In addition to the routine monitoring of the monitor wells, casing integrity tests will be performed on all injection wells prior to putting the injection wells into production. The integrity testing will also be conducted after any work that involves entering the cased wells with a cutting tool such as a drill bit or underreamer is preformed.

The failure of a recovery well causing a significant impact is not very high since recovery wells normally do not cause fluid migration to aquifers above and below the ore zone. The recovery wells generally operate at a lower pressure than the aquifers located above and below the ore zone aquifers meaning that any casing failures by a recovery well would more than likely lead to the water in the aquifers flowing into the failed well casing instead of the lixiviant being introduced into the aquifer.

7.5.7 Aquifer Communication Through Old Exploration Holes

The communication between aquifers of lixiviant through old exploration holes in the project area is unlikely. The old exploration holes that have been drilled in the project area are thought to be abandoned using either abandonment mud, drilling mud, a combination of bentonite and abandonment mud, or a combination of bentonite and drilling mud. The mud in the old exploration holes provides an effective seal against fluid communication between the various aquifers penetrated by the drilling of the exploration holes. Additionally, the rapid swelling and bridging of the isolating shales between the sandstone aquifer units provides the abandoned exploration drill holes additional sealing. In the event that an aquifer is contaminated from leakage from an abandoned drill hole, new wells would be drilled and completed in the contaminated aquifer. Water samples would be collected and if needed, the well would be produced to reduce the concentration of contamination in the aquifer to an acceptable level.

Another measure that will be taken to ensure that there is no communication between the aquifers from prior exploration holes is conducting pump tests before the start-up of a production area. The pump test will demonstrate that there is no significant communication between aquifers. In the event that leakage between aquifers from old exploration holes is detected during the tests, the old exploration holes would be re-entered and plugged. If contamination of an aquifer is also indicated, wells would be drilled and completed in the contaminated aquifer, water samples collected, and if needed, the wells would be produced to reduce the concentration of lixiviant to an acceptable level.

7.5.8 Aquifer Communication Through Coal Bed Methane and Oil/Gas Wells

The likelihood of lixiviant communicating from the ore zone aquifer to another aquifer through a coal bed methane (CBM) well or an oil/gas well is very low. Oil/gas wells that exist in the project area have been in place since the 1980's. If any issues with their completion existed, current water quality baseline sampling that has taken place for the Nichols Ranch ISR Project would have indicated contamination when compared to historic water quality sampling that took place in the 1970's. Additionally, the oil/gas wells are completed as such that their integrity would not allow communication between aquifers. Cementing of the oil/gas wells occurs from the surface to at least 1,000 ft deep. A cement bond log is run after the wells are completed to ensure that the cementing job used for completion has been properly done. Pressure monitoring on the oil/gas wells also ensures that the oil/gas wells are working properly and that the wells integrity is intact.

CBM wells are also completed in the same manner as the oil/gas wells. The CBM wells are usually 1,000 ft or deeper to reach the coals seams under the project area. When the CBM wells are drilled, they are drilled to the top of the coal seam and then cemented from there to the surface. A cement bond log is run after the cement job has had time to cure to ensure that the well is completed properly. The CBM wells that are and will be located at the Nichols Ranch ISR Project site will all be in place prior to the start of mining. Production area pump tests conducted prior to mining along with monitor wells installed in the overlying and underlying aquifers will be able to detect if any CBM wells are causing aquifer communication. In the event that a CBM or oil/gas well is found to be causing communication, contact will be made with the company that owns the well to work on repairing, or plugging and abandoning the well. If any contamination of an aquifer is detected, monitor wells will be drilled and completed in the contaminated aquifer. Water quality sample will be taken and, if necessary, the wells produced until the concentration of any lixivant in the aquifer is reduced to acceptable levels.

7.5.9 Occupational Incidents

Uranerz Energy Corporation will have comprehensive safety policies, procedures, and practices that will be used to prevent occupational incidents from occurring to all Uranerz Energy Corporation employees, contractors, visitors, and the public. The policies, procedures, and practices will take into account such things as; following all building and construction codes during the construction of the Nichols Ranch ISR Project in order to prevent items such as tank and pipeline failures, proper containment for any fluid containing vessels, and emergency response procedures in the event of an emergency. Additionally, all Uranerz Energy Corporations will be trained on company safety and environmental policies that will cover topics ranging from OSHA rules and regulations to the company vehicle policy, proper use of PPE, and the enforcement of speed limits when traveling to, within, and from the plant locations, etc. Training on Uranerz Energy Corporation polices, procedures, and practices for employees will take place prior to beginning work at Uranerz and on an annual basis. Additionally, employees will receive training prior to beginning work in the plants on the correct plant operations including such subjects as regular inspections of all wellfields and plant lines, equipment, and operations.

Additional measures to protect employees, contractors, visitors, and the public from any potential hazards that may result from the Nichols Ranch ISR Project will be built into the plant. These measures include both visual and audible process monitoring devices such as HIGH and LOW levels alarms, HIGH and LOW pressure alarms, and flow alarms that will notify plant personnel of any situations in which process parameters are out of normal process ranges. Interlocks will also be present that will shutdown any part of the process in the event that an incident occurs that could have an impact on the safety of employees, contractors, visitors, or the public.

7.6 ECONOMIC AND SOCIAL EFFECTS OF CONSTRUCTION AND OPERATION

7.6.1 Benefits

7.6.1.1 Employment

The construction and operation of the Nichols Ranch ISR Project will provide jobs to approximately 55-65 company employees and 10–20 contract employees during the life of the project. Because mining is a basic industry, this job creation will produce a multiplier effect on employment in the region. Since employees are expected to live in the region, the entire income benefit will also accrue to the local economy.

7.6.1.2 Taxes

The extraction and selling of yellowcake product during the life of the Nichols Ranch ISR Project will produce direct and indirect tax benefits to local, state, and federal governments through the collection of sales taxes, severance taxes, and state and federal royalties.

7.6.1.3 Roads

Uranerz Energy Corporation will assist in the maintenance of existing gravel roads used by Uranerz from the county gravel road to the project area during the life of the Nichols Ranch ISR Project. The assistance with the road maintenance will lower the cost of maintenance to the other road users that include the land owner, oil/gas producers, and coal bed methane producers.

7.6.1.4 United States Nuclear Energy Supply

The yellowcake product that is produced by the Nichols Ranch ISR Project will provide a domestic source of uranium to be used for the production of nuclear power. The production of nuclear power aids in providing an inexpensive, environmentally friendly source of energy to meet the growing energy demand of the world.

7.6.2 Socioeconomic Costs

7.6.2.1 Public Facilities and Services

No adverse impacts on public facilities and services, such as congestion of streets and highways, overloading of utilities such as water supply and sewage treatment systems, and the overtaxing of local schools, hospitals, police and fire protection is expected with the Nichols Ranch ISR Project. Employees for the Nichols Ranch ISR Project will be drawn from the surrounding areas located near the project site so that minimal impacts will be made to the individual communities and their facilities and services.

7.6.2.2 Housing

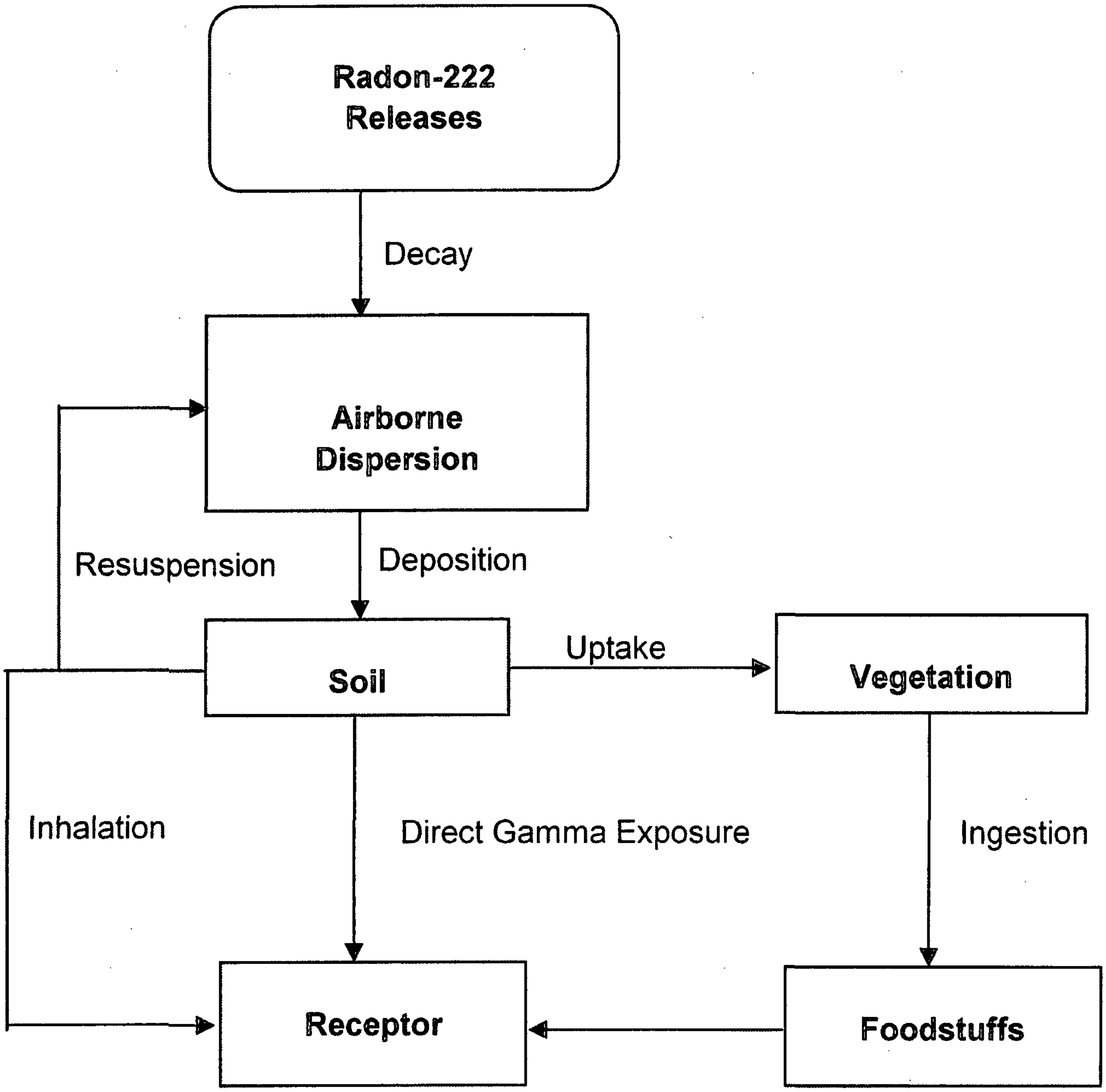
Although Wyoming is dealing with a housing shortage because of a statewide energy boom, the Nichols Ranch ISR Project should not have a negative impact on the housing in the areas surrounding the project area. The Nichols Ranch ISR Project will draw from the workforce that is present in the project area. By doing this, there will not be a need for new housing to be developed to accommodate employees.

7.6.2.3 Impairment of Historical, Scenic, and Recreation Values

With the location of the Nichols Ranch ISR Project on private, remote land with limited access, historical, scenic, and recreational values will not be adversely impacted. No official or unofficial historic and scenic places of interest exist or are found at the Nichols Ranch ISR Project. If any cultural resources are encountered during the construction or operation of the Nichols Ranch ISR Project, the appropriate agencies will be notified immediately. The recreational values of the land in the project area, such as hunting, are controlled by the landowner and will not be significantly impacted by the proposed project.

7.7 MINERAL RESOURCE IMPACTS

The only known mineral that can be recovered in economical quantities in the Nichols Ranch ISR Project area is uranium. Large coal seams do exist within the project area, but they are at such a depth that they are not economically feasible to mine at the current coal prices. Oil and gas production has and is occurring in the Hank Unit of the project. Because of its depth (<9,000 ft) compared to the depth of the uranium (300 to 700 ft) no impacts will occur. Coal bed methane (CBM) activity is also currently taking place in the project area. No adverse impacts are expected to occur between the CBM and uranium mining activities because of the separation of the depth between the two; CBM being deeper (~1,000 ft plus). Communication and working agreements have and are being developed between the CBM producers and Uranerz Energy Corporation to alleviate any possible concerns and impacts that may arise.



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NICHOLS RANCH ISR PROJECT

FIGURE 7-3a

EXPOSURE PATHWAYS DIAGRAM

By: SMF	Date: 2-6-2009
Datum: N/A	Revision Date:
Scale: N/A	Dwg#: figure 7-3a