

4.0 Site Characterization and Description

4.1 Potential Land Use Impacts

4.1.1 Proposed Action

As discussed in Sections 2.2 and 3.1 of this ER, the primary land uses at all sites covered under SUA-1548 are energy development and agriculture. While some land is used for wildlife habitat and recreation, it is such a small proportion that these functions are not expected to be impacted from ISR development. ISR production will be compatible with local energy development including oil and gas, coal, CBM, and wind. Surface disturbances and exclusionary fencing will reduce grazing capacity within all SUA-1548 license areas, but the loss will be relatively small compared to the available surrounding rangeland. The maximum area expected to be impacted at Smith Ranch, North Butte, Gas Hills, and Ruth by approval of this LRA is approximately 1,620 hectares (4,000 acres) or less than 10% of the total area. Approximately 40% (624 hectares or 1,542 acres) of the expected surface disturbances have already taken place as of September 2011 (see Section 3.3 for a complete discussion of existing surface disturbances). The additional potential land impacts expected from ISR operations will be less than 5% of the total SUA-1548 license areas and cumulative disturbances will be less than 8%. Disturbance estimates have remained similar since the last LRA and there is no anticipated change in the percent of disturbed area. Because only a small percentage of surface disturbances are anticipated, land use will likely continue to remain largely unaffected from ISR operations.

Potential impacts to land use are intrinsically tied to both the spatial and temporal extent of surface disturbances. ISR operations will include both long-term (more than one year) and short-term (less than one year) surface disturbances. In general, long-term disturbances include the CPP, CPF, uranium recovery satellite facilities, mine unit header houses, pump stations, and most access roads. Short-term disturbances include the construction of mine unit pattern areas and monitor wells, including drill holes, pipelines, and utility trenches. These short-term disturbance areas will be reclaimed and revegetated as soon as possible after construction has been completed. Surface reclamation and revegetation occur concurrently with well field construction in order to minimize potential land use impacts. Individual mine units will be temporarily fenced during the period of production and restoration and will not be available for grazing but the surrounding license area will be open and available for grazing. After reclamation, revegetated areas will be available for grazing and wildlife habitat for the remaining life of the project. Once production, restoration and reclamation are complete, all areas covered under SUA-1548 will be returned to the pre-ISR mining land use of livestock grazing and wildlife habitat for unrestricted use. Mitigation measures for the loss of agricultural production over the course of the project are discussed in Section 5.1. The following sections identify the specific potential impacts to land use within SUA-1548 and potential cumulative land use effects.

4.1.1.1 Smith Ranch

The Smith Ranch license area totals approximately 16,187 hectares (40,000 acres). The estimated total surface disturbances for the life of the project are expected to be approximately 761 hectares (1,880 acres), or less than 5% of the total area (Reynolds Plan of Operations, BLM, 2011). Currently, approximately 570 hectares (1,410 acres) are already disturbed. The proposed increase in surface disturbance will be approximately 190 hectares (470 acres), or approximately 1% of the total Smith Ranch license area.

The majority of the long-term disturbances (more than one year) in the Smith Ranch license area have been constructed and include: the Smith Ranch CPP and Highland CPF, uranium recovery satellite facilities, mine unit header houses, pump stations, powerline corridors, UIC Class I disposal wells, and most access

roads. Additional access roads and mine units are planned for the Reynolds Ranch Satellite but will be less than 1% of the Smith Ranch license area. These disturbances constitute approximately 13% of the total disturbed acreage of 99 hectares (244 acres) and will remain for the life of the Project.

Short-term disturbances (one year or less) will comprise more than 85% of the mine unit total disturbed acreage of approximately 662 hectares (1,635 acres) and will include construction of monitor wells, mine unit patterns, pipeline and utility trench areas that will be reclaimed and revegetated as soon as possible after construction has been completed. After initial revegetation, individual mine unit pattern areas will be temporarily fenced during the period of production and restoration and will not be available for livestock grazing. The revegetated acreage will be available for wildlife habitat for the life of the project. Cameco incorporates WDEQ and BLM guidelines into their fencing programs to ensure wildlife friendly fencing. Not only is the estimated loss of grazing and wildlife habitat less than 5% of the total area at Smith Ranch, but the exclusions associated with ISR development will be temporary.

Therefore, for the projected operational life of the Smith Ranch Project, it is estimated that approximately 99 hectares (244 acres) of the approximate 16,187 hectare (40,000 acre) project area will be completely removed from use until final reclamation. This represents less than 1% of the total permitted acreage. Mine unit areas (approximately 662 hectares [1,635 acres]) will be fenced to prohibit livestock entry. At the end of the Project, the entire 16,187 hectares (40,000 acres) will be returned to the pre ISR use of wildlife habitat and livestock grazing.

Other identified land uses at Smith Ranch include the development of other natural resources, including uranium, coal, oil and gas, and wind energy. Currently all of these land uses are present within or adjacent to the license area and approval of the proposed action will not affect these land uses.

4.1.1.2 North Butte Remote Satellite

The primary land use at the North Butte Remote Satellite is rangeland and grazing. The North Butte Remote Satellite consists of approximately 409 hectares (1,010 acres). It is anticipated that a total of approximately 162 hectares (400 acres) will be disturbed during the life of the project. Current (2011) surface disturbances total about 12 hectares (30.5 acres), primarily from boreholes and monitor wells. Additional short- and long-term surface disturbances will include mine unit pattern areas during well field construction, surge ponds, IX recovery and water treatment facilities, mine unit piping distribution centers, pipelines, booster pump stations, UIC Class I disposal wells and access roads. The proposed development is expected to disturb approximately 150 hectares (370 acres). Mine unit pattern areas will be temporarily fenced during the period of production and restoration and will not be available for livestock grazing. As with Smith Ranch, Cameco will incorporate WDEQ and BLM guidelines into their fencing to ensure wildlife friendly fencing. Since restoration, final reclamation and interim surface stabilization occur contemporaneously with development and production, the total disturbed area will not be more than approximately 162 hectares (400 acres) at any single point in time. In reality, this number will be even smaller since revegetation will immediately follow mine unit pattern establishment. Past experience at Smith Ranch suggests that vegetation will become well established within 3 years of initial disturbance. The potential impacts to land use are in all cases temporary and reversible by returning the land to its former grazing use through post-ISR surface reclamation. There will be no potential long-term impacts or institutional controls following site decommissioning.

Other land uses in the North Butte Remote Satellite area include the development of other natural resources such as oil, gas, uranium, and CBM. Currently all of these land uses are occurring within and adjacent to the license area and approval of the proposed action will not affect these land uses.

4.1.1.3 Gas Hills Remote Satellite

The Gas Hills Remote Satellite is predominately on public lands administered by the BLM, and is leased for sheep and cattle grazing. The license area is approximately 3,440 hectares (8,500 acres), but less than 20% (607 hectares or 1,500 acres) of the license area is expected to be disturbed throughout the lifespan of the project. Existing buildings, drill holes and access roads are present within the license area and currently account for approximately 40 hectares (98 acres) of the expected total disturbance. Surface disturbances will be similar to other satellite locations and will include mine unit pattern areas during well field construction, evaporation ponds, IX recovery and water treatment facilities, mine unit piping distribution centers, pipelines, booster pump stations, UIC Class I disposal wells and roads. Mine unit pattern areas will be temporarily fenced during the period of production and restoration and will not be available for livestock grazing. Fencing will be wildlife friendly in accordance with WDEQ and BLM guidelines. Because construction and development is done in stages and reclamation follows each construction project, the disturbed area at any given time will be less than the projected total of approximately 516 hectares (1,275 acres). All land disturbances can be reclaimed and returned to unrestricted pre-ISR uses when mining ceases.

Other identified land uses at the Gas Hills Remote Satellite include the development of other natural resources, including uranium, and oil and gas, as well as recreational usage of BLM land for hunting. Currently all of these land uses are present within or adjacent to the license area and approval of the proposed action will not affect these land uses.

4.1.1.4 Ruth Remote Satellite

The Ruth Remote Satellite is predominantly located on private grasslands. The license area is approximately 572 hectares (1,414 acres), although only a portion of this area will be disturbed similar to the other satellite locations. Surface disturbances will include mine unit pattern areas during well field construction, surge ponds, IX recovery and water treatment facilities, mine unit piping distribution centers, pipelines, booster pump stations and roads. Current disturbances at this site cover approximately 1.7 hectares (4.3 acres). Reclamation will follow all development projects and ensure that the disturbed area at any given time is kept to a minimum.

Other land uses within and adjacent to the Ruth Remote Satellite include the development of other natural resources such as oil, gas, uranium, and CBM. Currently all of these land uses are present within and adjacent to the license area and approval of the proposed action will not affect these land uses.

4.1.2 Potential Impacts of the No-Action Alternative

The no-action alternative would result in no additional potential land use impacts within SUA-1548 license areas. All current ISR production at Smith Ranch would cease and the current, though minimal potential land use impacts (fencing and restricted grazing) would slowly decrease as decommissioning, reclamation and restoration continue. The additional existing surface disturbances at the remote satellites will also need to be reclaimed. The total area within SUA-1548 license areas that will need to be restored and reclaimed is approximately 624 hectares (1,542 acres). These lands will return to grazing and other energy development land uses.

4.1.3 Potential Impacts of the Alternative Action

Conventional underground and/or open pit mining represent the two available alternatives to ISR for the uranium deposits at SUA-1548 license areas. Both of these alternatives involve significantly greater potential short- and long-term impacts to land use and have historically taken place within each license area. As compared to ISR, conventional mining practices include large areas of mining, especially open pit

mining, large stockpile areas, roads, processing facilities and large tailings disposal areas. Compared to the proposed action, conventional open pit mining could increase the acreage of disturbance by a factor of 100. Such lands disturbed by conventional mining would be removed from grazing for the life of the mine and often 10 years or more past reclamation. Conventional underground mining would result in an increase in land disturbance over ISR operations, but not as significant as conventional open pit mining. While the shaft and mill associated with underground mining is a smaller land disturbance, evaporation ponds and/or heap leach footprints can be substantial. In either case, the impact on land use would be far more significant if conventional mining methods were employed when compared to the proposed action.

4.1.4 Cumulative Effects of the Proposed Action

As discussed in Sections 2.2 and 3.1 of this ER, the primary land use within and adjacent to the SUA-1548 license areas is energy development (oil and gas, coal, CBM, ISR and wind) and agriculture (cattle and sheep grazing). No major changes in land use are expected in the foreseeable future. Cameco's ISR operations have been and will continue to be compatible with energy development in the region and will only minimally disturb land surfaces and agricultural uses. It is estimated that less than 10% of the total SUA-1548 licensed acreage will be disturbed throughout the life of the project, and ongoing efforts to minimize potential land use impacts will be taken (see Section 5.1). Cattle and sheep grazing will be temporarily limited as a result of construction and operation, but all land within SUA-1548 will be reclaimed and restored to its original use. Potential impacts to wildlife habitat and recreation will also be small because of the limited disturbance to the land. As a result, potential cumulative land use impacts from SUA-1548 are expected to be minimal in the Powder River Basin and Wind River Basin (see Section 2.2). Additional information regarding environmental effects of land use is discussed in Sections 7.1.2 and 7.2.3 of the TR.

4.2 Potential Transportation Impacts

4.2.1 Proposed Action

Selection of the proposed action will result in negligible potential impacts to transportation based on current traffic loading estimates (WYDOT, 2010) and transportation accidents impacts. Transportation activities associated with SUA-1548 include employee commuting, supply shipments, waste transportation, IX resin transport, and yellowcake transportation. ISR operations will increase local traffic volumes, but the change will be relatively small compared to local traffic volumes in the region. Less traffic disturbance is predicted during the construction, aquifer restoration, and decommissioning phases than during the operational phase. To reduce the potential impacts from a traffic accident, materials and supplies will be transported according to NRC and DOT regulations. Specific and quantifiable estimates of the potential impacts of the proposed action on local and regional transportation corridors are provided below. Mitigative measures, including emergency response plans and procedures, implemented to decrease potential impacts to transportation are discussed in Section 5.2 of this ER.

4.2.1.1 Smith Ranch

Most of the Smith Ranch license area is currently in operation so no major changes in workforce vehicle traffic are expected. There will be an increase in workforce at the remote satellites ranging from 50 to 60 people at North Butte to 75 people at Gas Hills. Yellowcake slurry from the remote satellite facilities to the CPF and/or the CPP will increase as well as dried yellowcake shipments from Smith Ranch to the conversion facilities in Metropolis, Illinois or Port Hope, Ontario, including anticipated shipments to either the Smith Ranch CPP or the Highland CPF due to toll milling of resin or yellowcake slurry received from Cameco's remote satellites or other NRC licensees. North Butte is expected to ship 170 truckloads of uranium-laden resin to Smith Ranch each year, while Gas Hills is expected to ship 447 truckloads of uranium-laden resin or yellowcake slurry to Smith Ranch each year. The number of shipments from these remote satellites is relatively small, with North Butte having an average daily truckload of 0.45 and Gas Hills having an average daily truckload of 1.2 relative to traffic loading estimates (WYDOT, 2010 and ER Section 3.2). The Ruth Remote Satellite would likely be similar to North Butte and ship less than one truckload per day to Smith Ranch. The addition of two to three truckloads between the remote satellites and Smith Ranch will not increase traffic rates on local roads by more than 1% and will likely be negligible. Specific traffic routes are discussed in further detail in Section 3.2 of this ER.

4.2.1.2 North Butte

In the Powder River Basin, the primary potential traffic impacts from resin transfers between the North Butte Remote Satellite and Smith Ranch CPP or CPF will be realized on State Highway 387 between State Highway 50 and Highway 259. The increase in traffic will be less than 0.25%. Project-related traffic will be greatest from the operations and construction workforce which will be housed in surrounding communities. This workforce will commute to and from worksites and travel within worksites during work hours. A total of **33** vehicles are expected to commute to the North Butte Remote Satellite each day with approximately 75% coming from Gillette and 25% coming from Casper. The percent increase on State Highway 50 coming from Gillette and the percent increase on State Highway 259 and 387 from Casper would be less than 3% and less than 1%, respectively.

4.2.1.3 Gas Hills

The Gas Hills Remote Satellite will increase traffic along the following routes: State Highway 136 between Riverton and the Gas Hills; Gas Hills Road from the satellite to State Highway 20 at Waltman; State Highway 26 north of Riverton to Shoshoni; and State Highway 20/26 from Shoshoni to Casper. Cameco estimates that ISR operations will increase travel to and from the Gas Hills Remote Satellite each day by approximately 20 to 30 vehicles and its greatest impact will be on traffic counts on the Gas Hills Road. Eighty percent are expected to travel from Riverton and 20% from Casper for the lifespan of the Gas Hills Remote Satellite. The percent increase on State Highway 136 would be 23% and the increase on State Highway 20/26 east of Casper would be less than 2% (WYDOT, 2010). Although the relative increase in traffic along State Highway 136 is large, the road capacity of this state highway can easily accommodate this increase. At one time Wyoming 136 (Gas Hills Road) had the transportation capacity to accommodate workers for three to four simultaneously operating conventional mines and mills (Pathfinder, Umetco, Energy Fuels and American Nuclear). This transportation capacity remains and has been significantly underutilized since the mid-1980s.

4.2.1.4 Ruth

Similar to North Butte, Ruth will likely have their workforce come from either Gillette or Casper. Increases in traffic are likely to be similar to North Butte and will not likely increase traffic from either Gillette or Casper by more than 3%. If both satellites operate simultaneously the net increase in traffic on Highway 50 could be approximately 5%.

4.2.2 Potential Transportation Accident Impacts

Resin, yellowcake slurry, dried yellowcake and 11e.(2) byproduct material shipments are made in accordance with DOT, NRC, and Transport Canada (when applicable) regulations. Transportation of hazardous materials to and from SUA-1548 can be classified as follows:

- Shipments of uranium-laden resin and/or yellowcake slurry from SUA-1548 satellites or third party uranium recovery facilities to the CPP or CPF for processing.
- Shipments of process chemicals or fuel from suppliers to any SUA-1548 facility.
- Shipment of dried yellowcake from the CPP or CPF to a conversion facility.
- Shipments of 11e.(2) byproduct material from the CPP or CPF and satellites to a NRC licensed disposal facility.

SUA-1548 is an operating license, and approval of the proposed action will allow transportation of the above types of materials to continue. Transportation accident risks may increase as the number of shipments increase, but mitigation measures such as transportation training, compliance with current and future transportation regulations and hazardous waste clean-up preparedness and training will reduce this accident risk and impact of any accidents. Accident risks involving potential transportation occurrences are discussed in the following sections. Mitigation and control measures to eliminate or minimize potential environmental impacts due to transportation accidents are discussed in Section 5.2.

4.2.2.1 Potential Accidents Involving Ion Exchange Resin or Slurry Shipments

IX resin or yellowcake slurry is transported to and from the CPP or CPF in 15 cubic meter (4,000 gallon) capacity tanker trailers. As many as four loads of uranium-laden resin may be transported for elution and up to four loads of barren eluted resin may be returned on a daily basis. The transfer of resin will occur on a combination of private, county, and state roads. For shipments of IX resin to a CPP, NRC determined that the probability of an accident involving such a truck was 0.009 in any year (NRC, 2009).

The worst case accident scenario involving resin transfer transportation would be an accident involving the transport truck and tanker trailer when carrying uranium-laden resin where all of the tanker contents were spilled. Because the uranium is ionically-bonded to the resin and the resin is in a wet condition during shipment, the potential radiological and environmental impacts of such a spill are minimized. The radiological and environmental impact of a similar accident with barren, eluted resin would be less significant. The primary environmental impact associated with either accident would be the salvage of soils impacted by the spill area and the subsequent damage to the topsoil and vegetation structure. Areas impacted by the removal of soil would be refilled, graded and revegetated.

4.2.2.2 Potential Accidents Involving Shipments of Process Chemicals and Fuel

It is estimated that approximately four bulk chemical, fuel, and supply deliveries are made per working day throughout the operational life of SUA-1548. Types of deliveries include carbon dioxide, oxygen, salt, soda ash, hydrogen peroxide, sulfuric acid, hydrochloric acid and fuel. All shipments are made in accordance with the applicable DOT hazardous materials shipping provisions.

4.2.2.3 Potential Accidents Involving 11e.(2) Byproduct Material

11e.(2) byproduct material, including unusable contaminated equipment generated during operations, will be transported to a NRC licensed disposal site. Because of the low levels of radioactive concentrations involved, these shipments are considered to have minimal potential environmental impact in the event

of an accident. Shipments are generally made bulk in sealed roll off containers in accordance with the applicable NRC and DOT hazardous materials shipping provisions.

4.2.2.4 Potential Accidents involving Yellowcake Transportation

NRC and others have previously analyzed the hazards associated with dried yellowcake transportation for both the generic case (Mackin, et al., 2001; NRC, 1980, NRC, 1977) and in site-specific environmental assessments (e.g., in NRC, 1997). These analyses are conservative and tend to overestimate potential impacts (e.g., release model, accident rates, dosimetry selections, exposed population density); however, they are appropriate for screening-level calculations. The NRC concluded that the risk analyses combined with past experience show estimated and actual consequences of such accidents are small, due in part to the appropriate use of safety controls and emergency response protocols on the part of the Licensee (NRC, 2009). An accident involving yellowcake slurry would actually present less of a risk since the material is wet and can easily be removed from the surface with minimal potential for residual surface or air quality impacts.

4.2.3 No-Action Alternative

The selection of the no-action alternative would result in a short term increase in 11e.(2) byproduct material transportation, but in general and over the long term a reduction in overall potential transportation impacts would occur as the workforce and shipments decrease. There may be some yellowcake shipments during restoration activities; however, overall construction activities, employee access and transportation of ISR-related fuels and supplies to the licensed facilities or waste materials away from facilities will cease following reclamation of existing SUA-1548 disturbances. Access roads, buildings and existing wells and well fields at Smith Ranch (approximately 570 hectares or 1,409 acres), North Butte (12 hectares or 30 acres), Gas Hills (39 hectares or 97 acres) and Ruth (1 hectare or 4 acres) will all need to be reclaimed. This will result in a temporary increase in construction traffic over current levels, but will result in overall reduction in potential transportation impacts as the workforce decreases.

4.2.4 Alternative Action

The alternative action would include a conventional underground or surface uranium mine and mill. The selection of this alternative would result in a significant increase in potential transportation impacts. A conventional mill may include processing facilities such as a new plant, tailings ponds or a conventional heap leach. A conventional open pit mine would include a significantly greater work force given the size of the operation and potential labor needs. Whereas ISR facilities require drilling rigs (2-3 men per rig) and facility operating staff travelling to the header houses, satellites and inspection of pipelines, a conventional mine/mill requires either contract or company labor to drive scrapers, dozers, trucks and shovels. To strip 7,646 meters (10,000 yards) per day, an operation would likely require eight scrapers, four trucks, and two shovels as well as management and supervisory staff. Geologic and mine planning conditions would dictate the acreage stripped to meet production goals. Additionally, for any operation, ISR or conventional, personnel are required to meet needs at the plant, including engineers, chemists, environmental and safety staff, etc. For an equivalent conventional operation, one might anticipate two to three times the impact on roads that one would see with an ISR operation. A conventional mill will also require hazardous materials to be transported to customers or to an off-site location for processing. For the purposes of this analysis and assuming production goals are the same, it is assumed that shipping hazardous materials would be equivalent for both ISR and conventional mine operations.

4.2.5 Cumulative Effects of the Proposed Action

Cumulative effects from transportation at SUA-1548 are not anticipated to be significant. The existing and additional ISR operations during the renewal period will only minimally impact local road traffic within

and adjacent to SUA-1548 license areas and when considered on a cumulative basis with regional energy development will have a negligible impact. ISR recovery at SUA-1548 facilities will contribute a proportionally small portion of additional traffic to area roads as compared to other energy development and agricultural activities. The SUA-1548 sites are remote and local transportation networks include agricultural traffic, and the workers associated with other ISR operations, CBM, conventional oil and gas as well as wind development. Smith Ranch is an ongoing operation and approval of this LRA will result in an increase of the number of personnel to approximately 170. The remote satellites will require additional personnel during initial construction, but this number will be reduced during operational periods. The majority of roads utilized by ISR operations are already built and additional roads will have relatively low rates of traffic so potential impacts to agriculture, recreation and wildlife are expected to remain small.

4.2.6 References

Nuclear Regulatory Commission. 2009. Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities (NUREG-1910). Page last reviewed/updated Sunday, March 13, 2011.

Wyoming Department of Transportation (WYDOT). 2010. Automatic Traffic Recorder Report – 2010. Prepared in cooperation with U.S. Department of Transportation, Federal Highway Administration.

4.3 Potential Geology and Soils Impacts

4.3.1 Proposed Action

Potential geologic and soil impacts associated with ISR operations are significantly less than conventional underground or open pit mining. SUA-1548 geologic impacts have been in the past and are anticipated to continue to be negligible, and soil impacts will be minimal as well. The following sections describe the potential impacts to geology and soils associated with the proposed action.

4.3.1.1 Potential Geologic Impacts

Smith Ranch and the North Butte and Ruth Remote Satellites

Potential geologic impacts at Smith Ranch and the North Butte and Ruth Remote Satellites are expected to be minimal, if any. Unlike conventional uranium mining, ISR does not remove formation material from the aquifer, minimizing the chance of subsidence. No significant matrix compression or ground subsidence has been observed during 25 years of ISR operations at Smith Ranch, nor is it expected to result in the future from the proposed action.

Historical seismic activity within and around SUA-1548 **sites** are summarized by county in Section 3.3 of this ER, and have been reviewed and evaluated by the NRC Staff during previous licensing actions for Cameco and other licensees operating in the region. While seismic activity has occurred, the earthquakes have been relatively small with minimal impacts. Additionally, no active faults with a surficial expression have been documented at Smith Ranch or the North Butte and Ruth Remote Satellites. As a result, potential environmental impacts from seismic activity are expected to be minimal. Mitigation measures to reduce potential impacts from seismic activity are discussed in Section 5.3 of this ER.

Gas Hills Remote Satellite

Potential geologic impacts from subsidence are expected to be minimal at the Gas Hills Remote Satellite for the same reasons as cited above for Smith Ranch, North Butte and Ruth Remote Satellites. Because ISR does not remove formation material from the aquifer, no subsidence or matrix compression is anticipated.

Section 3.3 of this ER summarizes historical seismic activity within and around the Gas Hills Remote Satellite. In general, there has been minimal expression of regional earthquakes. The closest major fault system, the Green Mountain segment of the South Granite Mountain Fault System, is located about 45 kilometers (28 miles) from the Gas Hills Remote Satellite. This fault was analyzed deterministically to estimate ground motion at the Gas Hills Remote Satellite. Results from this study indicated that horizontal ground acceleration at Gas Hills would be approximately 6%g for a magnitude 6.75 earthquake (see Section 3.3 of this ER). With seismic activity anticipated to be small, potential impacts at the Gas Hills Remote Satellite are also anticipated to be minimal. Mitigation measures, as described in Section 5.3 of this ER will minimize potential impacts from seismic activity at the Gas Hills Remote Satellite.

4.3.1.2 Potential Soils Impacts

The principal impact to **soils** at SUA-1548 **sites** will be from earthmoving activities associated with construction of ISR facilities. Earthmoving activities include:

- Clearing of ground or topsoil and preparing surfaces for the satellite facilities, pump houses, access roads, drilling sites, and associated structures;
- Excavating and backfilling trenches for pipelines and electrical cables;
- Excavating evaporation ponds and developing evaporation pond embankments; and
- Removal of potentially contaminated soils, if present, resulting from casing or pipeline leaks, surface spills from wells or header houses, and leakage from lined ponds or land application facilities.

Construction activities may increase the potential for erosion from both wind and water due to the removal of vegetation and the physical disturbances from vehicle and heavy equipment traffic. Likewise, compaction of soils and removal of vegetation resulting from construction activities may increase the potential for surface runoff and sedimentation in local drainages and streams outside disturbed areas. Section 3.8.3 of the TR describes topsoil management practices, topsoil stockpiling, erosion control methods, and the use of surface water diversions and best management practices (BMP) to minimize potential soil impacts associated with ISR operations.

Most soil disturbances associated with ISR are short-term. Topsoil and land recovery is initiated as soon as possible following construction. In general, soil disturbance of mine units typically lasts approximately 6 months. Compared to conventional mining practices, ISR surface disturbances are small and potential impacts are minimized by implementing appropriate mitigation measures (see Section 5.3.2 of this ER).

Although unlikely, an unexpected spill could impact soils. The monitoring plan designed by Cameco quickly detects and responds to spills to minimize potential impacts. Should a spill occur, potential impacts are expected to be localized and short-term. Further information regarding potential spills and associated impacts are discussed in Section 3.12 and 5.3.2 of this ER and Sections 3.10 and 4.2 of the TR. Mitigation measures to reduce the chance of a spill from occurring are presented in Section 5.0 of this ER.

Smith Ranch

It is estimated that construction and operations associated with the development of mine unit pattern areas will disturb approximately 761 hectares (1,880 acres), or less than 5% of the total Smith Ranch license area during the renewal period. Due to current operations, much of the Smith Ranch license area used for well field development has already been disturbed and subsequently reclaimed; existing disturbances cover approximately 570 hectares (1,409 acres) or 75% of the expected total. Therefore, additional potential impacts to the topsoil resource within the license area are anticipated to be minor. In

the 14 years between 1996 and 2010, approximately 7 hectares (17 acres) have been disturbed by pipeline spills, well or header house leaks. Since 2008 Cameco has significantly upgraded their leak detection systems, QA/QC of pipeline construction and welds as well as header house inspection and spill control (see Section 3 of the TR). During this license period, it is anticipated that the impact of spills to the topsoil resource will be significantly less than the 7 hectares (17 acres), which has already occurred.

North Butte Remote Satellite

The North Butte license area consists of approximately 409 hectares (1,010 acres). It is anticipated that a total of approximately 162 hectares (400 acres) of soil will be disturbed during the life of the project. Current surface disturbances total about 12 hectares (30.5 acres), primarily from boreholes and monitor wells (**Figure 1.10, Proposed Site Layout** in the TR). Because restoration, final reclamation and interim surface stabilization occur contemporaneously with development and production, at any given time the total area disturbed will be less than the projected figures. All system upgrades mentioned above for Smith Ranch will be applied at all of the remote satellites. During this license renewal period, it is anticipated that the impact of spills to the topsoil resource will be insignificant.

Gas Hills Remote Satellite

The Gas Hills Remote Satellite license area is about 3,440 hectares (8,500 acres), but less than 20% (607 hectares or 1,500 acres) of the Gas Hills Remote Satellite license area is expected to be disturbed throughout the lifespan of the project. Existing buildings, drill holes and access roads present at the Gas Hills Remote Satellite currently account for approximately 40 hectares (98 acres) of the expected total soil disturbances. Most of the disturbances will be short-term as revegetation and reclamation will immediately follow construction activities. To reduce potential impacts, topsoil will be stockpiled and erosion control measures will be implemented (see Section 3.7 of the TR). When considering potential soil impacts, pipeline spills and header house/wellhead leaks can result in a potential impact. As discussed above, Cameco will adapt updated engineered leak detection procedures and construction practices to all of their remote satellites. During this renewal period, it is anticipated that the impact of spills to the topsoil resource will be insignificant.

Ruth Remote Satellite

Similar to the other remote satellite locations, soils at the Ruth Remote Satellite will likely be minimally impacted from the planned ISR operations. The Ruth Remote Satellite license area contains 572 hectares (1,414 acres) and only a small portion of this area will be disturbed. Assuming a similar ratio as North Butte, one can assume that approximately 113 hectares (280 acres) of soils may be disturbed. Current disturbances at this site cover approximately 2 hectares (4 acres). Reclamation will follow all development projects and ensure that the disturbed area at any given time is kept to a minimum.

Although operating plans have not yet been developed for the Ruth Remote Satellite, these plans will be made available to NRC before ISR operations commence. The anticipated disturbances will likely be a small fraction of the license area, similar to development at the other remote satellite locations.

4.3.2 No-Action Alternative

The no-action alternative would not increase potential geology or soil impacts at SUA-1548 sites. Decommissioning and reclamation would involve aquifer restoration and heavy equipment used to complete reclamation. No new areas would be disturbed and the current uranium recovery operations at Smith Ranch would be terminated. Neither the decommissioning of Smith Ranch nor the reclamation of the current surface disturbances at the remote satellites will influence potential impacts to geology. Under the no-action alternative, soils that have been impacted by the construction of the existing

disturbances (buildings, roads, ponds and mine units) would be reclaimed and restored at Smith Ranch and the remote satellites (North Butte, Gas Hills and Ruth).

4.3.3 Alternative Action

Potential geologic impacts associated with conventional underground or open pit mining and milling are more severe compared to ISR. Conventional open pit mining removes all topsoil, overburden and the rock matrix and structure where the uranium is located. By removing, stockpiling and/or processing all of these rock materials, the entire geologic strata is radically disturbed. At the end of mining, the overburden material is indiscriminately returned to the mine pit as backfilled spoils. The natural horizontal and vertical stratification is destroyed. In the event of conventional underground mining, the overlying rock strata may collapse into the mining zone resulting in subsidence of the overlying strata.

Potential soil impacts associated with conventional underground or open pit mining have a greater footprint and are more long-term than soil impacts from ISR. In open pit mining, a significant proportion of soil is disturbed because topsoil has to be removed before any overburden can be removed. The storage of the overburden and tailings piles further impacts soils. While most potential soil impacts from ISR are short-term, most soil impacts from conventional underground or open pit mining are long-term. In conventional mining, the soils remain degraded throughout the life of the mining project because they cannot be reclaimed until the entire mining operation is completed. In contrast, ISR operations reduce potential soil impacts by reclaiming and restoring surface disturbances contemporaneously with development and operations throughout the project life.

4.4 Potential Water Resources Impacts

4.4.1 Proposed Action

4.4.1.1 Surface Water

Potential impacts to surface water bodies and wetlands as a result of constructing and operating the SUA-1548 ISR facilities may include:

- Water quality degradation from temporary increases in suspended solids concentrations above background levels during the construction of roads or well fields adjacent to drainages, as well as runoff from disturbed lands. With the exception of road crossings, no construction will occur within stream channels;
- Increased sedimentation in water bodies resulting from construction of roads or well fields adjacent to drainages or construction activities on adjacent upland areas;
- Channel and bank modifications that affect channel morphology and stability;
- Reduced flow in drainages where fill has occurred;
- Water quality degradation in water bodies, impoundments, or surface water supplies from spills or leaks of fuel, lubricants, or hazardous materials during construction, operation, or transportation of such materials; and
- Filling and destruction of wetland areas (NRC, 2009).

During operations, surface water could be impacted by accidental spills from the facility or by permitted discharges. Spills from the CPP or mine unit wells, as well as spills during transportation, could impact surface waters by contaminating available surface water or by contaminating surficial aquifers that are hydraulically connected to surface waters (NRC, 2009).

There have been minimal impacts to surface water at Smith Ranch as a result of past and ongoing ISR operations. It is anticipated that impacts will continue to be minimal during the next renewal period. A Storm Water Pollution Prevention Plan has been developed and will continue to be implemented for all construction and operations activities to protect surface waters. Cameco has and will continue to utilize BMP to ensure that all disturbed surface runoff is contained and treated (see Section 3.8.3 Erosion Control Methods of the TR). Mine unit construction disturbances are short term and are revegetated as soon as practicable following construction (see Section 4.5 of this ER). There has been and will continue to be little to no discharge to surface drainages of sediment-laden water produced by production or construction activities. Culverts are and will continue to be used to pass surface water flow below roads and facilities, and as such, there will be no retention or impounding of surface water.

All wastewater is disposed via permitted UIC Class I disposal wells, evaporation ponds or land application facilities. During operations, surface waters could be impacted by accidental spills from the facility. Cameco has a rigorous monitoring and inspection program that allows for the monitoring of mine unit well and pipeline pressures remotely as well as daily inspections to header houses and mine unit pattern areas. This monitoring program ensures that should a leak occur, it will be contained and cleaned up immediately upon discovery. Such impacts are short term and controlled and will not likely impact surface water.

To monitor surface water impacts from ISR operations, routine sampling has been and will continue (see Sections 3.4 and 6.2 of this ER, and Section 5.9 of the TR). This surface water quality sampling will ensure that residual source material from leaks or spills do not reach surface waters.

4.4.1.1.1 Smith Ranch

ISR operations are ongoing at Smith Ranch and there have been no negative impacts to area surface waters during the past 25 years of operations. Surface waters within Smith Ranch are predominately ephemeral. Streams generally flow in response to snowmelt and heavy rains. Seasonal flows, stock ponds, and impounded surface water are used for stock watering and are utilized by wildlife. Cameco does not utilize surface waters for any project related production or non-production uses. Samples are routinely collected at selected surface water locations and analyzed for certain radiological constituents to ensure that surface water is not being impacted by the ISR operations (see Section 3.4 of this ER). Based on the past data, and the fact that operational processes at Smith Ranch will not change within the next renewal period, it is anticipated that surface water impacts at Smith Ranch will continue minimal and insignificant.

All wastewater at Smith Ranch is disposed via permitted disposal wells or land application. From 1996 through 2010, approximately 6.7 hectares (16.5 acres) at Smith Ranch have been impacted by spills from pipeline leaks and leaks from header houses. None of these spills have affected surface water resources. Cameco has a rigorous monitoring and inspection program that allows for the monitoring of mine unit well and pipeline pressures remotely as well as daily inspections to header houses and mine unit pattern areas. This monitoring program ensures that should a leak occur, it will be contained and cleaned up immediately upon discovery. Such impacts are short term and controlled and will not likely impact the surface water. Spills from the CPP or during transportation of IX resin, yellowcake or waste materials will be closely monitored, and any spills will be cleaned up immediately (see Section 3.0 of the TR). It is anticipated that continual improvements in leak detection and alarm systems will make impacts from well field spills and leaks even less during the next renewal period.

4.4.1.1.2 Remote Satellites (North Butte, Gas Hills and Ruth)

Surface water within the remote satellite license areas for North Butte, Gas Hills and Ruth are generally ephemeral and flow in response to snowmelt or large rain events. There are two active springs that

provide intermittent flow to stream courses within the Gas Hills Remote Satellite license area. All 16 surface water rights at North Butte are for reservoirs and stock reservoirs. These reservoirs contain water during a wet spring and/or following a significant rainfall/runoff event. Both the Gas Hills and Ruth Remote Satellites have all but one surface water right allocated to livestock and wildlife use, and both satellites also have one industrial allocation. Cameco does not anticipate using surface waters at any of the remote satellite locations for any project related production or non-production use.

At North Butte and Ruth, all wastewater will be disposed via permitted UIC Class I disposal wells. At the Gas Hills Remote Satellite, Cameco anticipates the use of evaporation ponds while the use of UIC Class I disposal wells is being studied. Although pipeline or header house spills could impact surface water resources, it is very unlikely. Cameco will continue their rigorous monitoring and inspection program at each remote satellite. This will allow monitoring of mine unit well and pipeline pressures remotely. Daily inspections will provide additional protection against larger volume spills. This monitoring program ensures that should a leak occur, it will be contained and cleaned up immediately upon discovery. Such impacts are short term and controlled and will not likely impact the surface water.

4.4.1.2 Groundwater

Potential impacts to groundwater as a result of ISR operations may include the following:

- Consumptive use of the ore zone aquifer (lowering of the water table/potentiometric surface via “bleed”) during operations and groundwater restoration;
- Movement of lixiviant outside the mine unit monitor well ring or within aquifers above or below the production zone due to excursions;
- Inadequate groundwater restoration after ISR operations are complete; and
- Adverse effects on groundwater in shallow aquifers, if present, from casing or pipeline leaks, surface spills from wells or header houses, and leakage from lined ponds or land application facilities (NRC, 2009).

Groundwater modeling of the production zones at Smith Ranch and the North Butte and Gas Hills Remote Satellites has been completed and has determined that consumptive use of groundwater will have negligible impact on area use of groundwater resources. Since the approval of the last SUA-1548 LRA in May of 2001, there has been no defined diminution of groundwater resources to local area water users within and surrounding Smith Ranch. Based on operating history and the recent groundwater modeling, it is anticipated that impacts due to consumptive use of groundwater will continue to be negligible.

An excursion of production fluid beyond the monitor well ring or to an overlying or underlying aquifer could occur due to:

- An injection well casing failure;
- Failure to control well field pressures and/or flows;
- Uncontrolled movement of production fluids through an unidentified improperly abandoned drill hole; or
- Inadequate groundwater restoration after ISR operations are completed.

Although any of these potential impacts are possible over the life of an ISR operation, they are considered short term and local. Control of the ISR fluids and groundwater restoration is required by the regulatory agencies. Cameco is required by license condition to perform mechanical integrity testing of all Class III

injection wells to ensure that the wells are constructed properly. During operations, production fluid is removed from the aquifer at a slightly greater rate than what is injected, thereby maintaining an inward flow direction. Monitoring wells are installed in a manner that allows the identification of an excursion before the excursion can migrate beyond the production zone or exempted aquifer. Prior to putting a mine unit into operation, hydrologic testing is conducted to quantify aquifer properties and injection rates, and identify any improperly abandoned drill holes. Finally, the ability to restore groundwater quality within an ISR mine unit at Smith Ranch has been demonstrated in the Q-Sand pilot restoration program, followed by the successful production and restoration of Mine Unit A. Mine Unit B groundwater restoration has been approved by the WDEQ but an ACL application submitted by Cameco is under NRC Staff evaluation. These restorations, as well as successful restorations at other ISR sites, show that groundwater can be returned to a water quality standard that is protective of public health, safety, and the environment.

Past recoveries of excursions show that any impact from an excursion will be limited in aerial extent and to the volume of water which must be removed to restore the groundwater quality. The excursion would be short-term and controlled. The magnitude of the impact to the regional groundwater supply will be much less than impacts that have occurred during dewatering of conventional mining operations. In conclusion, long term impacts on groundwater quality are not anticipated. Excursion prevention and control measures are described in Section 3 of the TR. Groundwater restoration of impacted groundwater to baseline conditions is required by both WDEQ and NRC regulations using best practicable technology (BPT) which will also negate any potential impacts to groundwater caused by ISR operations (see Section 6 of the TR). Finally, shallow aquifers may be adversely impacted following well casing or pipeline leaks, surface spills from wells or header houses, and leakage from lined ponds or land application facilities. As mentioned previously, Cameco has instituted a rigorous monitoring and inspection program that allows the monitoring of injection/production well and pipeline pressures and flows remotely, as well as daily inspections to header houses and mine unit pattern areas. All evaporation ponds are double lined and contain a leak detection system. Failure of these ponds or pond liners and the ultimate release of fluids into the environment are unlikely to occur. In the event that a pond leak does occur, the leak will be immediately corrected and cleanup efforts will restore the local environment to ensure that the impacts are short term and isolated.

The operational groundwater sampling of monitor wells and nearby domestic and stock wells will ensure that there will be no impacts to nearby groundwater users due to excursions.

4.4.1.2.1 Smith Ranch

The affected groundwater aquifers at Smith Ranch are described in Section 3.4 of this ER. Cameco recognizes how important these aquifers are to the regional groundwater regime in that they can yield sufficient fresh water for beneficial use. Based on the available data and operational experience, drawdown impacts from SUA-1548 operations are expected to be minimal.

Aqui-Ver Inc. utilized consumptive use models and conservative (Theis) assumptions to assess potential hydrologic impacts from the ISR operations at Smith Ranch and concluded that ISR operations have in the past and will continue to have minimal impact on regional groundwater resources. Results from the Smith Ranch report predict that drawdown in the shallow water-table aquifer will be less than approximately 3 meters (10 feet) in stock and domestic well locations throughout the additional 33-year projected lifespan of the project. Only one stock watering and domestic supply well is expected to exceed 3 meters (10 feet) during the 33-year model period. Drawdown in this well, Mason #3, is expected to reach a maximum of approximately 6 meters (22 feet), because it is completed in the deeper production sand aquifer and is in close proximity to the Smith Ranch license boundary. Aqui-Ver's Cumulative Hydrologic Impact

assessment for Smith Ranch and the Reynolds Ranch Satellite are included in **Appendix E, Cumulative Hydrologic Impact Analysis Report for Smith Ranch and North Butte**. Section 3.4 of this ER discusses Cameco's use of ground water for production and non-production related purposes.

During ISR operation, production fluid is removed from the aquifer at a slightly greater rate than what is injected, thereby maintaining an inward flow direction. Monitoring wells exist at each well field and have the capacity to identify an excursion. Cameco has successfully recovered excursions that have gone beyond the production zone and no groundwater contamination has occurred. Finally, the ability to restore groundwater quality within an ISR mine unit has been demonstrated in the Q-Sand pilot restoration program, followed by the successful production and restoration of Mine Unit A. These restorations, as well as successful restorations at other ISR sites, show that groundwater can be returned to a water quality standard that is protective of public health, safety, and the environment.

4.4.1.2.2 Remote Satellites (North Butte, Gas Hills and Ruth)

The affected groundwater aquifers at the remote satellites are described in Section 3.4 of this ER. Based on the available data and operational experience, drawdown impacts from operations at the remote satellites are expected to be minimal.

Aqui-Ver Inc. (Aqui-Ver Inc., 2011b) utilized consumptive use models and conservative (This) assumptions to assess hydrologic impacts from ISR at the North Butte and Gas Hills Remote Satellites and that concluded that ISR operations will have minimal impact on regional groundwater resources at both locations. At the North Butte Remote Satellite, impacts to the shallow water-table aquifer are expected to be negligible. Stock and domestic wells in the production (B-sand) zone were found to be most likely impacted during the 16-year model period. The projected maximum drawdown will likely occur at the Pfister Ranch southeast of the North Butte Remote Satellite and is expected to be approximately 6 meters (22 feet). Wells completed in the overlying and underlying sands (C-Sand and A-Sand) at the North Butte Remote Satellite show maximum drawdowns of approximately 3 meters (10 feet). Although these drawdowns appear to be substantial, the modeling study, in addition to addressing North Butte operational impacts, also addresses the cumulative impacts of three additional existing and planned nearby ISR facilities (Willow Creek, Nichols Ranch and the Hank facility) as well as CBM operations located within proximity to the North Butte Remote Satellite.

As a practical matter, predicted hydrologic impacts associated with ISR and CBM development are typically not significant in magnitude. The potential impacts of the North Butte operation are even less when considered alone. Predicted drawdown from the North Butte ISR operation on its own are less than 8% of the available water column in wells having the greatest predicted drawdown impacts, and therefore would not adversely impact well yield. Equally important, wells having the greatest predicted North Butte drawdown are deep domestic and stock watering wells; these are typically low-yield wells which will not suffer loss of production given the small demand. In the event the predicted small drawdowns should cause a significant impact on any domestic well yield, Cameco would resolve this matter by providing an alternative or supplemental water supply for the well owner.

Results of the groundwater modeling study demonstrate that the proposed 1% bleed during production will be more than adequate to provide hydraulic containment of mining solutions at the North Butte Remote Satellite (e.g. inward hydraulic gradient across the well field at all times during the mine unit lifecycle). Furthermore, as the North Butte Remote Satellite matures and mine units are placed into restoration, the overall average facility bleed rate will increase significantly given relatively higher bleed rates approaching 5% during restoration. Higher future facility bleed rates will result in an overall increase

of hydraulic containment of well field fluids. The AQUI-Ver report on the Cumulative Hydrologic Impact Assessment for the North Butte Remote Satellite is included in **Appendix E**.

Hydrologic impacts due to the Gas Hills ISR development were simulated using a three-dimensional groundwater flow model. Hydrologic impacts were evaluated over an estimated 20 year ISR development and restoration period. The drawdown impact computed by the groundwater flow model was evaluated at 45 water well and spring locations within a 16 kilometer (10-mile) radius of the Gas Hills facility.

In general, maximum drawdown impacts are predicted to occur around Development Years 8 and 9, corresponding to the period of maximum groundwater withdrawals. Maximum on-site drawdown impacts are predicted to be approximately 3 meters (10 feet) at the permit boundaries within the production sand aquifer. Impacts to all domestic and stock wells are predicted to be less than 0.3 meters (1-foot) over the life of the mine development, with no measurable decrease in spring flow. Drawdown impacts are predicted to be relatively small primarily because stock and domestic wells are installed in the shallow water-table aquifer and are hydraulically isolated from the underlying production sand aquifer by lower permeability sediments. Drawdown in the production sand aquifer is also limited by the presence of pit lakes with large storage capacity, areas of higher transmissivity across the eastern portion of the facility, and the location of the facility adjacent to the Beaver Rim groundwater recharge area. Although not simulated, the presence of abandoned underground mine workings within Mine Units 2, 3, 4 and 5 should also act to reduce drawdown impacts due to the high conductivity and storage capacity of the workings. The AQUI-Ver report on the Cumulative Hydrologic Impact Assessment for the Gas Hills Remote Satellite is included in **Appendix E**.

Based on the hydrologic modeling performed at the remote satellites plus the fact that operational controls and constraints will be the same as are used at Smith Ranch, Cameco does not anticipate impacts to private domestic wells due to aquifer drawdown during ISR operations. Should problems be identified with any domestic well within 2 kilometers (1 mile) of the license boundary, Cameco commits to providing an alternate source of water to the water user.

4.4.2 No-Action Alternative

The no-action alternative will not have any positive or negative direct, indirect, or cumulative impacts on water resources. Site reclamation and restoration activities will commence. There will be a short term surface disturbance as buildings, roads, and ponds are removed. Existing well fields at Smith Ranch will enter restoration and groundwater impacts to the extent that they have occurred will decline over time as restoration is achieved.

4.4.3 Alternative Action

Selection of the Alternative Action (conventional underground and/or open pit mining) would result in an increase in disturbance to all water resources when compared to ISR. Surface water impacts are far more pronounced with respect to conventional open pit mining, where the footprint of the disturbed area includes the mine pit, adjacent spoil dumps, topsoil stockpiles, roads, and facilities typically requiring diversions of streams and drainages around the disturbed area. The potential for sediment runoff from conventional mining facilities is much greater and of a longer duration than what will occur with the proposed action. ISR results in significantly smaller land disturbance than conventional uranium mining and has significantly less impact on both surface and groundwater conditions.

With the alternative action, there would be a significant impact to groundwater. Both underground and open pit mining impact the groundwater by causing aquifers that were previously separated by confining layers to come in contact. In an effort to mine the uranium ore, mine dewatering is necessary which results in a

significant consumption of groundwater. Dewatered groundwater is often discharged to surface water and results in erosion and sediment transport downstream. During the dewatering and mining process, there is a net consumption of water and an overall drawdown of the aquifer. The volume of water permanently removed (consumed) and discharged from the aquifer is significantly greater than that associated with ISR. During the mine reclamation phase, unclassified overburden is indiscriminately backfilled into the mine pit. This results in not only a commingling of discrete sandstone aquifers, but may also result in elevated water quality parameters. Conventional mining causes the oxidation of the ore zone in air, which may result in the long term development of acid conditions in the pit or underground workings and will generally result in an overall change in groundwater and/or surface water quality. For example, oxidation of the ore zone, host rock and other mineralized areas (once groundwater recovers) will generally result in degradation of water quality due to an increase in total dissolved solids, sulfates and dissolved metals such as iron, manganese, aluminum, molybdenum, selenium, and boron. Backfilling of the mine pit may also introduce other mineral constituents associated with accidental spills and/or surface contamination.

4.4.4 Cumulative Effects of the Proposed Action

Cumulative effects on water resources associated with SUA-1548 ISR operations have been and are anticipated to continue to be small. Nominal surface water impacts are expected from ISR operations in both the Powder River and Wind River Basins, and cumulative impacts from other regional energy development (CBM, oil and gas, wind, uranium, and coal) are also expected to be insignificant. The majority of surface waters within the SUA-1548 license areas meet the State of Wyoming Class III or IV standards for livestock and approval of the proposed action will not significantly impact surface water quantity or quality.

Although impacts will likely be greater for groundwater than surface water, cumulative effects on groundwater are still anticipated to be relatively small for the lifespan of the sites. The hydrologic assessments conducted at Smith Ranch and the Gas Hills and North Butte Remote Satellites examined cumulative impacts to groundwater resources. For Smith Ranch, the production of formation fracturing (frack) water associated with development of the Niobrara Shale oil resource was added to the model, and groundwater impacts were still deemed insignificant (Aqui-Ver Inc., 2011a). For the North Butte Remote Satellite, impacts from ISR operations and CBM development outside of the North Butte Remote Satellite area were also taken into consideration. Results indicated that 23 of the 81 wells studied would have cumulative drawdown over 3 meters (10 feet) and two wells would have cumulative drawdown over 6 meters (20 feet). Drawdown is expected to be greatest in wells nearest the proposed ISR operations and in wells screened across equivalent horizons to ISR production sands. Despite anticipated drawdowns in some surrounding North Butte Remote Satellite wells, Aqui-Ver Inc. (2011b) concluded that ISR operations at the North Butte Remote Satellite will not impact nearby ISR facilities at Willow Creek, Hank, or Nichols Ranch, nor will it interfere with containment of ISR fluids at the North Butte Remote Satellite. In addition, cumulative impacts to water resources from ISR will be significantly less than those likely to occur from conventional underground or open pit uranium mining.

4.4.5 References

Aqui-Ver Inc., 2011a. Cumulative Hydrologic Impact Assessment: Cameco Resources, Smith Ranch-Highland and Reynolds Ranch Facilities, Converse County, Wyoming. Wheat Ridge, CO.

Aqui-Ver Inc. 2011a. Cumulative Hydrologic Impact Assessment: Cameco Resources North Butte Facility, Campbell County, Wyoming. Wheat Ridge, CO.

U.S. Army Corps of Engineers (USACE). "Nationwide Permits Effective March 19, 2007, Expire on March 19, 20102." Fort Worth, Texas: Fort Worth District. 2007a. <http://www.swf.usace.army.mil/pubdata/environ/regulatory/permitting/nwp/2007/index.asp>> (4 December 2007).

USACE. "Nationwide Permit 14: Linear Transportation Projects." Effective Date: March 19, 2007) (NWP Final Notice, 72 FR 11181, para.3). Fort Worth, Texas: Fort Worth District. 2007b. <http://www.swf.usace.army.mil/pubdata/environ/regulatory/permitting/nwp/2007/07nw14.pdf>> (4 December 2007)

USACE. "Nationwide Permit 12: Utility Line Activities." Effective Date: March 19, 2007 (NWP 40 Final Notice, 72 FR 11182, para. 12). Fort Worth, Texas: Fort Worth District. 2007c
<<http://www.swf.usace.army.mil/pubdata/environ/regulatory/permitting/nwp/2007/07nw12.pdf>> (December 4, 2007).

4.5 Potential Ecological Resources Impacts

4.5.1 Proposed Action

The type of disturbance associated with ISR operations will not result in large expanses of habitat being dramatically transformed from its original character as in conventional mining and milling operations. Additionally, all disturbed areas will be reclaimed either at the completion of construction or during decommissioning. The following sections address potential impacts to ecological resources at SUA-1548 facilities by location.

4.5.1.1 Smith Ranch

4.5.1.1.1 Vegetation Communities and Habitat

Grasslands make up approximately 82% of the vegetation cover with some shrubs (less than 8%) and forbs (less than 5%) also present (Appendix D8 of the WDEQ Permit). ISR operations will temporarily reduce vegetation within the Smith Ranch license area. Both short- and long-term disturbances will be revegetated as soon as possible to mitigate environmental impacts. Cameco will continue to employ active revegetation measures, utilizing native grasses and forbs as soon as possible after disturbance. Revegetation seed mixes are approved by appropriate state and federal agencies and live seed (pounds of live seed) are tested and certified. In some instances, the landowner may allow rapid colonization by annual and perennial species followed or intermixed with a native seed mix. The revegetation program considers not only erosion control but also plant succession, plant density and diversity. Current and ongoing revegetation efforts typically restore a robust vegetative cover within the first and second growing season. Reclamation techniques can be found in Section 6.2.4 of the TR, while reclamation goals, performance criteria, and evaluation methods are provided in Section 6.2 of the TR and Section 3.5.3 of the Smith Ranch WDEQ Reclamation Plan. Monitoring methods are consistent with baseline collection methods for comparative analysis. Methods are detailed in Appendix D8 of the WDEQ Smith Ranch application, Addenda to Appendix D8, and WDEQ/LQD Guideline 2- Vegetation.

Open grassland or shrub steppe communities are relatively resilient and will not be significantly impacted by ISR production (NRC, 2009). Long-term disturbances within the Smith Ranch license area are expected to be small, and short-term disturbances will be quickly restored with local plant species. The total area contained within the Smith Ranch license area is approximately 16,187 hectares (40,000 acres). Currently, disturbed surfaces cover 570 hectares (1,410 acres) of the Smith Ranch license area (see Section 4.1 of

this ER). The proposed expansion is expected to disturb no more than an approximate additional 190 hectares (470 acres), or less than 1.2% of the total Smith Ranch license area.

Wetland communities are a small percentage of the Smith Ranch license area. Cameco (Hayden-Wing and Associates, LLC) identified 19 potential wetlands (**Appendix A, Wetlands Survey-2011**) and in general, wetland regions are avoided by ISR operations. If a wetland region needs to be disturbed, Cameco will follow the appropriate measures prior to development to obtain the necessary permits to comply with Section 404 of the Clean Water Act.

4.5.1.1.2 Threatened and Endangered Plant Species

Two potential T&E plant species in Converse County are the Ute ladies'-tresses and blowout penstemon (USFWS, 2010). However, neither of these species nor any other T&E species were observed within the Smith Ranch license area during numerous field surveys. It is unlikely that any protected plant species are present on the permit area and accordingly, the impact to T&E species will be negligible.

4.5.1.1.3 Noxious Weeds

Eleven species of noxious weeds were encountered during the vegetation studies conducted at Smith Ranch including western ragweed, white-leaved ragweed, common burdock, Canada thistle, poverty weed, field bindweed, quackgrass, Russian knapweed, hounds tongue, tansy mustard and wild oat. The occurrence of these noxious species within Smith Ranch is limited, and they do not occur in such abundance or distribution as to make them a serious range management problem.

Construction activities, increased soil disturbance, and higher traffic volumes could stimulate the introduction and spread of undesirable and invasive, non-native species within the license areas. These species often out-compete desirable species, including special-status species, rendering an area less productive as a source of forage for livestock and wildlife. Additionally, sites dominated by invasive, non-native species often have a different visual character that may negatively contrast with surrounding undisturbed vegetation. Construction activities at **the** Smith Ranch license area have not resulted in a noxious weed problem. Weed control and spraying activities occur as necessary and are conducted by licensed professionals. Mitigation measures to lessen impacts on native vegetation and control state-designated noxious weeds are discussed in Section 5.5 of the ER and Sections 6.2 and 7.2.8 of the TR.

4.5.1.1.4 Wildlife

Although wildlife habitat may see limited impact from ISR activities, reclamation and re-vegetation of disturbed sites will mitigate the temporary loss of wildlife habitat. In general, most wildlife, including the larger and more mobile animals, will disperse from the disturbed area as construction activities intensify. These displaced species will colonize in adjacent, undisturbed areas or return to their previously occupied habitats after construction ends and suitable habitats are reestablished. No T&E or sensitive species are anticipated to be adversely affected and overall impacts to wildlife are expected to be minimal.

In accordance with WDEQ regulations Cameco consults with the USFWS and WGFD to create a wildlife monitoring plan to provide proper protection and mitigation measures to ensure no negative impacts are made on wildlife. The purpose of this Wildlife Monitoring Plan is to set forth protocols and schedules for monitoring the status of wildlife species identified by the regulatory agencies as species of concern that may occur in or proximal to the Smith Ranch License Area. The plan is designed to obtain data in sufficient detail to evaluate the effect of mining on the wildlife species in question and to develop mitigation proposals. This plan has been tailored to meet the specific wildlife monitoring needs of Smith Ranch and does not address species that are unlikely to occur in the survey area. Target wildlife species are chosen based on the following criteria; Species designated as Threatened or Endangered, Proposed Species,

Candidate Species, or Species of High Federal Concern by the USFWS, Species of Greatest Conservation Need by WGFD and species on the BLM's Sensitive Species List. When implementing this wildlife monitoring plan Potential impacts to wildlife will be very minimal and should not have any adverse impacts. The following wildlife protection measures have been implemented at Smith Ranch; reflective marking of power lines near PSR-2 and the water disposal pivot site to minimize collisions by waterfowl, USFWS recommended seasonal and spatial protection buffers for raptor nests and bald eagle winter roost sites, abide by the Wyoming Governor's Sage-grouse Executive Order which includes spatial and seasonal protection buffers, WGFD recommended protective buffer around active swift fox dens and waste water disposal site monitoring. Appendix D9 of the Smith Ranch-Highland WDEQ Permit to Mine provides a complete species list and detailed information regarding the results of wildlife surveys and contains the Wildlife Monitoring Plan.

4.5.1.2 North Butte Remote Satellite

4.5.1.2.1 Vegetation Communities and Habitat

According to the "Cleveland-Cliffs North Butte Vegetation Report" (Attachment D8-1 in Appendix D8 of the North Butte WDEQ Permit), vegetation cover at the North Butte Remote Satellite is approximately 62.2% sagebrush-grassland, 34.5% grassland, 2.5% bottomland and 0.8% juniper-sagebrush. Similar to the Smith Ranch license area, small portions of the vegetation cover will be disturbed during ISR development. Cameco will employ an active revegetation program following disturbance and most areas will begin to recover within six months of initial disturbance. The anticipated disturbances (operational life) to North Butte are about 150 hectares (370 acres) or 37% of the total area (409 hectares [1,010 acres]). All disturbed areas will be revegetated as soon as construction and/or production are completed to minimize ecological impacts.

Appendix D11 of the North Butte WDEQ Permit identifies two wetlands at the North Butte Remote Satellite. Sample Point 1 in Attachment D11-1 shows a small stock pond (0.02 hectares [0.05 acres]) which is the only wetland present within the proposed disturbance area. If this wetland cannot be avoided for ISR production, then Cameco will obtain the necessary permits to comply with Section 404 of the Clean Water Act before any disturbance to the wetland occurs.

4.5.1.2.2 Threatened and Endangered Plant Species

According to the most recent surveys completed at the North Butte Remote Satellite, no T&E plant species were observed; therefore, no impacts are anticipated. Updated surveys for T&E plant species will be conducted during operations and will be made available to NRC upon completion. For additional information on T&E plant species in the North Butte license area see Section 3.5.3 of this ER.

4.5.1.2.3 Noxious Weeds

The presence of two state-designated weeds, Canada thistle and field bindweed, were observed at the North Butte Remote Satellite during the baseline surveys. Increased development at the North Butte Remote Satellite could increase the spread of noxious weeds or introduce another non-native species. To protect the ecological integrity of the site, mitigation measures to lessen impacts on native vegetation and control state-designated weeds will be taken and are discussed in Section 5.5 of this ER and 7.2.8 of the TR.

4.5.1.2.4 Wildlife

In accordance with WDEQ regulations Cameco consults with the USFWS and WGFD to create a wildlife monitoring plan to provide proper protection and mitigation measures to ensure no negative impacts are made on wildlife. The purpose of this Wildlife Monitoring Plan is to set forth protocols and schedules for monitoring the status of wildlife species identified by the regulatory agencies as species of concern that

may occur in or proximal to the North Butte License Area. The plan is designed to obtain data in sufficient detail to evaluate the effect of mining on the wildlife species in question and to develop mitigation proposals. This plan has been tailored to meet the specific wildlife monitoring needs at the North Butte Remote Satellite and does not address species that are unlikely to occur in the survey area. Target wildlife species are chosen based on the following criteria; Species designated as Threatened or Endangered, Proposed Species, Candidate Species, or Species of High Federal Concern by the USFWS and Species of Greatest Conservation Need by WGFD. When implementing this wildlife monitoring plan, Potential impacts to wildlife will be very minimal and should not have any adverse impacts. The following wildlife protection measures have been implemented at the North Butte Remote Satellite to minimize the potential impacts to wildlife; USFWS recommended seasonal and spatial protection buffers for raptor nests, abide by the Wyoming Governor's Sage-grouse Executive Order which includes spatial and seasonal protection buffers, WGFD recommended protective buffer around active swift fox dens. Appendix D9 of the North Butte WDEQ Permit to Mine provides a complete species list and detailed information regarding the results of wildlife surveys and contains the Wildlife Monitoring Plan.

4.5.1.3 Gas Hills Remote Satellite

4.5.1.3.1 Vegetation Communities and Habitat

Approximately 86% of the Gas Hills Remote Satellite is covered with sagebrush-grassland, rough breaks, bottomland sagebrush and upland grassland (see Section 3.5.5 of this ER). A small portion of these plant communities will be temporarily impacted with the onset of ISR production. Additional surface disturbances at the Gas Hills Remote Satellite are expected to be less than 20% of the total area of 607 hectares (1,500 acres) or about 476 hectares (1,177 acres) and will be reclaimed as stated in Section 6.2.4 of the TR.

Potential wetlands cover no more than 0.3% of the license area (about 28 acres). Similar to other locations within SUA-1548 license areas, these wetlands will be avoided, if possible. Wetlands will be delineated and proper mitigation measures will be taken if ISR production is expected to impact these sensitive regions.

4.5.1.3.2 Threatened and Endangered Plant Species

The 2010 survey of the Gas Hills Remote Satellite did not identify any federally listed T&E plant species. Possible plants of concern within the license area are Rocky Mountain twinpod, cedar rim thistle, and Nelson's milkvetch. Because these species are not likely present at the Gas Hills Remote Satellite, no impact to T&E plant species is anticipated from ISR operations.

4.5.1.3.3 Noxious Weeds

The noxious weeds musk thistle, Canada thistle, hairy whitetop, field bindweed, tansy mustard, little blue mustard, and American licorice are present at the Gas Hills Remote Satellite (see Section 2.8.1.1 of the Gas Hills Environmental Assessment, NRC, 2004). Similar to the other SUA-1548 license locations, noxious weeds are often limited to previously disturbed sites and are controlled by Cameco. To prevent the future introduction and spread of noxious weeds at the Gas Hills Remote Satellite, Cameco will follow mitigation plans described in Section 5.5 of the ER and 7.2.8 of the TR.

4.5.1.3.4 Wildlife

In accordance with WDEQ regulations Cameco consults with the USFWS, WGFD and/or BLM to create a wildlife monitoring plan to provide proper protection and mitigation measures to ensure no negative impacts are made on wildlife. The purpose of this Wildlife Monitoring Plan is to set forth protocols and schedules for monitoring the status of wildlife species identified by the regulatory agencies as species of concern that may occur in or proximal to the Gas Hills remote Satellite License Area. The plan is designed

to obtain data in sufficient detail to evaluate the effect of mining on the wildlife species in question and to develop mitigation proposals. This plan has been tailored to meet the specific wildlife monitoring needs of Gas Hills Remote Satellite and does not address species that are unlikely to occur in the survey area. Target wildlife species are chosen based on the following criteria; Species designated as Threatened or Endangered, Proposed Species, Candidate Species, or Species of High Federal Concern by the USFWS, Species of Greatest Conservation Need by WGFD and species on the BLM's Sensitive Species List. When implementing this wildlife monitoring plan Potential impacts to wildlife will be very minimal and should not have any adverse impacts. The following wildlife protection measures have been implemented at Gas Hills to minimize the potential impacts to wildlife. USFWS and BLM recommended seasonal and spatial protection buffers for raptor and burrowing nests sites, abide by the Wyoming Governor's Sage-grouse Executive Order which includes spatial and seasonal protection buffers and BLM recommended protection for occupied mountain plover habitat patches. Appendix D9 of the Gas Hills WDEQ Permit to Mine provides a complete species list and detailed information regarding the results of wildlife surveys and contains the Wildlife Monitoring Plan.

4.5.1.4 Ruth Remote Satellite

4.5.1.4.1 Vegetation Communities and Habitat

According to Section 12, Volume 1 of the Ruth Supplemental Report, sprayed sagebrush-grassland and sagebrush-grassland accounted for 81.5% or about 466 hectares (1,152 acres) of the satellite area. Drainage bottomland and grassland made up the remaining 14.6% and 3.9%, respectively. These vegetation communities will be temporarily disrupted with the onset of construction. However, Cameco is not actively pursuing development of the Ruth Remote Satellite at the time of this LRA (January 2012). Prior to commencement of ISR activities, supplemental baseline data will be collected and compared with the original information for inclusion in an amendment proposal to the NRC.

4.5.1.4.2 Threatened and Endangered Plant Species

No studies have identified T&E plant species at the Ruth Remote Satellite location to date. Prior to ISR activities, vegetation studies identifying local T&E species along with other sensitive species will be conducted and the results will be presented to NRC for review and approval. The lack of T&E species at nearby locations (Smith Ranch and the North Butte Remote Satellite) suggest that potential future impacts to T&E species will be negligible. Additional surveys will be performed prior to the initiation of ISR operations at the Ruth Remote Satellite.

4.5.1.4.3 Noxious Weeds

Four noxious weed species were identified within the Ruth license area in 1989 including Canada thistle, quackgrass, perennial ragweed and wild licorice. Before ISR operations commence at the Ruth Remote Satellite, a vegetation study will be conducted to obtain current information about noxious weeds. Noxious weed study results will be presented to NRC and mitigation methods will parallel those used at other sites within the SUA-1548 license area.

4.5.1.4.4 Wildlife

According to the 1989 Ruth Supplemental Report, no big game migration routes or critical habitat were known to occur on the Ruth Remote Satellite area. Additionally, no T&E species were found living on or adjacent to the site. The bald eagle, peregrine falcon and the black-footed ferret could potentially live within the license area. To determine if any T&E or other sensitive species reside within the license area, a wildlife survey update will be conducted before pursuing ISR operations at the Ruth Remote Satellite. Cameco will amend the Ruth environmental impact analysis and provide an updated mitigation plan as required.

4.5.2 No-Action Alternative

The no-action alternative would prevent additional land from being disturbed. Reclamation of existing facilities would be required and may have a temporary impact on ecological resources. Developed sites such as Smith Ranch, will enter well field restoration and site reclamation, and as such, there will be a small but temporary additional impact to ecological resources. This impact will be mitigated when all ISR operations cease and land is reclaimed to support both native vegetation and wildlife.

4.5.3 Alternative Action

Adverse impacts to both vegetation and wildlife resources are directly related to the degree of disturbance to the land surface. Either open pit or underground mining would require a significant increase in the amount of land disturbance needed to mine the uranium deposits. The additional disturbance to the land surface would inevitably increase the impacts to ecological resources. Both underground and open pit mining would require the removal of large acreages of topsoil, including long term stockpiles of topsoil and overburden. The degree of disturbance to ecological resources under this alternative action will be significantly greater. A large open pit would remain for the life of the mine and possibly for many years after and as such vegetation, wildlife and wetlands will remain disturbed for upwards of 20 to 25 years or more.

4.5.4 References

Nuclear Regulatory Commission. 2004. Environmental Assessment for the Operation of Gas Hills Project Satellite In Situ Leach Uranium Recovery Facility.

Nuclear Regulatory Commission. 2009. Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities (NUREG-1910). Page last reviewed/updated Sunday, March 13, 2011.

4.6 Potential Air Quality Impacts

4.6.1 Proposed Action

4.6.1.2 Gaseous and Airborne Particulates

The selection of the proposed action will result in continued operations at Smith Ranch and continued ISR development at the remote satellites. The current release of gaseous and airborne particulates from ISR operations at Smith Ranch are below the allowable limits for the State of Wyoming. As a result, environmental impacts from these air emissions are minimal. The primary source of gaseous emissions and airborne particulates from ISR operations are from the process plant satellites and associated equipment and traffic. The most significant radioactive airborne effluent is Rn-222, which is released from the CPP, CPF, satellites, header houses, and the wellfields (see 7.3 of the TR). The IX vessels are pressurized downflow IX columns which keep the Rn-222 in solution so as not to be released to the atmosphere. There will be minor releases of Rn-222 during the air blow down prior to resin transfer to the resin trailer. The air blow down and the gas released from the vent during column filling are vented to the sumps and then to the atmosphere. The RO units used to treat restoration fluids also may emit Rn-222 during membrane maintenance or other activities that require opening the membrane chambers. At the CPP and the CPF, uranium particulate effluents are limited to the yellowcake drying and packaging unit. Because of the vacuum dryers, minimal uranium particulate emissions occur during the drying process. For additional details on the potential impacts associated with gaseous and airborne particulates and mitigative measures, please see Section 4.1 of the TR.

Non-radiological particulates, particularly fugitive dust, are the major air quality concern at SUA-1548. Unpaved roads are the largest contributor to fugitive dust in the United States, and the construction of

new roads and an overall increase in traffic will increase the amount of fugitive dust produced. Calculations of estimated fugitive dust from SUA-1548 license areas indicate that emissions have been and will remain below the State of Wyoming standards. To mitigate the potential release of fugitive dust, mitigation measures such as watering the roads or applying chemical treatments will be implemented as needed as stated in Section 5.6 of this ER and Sections 3.8.5, 7.1.1, and 7.2.1 of the TR.

Cameco does not monitor for air pollutants included in the NAAQS, as promulgated in 40 CFR Part 50.

The WDEQ Air Quality Division placed the Converse County ambient air quality station at the site of the former Smith Ranch-Highland Fowler Ranch air monitoring station. The converse county station is considered a long term ambient monitoring station which collects meteorological data and measurements of ambient oxides of nitrogen (NO, NO₂, NO_x) ozone (O₃), total hydrocarbons, methane, and non- methane hydrocarbons (THC, CH₄, NMHC) and continuous PM₁₀. Data collection began at the station on April 14, 2015. The annual reports from this monitoring station are included in the ER in Appendix B.1.

The NAAQS define acceptable ambient air concentrations for six common non-radiological air pollutants: nitrogen oxides, ozone, sulfur oxides, carbon monoxide, lead, and particulates. Primary NAAQS are established to protect public health, and secondary NAAQS are established to protect public welfare by safeguarding against environmental and property damage. NAAQS compliance attainment status is typically determined at the county level. Each NAAQS pollutant is designated into one of the following categories: attainment, nonattainment, or maintenance.

The NAAQS and Wyoming Ambient Air Quality Standards (WAAQS) set upper limits for concentrations of specific air pollutants at all locations that have public access. WDEQ, AQD limits incremental emissions increases to specific levels defined by the classification of air quality in an area. The PSD rules is designed to prevent deterioration of air quality and to limit incremental increases in concentration of nitrogen dioxide, sulfur dioxide, and particulate matter less than 10 microns in diameter (PM₁₀) to a legally defined baseline level based on the area's classification. PSD Class I areas include areas with special natural, recreational, scenic, or historic value (national parks or wilderness areas) and have the most stringent set of allowable increments. No PSD Class I areas were identified within or near the Smith Ranch facilities. The Smith Ranch project areas are all located in PSD Class II areas and are designated as attainment for all NAAQS and WAAQS. Areas are designated as attainment if atmospheric concentrations for a particular pollutant meet NAAQS and WAAQS.

The regional air quality data complies with applicable local, state, and national air quality rules and regulations. Since the 1970's, the WDEQ/AQD Monitoring Program has been working actively to evaluate monitoring requirements and use available resources effectively for the State of Wyoming. The Air Quality Resource Management Program serves the Division by looking at monitored data in conjunction with emission inventory trends and planned development to shape the AQD's air quality management policies in the future. Not only does the AQD run the State and Local Air Monitoring Sites (SLAMS) to monitor public health, but also runs or oversees several special purpose monitors (SPM) to track impacts from the many industrial sources that reside in Wyoming. For example, a significant number of monitoring stations are located in the Powder River Basin and are utilized to monitor the effects of extensive coal mining. Regional ambient air quality standards were provided by WDEQ/AQD (Table 4.6-1, Selected National and Wyoming Air Quality Standards) and the Division provides an annual summary of the air quality monitoring results for all monitoring stations. A review of the Wyoming Ambient Air Monitoring Annual Network Plan 2011 data collected at the AQD monitoring stations through 2010 shows that all monitors are attaining NAAQS for PM₁₀, PM_{2.5}, NO₂, SO₂, and CO. Currently all of the AQD monitors, except for

Boulder (Sublette County), are attaining the NAAQS for ozone. The primary potential airborne pollutant within the Smith Ranch project areas is particulate matter in the form of fugitive dust generated from natural and human sources. The WAAQS and NAAQS limits, ambient air quality data for the region, and PSD I and II increments are presented in Table 4.6-1.

4.6.1.3 Construction

The NRC evaluated potential air quality impacts from ISR facilities in NUREG-1910 (NRC 2009), and concluded that construction air quality impacts of ISR facilities are small. Construction activities at SUA-1548 have and will continue to cause minimal short-term effects on local air quality. Construction activities will cause an increase in suspended particulates from vehicular traffic on unpaved roads, fugitive dust from wind erosion of areas cleared of vegetation, and diesel emissions from construction equipment. However, once construction is finished, topsoil will be replaced on disturbed sites and revegetation will take place. Each disturbed site will be reclaimed to reduce the potential for long-term air quality impacts. Surface disturbances and construction traffic will decline once construction ends and operations begin. Therefore, the anticipated air quality impacts from construction at SUA-1548 license areas are expected to be small.

4.6.1.4 Operations

Operations (including restoration activities) at Smith Ranch currently result in minimal air quality emissions, and emissions at the North Butte, Gas Hills and Ruth Remote Satellites will also likely be minimal. Because the majority of air quality emissions from ISR operations are small and occur outdoors, impacts are considered to be minimal and temporary. Similar to the construction phase, fugitive dust is the primary source of air quality emissions during operations. Emissions such as Rn-222 and NO_x are also possible from ISR operations and although small, are discussed below.

As described above, small concentrations of Rn-222 are released from the CPP, satellites and mine unit header houses during operations (see Section 4.1 of the TR). Impacts from gaseous Rn-222 are minimal. Because the vacuum dryers are designed to have zero emissions, no particulate emissions are generated, and only a small amount of water vapor is produced. Current gaseous emissions at the Smith Ranch license area are approximately 0.58 metric tons (0.64 tons) per year and are below allowable limits for the State of Wyoming. Gaseous emissions monitoring and mitigation measures are taken to ensure Rn-222 emissions are minimal, as discussed in Section 4.1 of the TR. Exhaust from drilling equipment and vehicular traffic causes some emissions such as NO_x, but these emissions are small and do not have any significant impacts. For additional information about NO_x emissions, see Section 7.2 of the TR. As discussed above, the primary source of emissions is fugitive dust from vehicular traffic on un-paved access roads and in the well field areas. Fugitive dust calculations were performed in Section 3.6.6 of this ER according to the EPA AP-42 methodology. Current ISR operations at the Smith Ranch license area produce approximately 71 tonnes (78 tons) per year. With the addition of the Reynolds Ranch Satellite, fugitive dust is expected to increase to 141 tonnes (156 tons) per year when Smith Ranch is operating at full capacity. Estimates for fugitive dust emissions from the North Butte and Gas Hills Remote Satellites are approximately 95 and 130 tonnes (95 and 143 tons) per year, respectively. Cameco has not developed an operating plan for the Ruth Remote Satellite at the time of this LRA (January 2012). Once this plan has been developed, fugitive dust emissions will be calculated for this site as well. Fugitive dust emissions for all SUA-1548 license areas are well below allowable limits for the State of Wyoming, and therefore do not pose a significant environmental risk. In addition, the release of fugitive dust from operations will be significantly reduced by periodic watering or by chemically treating unpaved roads. Mitigation methods such as these will be used as necessary to reduce fugitive dust (see Section 5.6 of this ER).

Approval of the proposed action will not result in adverse impacts to air quality. Anticipated emissions are all below state of Wyoming regulations and will likely be minimal and temporary.

4.6.2 No-Action Alternative

Approval of the no-action alternative would not cause any additional impacts on air quality at SUA-1548 licensed facilities. Emissions associated with the current ISR operations would slowly decrease as ground water restoration and reclamation nears completion. Construction activities would continue as facilities and wellfields are reclaimed and restored. Fugitive dust at the remote satellites may temporarily increase as reclamation activities commence and then return to below current conditions. Air pollution from traffic related activity will continue until SUA-1548 licensed facilities are restored and reclaimed.

4.6.3 Alternative Action

Approval of the Alternative Action would result in a significant increase in fugitive dust and air quality impacts relative to the approval of the proposed action. Air quality impacts associated with conventional underground or open pit uranium mining are significantly greater than those associated with ISR (NRC 2009). Topsoil stripping and overburden removal are ongoing processes throughout the development of a conventional mine. Conventional mining employs a significantly larger fleet of construction equipment (dozers, scrapers, loaders, haul trucks) as well as a significantly larger work force to operate the mine. Air quality impacts caused by wind erosion of ore stockpiles, overburden stockpiles, tailings disposal facilities, and crushing and grinding operations associated with conventional mining, can cause high concentrations of particulate matter as well as Rn-222 to be released into the atmosphere. Tailings piles from underground or conventional open pit uranium mining and milling are considered long-term hazards since they continually emit Rn-222. By utilizing ISR recovery methods, the need for stockpiles and tailings is omitted which greatly reduces impacts on air quality.

4.6.4 Cumulative Effects of the Preferred Action Alternative

Cumulative effects from airborne gaseous and particulate emissions are expected to be minimal. SUA-1548 operations will contribute a proportionally small portion of additional traffic to area roads as compared to other energy development and agricultural activities. The SUA-1548 sites are remote and air quality contributions include agricultural traffic, other ISR project emissions, CBM continued development, conventional oil and gas and wind energy development. The Smith Ranch facility is an ongoing operation and approval of the proposed action will result in an increase of the number of personnel to approximately 170. The remote satellites will provide additional personnel during construction but this number will be reduced during operational periods. Air quality may be impacted during construction, but these impacts are localized and short-term as all disturbances are revegetated and reclaimed once construction ends.

According to the Powder River Basin Coal Review, the existing regional air quality conditions generally are very good. Modeling completed in 2002 (base year for the Powder River Basin Coal Review analysis) showed that there was a concern about some impacts of particulate matter with an aerodynamic diameter of 10 microns or less (PM₁₀) emissions within the near-field receptors of both Montana and Wyoming. Air quality at SUA-1548 sites is within ambient air quality standards, and the analysis presented above indicates that continued ISR operations at Smith Ranch and the remote satellites will not adversely impact air quality. The primary potential impact will be fugitive dust from construction and operational activities and traffic on local gravel roads.

Table 5.3-2 of NUREG-1910 (NRC, 2009) lists 15 coal mining projects in the Wyoming Powder River Basin. All have intensive air quality monitoring programs and all are deemed “in compliance” with all applicable

standards by WDEQ/AQD. The regional mines are not expected to cause cumulative air quality impacts on the SUA-1548 sites in the Powder River Basin given the minimal air quality impacts associated with ISR operations. Section 4.6 of this ER presents the anticipated quantifiable air quality impact associated with SUA-1548 licensed activities and its relative contribution to state wide particulate emissions. More than 99% (99.7%) of the total impact to air quality is from estimated fugitive dust emissions, calculated as worst case without any dust control measures applied. SUA-1548 license areas are anticipated to contribute less than 0.1% to statewide particulate estimates. Cumulative effects from the proposed action will be much less than those expected from conventional underground or open pit mining.

4.6.5 References

Bureau of Land Management (BLM). 2009. Update of the Task 2 Report for the Powder River Basin Coal Review Past and Present and Reasonably Foreseeable Development Activities. Prepared by AECOM, Inc. BLM High Plains District Office and Wyoming State Office. December 2009.

U.S. Nuclear Regulatory Commission (NRC). 2009. Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities (NUREG-1910). Page last reviewed/updated Sunday, March 13, 2011.

Wyoming Air Quality Monitoring Network, Converse County Monitoring Station Data, Annual Reports 2015, 2016. WWW.wyvisnet.com/Data/Reports.aspx

4.7 Noise Impacts

4.7.1 Proposed Action

Smith Ranch

ISR, conventional mining, rangeland, pasture, and wildlife habitat have been the primary land uses within the surrounding 3 kilometer (2 mile) radius of the Smith Ranch license area. Other land uses include oil and gas exploration, CBM development, and wind farming. The noise impacts associated with these other uses include increased construction traffic and equipment noises such as drilling, generators and pumps. The closest residence to Smith Ranch is the Vollman Ranch, which is located within the license boundary and is occupied year-round. As a result of the remote location of the project, its historic and current uranium recovery operations, and the low population density of the surrounding area, impacts from noise or congestion within the project area or in the surrounding 3 kilometer (2 mile) area have not created problems in the past and are not anticipated to cause problems in the future. Additionally, since the maximum increase of new workers associated with the proposed action is anticipated to be insignificant, noise and congestion impacts are not anticipated in Converse or any neighboring counties.

Cameco conducted tests in 2010 at Smith Ranch to determine the level of noise (in dBA) that is produced by ISR activities from six different locations throughout the license area. The loudest instrument was identified by these tests, and the level of noise at each testing site was recorded. These six locations included: Satellite No. 1, the selenium treatment facility, header house 2-2 in Mine Unit 2, a vacuum-truck, a wood or PVC chipper, and personnel sampling (transfer truck). **Table 4.7-1, Peak Noise Levels for Equipment Used at the SUA-1548 Project Sites and the Noise Levels at the Six Smith Ranch Testing Sites** describes the peak decibel levels determined for each of these test sites. Because the highest noise level determined from these tests was 125 dBA, produced by the wood (PVC) chipper at the PVC chipper test site, this noise level was examined further to determine the maximum noise impact from within the 3 kilometers (2 mile) surrounding area to determine the effect it would have on the nearest resident at Vollman Ranch (Cameco, 2010). According to Table 14-16 in the US Department of the Interior, Bureau of Reclamation and Freeport Regional Water Authority, when the distance of the reference sound level is

approximately 50 feet the basic sound level drop-off is 6 dBA per doubling distance (US Department of the Interior, 2003). Therefore, up to 3 kilometers (2 miles) away from the site boundary, the highest level of noise created by ISR activities at Smith Ranch is approximately 77 dBA. This implies that ISR activities can be heard from 3 kilometers (2 miles) away, as well as beyond this point up to a certain distance. However, a noise level of 77 dBA can be likened to the same noise level as a dishwasher, barking dog, or a vacuum cleaner, and therefore the noise impact is not considered extreme (NetWell, 2011). Furthermore the typical noise levels are significantly less than 125 dBA at the source, so the proportionate decrease in noise levels will be less than that described above.

North Butte Remote Satellite

Rangeland, pasture and wildlife habitat have been the primary land uses within the surrounding 3 kilometers (2 mile) radius of the North Butte Remote Satellite. Other land uses within the general area include uranium ISR recovery (16 kilometers [10 miles]) away, oil and gas exploration (5 to 10 kilometers [3 to 6 miles]), and coal bed natural gas development (adjacent to and within the license boundary). The noise impacts associated with these other uses include increased construction traffic, heavy machinery involved in either well field construction or reclamation of well fields as well as drilling and pipeline construction activities. Approval of the preferred action alternative will present similar types of impacts as described above.

Within close proximity of the North Butte Remote Satellite is one occupied unit, the Pfister Ranch house, located approximately 1 kilometer (0.5 mile) south of the site boundary and is occupied year-round. Any noise created by the North Butte Remote Satellite is expected to increase with increased uranium recovery and processing activity, and noise levels would indeed be higher for those individuals living near the North Butte Remote Satellite area, such as at the Pfister Ranch. However, the noise levels will decrease further away from the noise source. According to the tests conducted by Cameco and assuming the worst case noise generator (PVC chipper), the calculated noise level at a location 3 kilometers (2 miles) from the noise source would be 77 dBA. Because of the low population (very few noise receptors) within the 3 kilometers (2 mile) surrounding area and the low population that exists beyond that area, noise impacts will be insignificant. Additionally, since the maximum increase of new workers associated with the proposed action is anticipated to be relatively low, noise and congestion impacts are not anticipated in Campbell or any neighboring counties.

Gas Hills Remote Satellite

Approximately 19 kilometers (12 miles) northeast of the Gas Hills Remote Satellite boundary is the JE Ranch. The Gas Hills Remote Satellite will be using the same type of equipment as Smith Ranch and North Butte during the construction, operations and reclamation/decommissioning phases of the project. Using similar noise source assumptions as above (PVC chipper) and ideal noise propagating meteorological conditions, the nearest occupied housing unit (distance of approximately 19 kilometers [12 miles] from the site boundary) may hear noise from the ISR activities at a level of approximately 35 dBA or less (US Department of the Interior, 2003). This level of noise can be likened to the typical noise level of a humming refrigerator (NetWell, 2011). Furthermore the JE Ranch lies within a protected valley and is isolated topographically from any construction activities within the Gas Hills Remote Satellite. As a result of the remote location of the Gas Hills Remote Satellite and the low population density of the surrounding area, impacts to noise or congestion within the satellite area or in the surrounding 3 kilometers (2 mile) are not anticipated. Additionally, since the maximum increase of new workers associated with the proposed action is anticipated to be relatively low, noise and congestion impacts are not anticipated in Fremont or Natrona Counties.

Ruth Remote Satellite

There are no occupied housing units within 3 kilometers (2 mile) of the Ruth Remote Satellite. However, located approximately 10 kilometers (6 miles) west of Ruth is the town of Linch which had a population of approximately 40 people according to the 2000 U.S. Census. Based on the Bureau of Reclamation (US Department of Interior, 2003) calculations on sound drop off, noise level contribution of the site will be negligible within 5 kilometers (3 miles) of the site and will be insignificant at the town of Linch. As a result of the remote location of the Ruth Remote Satellite and the low population density of the surrounding area, impacts to noise or congestion within the satellite area or in the surrounding 3 kilometers (2 mile) are not anticipated. Additionally, since the maximum increase of new workers associated with the preferred action alternative is anticipated to be relatively low, noise and congestion impacts are not anticipated in Johnson or Campbell Counties.

4.7.2 No-Action Alternative

Under the no-action alternative, the licensee would be required to reclaim all existing ISR disturbances at Smith Ranch and the remote satellites. All facilities under SUA-1548 are considered to be remotely located with relatively low ambient noise levels. Any increase in construction activities, even the no-action alternative, would result in an increase in noise levels. Construction activity under the no-action alternative would include reclamation of any existing buildings, restoration of operating mine units, well abandonment and reclamation of well fields, and removal of all ponds, treatment plants and roads. In every case, heavy construction equipment such as bulldozers, scrapers, loaders, drill rigs, PVC chippers, and seeding equipment will be required.

The greatest noise levels will occur at Smith Ranch where the existing condition disturbance is greatest. At this location the no-action alternative would result in the shutdown of an operating mine, the immediate restoration of all operating wellfields and the reclamation of all disturbed lands. Some of these disturbances include the existing 18 buildings (e.g. the CPP, the CPF, satellite buildings, the yellowcake warehouse, deep disposal well buildings, and several others), access roads, a parking area, over 11,000 wells (i.e., monitoring wells, production wells, and injection wells), underground pipelines, storage ponds, and a salvage/boneyard area. These facilities would need to be decommissioned and effectively demolished. The disturbed ground underneath would need to be decontaminated if necessary with topsoil and seeded. The wells would need to be plugged and covered with soil, then seeded. Road surfaces would be dozer-ripped, gravel material salvaged, covered with topsoil and seeded. Where miles of pipeline exist within the ground, these areas would need to be reopened with trenching equipment and pipelines removed, then the trenches backfilled and reclaimed. All storage ponds would undergo natural or enhanced evaporation; all solid 11e.(2) byproduct materials would be removed and transported to a NRC licensed disposal facility. In each case, liners would have to be removed and similarly transported to the licensed disposal facility. Following clean up and decommissioning, these ponds would need to be refilled with subsoil and spread with topsoil, leveled, and seeded as well as other reclamation processes necessary to bring the existing landscape back to its original condition. These reclamation methods require equipment such as scrapers, dozers and graders (to tear up the access roads and spread out the soil), dozers and farm discs (to loosen the packed soil), bulldozers, loaders and dump trucks (for filling reservoirs with dirt and to push topsoil into place), drill rigs (to plug up the monitoring wells), jack hammers (to break up the concrete foundations for the warehouses/shops), backhoes and PVC chippers (to break up the PVC pipe into smaller, manageable pieces), pickup trucks (to help remove the fences within the project site), cranes (to help tear down the building structures, such as the satellite buildings, CPP, CPF, etc.), pipe trailers (to remove the pipeline pieces), pull trucks (to take down the power lines), flatbed trucks (for hauling), and dump trucks (to remove the rubble). Overall, the equipment noise level ranges from approximately 74 to 125 dBA, the loudest being the PVC or wood chipper at 125 dBA. **Table**

4.7-1, Peak Noise Levels for Equipment Used at the SUA-1548 Project Sites and the Noise Levels at the Six Smith Ranch Testing Sites provides the related noise levels for the other pieces of equipment used at SUA-1548, according to the U.S. Department of Transportation.

In the event that the no-action alternative is chosen, reclamation and decommissioning of the ISR facilities at Smith Ranch will result in noise levels of up to 125 dBA. Because of the concentrated activities of bulldozers, jack hammers and other heavy equipment, noise levels will increase over existing conditions. At a distance of 3 kilometers (2 miles) away, the noise levels will be dampened to approximately 77 dBA. As noted above, a noise level of 77 dBA can be likened to the same noise level as a dishwasher, barking dog, or a vacuum cleaner, and therefore the noise impact is not considered extreme (NetWell, 2011).

Implementation of the no-action alternative at the remote satellite sites will also result in the reclamation of existing disturbances. At each remote satellite facility, there are buildings, monitor wells and roads which will require reclamation. At the Ruth Remote Satellite there are also lined ponds which will need to be decommissioned. Since none of these remote satellites are operational, groundwater restoration of wellfields will not be required. In the event that the no-action alternative is chosen, reclamation and decommissioning of the current facilities will result in noise levels of up to 125 dBA. Because there are not as many buildings, roads and existing wells at these remote satellite facilities, the duration of the increased noise levels will be less than what might be anticipated at Smith Ranch.

4.7.3 Alternative Action

Under the alternative action, the licensee would mine uranium ore using either conventional underground or conventional open pit mining. Within SUA-1548, a conventional mining approach would result in significantly higher noise levels and would extend for a greater period of time. Because of the depth of the ore, it is possible both surface and underground methods would need to be employed. Such mining methods historically occurred at Smith Ranch and the Gas Hills Remote Satellite.

From a noise perspective, conventional mining will require the use of a diverse assemblage of heavy equipment including scrapers, loaders, haul trucks, drill rigs, draglines, bulldozers, road graders, generators, fans, compressors and a diverse number and types of support vehicles. Construction and ultimately reclamation of buildings and processing plants will still be required. Blasting may also be required and would result in the largest instantaneous decibel levels. Overall, the individual equipment noise level for a conventional mine ranges from approximately 74 to 125 dBA. Because of the large concentration of equipment within the operating mine pit, the combined noise may achieve levels of 135 dBA at peak periods of construction and if all equipment was operating at maximum power at the same time. A more reasonable noise level for the alternative action would be 90 to 100 dBA. Given the remoteness of SUA-1548 and the distance to occupied residences, noise levels will vary across the sites depending on the location of specific mine features: mine pits; mine shafts; operating plants; and, waste dumps. In general at a distance of 3 kilometers (2 miles) away, the noise levels (assuming 135 dBA at the source) will be dampened to approximately 87 dBA. Because there are not as many buildings, roads and existing wells at these remote facilities, the duration of the increased noise levels will be less than what might be anticipated at Smith Ranch. A noise level of 87 dBA can be likened to the same noise level as a snow blower or lawn mower (NetWell, 2011).

4.7.4 Cumulative Impacts

Rangeland, pasture, oil and gas exploration, CBM development, and wildlife habitat have been the primary land uses within the surrounding 3 kilometers (2 mile) of SUA-1548. Specific to Smith Ranch, ISR is ongoing and wind farming is a recent development. The noise impacts associated with these land uses include intermittent use of heavy equipment during initial phases of construction or reclamation as well

as the ongoing noise associated with increased construction traffic and ongoing equipment noises such as drilling, generators and pumps. As a result of the remote locations associated with the SUA-1548 license area and the low population density of the surrounding area, the cumulative impact related to noise within the surrounding 3 kilometers (2 mile) is not anticipated to be significant. Using worst case assumptions on increased traffic loading and ongoing construction, cumulative noise levels at the source will likely be in the 50 to 70 dBA levels. At a 3 kilometer (2 mile) distance the cumulative noise level increase would be negligible. If a PVC chipper was operating at the same time as the cumulative level of increased traffic and drilling, the individual chipper would dominate the noise calculation. In this case the cumulative impact with an operating PVC chipper would likely remain at 125 dBA.

Additionally, since the maximum increase of new workers associated with the preferred action alternative is anticipated to be relatively low, noise and congestion impacts are not anticipated to affect any of the surrounding counties including: Converse, Campbell, Johnson, Fremont or Natrona.

4.7.5 References

Cameco Resources Smith Ranch-Highland Operation: *Hearing Conservation Hazard Assessment Report*. July 2010.

NetWell Noise Control. *Decibel Chart*. 2011. [Web Page] <http://www.controlnoise.com/decibel-chart>

US Department of Commerce, Bureau of the Census. 2000. [Web Page] <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>

US Department of the Interior, Bureau of Reclamation and Freeport Regional Water Authority. *Freeport Regional Water Project: Environmental Impact Report/Environmental Impact Statement*. July 2003. [Web Site] http://www.freeportproject.org/nodes/explore/draft_eir_eis_v1/14_chapter.pdf.

US Department of Transportation: Federal Highway Administration-Office of Planning, Environment, & Realty (HEP). *Highway Traffic Noise: Construction Noise Handbook*. Sect. 9.0: Construction Equipment Noise Level and Ranges. 2001. Locate at: www.fwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm

4.8 Potential Historic and Cultural Resources Impacts

4.8.1 Proposed Action

Cameco has reviewed and updated historical and cultural resource surveys at SUA-1548, with the exception of the Ruth Remote Satellite, in accordance with the requirements of SHPO (see Section 3.8). Because of the localized nature of land-disturbing activities for ISR operations and the fact that ISR activities will avoid historic and cultural resources whenever possible, impacts to these resources are expected to be minimal. Overall impacts to cultural and historical resources during operations are expected to be less than those during construction, as operations are generally limited to previously disturbed areas (e.g., access roads, CPF, satellites and well fields).

4.8.1.1 Smith Ranch

A description of the existing historic and cultural resources present at Smith Ranch is presented in Section 3.8. The Holdup Hollow segment of the Bozeman Trail, listed in the National Register of Historic Places, was within the original Reynolds Ranch Satellite License boundary. In general, it was recommended that no ground-disturbing activity of any kind take place within the recognized boundaries of the Holdup Hollow segment of the Bozeman Trail. Accordingly, the sections of land associated with the Holdup Hollow segment were removed from the northern portion of the Reynolds Ranch Satellite license area. Therefore, there have not been and will not be any adverse 36 CFR 800 impacts to the Bozeman Trail by SUA-1548 operations. All of the other sites under question were determined ineligible for inclusion into the National Register of Historic Places.

If any previously unidentified historical or archaeological finds are discovered on the property, they will be protected and the appropriate state and/or federal office notified. Cultural and historical resource mitigation procedures used at all SUA-1548 facilities are provided in Section 5.8.

4.8.1.2 North Butte Remote Satellite

Section 3.8 provides a description of the existing cultural resources present at the North Butte Remote Satellite. There are two sites at the North Butte Remote Satellite that have been determined eligible for the National Register of Historic Places. One site is a diffuse scatter of chipped artifacts, suggesting that this site has the potential to yield significant scientific information. As a result, Cameco will not disrupt the ground surface near or within the site. The second site, Pumpkin Buttes, is an extremely large, discontinuous historic property that takes in the tops and sides of the physiographic features making up the Pumpkin Buttes (Dome Butte, North Butte, North Middle Butte, South Middle Butte, Indian Butte, and South Butte). All lands above the 1,609 meter (5,280 foot) contour line are included in the North Butte historical site, which has also been designated a TCP. Cameco will address this TCP in consultation with the NRC, SHPO and various Native American tribes during NRC's Section 106 consultation process to determine an appropriate course of action related to this site. Cameco has developed a plan for gathering Section 106 information about properties of religious and cultural significance to federally recognized Indian tribes that may be affected by ISR activities at the North Butte Remote Satellite. This plan is provided as **Appendix E, North Butte Section 106 Plan**.

The WSHPO has recommended that Cameco contact the appropriate state and federal agencies if subsurface cultural remains are found during construction. Cameco has agreed to this stipulation for all of its SUA-1548 sites and will also be following mitigation measures outlined in Section 5.8.

4.8.1.3 Gas Hills Remote Satellite

A review of the historic and cultural resources at the Gas Hills Remote Satellite is provided in Section 3.8. Two sites within the Gas Hills Remote Satellite were determined eligible for the National Register of

Historic Places. No disturbance is expected at one of the sites as it will be avoided during construction and operations. However, the other site is located within a wellfield area and will need to be addressed or mitigated (see Plate D3-2 in Appendix D3 of the WDEQ Gas Hills Permit). Mine Unit V may require a Class III inventory before construction commences to ensure minimal impacts to historic and cultural resources. However, the majority (approximately 70% of Mine Unit 5) was previously disturbed by conventional mining and reclamation activities.

As is the case for Smith Ranch and the North Butte Remote Satellite, should subsurface cultural remains be found during any construction activities, all activities within the area will halt and the appropriate state and federal agencies will be contacted immediately. See Section 5.8 for Cameco's mitigative measures used to protect cultural and historic resources.

4.8.1.4 Ruth Remote Satellite

As stated in Section 3.8, no cultural resources were located within the Ruth Remote Satellite during the 1980 survey and archeological clearance was given with the stipulation that if any cultural remains were found, the appropriate state and federal agencies would be contacted immediately. Because cultural studies conducted prior to 1981 are generally not accepted today, an updated historic and cultural survey will be conducted and submitted to NRC, LQD and WSHPO prior to commencing ISR operations at the Ruth Remote Satellite.

4.8.2 No-Action Alternative

The no-action alternative will not have any additional impacts on historical or cultural resources within SUA-1548 as new construction and operations activities will not take place. At Smith Ranch, construction of new mine units would cease and only restoration and reclamation activities would continue. Therefore, additional impacts on cultural and historical resources would be minimal.

4.8.3 Alternative Action

Underground and open pit mining would disturb much larger areas of land compared to ISR methods. Such conventional mining disturbances would include open pits, spoil piles, topsoil piles and construction of buildings. The increase in ground disturbance would undoubtedly increase the risk of adverse impacts to historical and cultural resources over the proposed action.

4.9 Potential Visual and Scenic Resources Impacts

4.9.1 Proposed Action

During ISR operations, there are temporary, short-term and long-term visual effects. The temporary and short-term visual effects occur during the construction phase of mine unit well field development which includes header house construction, well installation, well field access road construction, pipe and power line installation, etc. Following completion of well field installation, the temporarily disturbed areas are reclaimed. Only the long-term visual effects associated with operations and maintenance will remain during operations and are described below. SUA-1548 is an ongoing ISR operation and approval of the proposed action will continue the operations at Smith Ranch and allow new operations to commence at the remote satellites.

Long-term visual effects result from the addition of structures to the landscape that will exist over the life of the project. Within the SUA-1548 license areas, long-term visual disturbances consist of buildings, well field areas, access roads, fences, lighting, and related ancillary infrastructure such as storage ponds, salvage areas, and pipe and power line corridors. The visual disturbances at Smith Ranch include 18

buildings (e.g., the CPP, the CPF, satellite buildings, warehouse, maintenance/construction shop, selenium treatment facility, and deep disposal well buildings), individual well fields (mine units) and header houses, access roads, a parking area, storage ponds, fencing surrounding the mine units, and a salvage/boneyard area. Additional well fields, monitoring wells, UIC Class I disposal wells and a Reynolds Ranch Satellite building will be constructed during the license renewal period. License approval of the proposed action would allow these visual disturbances to remain on the landscape for the license period. At the end of ISR operations, all of these facilities will be removed and the land surface reclaimed.

The existing visual disturbances described above range in size from large building structures to wells within the well field areas. The Smith Ranch CPP is the largest building structure at approximately 122 by 30 meters (400 by 100 feet) in size followed by the Highland CPF facility at approximately 86 by 54 meters (288 by 176 feet). The satellite IX buildings average approximately 15 by 30 meters (50 by 100 feet) each. The well field areas comprise similar visual disturbances including booster station buildings, header houses, wells, power and pipe line corridors, and access roads. The booster station buildings, deep disposal well buildings, and header houses are the largest building structures in the well field. These larger structures are accompanied by smaller metal buildings, which are less than 15 by 30 meters (50 by 100 feet) in size. The booster station houses pumps necessary to move water from the well fields to the processing facilities. The header houses contain electrical components and injection and production headers connecting the wells to the pipelines. Each building is connected by an access road and is characterized by a small disturbance area to provide adequate access for operations and maintenance activities. Electric power lines connect these buildings to the main electric distribution poles. The electric distribution poles represent the tallest structure in the well field and are approximately 6 meters (20 feet) high. The smallest visual disturbance in the well field area is the well. Each operational well is encased in a weatherproof cover which is approximately 1 by 0.6 meters (3 by 2 feet) in size and come in a variety of shapes from cylindrical to pyramid. Under the proposed action, Cameco will maintain the same design for any new facilities that are constructed at Smith Ranch or any of the remote satellites. The fencing surrounding the mine unit pattern areas represents the largest visual impact in terms of overall meters (or feet) in length. There are approximately 100,000 meters (336,000 feet) of total fencing surrounding the mine units at the Smith Ranch project site, and an additional 30.5 meters (100,000 feet), approximately, to be erected later with the addition of the proposed mine units at the project site.

At the North Butte Remote Satellite, Cameco will initially construct three buildings (one satellite building, two UIC Class I injection well buildings), two surge ponds, additional monitoring wells, well field areas and header houses, electrical distribution lines, fencing, and access roads. Approval of the proposed action would allow these visual disturbances to be constructed during the license renewal period. At the end of ISR operations, all of these facilities will be removed and the land surface will be reclaimed. Although there is fencing present at the North Butte project site, there is less present at this site than at the Smith Ranch project site. Specifically, there are approximately 7,700 meters (25,000 feet) of fencing currently (2011) at the North Butte project site. An additional 1,100 meters (36,000 feet) are expected to be erected as the proposed mine units are developed.

At the Gas Hills Remote Satellite, the Carol Shop, approximately 40 monitoring wells, the radium treatment building, a settling basin and several miles of roads and drilling-related disturbances and site reclamation exist. Additionally, disturbances associated with historical conventional mining (both underground and surface) and reclamation, exist and represent the affected environment for the assessment of long-term visual impacts. Under the proposed action, Cameco will construct five mine units and associated well fields, header houses, upgrade and construct new roads, four to six evaporation ponds, UIC Class I injection wells and possibly an additional satellite facility. The amount of acreage fenced

off at the Gas Hills will be approximately 400 hectares (1,000 acres). Approval of the proposed action would allow existing long-term visual disturbances to remain and these additional visual disturbances to be constructed during the license period. At the end of ISR operations, all of these facilities will be removed and the land surface reclaimed.

At the Ruth Remote Satellite, there are three existing buildings (the processing plant, one warehouse, and a generator building), three monitoring wells, one two-celled evaporation pond and one access road. A detailed operations plan has not yet been completed for the Ruth Remote Satellite, so it is yet to be determined whether Cameco will remove and reclaim several of these existing visual disturbances and replace them with new facilities. Cameco anticipates starting development of the Ruth Remote Satellite near the end of the renewal period and will provide an updated operating plan and environmental analysis at that time.

Exterior lighting will be necessary for safe and secure operations throughout the SUA-1548 operations. Cameco will use both continuous and intermittent lighting systems at each project site, with continuous lighting used in locations such as at the front door of the header houses and in front of major buildings including warehouses, the CPP, and Carol Shop. This continuous lighting will be used during the nighttime for safety purposes. Intermittent lighting will also be used periodically where Cameco personnel may be required as well as in parking areas. Historically, light pollution has not been an issue or concern at the SUA-1548 project sites, resulting in no complaints from the local residents or passers-by since the start of the Cameco operations. Therefore, Cameco does not foresee an issue with the lighting at the present time nor with the development of future projects. Surrounding topography and the distance of the project sites from nearby towns and housing developments play an important role in limiting the potential light pollution that may be caused by Cameco operations. Due to the rural locations of each of the SUA-1548 project sites and the surrounding topography of high rolling hills that surround each site, the amount of light pollution is extremely limited. However, because Cameco is aware that there may be some possible concerns with light pollution, some alternatives have been addressed to further limit the amount of the potential light pollution present at each project site. Some of these alternatives include using downward lighting, adding shielding to the lights to direct the light only towards the work area and make it less visible from a distance, using lighting of minimal intensity (in lumens), using lighting sources on timers or activated by sensors so they are off when not in use, to examine alternative fixtures to decrease the amount of visible light, fitting building windows with shutters (if and where appropriate) to block light emissions, and placing lighting systems behind structures that will block the light emissions, such as behind trees or already-existing man-made structures. The potential for light pollution impacts beyond the immediate area (more than 6.4 kilometers [4 miles] from the project site boundaries) is highly unlikely due to landforms and topography outside of 6.4 kilometers (4 miles), which effectively limit the visual impact of major lighting sources such as the CPP at the Smith Ranch project site. Exterior lighting is and will be necessary to safely produce uranium at the proposed SUA-1548 project sites. However, natural conditions provided by topography, landforms, and vegetation reduce the impacts tremendously.

With the approval of the proposed action, Cameco will continue to mitigate the visual impacts by ensuring that these structures blend in with their surroundings as much as possible, including painting them a neutral color to mask their presence. During final decommissioning and reclamation, all structures will be removed thereby removing any visual impacts created by these structures. Any structures built for the purpose of the ISR operation are expected to have very little impact on the overall visual quality of the surrounding area.

4.9.2 No-Action Alternative

The no-action alternative for Smith Ranch would require the reclamation of all visible structures that currently exist at the site. Construction activity under the no-action alternative would include reclamation of any existing buildings, restoration of operating mine units, well abandonment and reclamation of well fields, and removal of all ponds, treatment plants and roads. The buildings would need to be decommissioned and effectively demolished. The disturbed ground underneath would need to be covered with topsoil and seeded. The wells would need to be plugged and covered with soil, then seeded. Road surface would need to be dozer-ripped, gravel material salvaged, covered with topsoil, and seeded. Buried pipelines would need to be removed using trenching equipment and the trenches backfilled and reclaimed. All storage ponds would undergo natural and enhanced evaporation, and regulated solids would be removed and transported to a NRC-licensed disposal facility. In each case, liners would have to be removed and disposed at a NRC-licensed disposal facility. Following clean up and decommissioning, these ponds would need to be backfilled with subsoil, leveled, spread with topsoil and seeded.

At the North Butte Remote Satellite, there is currently (January 2012) no structures, well fields, and limited access roads. Under the no-action alternative, no new structures would be constructed and all existing ISR disturbance (e.g., monitor wells and access roads) would be removed and reclaimed.

At the Gas Hills Remote Satellite, the visual structures include the Carol Shop, more than 40 monitoring wells, the radium treatment building, and existing access roads. Under the no-action alternative, no new structures would be constructed and all existing structures, monitor wells and access roads would be removed and reclaimed.

At the Ruth Remote Satellite, the visible structures include three buildings (the processing plant, one warehouse, and a generator building), three monitoring wells, one two-celled evaporation pond and one access road. Under the no-action alternative, no new structures would be constructed and all existing structures, access roads, the pond, monitor wells and a small well field area would be decommissioned and reclaimed.

4.9.3 Alternative Action

The visual and scenic resource impacts of the alternative action would be greater than those of the proposed action. Under the alternative action, the overall land disturbance would be significantly greater and will include large conventional open pit and/or underground mine facilities. The long-term visual disturbance would include large mine dumps, topsoil stockpiles, multiple roads, multiple buildings, dewatering wells and facilities as well as conventional milling and tailings facilities. Open pit mining would remove and stockpile hundreds of cubic yards of overburden before reaching the ore zone. Underground mines would also have hoist house structures that would be taller than any of the proposed project buildings. The larger size of a conventional mill will have greater long-term visual impact relative to the proposed action.

4.9.4 Cumulative Impacts

The cumulative impacts to the visual/scenic resources of SUA-1548 licensed activities are not expected to be significant. The project sites are located in remote areas that are primarily on private and BLM-administered lands and a small amount of state-owned land, with limited or no access. This restricts the number of people that will be able to see the operations. On a cumulative basis, the adjacent existing landscape includes features associated with other energy development enterprises including wind energy generators, CBM well fields, conventional oil and gas drilling pads and ponds, as well as ancillary roads and buildings. The cumulative impact of an ISR operation within these remote areas will be insignificant.

Cameco proposes certain mitigation measures that include painting processing facilities, office and maintenance buildings, well casing covers, and any other visible structures with neutral colors to blend in with the natural landscape. Power lines will be laid underground whenever possible to limit the number of poles and overhead lines. Well field revegetation will alleviate any potential visual/scenic impact that may temporarily occur due to well field construction and installation.

4.10 Potential Socioeconomic Impacts

4.10.1 Proposed Action

The construction and operating workforce for the proposed action will come from the region surrounding each site; primarily Converse, Campbell, Fremont, and Johnson Counties. Smith Ranch is located in Converse County and is an ongoing operation. Much of the current and ongoing effects to housing, public and other community services, recreation, county and municipal finances, crime, and the local transportation network occur within Converse and Natrona Counties. With respect to the remote satellite operations at North Butte, Gas Hills, and Ruth; Campbell County, Fremont County, and Johnson County would likely experience similar, but to a lesser extent socioeconomic impacts.

It is anticipated that the overall effect of the proposed action on the local and regional economy for these counties and the state as a whole would be beneficial. Purchases of goods and services by the project and project employees would contribute directly to the economy. Local, state, and federal governments would benefit from taxes paid by the ISR operations and its employees. Indirect impacts, resulting from the circulation and recirculation of direct payments through the economy, would also be beneficial. These economic effects would further stimulate the economy, resulting in the creation of additional jobs. Beneficial impacts to the local and regional economy provided by the ISR operation would continue for the life of SUA-1548, which, if the proposed action is approved, may result in an additional 36 years for Smith Ranch, 20 years for the North Butte Remote Satellite, 20 to 25 years for the Gas Hills Remote Satellite, and 10 years for the Ruth Remote Satellite. Economic impacts of the proposed action are discussed in further detail in Sections 3.10 and 7.0 of this ER.

4.10.1.1 Construction

The construction phase of an ISR project causes a temporary, moderate impact on the local economy resulting from the purchases of goods and services directly related to construction activities. Impacts to community services in Converse, Campbell, Fremont, and Johnson Counties, such as roads, housing, schools, and energy costs, would be minor to non-existent.

When construction commences at the Ruth Remote Satellite, it is anticipated that the majority of the workers will be hired from communities located within Campbell and Johnson Counties; and when construction commences at the Gas Hills Remote Satellite, it is anticipated that the majority of the estimated 20 required employees will be hired from communities located within Fremont County (eg., Riverton and Lander).

Most construction work available to the local construction labor pool consists of temporary contract work that varies in duration, depending on the scope of each construction project. The number of unemployed construction workers does not represent the number of workers that would be available to the project from the local construction labor pool. The “unemployed” number is an annual average that does not take into account monthly variations in the available construction labor pool from construction start-ups and completions. Cameco will likely hire from the local construction labor pool. The actual number of construction workers available for SUA-1548 sites draws from the entire construction labor pool of

approximately 7,100 (2010 estimate). This pool will fluctuate as construction activities from some active projects conclude and new workers become available for construction activities under the proposed action.

4.10.1.2 Operations Workforce

An estimated 153 full-time employees are currently employed at Smith Ranch for operations and restoration activities. This number is expected to increase to 170 full time employees under the proposed action. An approximate operating base of 32 employees will be employed at the North Butte Remote Satellite facility. It is anticipated that approximately 65 employees will be required for the operational phase of the Gas Hills Remote Satellite facility. It is not known how many of the required operations workforce would be hired from outside of Converse, Campbell, Fremont, Natrona and Johnson Counties. In the event that the entire operations workforce and their families relocated to the counties within which the projects are located, the population increase would be a maximum of 360 in Converse County, 144 in Campbell County, 180 in Fremont County, and 48 in Johnson County based on the 2010 average Wyoming household size of approximately two people. This increase would account for less than 1% of the population of Converse, Campbell, and Johnson Counties, and approximately 1% for Fremont County. These increases are smaller than the projected annual growth rate. Therefore, there would be little to no effect on the vacancy rates of any type of housing in the affected counties.

4.10.1.3 Restoration Workforce

When operations cease at Smith Ranch and ground water restoration is the only activity, the workforce will likely shrink from the approximate 170 employees to approximately 85. As restoration of wellfields continue to be successful, it is anticipated that the number of employees will slowly continue to decline until, at the time of final decommissioning and reclamation the workforce will comprise approximately 50 employees.

At the time the North Butte Remote Satellite ceases production and is completely in ground water restoration, it is anticipated that the number of employees will be reduced to approximately 16. The number of employees will continue to slowly decline as restoration continues until at the time of final decommissioning and reclamation, Cameco estimates that approximately 10 employees will remain at the site.

At the time the Gas Hills Remote Satellite ceases production and is completely in a restoration mode, it is anticipated that the number of employees will drop from 65 to approximately 50. As mine units continue to be restored, it is anticipated that the workforce numbers will continue to slowly decline until at the time of final decommissioning and reclamation, the number of employees will be approximately 40.

4.10.1.4 Effects to Housing

Smith Ranch is within commuting distance of Glenrock and Douglas in Converse County, and Casper in Natrona County. The North Butte and Ruth Remote Satellites are within commuting distance of Gillette and Wright in Campbell County; Midwest, Edgerton and Casper in Natrona County; and, Kaycee in Johnson County. The Gas Hills Remote Satellite is within commuting distance of Riverton and Shoshoni in Fremont County and Casper in Natrona County. Therefore, workers from these counties would likely commute from their homes. There would be no impact on temporary housing located within commuting distance (approximately 1 to 2 hours) of the SUA-1548 license areas.

In the event that temporary workers from other states are hired for construction at SUA-1548 license areas, temporary housing such as motel/hotel rooms and RV sites located within commuting distance

would be required, as no on-site housing is available or planned. The available stock of motel/hotel rooms for Smith Ranch and the remote satellites would accommodate relocating workers.

It is recognized, however, that the coal, CBM, oil and gas, and other uranium projects in the area are presently a dominant influence on temporary housing, and the workforce employed in these industries occupy much of the temporary housing that is currently available. Wyoming counties are often faced with a shortage of temporary housing and have adapted to this shortage by the construction of new temporary facilities.

It is anticipated that only a few members of the construction workforce would purchase or rent housing of any type. Therefore, there would be no effects on the costs of any type of housing in the affected counties. Because rental housing usually requires a long-term lease (generally a minimum of six months), only long-term employees would likely enter into this type of lease agreement. Under a hiring scenario that assumes all of the proposed operations workforce would need to relocate to the area, approximately 210 housing units would be required over the life of the project for Smith Ranch, approximately 144 for the North Butte Remote Satellite project, approximately 180 for the Gas Hills Remote Satellite project, and approximately 28 for the Ruth Remote Satellite project. Since Smith Ranch is an operating uranium ISR facility, the need for 210 housing units is unrealistic. In 2010, there were a total of 2,513 vacant housing units in Converse and Campbell Counties combined, and 3,112 vacant housing units in Fremont and Johnson Counties. When combined and assuming the above worst case assumptions, this would meet the future demand for housing in these four counties from anticipated population growth. There would be little to no effect to the rental rates of any type of housing in the affected counties

4.10.1.5 Effects to Services

It is likely that both the construction and operating workforce for the project would be from Converse, Campbell, Fremont, and Johnson Counties, or other nearby communities, and would not require permanent or temporary housing. In the event that up to 50% of the construction and operating workforce are non-local workers, it is anticipated that there would be less than a 1% increase in the population of the affected counties from the permanent relocation of the workers and their families. Most non-local workers are anticipated to utilize temporary housing. Because existing mobile home and RV parks will be used for a majority of the temporary housing, the project will not require new water, sewer, electrical lines, or other infrastructure. There will be no additional demands or increases in service levels for local infrastructure, such as police, fire, water, or utilities. In addition, there would be little measurable increase in non-basic employment, as these jobs are generated from ongoing employment of the existing base of construction workers, and would be maintained through the continued employment of local construction workers. Therefore, construction and operation of SUA-1548 facilities during the renewal period would not significantly affect the various public and non-public facilities and services described above from the influx of workers for non-basic employment opportunities.

Families moving into the affected county school districts as a result of SUA-1548 operations would not stress the current school system because it is presently under capacity in each of the affected counties.

4.10.1.6 Economic Impact Summary

Economic impacts are discussed in detail in the benefit-cost analysis in Section 7.0.

4.10.2 No-Action Alternative

The no-action alternative would result in a negative economic impact to local towns and counties by reducing the sales tax revenue for goods and services in Converse, Campbell, Fremont, and Johnson Counties. Selection of this alternative would impede any chance of further boost to the economy for the

towns that would provide housing and services for workers associated with SUA-1548. The no-action alternative overall would create no additional jobs and would inhibit any positive effects that the project has and would have continued to have on the economy at the local, state, and federal level.

The no-action alternative would; however, increase the number of available housing units (temporary or permanent) in the cities and towns that are within commuting distance of the SUA-1548 license areas since they would not be occupied by the Cameco employees. Also, the no-action alternative would prevent an increase in the number of students that would occupy the local schools, and would increase the vacancy levels at nearby mobile home communities and RV parks. However, based on the number of workers anticipated for each of the SUA-1548 license areas, the no-action alternative is unlikely to have a positive effect on local housing or the local school system.

4.10.3 Alternative Action

The socioeconomic impacts of conventional mining would be similar, though possibly greater than those associated with the proposed action. In particular, the labor force associated with a conventional mine and the upfront capital requirements would be greater. Because of the increase in labor, the overall demand for housing and school will be higher and additional housing may need to be created. Tax revenue from a conventional mine is likely to be greater, both in the number of employee's spending money locally as well as the significantly larger capital investment in equipment, materials, fuel and supplies. Additionally, more out-of-area/state workers may be required to fill all of the open positions of an open pit or underground mining operation.

4.10.4 Cumulative Impacts

The proposed action will provide an overall positive contribution to cumulative socioeconomic impacts in the region. The affected counties are all "energy affected counties" and the energy specialized workforce is in place. The cumulative jobs associated with approval of the proposed action are all high paying jobs and will likely be similar to those associated with conventional oil and gas, wind energy, shale fracking, other uranium ISR operations, coal, and CBM. The proportion of new jobs associated with the NRC approval of the proposed action will be insignificant relative to the cumulative nature of energy development within the region. On a cumulative basis, the energy development within these counties has provided jobs, wages, and tax revenues to the state and surrounding communities without adverse impacts to local infrastructures like hospitals, schools, and community services. In fact, the cumulative taxes associated with mineral and resource recovery has provided funding for capital improvements, including critical infrastructure improvements on a statewide basis. If the proposed action is approved by the NRC Staff, the positive socioeconomic effects will be accentuated.

4.11 Potential Environmental Justice Impacts

4.11.1 Proposed Action

Based on the data provided in this section, no large populations of Native Americans, other minorities, or people living below the poverty level are located near any of the SUA-1548 license areas. Therefore, it is concluded that the ISR operations are not now nor will they in the future create any adverse environmental justice impacts on any of these populations. Except for scattered ranches, the majority of the population nearest to Smith Ranch and its contiguous satellites live in Casper, Glenrock, Rolling Hills, Douglas and other smaller communities along the I-25 corridor. Similarly, the majority of the population near the North Butte and Ruth Remote Satellites reside in Gillette, Wright and other smaller communities along Highways 387, 50 and 59. The majority of the population near the Gas Hills Remote Satellite resides in Riverton, Lander and Casper. These cities, towns, and communities also possess a low percentage of

minority and low-income populations compared to the state as a whole (U.S. Department of Commerce, 2010b).

While opportunities for developed and dispersed recreation exist throughout the regions surrounding all SUA-1548 license areas, there are limited recreational uses within the license areas or in the surrounding 3 kilometer (2 mile) area. Private lands within the license areas allow limited hunting opportunities. Public lands within and adjacent to the Gas Hills Remote Satellite are used for pronghorn antelope hunting and limited other recreational interests; North Butte, Ruth, and Smith Ranch public lands are used for antelope and deer hunting and limited other recreational interests. Section 3.1.3 of this TR describes all state and federal recreational lands within 80 kilometers (50 miles) of all SUA-1548 sites. There have not nor will there be any significant impacts on recreational opportunities as a result of SUA-1548 operations. The physical remoteness of the sites and the lack of proximity to any well recognized federal or state site of recreational interest indicate that there are no significant long-term impairments to recreational values from expanding SUA-1548 operations.

Hunting activities on and near the permit area are primarily limited to pronghorn and mule deer. Since the permit area surface is predominantly under private ownership, hunting is controlled by the landowners. Under agreements with the individual landowners, hunting activities are precluded within NRC restricted areas (i.e., CPP and satellite facilities). Mine unit areas on public land are open to hunting. Cameco requests that all hunters check in at the SR or remote satellite office prior to hunting in these areas.

4.11.1.1 Smith Ranch

The 2010 U.S. Census Decennial Population program provides race and poverty characteristics on a census tract basis. Based on a 6.4 kilometer (4 mile) radius, Smith Ranch consists of only one potentially-impacted census tract: Converse County Tract 9566.

As summarized in **Table 4.11-1, 2010 Race Characteristics of the Population for the Census Tract Included in the 6.4 Kilometer Radius Surrounding Smith Ranch**, the total population of Converse County Tract 9566 was approximately 3,200, according to the 2010 U.S. Census (U.S. Department of Commerce, 2010b). The State of Wyoming minority and low-income housing data was compared to the Converse County tract totals to demonstrate how the minority and low-income populations of the tract directly compare to the state as a whole. There are approximately 230 minorities (approximately 0.4% of the total state population) living in Converse County Tract 9566, whereas there are approximately 80,000 minorities (approximately 14% of the total state population) living in the entire state of Wyoming (U.S. Department of Commerce, 2010b).

The Converse County Tract 9566 census tracts exhibits a smaller percentage of the population living below the poverty level than the state as a whole. The approximate poverty level population is 7, whereas the state overall has a poverty level average of approximately 11%. **Table 4.11-2, 2011 Estimated Poverty Level Characteristics of the Population for the Census Tracts Included in the 6.4 Kilometer Radius Surrounding Smith Ranch** summarizes the median household income, per capita income, and population below the poverty level for each of the impacted census tracts as well as the state as a whole. No disproportionate adverse Environmental Justice impacts have been identified for low-income populations within the census tracts due to the operations at Smith Ranch.

4.11.1.2 North Butte and Ruth Remote Satellites

Because of their close proximity to one another (the Ruth Remote Satellite is approximately 13 to 16 kilometers (8 to 10 miles) southwest of the North Butte Remote Satellite), the Environmental Justice impacts of these two facilities have been analyzed together.

As summarized in **Table 4.11-3, 2010 Race Characteristics of the Population for the census Tracts Included in the 6.4 Kilometer Radius Surrounding North Butte** and **Table 4.11-4, 2010 Race Characteristics of the Population for the Census Tracts Included in the 6.4 Kilometer Radius Surrounding Ruth**, the combined population of Campbell County Tract 1 and Johnson County Tract 9551 is approximately 11,400, according to the 2010 U.S. Census (U.S. Department of Commerce, 2010b). Of that population total, there are approximately 830 minorities (approximately 0.14% of the total state population) living within the two census tracts, whereas there are approximately 80,000 minorities (approximately 14% of the state population) living in the state of Wyoming (U.S. Department of Commerce, 2010b).

The Campbell County Tract 1 and Johnson County Tract 9551 census tracts exhibit a lower percentage of the population living below the poverty level than the state as a whole. Their approximate poverty level populations, respectively, are 5% and 7%, whereas the state has an overall poverty level population of approximately 11%. **Table 4.11-5, 2011 Estimated Poverty Level Characteristics of the Population for the Census Tracts Included in the 6.4 Kilometer Radius Surrounding North Butte** and **Table 4.11-6, 2011 Estimated Poverty Level Characteristics of the Population for the Census Tracts Included in the 6.4 Kilometer Radius Surrounding Ruth** summarize the median household income, per capita income, and population below the poverty level for each of the impacted census tracts as well as the state of Wyoming.

4.11.1.3 Gas Hills Remote Satellite

According to the 2010 U.S. Census, and summarized in **Table 4.11-7, 2010 Race Characteristics of the Population for the Census Tracts Included in the 6.4 Kilometer Radius Surrounding Gas Hills**, the combined approximate population of the two census tracts included in this area (Natrona County Tract 18 and Fremont County Tract 3) was 8,600 (U.S. Department of Commerce, 2010b). Of that total, there are approximately 700 minorities (approximately 0.12% of the total state population) living within the two census tracts, whereas there are approximately 80,000 minorities (approximately 14% of the state population) living in the entire state of Wyoming (U.S. Department of Commerce, 2010b).

The percentage of the population residing within Fremont County Tract 3 and Natrona County Tract 18 census tracts exhibit fewer people living below the poverty level than the rest of the state. Their approximate poverty level populations are both 7%. **Table 4.11-8, 2011 Estimated Poverty Level Characteristics of the Population for the Census Tracts Included in the 6.4 Kilometer Radius Surrounding Gas Hills** summarizes the median household income, per capita income, and population below the poverty level for each of the impacted census tracts and the entire state.

4.11.2 No-Action Alternative

Under the no-action alternative, a number of workers would be required to decommission (including groundwater restoration) and reclaim the SUA-1548 license areas back to their original pre-ISR condition. At Smith Ranch, approximately 75 employees would be necessary to successfully carry this out. At the North Butte Remote Satellite, approximately 30 employees would be needed to complete decommissioning and reclamation activities. At the Gas Hills Remote Satellite, approximately 38 employees would be needed; and at the Ruth Remote Satellite, approximately 10 workers would be necessary. During the decommissioning and reclamation process, the number of required workers at each of the SUA-1548 license areas will decrease as the process progresses and tasks are completed. As

demonstrated with the proposed action (see Section 4.11.1 above), there is not now, nor will there be in the future, any disproportionate potential adverse impacts to minority and low-income populations from the operation of SUA-1548 license areas. Therefore, the number of employees and activities necessary to successfully decommission and reclaim each of the four sites would exhibit less of an impact on the minority and low-income populations than the proposed action.

4.11.3 Alternative Action

Under the alternative action, Cameco would mine the uranium ore using conventional underground or open pit mining methods. A conventional mining approach would result in a significantly larger work force. The greater number of employees and contract labor workers required for each of the SUA-1548 license areas would likely reside in the same cities and towns described for the proposed action. Housing is somewhat limited in these communities (see Section 4.10 of this ER) and additional housing may need to be created. The increased demand in housing may result in higher rents and/or availability of housing to the minority and poverty level populations. This increased stress on the community housing and infrastructure could cause potential adverse impacts on the minority and poverty level populations that would not exist with the proposed action.

4.11.4 Cumulative Impacts

The SUA-1548 license areas are located in remote areas of the state surrounded by rural populations with no significant minority or low-income populations. The average salary, including salaries of the proposed action, for the areas within 6.4 kilometers (4 miles) of each of the SUA-1548 license areas, is significantly higher than the poverty level. This fact alone indicates that the proposed action will have a positive impact on any minority and low-income individuals living in communities surrounding the SUA-1548 license areas by making available additional high salary jobs to the people of Wyoming. Therefore, based on an analysis of the impacts caused by the existing Smith Ranch operation and publicly available statistics, it is not anticipated that the proposed action will result in any adverse Environmental Justice impacts on the surrounding local communities or the State of Wyoming.

4.12 Potential Public and Occupational Health Impacts

4.12.1 Proposed Action

ISR operations under the proposed action pose a low risk to public and occupational health. To ensure risk levels from non-radiological and radiological impacts remain low, Cameco has instituted standard operating procedures for handling, processing, storing, transporting or disposing of source and byproduct and hazardous materials. Approval of the proposed action will not result in significant risk to public and occupational health.

4.12.1.1 Smith Ranch

Non-Radiological Impacts

The proposed action includes continued operations at Smith Ranch and expansion to the Reynolds Ranch Satellite. Non-radioactive airborne effluents at Smith Ranch are limited to fugitive dust from access roads and mine unit activities and non-radioactive NO_x particulate emissions from the CPP yellowcake vacuum dryer and packaging room scrubber system. Non-radioactive particulates from the CPP have been negligible in the past and are anticipated to continue to be so. During construction, non-radiological impacts are those associated with fugitive dust from access roads and mine unit activities along with gasoline and diesel emissions from construction equipment and field vehicles. Fugitive dust would result from land disturbance activities associated with construction as well as vehicular traffic. Impacts from

these emissions are expected to remain small due to both the short duration of the release and the fact that emissions are readily dispersed into the atmosphere (NRC, 2009). A summary of the estimated annual fugitive dust emissions is provided in Section 7.2.1 of the TR and indicates that the fugitive dust emission estimates are well below the allowable limits of the State of Wyoming. For additional information on the non-radiological impacts associated with Smith Ranch please see Section 4.6 of this ER and Section 7.4 of the TR.

No highly hazardous chemicals, toxics, or reactives listed in Appendix A to 29 CFR 1910.119 are used at SUA-1548 facilities. While some hazardous chemicals are used at ISR facilities, small risks are expected in the use and handling of these chemicals during normal operations (NRC, 2009). However, accidental releases of these hazardous chemicals can produce significant consequences and impact public and occupational health and safety. Mitigation measures as described in Section 5.12 of this ER and Section 7.5 of the TR are used by Cameco to reduce the chance of such an accident. If an accident did occur, Cameco has established emergency response plans and procedures for transportation accidents (see Section 5.2.1.1 of the TR) that will minimize the risks and impacts. For additional information on the non-radiological impacts associated with hazardous materials at Smith Ranch, please see Sections 5.2.1.2 and 7.5 of the TR.

Non-11e.(2) liquid and solid wastes will be properly disposed to prevent any significant impacts to public and occupational health. The different types of wastes are characterized as follows:

Non-11 e.(2) Liquid Wastes:

- Liquid wastes not affected or contaminated by uranium processing. Reagents and fuels stored outside and near the facilities are placed within bermed areas to provide secondary containment and meet requirements of the Spill Prevention Control and Countermeasures (SPCC) regulations. Contained spills are then removed for appropriate disposal.
- Domestic liquid wastes from restrooms and lunchrooms are disposed in an approved septic system that meets the requirements of the State of Wyoming. Liquid wastes from the facility laboratories are disposed at UIC Class I disposal wells.
- Storm water management is controlled under WYPDES permits issued by the WDEQ/WQD. Facility drainage is designed to route storm water away or around buildings, ancillary buildings and parking areas, chemical and fuel storage areas. Refer to Section 4.0 of the TR and Section 3.12 of this ER for more information on Non-11-e.(2) liquid wastes.

Non-11 e.(2) Solid Wastes:

Solid materials which are not contaminated with radioactive material or which can be decontaminated to unrestricted release criteria. To be released for unrestricted use, decontaminated materials must have activity levels lower than those specified in NRC guidance titled *“Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct or Source Materials”*, September 1984.

Waste management and potential impacts related to these materials are provided in greater detail in Section 4.2 of the TR and 3.12 of this ER.

Radiological Impacts

During typical ISR operations, there is a small potential for radionuclides to be released to the environment. Rn-222 can be emitted from IX facilities, the CPP and the mine unit header houses during operations. However, ISR activities do not release significant amounts of gaseous or airborne particulates (see Section 4.6 of this ER). Specific information relating to the radiological impacts associated with Smith Ranch, including all MILDOS modeling, pathway assessment, and public and occupational exposure information can be found in Section 7.3 of the TR. Information related to the radiological impacts associated with spills at Smith Ranch can be found in Section 7.5 of the TR.

Under the proposed action, yellowcake processing will be performed at the Smith Ranch CPP and CPF facilities. The primary potential source of airborne uranium occurs during yellowcake packaging. Packaging of the yellowcake will be confined to the dryer room, which will be closed and posted as an airborne radioactivity area. Within the yellowcake drying and packaging areas at the CPP and CPF, the potential exists for exposure to yellowcake dust. However, airborne particulate levels at ISR plants that employ vacuum dryers are very low since there are no radionuclide emissions from the dryer. Cameco utilizes vacuum dryers rather than calciner type dryers (yellowcake roasted at 800 °C [1,472 °F] in a gas fired furnace) to reduce migration of air particulates from the drying process. Drying takes place in a vacuum. Material is sucked into the canister so particulates are not allowed to escape into the environment.

In the slurry unloading area, the potential for exposure to airborne uranium is considerably less than in the drying and packaging areas as slurry unloading will be performed on an infrequent basis. Dryer operators are required to wear precautionary respiratory protection during yellowcake packaging operations to provide another layer of protection from the potential release of airborne uranium during this procedure.

Cameco uses downflow pressurized IX columns instead of open columns to minimize exposure to Rn-222. All facilities have ventilation systems that remove released radon from building units and discharge it to the atmosphere. These and other measures ensure the radiological impacts to public and occupational health from ISR mining are ALARA.

Cameco performs extensive testing to monitor the potential for radiological impacts to public and occupational health. External gamma radiation surveys are regularly performed at worker occupied stations and areas of potential gamma source exposure such as tanks and filters at Smith Ranch. Area samples are collected and analyzed at specified sample location in accordance with standard operating procedures (see **Figure 5.2, Radiological Sampling Locations at the CPP, Figure 5.3, Radiological Sampling Locations at Satellite #2 and Selenium Plant, Figure 5.4, Radiological Sampling Locations at Satellite #3, Figure 5.5, Radiological Sampling Locations at SR-1** and **Figure 5.6, Radiological Sampling Locations at SR-2** in the TR). Workers are also monitored to ensure they receive less than 10% of the dose limits for internal or external radiation. Lastly, occupational airborne radioactivity concentrations at Smith Ranch are monitored daily, weekly and monthly to allow for timely investigations and corrective actions, if needed, to respond to conditions or practices resulting in airborne radioactivity concentrations above the action level of 25% of the DAC. For additional information about current activities and mitigation measures, see Sections 3.12 and 5.13 of this ER and Section 5 of the TR.

4.2.1.2 Remote Satellites (North Butte, Gas Hills, and Ruth)

Non-Radiological Impacts

Approval of the proposed action at the remote satellites will allow the commencement of uranium recovery operations at these facilities. Construction and operations at the remote satellites will have

similar safeguards as those utilized at Smith Ranch. Therefore, potential impacts on public and occupational health at the remote satellite locations are expected to be small. Increases in fugitive dust levels as construction and operation activities commence are anticipated, but impacts on local air quality will be minimal (see Section 4.6 of this ER and Section 7.0 of the TR). Measures to reduce dust from vehicular traffic include applying water or chemically treating unpaved roads. Estimated fugitive dust emissions during construction of ISR facilities are less than 2% of the NAAQS for PM_{2.5} and less than 1% for PM₁₀ (NRC 2009).

Hazardous materials use will be kept to a minimum and handling of these materials will be according to standard operating procedures. Should an accident or spill occur, emergency response plans will be followed to minimize potential health impacts. Non-radiological impacts are discussed in further detail in Section 7.5 of the TR.

Waste management procedures are in place at Smith Ranch, and reflect those approved in the 2001 license renewal, to reduce public and occupational health impacts from liquid and solid wastes. Monitoring and sampling of waste effluent show that management measures are successful as levels are within acceptable values. These management and sampling procedures will also be used at the remote satellites. Information regarding potential impacts from waste management is discussed in Section 4.2 of the TR and Sections 3.12 and 5.13 of this ER. At this time, site planning and proposed construction activities for the Ruth Remote Satellite have not been finalized. Consequently, impacts from construction and operations will not be experienced at the Ruth Remote Satellite until future operational details are finalized.

Radiological Impacts

Airborne effluents from ISR operations at the remote satellites are anticipated, but constituent concentrations will likely be minimal. In particular, Rn-222 is the main potential radioactive effluent expected during operations. Potential sources include plant buildings evaporation ponds (if utilized) and well field locations. Although these sources do provide a transfer mechanism to the atmosphere, anticipated levels of airborne Rn-222 is small and will immediately be dispersed in the atmosphere further reducing any potential concentrations.

Similar to Smith Ranch, once construction and operations begin at the remote satellites, Cameco will closely monitor radiological levels of its workers, site locations and air quality to reduce potential impacts to public and occupational health. Conversely, upon completion of ISR activities, equal attention will be given to decommissioning and restoration efforts. Section 5.0 of this ER and Sections 5.0 and 6.0 of the TR provide detailed information regarding mitigation measures. Measures include cleanup criteria for structures, which includes radiological surveys and sampling of all facilities, equipment, materials, and soils to determine the level of contamination and resultant mitigation efforts. As part of this process, appropriate safety measures will be initiated to protect both workers and the environment through the decommissioning process. Gamma exposure rate surveys are performed in accordance with standard operating procedures. Proposed in-plant monitoring locations for the North Butte and Gas Hills remote satellite buildings are shown on **Figure 5.6A and 5.6B** of the TR, respectively. Gamma survey instruments will be checked prior to each day's use in accordance with the manufacturer's instructions. Surveys will be performed in accordance with the guidance contained in NRC Regulatory Guide 8.30.

4.12.2 No-Action Alternative

Under the no-action alternative there would be no significant impacts on public and occupational health at SUA-1548. Both non-radiological and radiological public and occupational health impacts at Smith Ranch would remain at current levels and diminish over time as decommissioning and restoration

activities were completed. There would be construction activities at the remote satellites as existing disturbances are reclaimed and, as such, there may be a temporary increase in fugitive dust or other non-radiological emissions.

4.12.3 Alternative Action

Non-radiological impacts to public and occupational health are significantly less at an ISR operation than conventional underground or open pit uranium mining. The larger work force and scale of conventional underground and open pit mining would cause a major increase in the amount of gaseous and airborne particulates, particularly from fugitive dust. In addition, the structure and design of an ISR facility also decreases potential public and occupational health hazards that are present in conventional mining operations. Hazardous structures exist not only with underground, but also open pit mining and increase the potential for health impacts. In contrast, ISR recovery has no open pits, shafts or other potentially hazardous structures reducing the chance of injuries.

Radiological exposure is also greater from conventional uranium mining than ISR. At an ISR facility, operating personnel are not exposed to the radionuclides present in and emanating from the ore and tailings. Conventional mill tailings can contain all of the Ra-226 originally present in the ore, whereas ISR operations may have less than 5% of the original Ra-222 in the ore zone (Energy Metals Corporation, 2007). The alternative action will result in greater public and human health impacts than the proposed action.

4.12.4 References

Crow Butte Resources, Inc. "License Renewal Application: SUA-1534." Crawford Nebraska: Crow Butte Resources, Inc. 2007.

Energy Metals Corporation, U.S. "Application for NRC Source Material License Moore Ranch Uranium Project, Campbell County, Wyoming: Environmental Report." Casper, Wyoming: Energy Metals Corporation, U.S. [ADAMS Accession Number: ML072851249]. September 2007.

NRC. 2006. "Environmental Assessment for the Addition of the Reynolds Ranch Mining Area to Power Resources, Inc.'s Smith Ranch/Highlands Uranium Project Converse County, Wyoming." Source Material License No. SUA-1548. Docket No. 40-8964. Washington, DC: NRC.

NRC. 2009. Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities (NUREG-1910). Page Last Reviewed/Updated Sunday, March 13, 2011.