U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

DIVISION OF FUEL CYCLE SAFETY, SAFEGUARDS, AND ENVIRONMENTAL REVIEW

FINAL ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED RENEWAL OF SOURCE MATERIALS LICENSE NO. SUA-1548, SMITH RANCH-HIGHLAND URANIUM PROJECT IN CAMPBELL, CONVERSE, FREMONT, JOHNSON, AND NATRONA COUNTIES, WYOMING

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ABBREVIATIONS AND ACRONYMS

ACL	alternate concentration limit
ALARA	as low as reasonably achievable
AML	Abandoned Mine Land
AOC	Administrative Order on Consent
APE	Area of Potential Effect
BLM	Bureau of Land Management
BMP	best management practice
CAL	Confirmatory Action Letter
CBM	coal bed methane
CCPA	Converse County Project Area
CCS	Center for Climate Strategies
CEQ	Council on Environmental Quality
CISA	cumulative-impact study area
CPF	Central Processing Facility
CPP	Central Processing Plant
CWA	Clean Water Act
dBa	A-weighted decibel(s)
DEIS	Draft Environmental Impact Statement
DOE	U.S. Department of Energy
DDW	deep disposal well
EA	Environmental Assessment
EIS	Environmental Impact Statement
EOP	Executive Office of the President
EPA	U.S. Environmental Protection Agency
ER	Environmental Report
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
FWS	Fish and Wildlife Service
GCRP	Global Change Research Program
GEIS	Generic Environmental Impact Statement
GHG	greenhouse gas
IPaC	Information, Planning, and Conservation
ISL	in situ leach
ISR	in situ recovery
LOI	Letter of Intent
LQD	Land Quality Division
MCL	maximum concentration limit

MIT	mechanical integrity testing
NAAQS	National Ambient Air Quality Standard
NEPA	National Environmental Policy Act
NHPA	National Historic Protection Act
NMSS	Nuclear Material Safety and Safeguards
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NWS	National Weather Service
OHV	off-highway vehicle
OSHA	Occupational Safety and Health Administration
PRI	Power Resources, Inc.
PSD	Prevention of Significant Deterioration
PSR	Purge Storage Reservoir
R&D	research and development
RAI	Request for Additional Information
RFFA	Reasonably foreseeable future actions
ROI	Region of Influence
RTV	restoration target value
SER	Safety Evaluation Report
SHPO	State Historic Preservation Office(r)
SWPPP	Surface Water Pollution Prevention Plan
TDS	total dissolved solid
THPO	Tribal Historic Preservation Officer
TLD	thermoluminescent dosimeter
TR	Technical Report
UCL	Upper Control Limit
UIC	Underground Injection Control
UPZ	Uranium Point Fault Zone
USACE	U.S. Army Corps of Engineers
USDOT	U.S. Department of Transportation
USGCRT	U.S. Global Change Research Team
USGS	U.S. Geological Survey
VRI	Visual Resource Inventory
VRM	Visual Resource Management
WAAQS	Wyoming Ambient Air Quality Standard
WDEQ	Wyoming Department of Environmental Quality
WEUMR	Wyoming East Uranium Milling Region
WGFD	Wyoming Game and Fish Department
WQD	Water Quality Division
WSEO	Wyoming State Engineer’s Office

WWUMR	Wyoming West Uranium Milling Region
WYDOT	Wyoming Department of Transportation

1.0 INTRODUCTION

1.1 License Renewal Application

By letter dated February 1, 2012[1],Power Resources, Inc. (PRI), doing business as Cameco Resources (Cameco, also referred to herein as the licensee) submitted an application to renew its U.S. Nuclear Regulatory Commission (NRC) source material[2] license SUA-1548 for the Smith Ranch Project (the Project) (Cameco, 2012). If granted, the NRC would authorize Cameco under the renewed license to continue activities at the Smith Ranch Project for a period of 10 years[3].

License SUA-1548 authorizes Cameco to conduct uranium in situ recovery (ISR) operations at the following Project sites in Wyoming:

- the Smith Ranch site in Converse County (which encompasses the contiguous Smith Ranch, Highland, and Reynolds Ranch properties);
- the Gas Hills remote satellite site in Fremont and Natrona Counties;
- the North Butte remote satellite site in Campbell County; and
- the Ruth remote satellite site in Johnson County.

Figure 1-1 shows the approximate geographic locations of these properties. Cameco's ISR operations conducted under License SUA-1548 are subject to the safety requirements found in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 40, "Domestic Licensing of Source Material" and 10 CFR Part 20, "Standards for Protection Against Radiation."

By letter dated July 5, 2012, the NRC staff notified Cameco that its renewal application had been accepted for detailed technical review (NRC, 2015). The NRC staff initiated its review of the application, and by letter dated May 2, 2013 (NRC, 2013), sent Cameco a Request for Additional Information (RAI) to address safety and environmental issues. Cameco provided its response to the environmental RAIs by letters dated November 18, 2014 (Cameco, 2014) and April 10, 2015 (Cameco, 2015a), and to the safety RAIs by letter dated April 21, 2015 (Cameco, 2015b). With its responses to the RAIs, Cameco submitted updated sections of its Environmental Report (ER) and Technical Report (TR). By letters dated March 7, July 30, 2018 and emails dated August 15, and August 16, 2018, Cameco provided additional responses to the NRC staff's RAIs (Cameco, 2018c, 2018d, 2018e, and 2018f).

On September 19, 2012, NRC published a Notice of License Renewal Request and an Opportunity for Hearing in the *Federal Register* (FR) (77 FR 58181) (NRC, 2014). No requests for hearing were received.

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[1] Cameco's February 1, 2012 application supersedes its previous license renewal application submitted on August 12, 2010 (Cameco, 2010b).

[2] *Source Material* means: (1) Uranium or thorium, or any combination thereof, in any physical or chemical form or (2) ores which contain by weight one-twentieth of one percent (0.05%) or more of: (i) Uranium, (ii) thorium or (iii) any combination thereof. Source material does not include special nuclear material.

[3] As discussed in SECY 17-0086 (NRC, 2017), the NRC staff increased the term for uranium recovery licenses from 10 years to 20 years. Cameco submitted its license renewal request prior to the NRC staff's policy change. The NRC staff provided Cameco the opportunity to modify its application to request a 20-year license term. However, Cameco did not modify its application. Therefore, the NRC staff performed its review based on a 10-year renewal term.

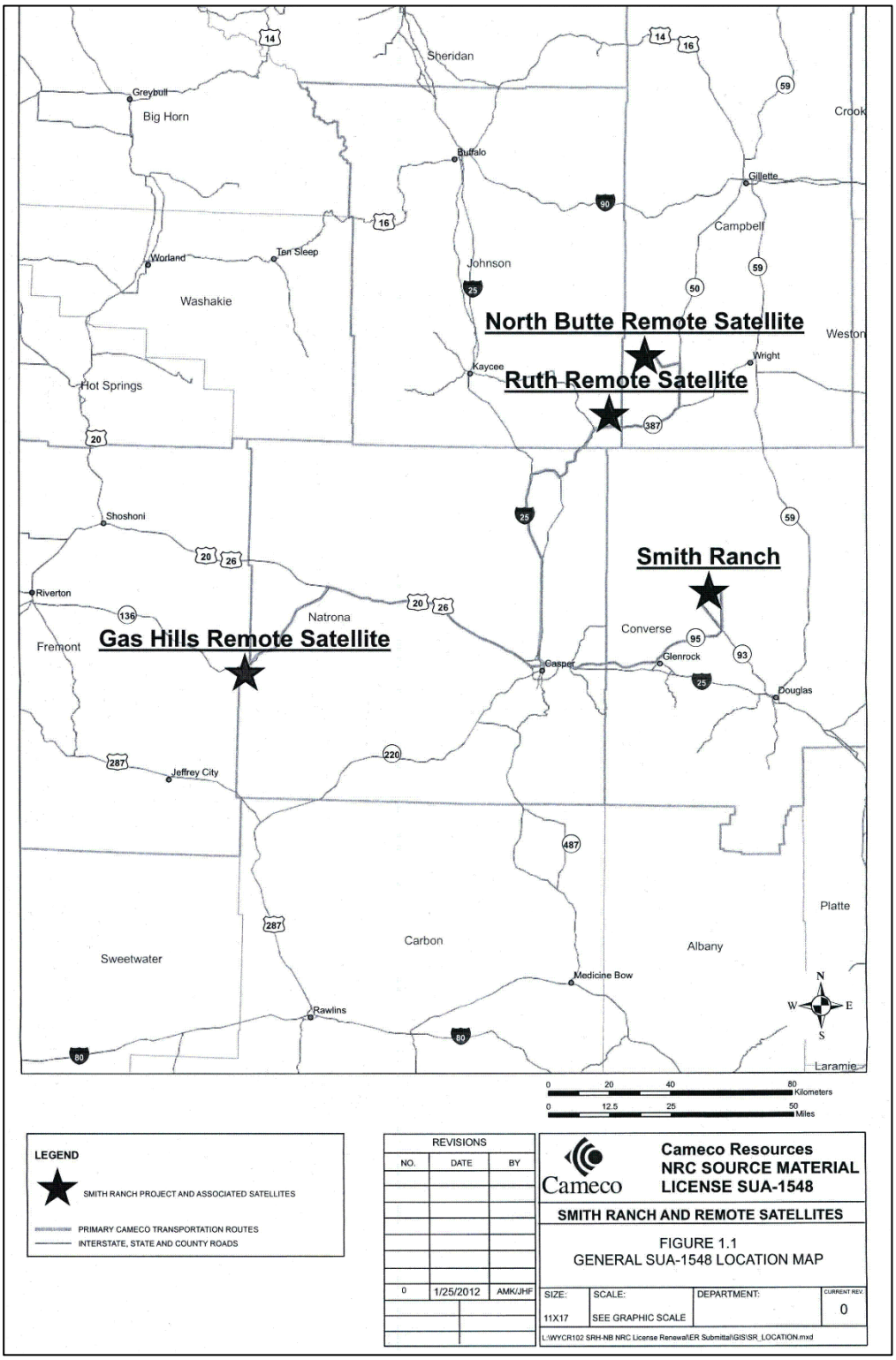

Figure 1-1. General Location Map for Smith Ranch Project Properties (Cameco, 2015b)

By letter dated April 2, 2018, the licensee notified NRC of Cameco's February 5, 2018, decision to cease uranium production at its U.S. operations due to continued low uranium prices (Cameco, 2018). In its letter, the licensee provided an update on activities at the Smith Ranch and North Butte sites due to this decision. At both sites, injection and production flow at specified mine units had been shut off, with operation at a limited number of wells continued to maintain a small "bleed" control of mining fluids (Cameco, 2018). Cameco expressed its desire to keep production equipment on standby to provide the option to restart in the future should market conditions warrant. Cameco also stated that it would continue to perform required environmental and health physics monitoring at both sites, and that restoration efforts would continue to produce a small amount of uranium and byproduct material that would be transported offsite. Finally, the licensee also committed to submitting alternate decommissioning schedules for both sites within 21 months (Cameco, 2018).

This site-specific EA incorporates by reference applicable aspects of the "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities" (NRC, 2009a) (herein referred to as the GEIS) in accordance with the process described in GEIS Section 1.8. The GEIS used the terms "in-situ leach (ISL) process" and "11e.(2) byproduct material" to describe this uranium milling technology and the radiologically contaminated waste stream generated by this process. For the purposes of this EA, ISR is synonymous with ISL, and the term "byproduct material"[4] is used instead of "11e.(2) byproduct material" to be consistent with the definition provided at 10 CFR 40.4.

1.2 Regulatory History

Various companies have conducted ISR operations at the Smith Ranch and Highland sites since the late 1970s. In 2003, separate NRC licenses for the Smith Ranch, Highland, and North Butte/Ruth properties were combined under License SUA-1548, and the Gas Hills and Reynolds Ranch properties were added by license amendment in 2004 and 2007, respectively. Table 1.1 provides information on NRC environmental reviews conducted in support of major NRC licensing actions at the Project sites since the late 1970s.

Table 1-1 NRC Environmental Reviews for Major Licensing Actions for the Smith Ranch Project

Site	Licensing Action	Date	Environmental Document	Federal Register Cite and Date
Smith Ranch	R&D license issued	June 2, 1981	EIA / FONSI	46 FR 30924 June 11, 1981
	Renewal of R&D license	January 29, 1988	EA / FONSI	53 FR 459 January 7, 1988
	Commercial-scale license issued	March 12, 1992	EA / FONSI	57 FR 506 January 10, 1992
	License renewed	May 8, 2001	EA / FONSI	66 FR 22620 May 4, 2001

[4] *Byproduct Material* means the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by such solution extraction operations do not constitute "byproduct material" within this definition.

Table 1-1 NRC Environmental Reviews for Major Licensing Actions for the Smith Ranch Project				
Site	**Licensing Action**	**Date**	**Environmental Document**	**Federal Register Cite and Date**
Highland	Production-scale in-situ uranium recovery authorized	January 25, 1979	FES	43 FR 58660 December 15, 1978
	Commercial-scale license issued	July 1, 1987	EA / FONSI	52 FR 25094 July 2, 1987
	License renewed	August 18, 1995	EA / FONSI	60 FR 44367 August 18, 1995
North Butte	Commercial-scale license issued	December 21, 1990	EA / FONSI	55 FR 52229 December 20, 1990
Ruth	R&D license issued	October 28, 1981	EA / FONSI	46 FR 55027 November 5, 1981
	Commercial-scale license issued	December 21, 1990	EA / FONSI	55 FR 52229 December 20, 1990
Smith Ranch – Highland – North Butte – Ruth	Smith Ranch license amended to include these sites	August 18, 2003	CATEX	None
Gas Hills	Amendment to Smith Ranch license	January 29, 2004	EA / FONSI	69 FR 3184 January 22, 2004
Reynolds Ranch	Amendment to Smith Ranch license	January 31, 2007	EA / FONSI	72 FR 3 January 5, 2007

R&D Research and Development
EIA Environmental Impact Assessment
FES Final Environmental Statement
EA Environmental Assessment
FONSI Finding of No Significant Impact
CATEX Categorical Exclusion

1.3 Proposed Action

As stated in Section 1.1, Cameco submitted an application on February 1, 2012, to renew License SUA-1548 for the Smith Ranch Project for a 10-year period. Based on the application, the NRC's Federal action is the decision to either grant or deny renewal of License SUA-1548. If granted, License SUA-1548 would allow Cameco to continue operations at the Smith Ranch Project. The licensee's proposal is described in more detail in Chapter 2 of this EA and Cameco's proposed changes to currently approved operations are summarized here:

- Increased ground water processing flow rates at the Reynolds Ranch satellite site, and at the North Butte and Gas Hills remote satellite sites;

- Production of yellowcake slurry and the use of deep disposal wells for liquid process wastes at the Gas Hills remote satellite site;
- Receipt and processing of non-Project toll shipments of uranium-laden ion exchange resin and yellowcake slurry at the Highland Central Processing Facility (CPF);
- Resume yellowcake processing in the refurbished Highland CPF; and
- Approval of evaporation pond designs and specifications for the Gas Hills remote satellite site.

In addition to these proposed changes, Cameco intends to do the following:

- Continue uranium recovery and aquifer restoration in existing wellfields at the Smith Ranch and Highland properties, and construct and operate additional wellfields at those properties;
- Construct and operate wellfields and deep disposal wells at the Reynolds Ranch satellite site and the North Butte and Gas Hills remote satellite sites; and
- Continue ore delineation drilling at each Project site except at the Ruth remote satellite site.

At the Ruth remote satellite site, Cameco would continue to perform and document quarterly visual inspections of the evaporation pond embankments, fences, and liners, as well as measurements of pond freeboard. These are required by license condition under SUA-1548 (NRC, 2016c).

1.4 Purpose and Need for the Proposed Action

NRC regulates uranium milling, including the ISR process, under 10 CFR Part 40, "Domestic Licensing of Source Material." Cameco is seeking to renew License SUA-1548 that authorizes commercial-scale ISR activities at the properties identified under the license for an additional 10 years. The purpose and need for the Proposed Action are to provide an option that allows Cameco to recover uranium at these properties and to produce yellowcake at the Smith Ranch and Highland project sites. Yellowcake, the uranium oxide product of the ISR process, is used in the production of fuel for commercially-operated nuclear power reactors.

This definition of purpose and need reflects the Commission's recognition that, unless there are findings in the NRC's safety review required by the *Atomic Energy Act of 1954*, as amended, or findings under the *National Environmental Policy Act of 1969*, as amended (NEPA), that would lead NRC to reject the license renewal application, the NRC has no role in a company's business decision to submit such an application for continued operation of an ISR facility at a particular location.

1.5 The No-Action Alternative to the Proposed Action

Under the No-Action alternative, the NRC would not renew License SUA-1548 for continued ISR operations. As a result, Cameco would be required to transition ongoing uranium recovery in operating wellfields at Project sites (i.e., the Smith Ranch site and at the North Butte remote satellite site) to aquifer restoration, with the ongoing aquifer restoration at the Smith Ranch site continuing. Restoration efforts would continue to produce a small amount of uranium and byproduct material that would be transported offsite. Site development activities (e.g., wellfield construction and deep disposal well construction) at Project sites would not proceed, and well abandonment and surface reclamation of the affected construction sites would occur.

The NRC and the Wyoming Department of Environmental Quality (WDEQ) would approve wellfield aquifer restoration in individual wellfields as restoration is completed.[5] Cameco would then plug and abandon injection, production, and monitoring wells in accordance with WDEQ guidelines, remove trunklines and other supporting pipelines within wellfields, decommission wellfield infrastructure, and conduct final surface reclamation of the wellfields. Surface reclamation of other affected areas of the site, including areas affected by prior spills and leaks, would also occur. After restoration and reclamation of the wellfields, Cameco would decommission surface structures, including the North Butte remote satellite ion-exchange building, the Smith Ranch Central Processing Plant, and the Highland CPF.

Cameco would be required by 10 CFR Part 40.42(d) to submit a detailed decommissioning plan to the NRC staff for review and approval at least 12 months before the planned commencement of final decommissioning. If approved, this plan would amend the license and initiate the decommissioning process (NRC, 2009a).These activities would occur during the proposed 10-year renewal period, but would be expected to take longer than the renewal period.

1.6 Scope of Environmental Analysis

The NRC staff prepared this EA to analyze the environmental impacts (i.e., direct, indirect, and cumulative impacts) of the Proposed Action and of the No-Action alternative. The scope of this EA considers both radiological and non-radiological impacts associated with the Proposed Action and the No-Action alternative.

This EA reviews the environmental impacts associated with the new and continuing ISR activities proposed by the licensee for the renewal period, changes in the affected environment, and the Project's operating history since the last license renewal.

[5] On November 14, 2017, Wyoming submitted a final application to become an NRC Agreement State for the control of source material involved in the extraction or concentration of uranium or thorium in source material and ores at milling facilities, and the management and disposal of byproduct material (Wyoming, 2017). If Wyoming becomes an Agreement State, the NRC would no longer have regulatory authority for ISR facilities in the State, including the review and approval of wellfield aquifer restoration.

1.6.1 Federal and State Authorities

NRC source material licenses are issued under 10 CFR Part 40. As stated in 10 CFR 40.3, a "person subject to the regulations in this part may not receive title to, own, receive, possess, use, transfer, provide for long-term care, deliver or dispose of byproduct material or residual radioactive material...or any source material after removal from its place of deposit in nature, unless authorized in a specific or general license issued by the Commission...." In addition, the Uranium Mill Tailings Radiation Control Act of 1978, as amended, requires persons who conduct uranium source material operations to obtain a byproduct material license to own, use, or possess tailings and wastes generated by ISR operations (including aboveground wastes).

This EA has been prepared in accordance with 10 CFR Part 51, "Licensing and Regulatory Policy Procedures for Environmental Protection," the NRC's NEPA-implementing regulations. In accordance with 10 CFR Part 51, an EA serves to (1) briefly provide sufficient evidence and analysis for determining whether to prepare an Environmental Impact Statement (EIS), or a Finding of No Significant Impact (FONSI); (2) facilitate creation of an EIS when one is necessary; and (3) aid the NRC's compliance with NEPA when an EIS is not necessary.

The NRC staff also is preparing a Safety Evaluation Report (SER) to accompany the licensing action, if approved. The purpose of the SER is to provide NRC's analysis of the licensee's proposal with respect to NRC's regulations found in 10 CFR Part 20, "Standards for Protection Against Radiation" and in 10 CFR Part 40. In preparing both the EA and the SER, the NRC staff has evaluated the potential environmental impacts and the health and safety issues associated with the continued commercial operation of the Smith Ranch Project. In addition to issuing this EA and FONSI, if the NRC determines in the SER that health and safety issues are appropriately addressed, a renewed commercial source material license would be issued to Cameco.

U.S. Army Corps of Engineers (USACE) permits under Section 404 of the Clean Water Act are required for placing fill, excavating, or using earthmoving equipment to clear land in jurisdictional wetlands or waters of the United States.

The WDEQ administers and implements the State of Wyoming's rules and regulations for environmental protection at the Smith Ranch Project under Permits to Mine for the Project sites and other permits issued under its authority. The various permits issued by the WDEQ are identified in Tables 1-1 through 1-4 in the ER submitted as part of Cameco's license renewal application (Cameco, 2014a).

1.6.2 Basis for Review

The NRC staff has addressed the environmental impacts associated with the renewal of the License SUA-1548 and documented the results of the assessment in this EA. The staff performed this assessment in accordance with the requirements of 10 CFR Part 51, using staff guidance found in NUREG-1748, *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs* (NRC, 2003a).

In conducting this assessment, the staff considered the following:

- Cameco's license renewal application (Cameco, 2012), and its RAI responses and updated applications sections (Cameco, 2014a, 2014b, 2015);
- Amendments to License SUA-1548 since 2001;
- The operational history since the previous Smith Ranch license renewal in 2001, as evidenced in part by semiannual environmental monitoring reports submitted pursuant to 10 CFR 40.65 and wellfield restoration information;
- Reports of wellfield excursions, evaporation pond leaks, and pipeline spills for the Smith Ranch Project and the licensee's responses; and
- Information derived from NRC site visits and inspections of the Project sites since 2001.

1.6.3 Additional Site-Specific Environmental Reviews

As discussed previously, the various properties under the Smith Ranch Project have received prior NRC review and approval for the conduct of ISR operations. Environmental reviews for the properties provide historical and background information about each property and about the level of operations approved by the NRC at that time. In addition to the documents identified in Table 1.1, the NRC staff also reviewed the following NRC and BLM site-specific environmental documents in preparing this EA:

- *Final Environmental Impact Statement for the Gas Hills In-Situ Recovery Uranium Project (*BLM, 2013). This EIS evaluated the environmental impacts associated with Cameco's proposed Plan of Operations to recover uranium from existing mining claims that Cameco owns for the Gas Hills remote satellite site.
- *Environmental Assessment for Cameco Resources/Power Resources Incorporated Reynolds Ranch In-Situ Uranium Recovery Project Converse County, Wyoming* (BLM, 2011). This EA evaluated the environmental impacts associated with Cameco's Plan of Operations to develop all or portions of ISR wellfields at the Reynolds Ranch property.
- *Final Environmental Assessment for the Third Party Processing of Ion Exchange Resin to Power Resources, Inc.'s Smith Ranch / Highland Uranium Project, Converse County, Wyoming* (NRC, 2009a). This EA evaluated the environmental impacts associated with the Smith Ranch Project's receipt and processing of ion exchange resin generated at other uranium recovery facilities in Wyoming. For the purposes of the evaluation, the resin was assumed to come from the Powder River Basin, the Gas Hills district, and the Great Divide Basin.
- *Environmental Assessment: Construction and Operation of In Situ Leach Satellite SR-2, Amendment No. 12 to Source Materials License SUA-1548, Power Resources, Inc., Smith Ranch-Highland Uranium Project (SR-HUP), Converse County, Wyoming* (NRC, 2007). This EA evaluated the environmental impacts associated with the construction and operation of an ion-exchange ISR satellite facility to service four wellfields located in the southwest corner of the Smith Ranch site.

Where the NRC staff is relying on previous analyses for impact conclusions within this EA, the NRC has determined that they remain valid based on current information. With respect to the two BLM documents identified above, the NRC staff incorporates by reference various discussions of the affected environment. The staff also adopts certain impact conclusions based on NRC's review of these discussions and conclusions and the staff's finding that such

incorporation is acceptable for the purposes of NRC's independent evaluation of environmental impacts for this Proposed Action. These incorporations and adoptions are described in more detail in the appropriate sections below.

1.6.4 Relationship to the GEIS

As stated in Section 1.1, this EA incorporates by reference applicable aspects of the GEIS (NRC, 2009a). The GEIS assessed the environmental impacts associated with the construction, operation, aquifer restoration, and decommissioning of an ISR facility that could be located in four specific geographic regions of the western United States. The properties under License SUA-1548 are located in two of the four GEIS-identified regions: the Wyoming East Uranium Milling Region (the Smith Ranch, Highland, Reynolds Ranch, North Butte, and Ruth properties) and the Wyoming West Uranium Milling Region (the Gas Hills property).

The GEIS provides a starting point for NRC NEPA analyses for site-specific license applications for new ISR facilities, as well as for applications to amend or renew existing ISR licenses (NRC, 2009a). For each environmental resource area (e.g., air quality, transportation, ground water), the GEIS provides criteria for assessing the significance level of impacts. As applicable, the NRC staff applied these criteria to the site-specific conditions at the Smith Ranch Project properties. This EA incorporates by reference relevant information, findings, and conclusions, as appropriate, from the GEIS concerning environmental impacts. The extent to which the NRC staff incorporates the GEIS impact conclusions depends on the consistency between: (i) the licensee's existing and proposed facilities and activities, recent operational history, and conditions at the Smith Ranch Project properties; and (ii) the reference facility description, and activities, applicable historical operational history, and information in the GEIS. Chapter 4 of this EA describes the NRC staff determinations regarding environmental impacts and the extent to which GEIS impact conclusions were incorporated by reference.

1.7 Current Licensing and Permitting Status

In addition to renewing its NRC source and byproduct material license for continued ISR operations at the Smith Ranch Project, Cameco is required to obtain permits and approvals from other Federal and State agencies to address, among other issues: (i) the underground injection of lixiviant solutions and liquid effluent from the ISR process, (ii) the exemption of all or a portion of the ore-zone aquifer from regulation under the *Safe Drinking Water Act*, and (iii) the discharge of storm water during construction and operation of the ISR facility. Tables 1-1 through 1-4 in Cameco's ER (Cameco, 2014) provide the status of the required licenses, permits, and approvals for the Smith Ranch Project.

1.8 Structure of the EA

Chapter 2 of this EA describes Cameco's Proposed Action in more detail, Chapter 3 describes the environment to be affected by the Proposed Action, and Chapter 4 evaluates the potential environmental impacts resulting from the Proposed Action and the No-Action alternative. Cumulative environmental impacts are discussed in Chapter 5, and Cameco's environmental measurement and monitoring programs for the Project are described in Chapter 6. The NRC's consultation with relevant Federal, State, and local agencies during the preparation of this EA is discussed in Chapter 7, and the NRC staff's conclusion regarding the environmental impacts from the Proposed Action is presented in Chapter 8. Chapter 9 identifies the persons involved

in preparing this EA, and Chapter 10 provides references for the documents used by the NRC staff in preparing this EA.

2.0 PROPOSED ACTION

As discussed in Section 1.1, the Smith Ranch Project encompasses four separate sites: (1) the Smith Ranch site in Converse County, Wyoming (encompassing the contiguous Smith Ranch, Highland, and Reynolds Ranch properties); (2) the Gas Hills remote satellite site in Fremont and Natrona Counties, Wyoming; (3) the North Butte remote satellite site in Campbell County, Wyoming; and (4) the Ruth remote satellite site in Johnson County, Wyoming. Figure 1-1 shows the general locations of these sites.

NRC License SUA-1548 currently allows Cameco to process at a combined average monthly ground water flow rate of 76,000 liters per minute (lpm) (20,000 gallons per minute (gpm)), exclusive of restoration flow, at the Smith Ranch site and to produce up to 2.5 million kilograms (kg) (5.5 million pounds (lb)) of yellowcake (as U_3O_8) per year (NRC, 2013a). Since 2001, Cameco's yearly yellowcake production has ranged from 0.33 – 1.01 million kg ((0.73 – 2.22 million lb)), with an annual average of 0.68 million kg ((1.5 million lb)) between the years 2009 and 2013 (Cameco, 2013e). By its renewal application, Cameco proposes some changes in the approved flow rates at specific Project sites, but no change to the combined average monthly flow rate or in the annual yellowcake production limit (Cameco, 2017; RAI response 1N).

Section 2.1 briefly describes the uranium in situ recovery (ISR) process; Section 2.2 describes Cameco's current and planned ISR facilities and operations at each of the Project sites; Section 2.3 addresses effluents and waste management; Section 2.4 describes transportation and employment at the Project sites; and Section 2.5 addresses operational experience since the last license renewal for License SUA-1548.

2.1 ISR Process Description

The ISR process is described in detail in GEIS Section 2 (NRC, 2009a) and is further discussed in previous environmental analyses pertaining to the various facilities and sites of the Smith Ranch Project. The ISR process employed by Cameco (Cameco, 2015, TR 3.6.1.2 to 3.6.1.4) under its NRC license is consistent with that described in the GEIS. This process is summarized below.

During the ISR process, the licensee injects a solution, called a lixiviant, through wells drilled into delineated portions of the production zone aquifer (i.e., the subsurface water-bearing unit that contains the uranium-ore body). Typically, the lixiviant is made by adding carbon dioxide and/or sodium carbonate/bicarbonate, with oxygen or hydrogen peroxide, to the ground water taken from the production-zone aquifer. The lixiviant oxidizes and dissolves the mineralized uranium (and other metals) in the ore body, forming a uranium-rich solution. This solution is drawn to the surface through recovery or production wells and then transferred to a central processing facility or to a satellite facility through a network of subsurface pipelines. Additional wells drilled in the production zone, and in the underlying and overlying aquifers, are used to monitor the potential movement of the lixiviant outside the production horizon.

At the satellite facility or in the processing facility, the solution is pumped into ion-exchange (IX) columns, where the uranium is adsorbed onto IX resin beads that selectively remove uranium from the solution. When an IX column containing the resin beads become saturated with uranium, that column is taken offline, and other columns are brought online to continue the adsorption process. At satellite facilities, the uranium-bearing resin typically is not processed

further, but rather is discharged to a truck for transport to another facility for further processing. This is the case for the Smith Ranch onsite satellites, and for the North Butte remote satellite, the loaded resin transported to the Smith Ranch Central Processing Plant (CPP) for further processing.

In the processing facility and at some satellite facilities, the resins beads are eluted (i.e., washed) with salt water, and then the uranium is precipitated from the resulting eluant. After precipitation, the resulting uranium-rich slurry is sent to a thickener where it is settled, washed, filtered, and dewatered. At this point, the slurry is 30 to 50 percent solids. This thickened slurry may be processed into yellowcake onsite or transported offsite for processing elsewhere. In yellowcake processing, the slurry is filter pressed to remove water, and then dried. The dried yellowcake is packaged into NRC- and U.S. Department of Transportation (USDOT)-approved 208-liter (55-gallon) steel drums and trucked offsite to a licensed uranium-conversion facility. Cameco has proposed to produce yellowcake slurry at the Gas Hills remote satellite with the slurry to be transported to the Smith Ranch CPP where it would be processed into yellowcake.

After uranium recovery in a wellfield has ended, the licensee is required to restore the ground water quality of the production zone aquifer in the wellfield. The goal of this effort is to restore the ground water in each affected well field to its pre-ISR water quality, on a constituent-by-constituent basis. For those ground water constituents that the operator is unable to restore to its pre-ISR concentration, the licensee may propose to meet the other ground water protection standards for that constituent as specified at 10 CFR Part 40, Appendix A, Criterion 5B(5).

Once ground water restoration in a wellfield is completed and approved by the pertinent federal and/or state regulatory agencies, the licensee may proceed with plugging and abandonment of the injection, production, and monitoring wells, decommissioning of the wellfield infrastructure, and surface reclamation activities.

A picture of a header house within a wellfield at the Smith Ranch site is shown in Figure 2.1-4 of the GEIS (NRC, 2009a), and examples of a manifold and a computerized flow rate meter inside a header house are shown in Figures 2.3-2 and 2.3-3, respectively, in the GEIS (NRC, 2009a).

2.2 Proposed Action

This section discusses Cameco's current facilities and level of ISR operations at each of the Project sites as well as Cameco's proposed changes to those facilities and operations during the renewal period. As such, this level of site operations does not reflect Cameco's announced cessation of operations at the Smith Ranch Project due to poor market conditions (see discussion in section 1.1 of this EA).

2.2.1 Smith Ranch Site

The Smith Ranch site is located approximately 35 road kilometers (km) (22 road miles (mi)) northeast of Glenrock, Wyoming, and 40 road km (25 road mi) northwest of Douglas, Wyoming. One can access the site main office by traveling approximately 11 road km (7 road mi) on Converse County Road 31 (i.e., the Ross Road) northwest from the intersection of Wyoming State Highways (SHs) 93 and 95 (Cameco, 2015, TR 3.7.1.1). The Reynolds Ranch satellite site is accessed via Ross Road, by continuing north past the entrance to the Smith Ranch main office and CPP complex. The site, as shown in TR Figure 1.2 (Cameco, 2015), encompasses approximately 16,188 hectares ((ha)) (40,000 acres (ac)).

Facilities and Operations

Table 2.1 identifies the facilities on the Smith Ranch site and their respective status; the facilities are organized by the property on which they are located (i.e., either Smith Ranch, Highland, or Reynolds Ranch). The following discussion provides a brief discussion of these facilities and their levels of operations.

The Smith Ranch main office complex and CPP area occupy approximately 16.2 ha ((40.0 ac)). Facilities within the area include: (1) several buildings that house the CPP, the office, a shop, and a storage warehouse; (2) a chemical-storage area with tanks for gasoline, diesel, sulfuric acid, carbon dioxide, hydrogen peroxide, and ammonia; (3) three catchment basins for storm water control; (4) the East Storage Pond and the West Storage Pond; and (5) an area used to store materials, such as wood pallets and cable spools, until they are disposed during periodic permitted controlled burns (Cameco, 2015, TR 3.6.1.1). The main office complex and CPP area are surrounded by a security fence. TR Figure 3.18 of (Cameco, 2015) provides a schematic layout of the area.

In the CPP, Cameco produces the yellowcake for the Smith Ranch Project (Cameco, 2015, TR 3.6.1.1). The CPP contains equipment for (1) the injection of lixiviant into wellfields and the recovery of uranium-rich lixiviant from the wellfields; (2) ion-exchange; (3) the transfer of uranium-bearing IX resin from other on-site satellite and remote satellite facilities; (4) elution, precipitation and yellowcake processing, drying, and packaging; (5) reverse-osmosis for water treatment; (6) bioremediation for groundwater restoration; and (7) the disposal of wastewater in the Underground Injection Control (UIC) Class I Well SR#1. The CPP directly processes the uranium-rich lixiviant from Mine Unit (MU) 3 (Cameco, 2015, TR 3.6.1.1). Uranium-rich lixiviant from other wellfields on the Smith Ranch property is processed in on-site satellite facilities SR-1 and SR-2 (see Table 2.1).

Onsite satellites SR-1 and SR-2 contain IX columns, water treatment equipment, resin transfer facilities, pumps for injection of lixiviant, reverse osmosis units and bioremediation materials for groundwater restoration, a laboratory area, offices, and an employee break room (Cameco, 2015, TR 3.6.1.1). Compressed carbon dioxide (CO_2) and oxygen (O_2) are stored adjacent to each satellite building or in the mine unit areas. SR-1 serves MUs 3, 4, 15/15A, and is designed to operate with a maximum production flowrate of 17,032 lpm (4,500 gpm). Satellite SR-2 serves MU 9 and will serve additional mine units planned in the southwest area, including MUs 10, 11, and 12. This satellite is designed to operate with a nominal flow of 18,924 lpm (5,000 gpm) for production operations. Both satellites also contain 1,892 lpm (500 gpm) of reverse osmosis capacity for ground water restoration purposes (Cameco, 2015, TR 3.6.2.1).

In April 2016, five wellfields were in production in the Smith Ranch property area (Mine Units 3, 7, 9, 10, and 15/15A), while two other wellfields (MUs 2 and 4/4A) were in active restoration (NRC, 2016). MU 1 was in the stability-monitoring phase of restoration, and several other wellfields were proposed (see Table 3-1 in Cameco, 2015). Within each wellfield, injection and production wells are connected to manifolds in the header house, and the manifolds connect to pipelines that carry solutions to and from the recovery plant or satellite facility. Meters and control valves (usually computerized) in individual well lines monitor and control flow rates and pressures for each well to maintain water balance and to aid in identifying leaks. The number of header houses in a wellfield varies depending, in part on the size of the wellfield.

To dispose of excess water generated by both mine unit and yellowcake processing operations, Cameco is permitted by the WDEQ for 10 UIC Class I injection wells on the Smith Ranch site (see Table 3-6 in Cameco, 2015). The locations of these wells are shown on Figures 1.4 through 1.8 of (Cameco, 2015). These wells are permitted to inject into the Parkman, Teapot and Teckla Formations, which are located deeper than approximately 2,400 m (8,000 ft) below the ground surface (Cameco, 2015).

Highland Property

The Highland CPF occupies approximately 4.0 ha ((10 ac)) and has been on standby status since 2003, Cameco has been refurbishing and upgrading the CPF to allow for additional capacity for ion exchange and yellowcake production (Cameco, 2014, ER Section 1.2). These activities have included: (1) dismantling and disposing of the Highland offices and extraneous equipment and materials outside the CPF building and the modernization of electrical services; (2) removal and replacement of tanks, vessels and piping within the CPF; (3) removal and disposal of the former calciner dryer; and (4) installation of low-temperature rotary vacuum dryers (Cameco, 2014, ER Section 1.2). When the Highland CPF is operational, the licensee plans to process there the loaded IX resins and yellowcake slurry received from the Gas Hills and North Butte remote satellites and from third party licensed ISR facilities (Cameco, 2014, ER Section 1.2).

Two ponds are located near the Highland CPF. The NRC staff understands that one of the ponds was used to control storm water runoff from the areas around the Highland CPF. The second pond was used in the solvent extraction process when the Highland CPF supported conventional uranium milling activities. The solvent extraction pond is located approximately 220 m (750 ft) southwest of the Highland CPF. The NRC staff understands that the solvent extraction pond is no longer in use and that the licensee has included costs to complete decommissioning and reclamation activities at the solvent extraction pond in its financial assurance estimate for License SUA-1548 (Cameco, 2015b)

Onsite satellites 1, 2, and 3 are located within the Highland property. Satellite 1 serves MUs A and B, both of which have ceased production, and so the satellite is not currently in use (Cameco, 2015, TR 3.6.2.1). Satellite 2 serves MUs C, D, D-Extension, E, F, H, and I, and is designed to operate with a maximum flow of 12,111 lpm (3,200 gpm) during production operations. MUs C, D, D-Extension and E are undergoing groundwater restoration, and MUs H and I are in production (Cameco, 2015, TR 3.6.2.1). Satellite 3, designed to operate with a maximum production flow of 22,709 lpm (6,000 gpm), serves MUs D-Extension, F, J and K. Satellite 3 may also serve additional mine units that are being geologically evaluated for future expansion in an area west of Satellite 3 (Cameco, 2015, TR 3.6.2.1).

There are two synthetically-lined and clay-lined settling basins located east of Satellite 1 that were constructed in 1987 to settle residual radium-barium sulfate out of Satellite 1's waste water following filtration. Water from the basins then went to Purge Storage Reservoir 1 (PSR-1), where it was stored prior to periodic land application. The basins are no longer in use, and Cameco is in the process of decommissioning them. The licensee has removed the synthetic liner, the leak detection system, and most of the clay liner and disposed of it as byproduct material at an NRC-licensed disposal site. Cameco estimates that approximately 371 cubic meters (m^3) (485 cubic yards (yd^3)) of clay liner and underlying soils containing low levels of uranium and Radium-226 remain to be disposed (Cameco, 2014, ER 3.12.1.2.2).

PSR-1 currently is not operating and only contains water after rainfall or from snowmelt. The licensee identified leakage from PSR-1 in 1994, and has taken corrective actions to repair the leak and to address near surface ground water contamination (Cameco, 2014, ER 3.12.1.2.3). The leak and the corrective actions are discussed in more detail in Section 3.2.4.3 of this EA.

Northeast of Satellite 2 is another storage reservoir, PSR-2, and its associated land application area (Cameco, 2015, TR Figure 1.3). Treated waste water from Satellites 2 and 3 and from a selenium treatment facility located near Satellite 2 are discharged into PSR-2, which is underlain by several low permeability clay units (Cameco, 2015, TR 3.6.2.3). The licensee first identified leakage from PSR-2 in 1997-98 and has been taking corrective actions to address contamination of near surface ground water. The leakage and Cameco's corrective actions are discussed in more detail in Section 3.2.4 of this EA.

A selenium treatment facility is located approximately 9 m (30 ft) southwest of Satellite 2. This facility handles process-related waste waters to remove selenium to a target average concentration of 0.1 mg/L (0.1 ppm). The average concentration for samples taken from the PSR-2 compositor during the entire operating season (March – October) is not to exceed 0.1 mg/L (0.1 ppm) selenium (Cameco, 2014, ER 3.12.1.2.6 and Cameco, 2015, TR 3.6.2.3).

The selenium treatment facility also includes a radium removal circuit (Cameco, 2015, TR 3.6.2.3). Waste/remediation water is first treated for radium removal using a barium chloride solution that precipitates the radium; the precipitate is allowed to gravity settle and then concentrated by a filter press. Following radium removal, the remediation stream is processed in selenium removal columns. As in radium removal, the resulting treatment precipitate is allowed to gravity settle and is then concentrated in a filter press. The filtered solids from both radium removal and from selenium treatment are disposed at a licensed byproduct material disposal facility (Cameco, 2014, ER 3.12.1.2.6).

Reynolds Ranch Property

On the Reynolds Ranch property, Cameco has installed a deep waste water disposal well, Reynolds DW#1 (Cameco, 2015, TR 3.6.1.5). This well has an approved injection rate of 397.5 lpm (105 gpm) (Cameco, 2015, TR Table 3-6).

Proposed Changes to Facilities and Operations

Within the Smith Ranch and Highland properties, Cameco had expected to develop and bring online several additional wellfields, with associated infrastructure, by the year 2021 (Cameco, 2014a). The proposed wellfields and the anticipated schedule for their development and operation are shown in Table 3-1 of the TR (Cameco, 2015). Cameco has decided to cease uranium production at the Smith Ranch site (see related discussion in Section 1.1 of this EA).

The licensee also expected to bring the Highland CPF into operation and so provide additional IX resin and yellowcake processing capacity up to 1.4 million kg (3 million lb) of dried yellowcake. As discussed previously, Cameco could process loaded IX resins from the North Butte remote satellite facility and yellowcake slurry from the Gas Hills remote satellite facility and from other licensed ISR sites in the Highland CPF. Cameco also requested that NRC reauthorize the Highland CPF to receive and process yellowcake slurry from licensed ISR third parties (Cameco, 2015, TR 1.5).

At the Reynolds Ranch property, Cameco identified eight wellfields that the licensee anticipated would be developed and operating during the renewal period (Cameco, 2015, TR 3.3.1.3). The Reynolds Ranch satellite facility would process uranium-rich lixiviant from these wellfields and produce uranium-loaded IX resins for transport to the Smith Ranch CPP for processing into yellowcake. As stated previously, the licensee proposed to increase the maximum processing flow rate for the Reynolds Ranch satellite from 17,032 lpm (4,500 gpm) to 22,709 lpm (6,000 gpm) (Cameco, 2015, TR 1.5). The satellite building also would be sized to eventually include up to 3,785 lpm (1,000 gpm) of reverse osmosis capacity for ground water restoration activities (Cameco, 2015, TR 3.2.1).

Cameco's schedules for the operation and aquifer restoration of the various wellfields at the sites under the Smith Ranch Project are provided in TR Tables 3-10 to 3-14 of (Cameco, 2015). These tables show that both operation and aquifer restoration are phased over time, such that multiple wellfields may be in operation at the same time as other wellfields are in aquifer restoration (Cameco, 2015, TR Tables 3-10 to 3-14).

2.2.2 North Butte Remote Satellite Site

The North Butte remote satellite site is located approximately 80 km (50 mi) southwest of Gillette and approximately 64 km (40 mi) west of Wright as shown in Figure 1.1 of (Cameco, 2015). The licensed area, which encompasses 410 ha (1,015 ac), is accessed from SH 50, via Van Buggenum Road, then Christensen Road, to an oil-field road owned by the T-Chair Ranch (Cameco, 2015). The distance by road from the North Butte remote satellite area to the Smith Ranch CPP is approximately 112 km (70 mi) (Cameco, 2014). TR Figure 1.10 (Cameco, 2015) shows the current and planned layout for the site.

Facilities and Operations

Cameco began operations at the North Butte site in May 2013 with the injection of lixiviant into mine unit (MU)-1 (NRC, 2013b). The licensee operated MU-1 and MU-2 (NRC, 2016), and the recovered uranium from the two mine units was loaded onto IX resin in the approximately 2,378 m^2 (25,600 ft^2) satellite IX facility. Cameco transported the loaded IX resin by truck from the North Butte site to the Smith Ranch CPP for further processing into yellowcake. The licensee states that the North Butte site has a maximum sustainable uranium production capacity of 680 metric tons (750 tons) per year (Cameco, 2015, TR 3.9.2).

Underground pipelines and overhead power lines would follow the site access roads, and the pipelines and power lines would be on opposite sides of the roads. The diameters of the pipelines are projected to range from 8 inches (in.) in the wellfields to 24 in. for the main collection and distribution pipeline (Cameco, 2015, TR 3.6.3.1).

The licensee also has constructed a two-cell, 85-m x 100-m (280-ft x 340-ft) clay- and synthetically-lined storage pond to hold waste water from the satellite IX building (Cameco, 2015, TR 3.6.3.3). The pond design incorporates a leak detection system between the two synthetic liners. The waste water from IX processing is stored in the storage pond prior to being injected into a UIC Class I well.

Cameco has an existing UIC Class I permit for two deep disposal wells, and as of 2014, has installed one of the wells at the North Butte site (Cameco, 2015, TR 3.6.3.3). A building approximately 6.0 m x 7.3 m (20 ft x 24 ft) in size is associated with the one active well (Cameco, 2014a). Cameco has requested authorization from the WDEQ to drill, complete, and operate up to three additional UIC Class I wells (WDEQ/WQD, 2013a).

Proposed Change to Facilities and Operations

Under the Proposed Action, Cameco would continue to operate the North Butte remote satellite IX plant and the two wellfields, with the goal of developing three additional wellfields to bring into production. Delineation of uranium-ore bodies also would continue. Loaded IX resins would continue to be transported to the Smith Ranch CPP (Cameco, 2015, TR 3.3.2).

Cameco proposed to increase the processing flowrate at the North Butte site, from the currently approved rate of 15,140 lpm (4,000 gpm) to 22,710 lpm (6,000 gpm). Cameco constructed the satellite building to accommodate a flowrate of 22,170 Lpm (6,000 gpm) (Cameco, 2015, TR 3.6.3.1).

Under the Proposed Action, Cameco would dispose of liquid effluents primarily in UIC Class I wells, although Cameco leaves open the possibility of also using evaporation ponds, land application, and other technologies (Cameco, 2015, TR 3.6.3.3). Cameco anticipated a total of four UIC Class I wells could be constructed and operated depending on operational and aquifer restoration needs (Cameco, 2015, TR Sections 3.6.3.3 and 3.9.2).

2.2.3 Ruth Remote Satellite Site

The Ruth remote satellite site encompasses approximately 572 ha (1,414 ac) and is located in southeast Johnson County, Wyoming (Cameco, 2014, ER 4.1.1.4, Cameco, 2015, TR Figure 1.13). The site is approximately 100 km (60 mi) north of Casper and approximately 120 km (72 mi) southwest of Gillette. The Ruth site can be accessed by driving north about 8 km (5 mi) on unpaved road off of SH 387. The driving distance from the Ruth satellite site to the Smith Ranch CPP is approximately 229 km (142 mi) (Cameco, 2014).

The NRC licensed commercial-scale ISR operations at the Ruth site in 1990, and the site was to act as a satellite to the planned main North Butte operations (NRC, 1990). Commercial-scale operations at the Ruth site have not been conducted to date.

Facilities and Operations

The features at the Ruth site are remnants of an ISR research and development (R&D) project conducted under NRC license by Uranerz, USA, in the early 1980s (Cameco, 2015; WDEQ/LQD, 2013). Structures consist of a processing building, a small warehouse, a generator building, a two-celled evaporation pond that only sometimes contains rainwater, two vegetated stockpiles of topsoil, and the access road (Cameco, 2014, ER 4.9.1). With the exception of three monitoring wells, wells at the site have been plugged and abandoned (WDEQ/LQD, 2013; Cameco, 2015, TR 3.5.2.8). The total surface disturbance is approximately 1.7 ha (4.3 ac) (Cameco, 2014, ER 4.1.1.4).

Proposed Changes to Facilities and Operations

Cameco does not propose to construct new facilities or to conduct ISR operations at the Ruth remote satellite site during the proposed 10-year license renewal period (Cameco, 2014, ER 1.4.2). Cameco has identified three mine units at the Ruth site, but would need to submit an operations plan for NRC review and approval prior to further ISR activities at the site (Cameco, 2014b, TR 1.4).

2.2.4 Gas Hills Remote Satellite Site

The Gas Hills remote satellite site is located approximately 105 km (65 mi) west of Casper and 73 km (45 mi) east of Riverton, Wyoming. The licensed area includes approximately 3,440 ha (8,500 ac), as shown in Figures TR 1.11 and 1.12 of (Cameco, 2015). The air distance from the Gas Hills site to the Smith Ranch CPP is approximately 151 km (94 mi) (Cameco, 2015, TR 2.4.1). The site is accessed from Riverton via SH 136 to Dry Creek Road, then to the Abandoned Mine Lands (AML) Road, and finally to the Carol Shop Road. From Casper, the site is accessed by taking US 20 West/US 26 West to County Road (CR) 212 (which turns into Dry Creek Road), and then taking the AML Road to the Carol Shop Road.

The NRC licensed the Gas Hills remote satellite site for ISR operations in 2004. At that time, Cameco anticipated developing five mine units, with uranium recovery onto IX resin beads, and transporting the IX resins to the Smith Ranch site for final processing (NRC, 2004). Cameco expected to disturb approximately 1275 ac of the 8500 ac Gas Hills site, as a result of its ISR operations (NRC, 2004). Cameco states that the estimated annual average uranium production rate for the Gas Hills site is 907 metric tons (1,000 tons) (Cameco, 2015, TR 3.9.3).

Facilities and Operations

No ISR activities have been conducted to date at the Gas Hills site, although Cameco has been conducting ore-body delineation drilling (Cameco, 2015).

The existing Carol Shop facility and its associated disturbance occupies approximately 11 ha (27 ac) (BLM, 2013; Section 2.1.1), and is a large, multi-bay structure (5,300 m^2 (57,000 ft^2)) that was used as a maintenance shop for past uranium mining activities. Overhead power lines that supported Carol Shop operations and other historic mine areas are also present (BLM, 2013, Section 2.1.1).

Cameco also installed a meteorology monitoring station onsite. This station operated between 2010 and 2013, collecting site-specific meteorological data (Cameco, 2104, ER 3.6.4).

Cameco has requested authorization from WDEQ to complete, operate, and convert two existing UIC Class V test wells (Wells DDW #1, DDW #2) into UIC Class I wells, and requested authorization to drill, complete, and operate another proposed UIC Class I Well, DDW #3 (WDEQ/WQD, 2013b). Cameco is investigating the feasibility of a mine wastewater disposal UIC Class I injection well or multiple wells at the Gas Hills site as a disposal supplement to the planned evaporation ponds. The licensee has drilled test wells at two candidate sites but has deferred testing and completion of the wells to a later date (Cameco, 2015, TR 3.6.4.3).

Proposed Changes to Facilities and Operations

Cameco anticipated that five wellfields with associated infrastructure (e.g., header houses, underground piping, overhead power lines, and access roads) would be developed at the Gas Hills satellite site. Figures 1.11 and 1.12 in (Cameco, 2015) show the anticipated locations and layouts of the wellfields. Given the different elevations of the planned wellfields and the distance to the satellite plant(s), Cameco planned to construct injection composite booster stations to help move lixiviant to and from the wellfields (Cameco, 2015, TR 3.6.4.1).

The Carol Shop would be converted to the Carol Shop Satellite Building and would house equipment to conduct uranium processing and water treatment activities. Process equipment in the Carol Shop facility would include IX columns for uranium extraction, resin-elution equipment to flush the uranium from the loaded resin, equipment for uranium precipitation, and filtration equipment to thicken the slurry that would be transported to either the Smith Ranch CPP or the Highland CPF (when it becomes operational). Cameco was considering a second onsite satellite facility to contain the equipment to produce uranium-loaded IX resin (i.e., an IX column) (Cameco, 2015, TR 3.2.3).

With this proposed action, Cameco requests an increase in the approved processing flow rate from the wellfields through the satellite plants from the currently licensed rate of 45,000 lpm (12,000 gpm) to 51,095 lpm (13,500 gpm). If the second onsite satellite is constructed, it would process at a flow rate of 17,032 lpm (4,500 gpm), while the Carol Shop would process at 34,063 lpm (9,000 gpm) (Cameco, 2015, TR 3.2.3). If the second satellite was not constructed, the Carol Shop would be sized to process at 51,095 lpm (13,500 gpm).

As part of its liquid waste management system, Cameco planned to construct two evaporation ponds initially and up to an additional four evaporation ponds, depending if the deep disposal wells are approved, for use at the Gas Hills site (see Figure 1.11 of Cameco, 2015). Additionally, Cameco anticipates use of a forced evaporation process, which could generate as

much as 3,500 m^3 (4,600 yd^3) of solid byproduct material per year, during peak operational periods (Cameco, 2015, TR 3.6.4.3).

Cameco would give special consideration to wellfield design in areas of the Gas Hills site that contain discontinuities such as faults, improperly abandoned drill holes, historical underground mines, water-filled pits, backfilled pits, and areas undergoing reclamation (Cameco, 2015). The objective of the wellfield design around the discontinuous features would be to prevent the loss of production fluid and/or of ground waters with different water qualities. Prior to uranium production in each of the mine units, Cameco would perform mine unit hydrologic tests and evaluations (Cameco, 2015, TR 3.3.3.3).

2.2.5 Additional Details on Proposed Changes

Facility and Infrastructure Construction

Construction of the Gas Hills remote satellite facility would follow the design used for the SR-2 satellite at Smith Ranch and the North Butte remote satellite IX facility (Cameco, 2012). The pipeline arrangements within the wellfields at these sites, and between the wellfields and satellite facilities, would be designed to facilitate uranium production and to allow aquifer restoration to begin as soon as production has ceased within a wellfield or a portion of a wellfield (Cameco, 2015, TR 3.5.3.3). At each satellite site, the design would allow excess water from any wellfield to be used in another wellfield, thereby minimizing the volume of groundwater disposed as a liquid byproduct material (Cameco, 2015).

Pipelines would be constructed of high density polyethylene and buried at a minimum of 1.7 m (5.5 ft) below the ground surface. The size of the pipelines would vary from 3 – 5 cm (1.25 – 2 in) in diameter for lines between wells and a header house, to as large as 46 cm (18 in) in diameter for the trunk lines between the header houses and the satellite facilities (Cameco, 2015, TR 3.5.3.3). Pipelines that would be used continuously would be equipped with pressure sensors and flow meters to provide safe shutdown in the event of upset conditions such as breaks or blockages (Cameco, 2015). Further discussion of Cameco's installation, testing, and use of these various pipelines is provided in TR 3.5.3.3 (Cameco, 2015).

Cameco's construction of header houses in wellfields would follow the design employed at the Smith Ranch site since 2008 (Cameco, 2015). That design includes a concrete basement to prevent fluids that might be released from infiltrating into the soil, and a sump and sump pump capable of pumping released fluids from the floor into a production pipeline. Cameco would emplace instrumentation in each new header house to cause shut down of injection and recovery wells in the event of a pipeline failure and/or fluid release (Cameco, 2015).

Wellfield Construction

Injection and recovery (i.e., production) wells would be located and constructed according to WDEQ/Land Quality Division's (LQD's) *Rules and Regulations*, Chapter 11 (WDEQ/LQD, 2005). In addition to the injection and recovery wells, monitoring wells would be placed around the perimeter of the wellfield, and in the aquifer overlying and underlying the area where uranium recovery would occur (Cameco, 2015). In overlying and underlying aquifers, one monitoring well would be installed for each 1.2 ha (3 ac) of proposed wellfield. Prior to initiating operation, all wells would undergo mechanical integrity testing (MIT) according to WDEQ/LQD requirements.

During wellfield construction, one well in each 1.2 ha (3 ac) of wellfield would be installed in the ore-zone aquifer (Cameco, 2015). These wells would be sampled before any uranium-recovery operation takes place, and the resulting water-quality data would be used to establish the Class of Use and the pre-operational water-quality concentrations according to the protocol set forth in the license-renewal application (Cameco, 2015). The pre-operational water-quality concentrations would serve as the groundwater-protection standards for aquifer restoration as specified at 10 CFR Part 40, Appendix A, Criterion 5B(5) and are often referred to as the restoration target values (RTVs).

Cameco's primary mine unit pattern design is the five-spot pattern in areas of higher permeability; seven-spot patterns are used in areas of lower permeability (Cameco, 2015, TR 3.5.1.1). The licensee may also use line-drive (alternating or staggered) patterns where the orebody is too narrow to accommodate either five-spot or seven-spot patterns. Figure 2.3-1 of the GEIS (NRC, 2009a) provides a schematic drawing of five-spot and seven-spot patterns.

Wellfield Operation

Prior to commencing ISR operation in a wellfield, Cameco would collect samples from the monitoring wells. Analysis of groundwater samples obtained from each well would produce the pre-operational concentrations. These values would be used to calculate, with statistical procedures, upper control limits (UCLs) for chloride, bicarbonate, and conductivity (Cameco, 2015). The pre-operational water quality and the calculated UCLs would be established for each separate wellfield. During operations, Cameco would sample groundwater from the monitoring wells on a regular basis and compare the resulting analytical values to the respective UCLs to determine whether an excursion of lixiviant into the surrounding aquifers has occurred.

ISR operations under the Proposed Action would employ the uranium-recovery process described in EA Section 2.2. During these operations, approximately 99 percent of the water withdrawn from the production aquifer would be returned to the same aquifer, (i.e. an average of 1 percent bleed) (Cameco. 2015). Down-hole injection pressures for all injection wells would be maintained below the formation-fracture pressure as required by WDEQ/LQD regulations (WDEQ/LQD, 2005).

2.3 Waste Generated and Waste Management

Both radioactive and nonradioactive effluents and wastes would be produced during all ISR phases of the Project (i.e., construction, operation, aquifer restoration, and decommissioning). The airborne effluents and the solid and liquid wastes expected from the proposed Project and the associated waste-management practices Cameco proposes are consistent with the industry standards reported in GEIS Section 2.7 (NRC, 2009a).

2.3.1 Airborne Emissions

The primary airborne emissions generated during operations would be from vented process equipment in the CPPs and satellite facilities, including waste tanks and IX columns (Cameco, 2015). The only significant radioactive airborne effluent would be radon-222. Yellowcake slurry would potentially be produced at the Gas Hills remote satellite, but, because it would be a wet product, no airborne emissions beyond radon-222 would be produced (Cameco, 2015). At the Smith Ranch CPP and the Highland CPF, the primary emissions would be radon-222. Radon would be managed by engineered venting and exhaust fans (Cameco, 2015). Small amounts of

radon would potentially be released within the wellfields. Because the yellowcake dryers themselves are low-emission equipment and contain no vent stacks, virtually no uranium particulates would be released to the atmosphere during normal yellowcake drying (Cameco, 2015). Small amounts of uranium particulate emissions would be released only in the yellowcake packaging area, when the dried product is being packaged into drums.

Monitoring for radon-222 would follow the same design and methodology as those implemented at the Smith Ranch site. The monitoring record for the Smith Ranch site shows the absence of negative impacts to employees, the public, and the environment (Cameco, 2015).

Non-radiological emissions as a result of uranium recovery would include minor sodium carbonate releases while storage vessels are filled, and potential releases of process chemicals, such as hydrochloric acid used in the plants during operations (Cameco, 2015). Exhaust fumes and fugitive dust from vehicular traffic would also be generated during all phases of the Project.

2.3.2 Liquid Effluents

At the Smith Ranch site, disposal of liquid byproduct material is accomplished by deep injection into UIC Class I wells, evaporation, and land application. The Class I injection wells used for deep disposal at the Smith Ranch site are listed in Table 2.1. Liquid byproduct material from the onsite Satellites 2 and 3 is treated at the Selenium Treatment Plant and transferred to PSR-2. During warmer months, the treated liquid byproduct is transferred from PSR-2 to the Satellite 2 land application facility.

The aquifer-restoration actions proposed for the Smith Ranch Project are: (1) one pore volume of groundwater removed by groundwater sweep; (2) extraction of eight pore volumes of groundwater followed by RO treatment and reinjection of the permeate; and (3) stabilization monitoring (Cameco, 2015; NRC, 2009a). Cameco expects to continue researching aquifer-restoration methods to improve efficiency and to reduce the time required to complete restoration. Among the methods Cameco is exploring are: (1) ensuring adequate capacity for wastewater disposal; (2) increasing the efficiency of the reverse osmosis treatment; (3) reducing the quantities of oxygen and carbonate added to the lixiviant during operation; and (4) improving the application of bioremediation technology (Cameco, 2015).

The resulting solution, which is “barren” of uranium, can be treated by reverse osmosis, which produces a relatively clean water stream (i.e., permeate) and a small volume of brine (i.e., salt water). The permeate is recharged with the oxidant (i.e., oxygen or hydrogen peroxide) and re-injected as lixiviant to recover more uranium from the wellfield. The brine is disposed as a byproduct liquid.

The volume of water withdrawn through the recovery wells is greater by about 1 – 3 percent than the volume of water that was injected, thereby creating an inward groundwater-flow gradient. The flow gradient into a wellfield minimizes the potential movement of lixiviant and its associated contaminants out of the wellfield (NRC, 2009a). The excess water from the wellfield is referred to as “bleed” and is generally equivalent to the brine and other process fluids that are later disposed as liquid byproduct materials.

Liquid byproduct effluents include brine from the reverse osmosis treatment of lixiviant after removal of the uranium, other process solutions (e.g., resin-transfer water and brine generated by the elution and precipitation circuits), ground water bleed generated during operations and

aquifer restoration, plant wash-down wastewater, well-development and well-maintenance groundwater, excess sample-collection wastewater, and laboratory wastewater (Cameco, 2014). Disposal of byproduct liquids would continue as is currently accomplished at the Smith Ranch site, except that greater volumes would be generated at the Reynolds Ranch, North Butte, and Gas Hills properties by the Proposed Action as a result of the increased flow rates.

At the Smith Ranch site, permitted UIC Class I Wells would be installed as needed to provide additional capacity for the disposal of liquid byproduct materials. Cameco is assessing the resumption of disposal of liquid byproduct waste at PSR-1 and irrigation area 1 to provide added capacity (NRC, 2013b).

At the North Butte site, UIC Class I Well Federal BY-2 would continue to be used for disposal of byproduct liquids (Cameco, 2015). Three additional Class I wells (i.e., North Butte No. 3, North Butte No. 4, and North Butte No. 5) would potentially be installed and used for disposal of byproduct liquids (WDEQ/WQD, 2013a).

UIC Class I wells, solar-evaporation ponds, and forced evaporation could be used at Gas Hills (Cameco, 2014). Up to three UIC Class I wells (i.e., DDW #1, DDW #2, and DDW #3) would potentially be installed and used for disposal of byproduct liquids (WDEQ/WQD, 2013b). Injection Wells DDW #1 and DDW #2 may be converted from existing UIC Class V test wells to UIC Class I wells if approved by WDEQ WQD.

2.3.3 Solid Waste Management

Solid effluents (i.e., wastes) generated by the Smith Ranch Project would consist of byproduct material-containing solids, non-byproduct material-containing wastes, and hazardous wastes. Solid byproduct materials would include spent resin, filter media, and process pipelines and equipment, barium sludge and selenium treatment sludge from the selenium treatment plant, and sludge from surface impoundments. Non-byproduct solid wastes would include trash, construction debris, and empty reagent containers. Hazardous wastes would consist of small quantities of spent batteries and florescent light bulbs (Cameco, 2015, TR 4.2.3). The licensee's management and disposal of solid wastes would be accomplished in the same manner as is currently being accomplished at the Smith Ranch Project.

According to License SUA-1548, Cameco is required to maintain a waste disposal agreement with an NRC- or Agreement-State licensed facility for the disposal of solid byproduct materials generated by Smith Ranch Project ISR activities. All contaminated items that cannot be decontaminated to meet unrestricted release criteria are properly packaged, transported, and disposed at an NRC- or NRC Agreement State-licensed disposal site to accept byproduct material. The licensee estimates that 38 to 229 cubic meters (m^3) (50 to 300 cubic yards (yd^3)) of solid byproduct material would be generated each year at the Smith Ranch Project sites, and approximately 150,000 kg (330,000 lb) of barium sludge annually would be shipped off-site for disposal (Cameco, 2014, ER 3.12.2.2).

Cameco collects uncontaminated solid wastes on the respective site and disposes of in the nearest solid waste sanitary landfill. The licensee estimates that the Smith Ranch site disposes of approximately 32,650 kg (72,000 lb) of uncontaminated solid waste per year at the Converse County Landfill (Cameco, 2015, TR 4.2.3). Cameco further estimates that the operation of the Reynolds Ranch site would generate 153 m^3 (200 yd^3) of uncontaminated solid wastes a year, while the North Butte and Gas Hills remote satellites would each generate approximately 229 to 382 m^3 (300 to 500 yd^3) of uncontaminated solid waste per year (Cameco, 2015, TR 4.2.3).

Cameco estimates that it recycles approximately 150 light bulbs each year, 30 of which are mercury halide bulbs (Cameco, 2014, ER 3.12.2.1). One 5-gallon bucket of batteries is recycled off site each year, and no pesticides or antifreeze are stored on site. The licensee burns used oil for heat and the surplus is recycled off site. In 2010, two (500-gallon) barrels of oil were recycled off site (Cameco, 2014, ER 3.12.2.1). Cameco stores waste electronics on site until an adequate recycling vendor is contracted. Tires are periodically picked up from Smith Ranch and recycled, with approximately 350 tires recycled in 2010. Domestic solid wastes (septage) from the restrooms and lunchrooms are disposed in the septic systems (Cameco, 2014, ER 3.12.2.1).

2.4 Transportation

Under the Proposed Action, Cameco would employ the same transportation methods as those currently being used for trucks and passenger vehicles, although at increased levels in anticipation of ISR operations at the Reynolds Ranch satellite, the North Butte and Gas Hills remote satellites, and toll milling of third-party IX resins (Cameco, 2014, ER 4.2.1.1). Transportation activities would include workers commuting and hauling supplies and materials in and out of the sites. Trucks would carry construction equipment and materials, processing supplies, uranium-loaded IX resin and slurry, yellowcake product, and various solid wastes (Cameco, 2014, ER 4.2.1). Transport of uranium-bearing materials would be conducted in accordance with NRC and U.S. Department of Transportation shipping regulations for such materials (Cameco, 2014, ER 4.2.2.1).

Approximately 170 workers would travel to and from the Smith Ranch Site each day, coming primarily from three communities: Casper (20%), Douglas (40%), and Glenrock (40%) (Cameco, 2014, ER 4.10.1.2). Cameco anticipates employing 50 to 60 employees at the North Butte remote satellite site, and assumes that 75% of the employees would live in Gillette and 25% would live in Casper. For the Gas Hills remote satellite site, Cameco expects approximately 75 employees, 80% of whom would live in Riverton and 20% in Casper (Cameco, 2014, ER 4.2.1.1).

The Smith Ranch Site also receives chemicals used in the ISR process and fuel for onsite trucks, and sends offsite processed yellowcake and byproduct wastes. These deliveries, onsite and offsite, equal approximately two per day (Cameco, 2014, ER 4.2.1.1). 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 (Cameco, 2014, ER 4.2.1.1).

2.5 Operational Experience since the Last Renewal

Since 2001, the licensee has recorded 37 excursions at the Smith Ranch Project, with certain monitoring wells being placed on excursion status more than one time. Predominantly, the excursions have occurred in the Highland property, where the earliest ISR activities were conducted for the Project. Several excursions were detected in areas that have underground mine workings that were related to past conventional mining activities at the Smith Ranch site.

The licensee also has experienced 89 unplanned fluid releases since 2001, the largest of which, a spill of 750,300 liters (198,500 gallons) of injection fluids, occurred in 2007. These releases have involved lixiviant injection fluids, mine unit production fluids, and fluids at deep disposal

wells. In response to each event, the licensee conducted mitigative actions (e.g., collection of spilled liquids, radiological surveys of the affected soils, soil sampling and analysis as needed) and documented the affected area for future assessment during site decommissioning. None of these events met the NRC's criteria for reporting found in Subpart M to 10 CFR part 20 or 10 CFR 40.60.

Nine leaks have been recorded at the evaporation ponds near the Smith Ranch CPP. Cameco's pond inspection program detected the pond leaks, and Cameco replaced the liner system for the east and west evaporation ponds in 2014.

Cameco was under an Administrative Order on Consent (AOC) with the WDEQ. The AOC, originally dated August 9, 2000, was related to an increased number of failed MITs in MUs C, E, and F at the Smith Ranch site[6]. Cameco's field investigation identified potential contamination from MIT failures in the overlying aquifers between the ore zone and the ground surface. By letter dated September 2, 2015, the WDEQ determined that all of the conditions and requirements contained in the AOC had been addressed (WDEQ, 2015). Cameco is progressing with its corrective actions in MUs C, E, and F. The NRC staff observes that wells located in MUs C, E, and F were primarily constructed using glue and screw joints. This construction method was subsequently found to be problematic, as evidenced by the observed MIT failure rate in Table 1-6 of Cameco's application (Cameco, 2015). Within MUs C, E, and F, Cameco has installed replacement wells to address the issue. The NRC staff observes that the more recent mine units constructed at Smith Ranch site use spline joints. Cameco's observed MIT failure rate in subsequent mine units indicates the issue has been addressed.

Since the last license renewal in 2001, two transportation incidents have occurred, both involving shipments of byproduct material to the White Mesa uranium mill site in Blanding, Utah (Utah, 2016). Both incidents – the first on August 20, 2015, and the second on March 29, 2016 – involved leaks from intermodal containers that were carrying barium sulfate sludge from the Smith Ranch site to the White Mesa mill site for disposal of the material. The NRC conducted inspections at the Smith Ranch in response to these incidents in June 2016 and in November 2016 and issued a Confirmatory Action Letter (CAL) in August 2016 (NRC, 2016b). By letter dated June 29, 2017 (NRC, 2017b), the NRC issued to Cameco nine violations of regulatory requirements, five of which were collectively categorized as a Severity Level III problem given the same root cause, with the remaining four categorized at Severity Level IV. In the same letter, the NRC stated that Cameco had partially completed implementation of the corrective actions in response to the CAL.

[6] Cameco recorded a total of 908 MIT failures for existing wells at the Smith Ranch site during the period from 2001 to 2011 (Cameco, 2015; TR 1.10.12 and TR Table 1-6).

Table 2.1 Current Facilities of the Smith Ranch Site		
Property	**Facility Infrastructure**	**Status in April 2016**
Smith Ranch	Central Processing Plant (CPP) and Office Complex	Operational
	Satellites SR-1 and SR-2	Operational – serve Wellfields 3, 4, 10, 10-ext (formerly called 11), 12, 15, and 15A
	MUs 2, 3, 7, 9, 10, 15, and 15A	Operational
	MUs 2, 4, 4A in active restoration. MU 1 is in the stability-monitoring restoration phase.	In aquifer restoration phase
	UIC Class I Wells SR DDW#1, SRHUP#6, SRHUP#7, SRHUP#10	Operational
	UIC Class I Well SR DDW#2	Plugged and abandoned
	UIC Class I Well SRHUP#8	Inactive
	Two surface impoundments associated with CPP (referred to as the East and West lined, surface storage impoundments in the license application)	Used for storage of process effluent prior to disposal of liquid in Class I wells
Highland	Central Processing Facility (CPF)	On standby status since 2003
	Sat-1: previously served Wellfields A and B	Inactive
	Sat-2: serves Wellfields C, D, D-Extension, F, E, H, and I	Operational
	Sat-3: serves Wellfields F, J, K, and K-North	Operational
	Wellfield A	Aquifer restoration approved by NRC
	Wellfield B	Aquifer restoration conducted; Cameco submitted an alternate concentration limit application May 2013.

Table 2.1 Current Facilities of the Smith Ranch Site		
Property	**Facility Infrastructure**	**Status in April 2016**
	UIC Class I Wells SRHUP#9, Morton 1-20, Vollman 33-27	Operational
	Purge storage reservoir PSR-1 and land application area 1 at Highland Sat-1	In interim stabilization status with monitoring
	Purge storage reservoir PSR-2 and land application area 2 at Highland Sat-2	Used for disposal of wastewater from Sat-2 and Sat-3
	Selenium treatment facility at Sat-2	Treats wastewater from Sat-2 and Sat-3
	Radium settling basins at Sat-1	Undergoing decommissioning
Reynolds Ranch	Satellite REY-1	Not yet constructed
	Wellfield 27	Not installed
	UIC Class I Well Reynolds Ranch #1	Installed but not in operation
Description and status found in Cameco, 2015, Cameco, 2013c, NRC, 2016a, NRC, 2013a, and NRC, 2004b		

3.0 AFFECTED ENVIRONMENT

3.1 Introduction

Cameco operates the Smith Ranch Project under NRC license SUA-1548. The Project encompasses four separate sites: (1) the Smith Ranch site in Converse County; (2) the North Butte remote satellite site in Johnson County; (3) the Ruth remote satellite site in Campbell County; and (4) the Gas Hills remote satellite site in Fremont and Natrona Counties, all in Wyoming. The Smith Ranch, North Butte, and Ruth sites are located in the Powder River Basin, in the WEUMR (Wyoming East Uranium Milling Region) as defined in the *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (GEIS) (NRC, 2009a). The Gas Hills Satellite site is located in the Wind River Basin, in the WWUMR (Wyoming West Uranium Milling Region) (NRC, 2009a). This chapter describes the current environmental conditions at the respective Project sites.

The description of the affected environment is based upon information provided in previous NRC and BLM environmental documents, WDEQ permits, and Cameco's license application and Cameco's responses to the NRC's RAIs. This description is supplemented by additional information identified by the NRC in the public domain. The facility and operational information provided in Chapter 2 of this EA together with the information about the environment in this chapter form the basis for the NRC's evaluation of the potential impacts to each resource area by the Proposed Action and the No-Action Alternative that are discussed in Chapter 4 of the EA.

3.2 Smith Ranch Site

The affected environment at the Smith Ranch site has been previously described in prior NRC and BLM environmental review documents (e.g., NRC, 1995, NRC, 2006; BLM 2011). The NRC staff has kept itself apprised of changes to the environment since the publication of those documents and finds the current environmental conditions to be consistent with the prior descriptions, except where specifically called out. Therefore, summary discussions of the resource areas are provided in the following sections, and the reader is referred to the prior environmental documents for a more detailed description.

3.2.1 Land Use

The predominant land uses at the Smith Ranch Project sites are pastureland, rangeland, and cropland; minerals and energy production; hunting and recreation; and broadly dispersed rural residences.

Land use at the Smith Ranch site is discussed in previous NRC and BLM environmental documents (e.g., NRC, 1992; NRC, 1995, NRC, 2006; BLM, 2011). Located in Converse County, Wyoming, at southern portion of the Powder River Basin, the Smith Ranch site encompasses approximately 16,000 ha (40,000 ac) and consists primarily of privately-owned land (84 percent). Of the remaining lands, approximately 10 percent is owned by the State of Wyoming and 6 percent is managed by the BLM (Cameco, 2014, ER 3.1.6.1).

The Smith Ranch site is rural and agricultural in character, with widely-dispersed ranches and a low population density. Rangeland grazing of cattle and sheep is the predominant land use at the site. In Converse County, rangeland is also the predominant land use overall, representing 89 percent of the total land area of the county (Cameco, 2014, ER 3.1.6.1).

Twelve occupied ranch residences are within 8 km (5 mi) of the Smith Ranch site. Of these, the Vollman Ranch, which is approximately 6 km (4 mi) east of the Smith Ranch CPP, is the only one found within the current license boundary area. The locations of the 12 ranch residences are provided in ER Figure 3.1.4 of Cameco's application (Cameco, 2014).

Because the majority of land within the site is privately owned, there is limited public access for hunting and other outdoor recreation (BLM, 2011; Section 3.10). Limited hunting of deer and antelope occurs on the BLM-managed lands of the site, but elk-hunting opportunities are considered to be nonexistent given that elk have not been observed in the project area (BLM, 2011; Section 3.10).

Cameco's review of Wyoming Oil & Gas Conservation Commission records found three oil and gas wells that had been drilled within the site, but they were plugged or abandoned due to uneconomic quantities of hydrocarbons; and other producing wells are approximately 1.5 km (1 mi) or more from the license boundary (PRI, 2014). Existing and proposed wind-energy projects are located southwest of the Smith Ranch site, to the northwest and southwest of Glenrock, Wyoming.

A portion of the Smith Ranch site has been previously disturbed in connection with currently licensed uranium-recovery activities. As of the year 2010, the existing area of disturbance from prior construction of buildings, roads, wellfields, and surface impoundments was approximately 571 ha (1,410 ac) (Cameco, 2014, ER 3.1.6.1), and an estimated approximately 190 ha (470 ac) are to be disturbed under the Proposed Action (Cameco, 2015, ER 4.1.1.1). Portions of the Smith Ranch site also have been affected by ISR operations. These effects, both intended and unintended, include land application of treated process fluids and impacts from surface spills of process-related fluids. The effects of land application and of surface spills are discussed in section 3.2.3 of this EA.

The estimated total surface disturbances for the life of the project are expected to be approximately 761 ha (1,880 ac), or less than 5 percent of the total area (Reynolds Plan of Operations, BLM, 2011). Under the Proposed Action, the proposed increase in surface disturbance (approximately 190 ha (470 ac)) would be approximately 1% of the total Smith Ranch license area.

The existing wellfields at the Smith Ranch and Highland properties range in size from approximately 4 ha to 64 ha (9 ac to 157 ac) for a total area of approximately 587 ha (1,450 ac) (Cameco, 2013c). The current wellfields contain a total of approximately 250 header and booster houses, and nearly 12,000 wells for the purposes of lixiviant injection, uranium recovery, monitoring, and ground water restoration (Cameco, 2013c). In total, the wellfields contain approximately 92 km (57 mi) of roads and 1,030 km (640 mi) of buried pipe and trunk lines.

Cameco uses drillholes to delineate the size and shape of the subsurface uranium-ore bodies within the wellfields. Usually, drillholes are plugged and the surface is reclaimed in the same year or in the year following drilling (Cameco 2013e). Cameco's operation of planned wellfields depends on the market conditions for the yellowcake product that the licensee produces.[7]

[7] By letter dated April 2, 2018, the licensee notified NRC of Cameco's February 5, 2018, decision to cease production at its U.S. facilities due to continued low uranium prices (Cameco, 2018). See Section 1.1 of this EA for more details concerning this decision.

3.2.2 Transportation

Transportation routes around the Smith Ranch Site have been discussed in previous NRC and BLM environmental reviews (NRC, 2006; NRC, 2007; NRC, 2009a; BLM, 2011). The Smith Ranch CPP, Highland CPF, and the main office complex are all located at the Smith Ranch site, approximately 39 km (24 mi) northeast of Glenrock, Wyoming. Access to this site is from Ross Road (Converse County Road 31), which begins at the junction of Wyoming State Highways (SH) 93 and 95 (approximately 13 km (8 mi) southeast of the site entrance) and ends at the intersection with State Route (SR) 387 in Campbell County, Wyoming. The posted speed limit on Ross Road is 89 km/hr (55 mph) and the entrance to the Site is between Mileposts 7 and 8 from the intersections of SH 93 and SH 95 (NRC, 2007).

The Wyoming Department of Transportation (WYDOT) estimates the annual average daily traffic along Wyoming roads using permanent traffic recorders, portable traffic recorders, and manual traffic classification counts (WYDOT, 2018). WYDOT estimated that an annual average of 102 vehicles per day passed the junction of SH 93 and SH 95 in 2013 (WYDOT, 2016). This represents an approximately 20 percent increase in the annual average daily vehicle count at this location compared to 2003 counts (WYDOT, 2013).

3.2.3 Geology, Seismology, and Soils

The regional geology and soils of the Powder River Basin where the Smith Ranch site is located are described in GEIS Section 3.3.3 (NRC, 2009a). The uranium mineralization, as described in previous environmental documents, is located at a depth and in a geologic setting favorable to ISR (NRC, 1987; NRC, 1992; NRC, 2001; NRC, 2007; BLM, 2011). These same documents also discuss the geology, soils, and seismology of the Smith Ranch site in some detail.

Geology

At the Smith Ranch site, Cameco recovers uranium from subsurface ore deposits found in the sandstone layers of the upper Fort Union Formation and the lower Wasatch Formation. These ore deposits are located at depths ranging from 61 m to 366 m (200 ft to 1,200 ft) below ground surface (Cameco, 2015, Section 3.3.1.1). Potentially 10 separate uranium-bearing sandstones have been identified beneath the Smith Ranch site (Cameco, 2014, Section 3.3.2.1.2).

The WDEQ has permitted 10 UIC Class I injection wells at the Smith Ranch site (WDEQ/LQD, 2012). As of April 2015, Cameco has drilled eight of these wells into the Teckla, Teapot, and Parkman sandstone members of the Mesaverde Formation (Cameco, 2015, Section 3.6.1.5 and Table 3-6).

Below the Mesaverde Formation are the Cody Shale and Niobrara Formations. Within Converse County, the Niobrara Formation is an established source of oil production (BLM, 2018). In this area, lesser amounts of oil have been developed from the Cody Shale and Mesaverde Sandstones. Additional oil and significant amounts of gas are estimated to be discoverable from the Niobrara and other upper Cretaceous rocks (BLM, 2018). Recent interest in oil and gas reserves in Converse County has also identified the Frontier Formation, the Muddy Sandstone, and the Mowry Shale as promising geological targets (BLM, 2018; Section 3.3.3.1).

Deeper formations, such as the Tensleep and Madison Formations, are used regionally as sources of water (NRC, 2009a). However, in the vicinity of the Smith Ranch site, these aquifers are located at depths of more than 4,500 m (15,000 ft)—too deep to be practicably tapped—and

the water quality is expected to be poor due to high total dissolved solids (TDS) (Whitcomb et al., 1966).

Seismology

Analysis of ground motion from seismic activity shows that eastern Wyoming is in a relatively quiet seismic area of the United States (Peterson, et al., 2014). No major faults in the bedrock within the Smith Ranch have been detected through all of the exploration holes drilled by the Licensee and its predecessor NRC licensees for this site (Cameco, 2014: Section 3.3.2.1.4).

Twelve earthquakes of magnitude 3.0 or greater have been recorded in Converse County (Case, et al., 2002). The strongest, a magnitude 4.2 earthquake, occurred in 1996, about 8 km (15 mi) northeast of Casper, Wyoming. The intensities of the recorded earthquakes have been between III and V (weak to moderate shaking) (Case, et al., 2002).

The U.S. Geological Survey's (USGS's) National Seismic Hazard Maps indicate that the Smith Ranch site is located within an area with a 10-percent probability of experiencing peak ground acceleration greater than 0.04 g but less than 0.06 g (between 4 and 6 percent of the force of gravity) in 50 years (Peterson et al., 2014). A peak ground acceleration of 0.06 generally corresponds to a perceived moderate shaking and potential light structural damage (USGS, 2003).

Soils

Beginning in the 1980s, numerous soil surveys have been conducted for the Smith Ranch site to support the licensing process for each property. Study results are presented in Appendix D7 of the WDEQ/LQD Permit to Mine for Smith Ranch-Highland (Cameco, 2012a) and are summarized in Section 3.3.4.1 in the licensee's ER (Cameco, 2014).

The overall topography of the Smith Ranch site is gently rolling upland areas and broad stream valleys that are dissected by numerous draws with relatively steep slopes. The soils vary widely in depth and suitability for developing topsoil and supporting vegetation. Steeper areas generally produce thinner soils. Thicker soils are present in gently sloping areas and where alluvium (i.e., materials washed down from uplands and re-deposited in drainages) has accumulated.

Areas underlain by sandstone and sandy shale develop medium-textured, friable soils (e.g., sandy loam), and areas underlain by clayey shales develop heavy clayey soils. The erosion hazard of the sandy loam is moderate to severe. As indicated in Appendix D7 of Smith Ranch-Highland WDEQ/LQD Permit to Mine, the erosion hazard for loam and clay loam is generally moderate (Cameco, 2012a).

Soils have been affected by ISR-related activities over the course of licensed operations at the Smith Ranch site. These activities have included the construction of processing buildings and well fields and the infrastructure associated with both, the laying and grading of access roads, the land application of treated process-related fluids, and spills of process fluids due to pipeline breaks. As discussed in Section 3.2.1 of this EA, approximately 571 ha (1,410 ac) of land have been affected, as of the year 2010. Between 2001 and 2016, Cameco experienced 89 unplanned releases of process-related fluids (see Section 2.5 of this EA).

With respect to land application, Cameco and previous licensees have applied treated mine unit purge water and ground water restoration fluids in two areas: (1) the PRS-1 (Purge Storage Reservoir-1) land application area east of Satellite 1 near PSR-1 and (2) the PRS-2 land

application area that serves Satellites 2 and 3 (Cameco, 2014, Sections 3.12.1.2.4 and 3.12.1.2.5). Land application at the PRS-1 area led to elevated selenium concentrations in the soils affected (Ramirez and Rogers, 2000). Near surface and ground water effects from PSR-1 and PSR-2 leakage are discussed in Section 3.2.4 of this EA.

3.2.4 Water Resources

Water resources (surface water, wetlands, and ground water) at the Smith Ranch site have been previously described in some detail in NRC and BLM environmental documents (NRC, 1987; NRC, 1992; NRC, 2001; NRC, 2007; BLM, 2011) and are summarized here.

Surface Water

The Smith Ranch site is located in the Sage Creek drainage of the North Platte River drainage system and the Box Creek, Duck Creek, Willow Creek, and Brown Springs Creek drainages of the Little Cheyenne River drainage system. Stock impoundments have been constructed in many of the drainages, but they are dry much of the time (Cameco, 2014, ER 3.4.2.1.1). A considerable portion of the Smith Ranch site drains internally to playas (i.e., areas with no outflow) (Cameco, 2014, Section 3.4.2.1.1).

Streams within the Smith Ranch site flow only during heavy thunderstorms or when snow melts. There are no gauging stations within the Smith Ranch site; but, the USGS has stream flow records for Sage Creek, which flows through the southeast downgradient of the site (Cameco, 2014). The Sage Creek stream gage, located approximately 3 km (2 mi) southeast of the site, recorded peak stream flow values from 1965 to 1984. The gauge data indicate that flow in Sage Creek is highly variable, annual peak flow rates range from 0 - 1.5 x 10^{-9} m^3/s (0 ft^3/s - 230 ft^3/s) and 5 out of 19 years are dry (Cameco, 2014, ER 3.4.2.1.1).

The surface-water quality at the Smith Ranch site exhibits wide variability. WDEQ has designated the surface waters within the Smith Ranch site as Class 3 waters (WDEQ/WQD, 2001), although in some locations and at some times during the year, the water quality exceeds the Wyoming water-quality criteria for aquatic life that apply to Class 3 water bodies (WDEQ/WQD, 2007).

The adjudicated rights for surface-water use located within a 5-km (3-mi) radius of the Smith Ranch site are identified in Table 3.4-3 and Figure 3.4-1 of Cameco's ER (Cameco, 2014). The majority of the surface-water rights are limited to small stock impoundments and associated ditches (Cameco, 2011; Appendix D-6, Hydrology).

Wetlands

Cameco conducted a wetlands survey of the Smith Ranch site in 2011, and the results are provided in Appendix A of the ER (Cameco, 2014). Cameco evaluated 19 locations within the Smith Ranch site for the presence of wetlands and documented characteristics consistent with wetlands at 11 locations. Cameco did not map any wetland boundaries as part of this work. Wetland delineations would be conducted if surface disturbing activities occur near one of these potential wetlands.

Ground Water

The Wasatch Formation underlies all portions of the Smith Ranch site, except the southwestern and extreme western portions, and ranges in thickness from 0 m to approximately 150 m (0 – 500 ft). For the most part, ground water in the Wasatch Formation exists under water-table

(i.e., unconfined) conditions, and its primary use at the site includes low-yielding wells used for watering livestock. Artesian (i.e., confined) zones near the base of the Formation are separated from near-surface deposits and from each other by impermeable shale layers.

The Fort Union Formation, which contains the uranium ore deposits at the site, underlies the Wasatch Formation. The top of the Fort Union is exposed at the surface in the southwestern and western portions of the Smith Ranch area, but may be at depths of 150 m (500 ft) or more in the eastern and northeastern part of the site. The Formation is as much as 900 m (3,000 ft) thick beneath the Smith Ranch site. Nearly all of the wells at the site are completed in the Fort Union Formation. Substantial volumes of ground water can be produced from this formation over extended periods, as demonstrated by the various historical and current mining operations in the southern Powder River Basin area of Wyoming (Cameco, 2014, ER 3.4.2.2.1).

Regionally, the quality of the ground water in the Fort Union Formation within the Powder River Basin ranges from poor to good (Whitcomb et al., 1966). The water quality at the Smith Ranch is consistent with the water quality occurring regionally in the upper Fort Union. Total dissolved solids (TDS) concentrations in this aquifer are often greater than WDEQ's drinking-water standard of 500 mg/L, but they are generally less than the WDEQ's Class II standard for agriculture of 2,000 mg/L (NRC, 2009a; Whitcomb et al., 1966; WDEQ/WQD, 2005). Sulfate concentrations often exceed WDEQ's drinking-water standard of 250 mg/L, but they are less than WDEQ's Class III standard for livestock of 3,000 mg/L (WDEQ/WQD, 2005). Concentrations of iron, manganese, and selenium often exceed drinking-water standards. The uranium concentrations are often greater than U.S. Environmental Protection Agency (EPA) Maximum Contaminant Level (MCL) for drinking water of 0.030 mg/L. Levels of radium-226 regularly exceed the standard of combined radium-226 + 228 of 1.8 Bq/L (5 pCi/L) which applies to drinking water and WDEQ's Class II and Class III standards for agriculture and livestock (WDEQ/WQD, 2005).

There are more than 1,400 ground water rights within the Smith Ranch site and within an approximately 5-km (3-mi) radius from its boundaries (Cameco, 2014, ER 3.4.2.2.7; also ER Table 3.4-4). The great majority of these rights are for wells installed for hydrologic monitoring or dewatering purposes at decommissioned uranium mining operations as well as ISR operations at the Smith Ranch site. Of the 1,400 ground water rights, 162 are associated with wells installed for livestock water, 3 wells are used for irrigation water, and 32 ground water rights are permitted for domestic water supply. The majority of these wells are less than 60 m (200 ft) in depth, above the zones where uranium would be recovered.

Within the Smith Ranch site, there are five ground water rights permitted for irrigation water and for domestic water. Two wells are located in the northeast quarter of Section 12, T35N, R74W, one a stock well and the other used for irrigation. The stock well is drilled to a depth of 42.7 m(140 ft), and has a maximum flow rate of 12 gpm. The irrigation well has a total depth of 182.9 m (600 ft), and a maximum flow rate of 100 gpm (Cameco, 2015, Responses to RAIs 7 and 8). Three ground water rights are for wells used intermittently for domestic water supply. One well serves the Fowler Ranch. This well is located north of the northeast comer of the Highland area of the site and is 64.6 m (212 ft) in depth. The second domestic well is associated with the Vollman Ranch house, which is located near the center of the Smith Ranch area of the site and is 55 m (180 ft) in depth. The third domestic well is located at the Sundquist Ranch, approximately 4.2 km (2.6 mi) south of the Smith Ranch CPP.

Cameco also uses approximately 3.8 million liters (1 million gallons) of ground water at the site for project-related, non-production purposes. This water, drawn from non-uranium bearing sands in the upper Fort Union and lower Wasatch formations, is used by the licensee for

sanitary purposes, non-process equipment cleaning, office cleaning, and other uses. Cameco obtains drinking water for the site from a commercial water bottling supplier (Cameco, 2014, ER 3.4.2.2.7).

Contamination

PSR-1, located east of Satellite 1, was used to store treated mine unit purge water and treated water from MUs A and B restoration activities (Cameco, 2014, ER 3.12.1.2.3); water from PSR-1 was periodically land applied depending on weather conditions. Leakage from the reservoir was first identified in 1994 and affected two ephemeral drainages south and east of PSR-1 (Cameco, 2014, ER 3.12.1.2.3). Under an approved Corrective Action Plan, the licensee repaired the leak in PSR-1 and constructed an interceptor trench to capture subsurface seepage and a system to pump the collected seepage back into PSR-1. Both the trench and pump-back system currently are on standby because PSR-1 is not in use and contains no water (Cameco, 2014, ER 3.12.1.2.3).

Originally constructed in 1979 and refurbished in 1994, PSR-2 was and is used by Cameco as a storage pond to hold treated process waste waters prior to land application (Cameco, 2015). Leakage from PSR-2 into near surface ground water was first reported in a 1997-98 Cameco report to the WDEQ based on sampling of two shallow wells which were installed 1994. The licensee has installed an additional 16 leak detection monitoring wells adjacent to PSR-2 between 2009 and 2014. The licensee also uses approximately 30 shallow wells in Mine Unit C-North to detect leakage from PSR-2. Cameco has characterized the near surface hydrologic units and provided proposed corrective measures for the identified contamination to NRC (Cameco, 2015a).

Cameco also has an on-going investigation of subsurface effects from failed ground water injection well casing leaks. The investigation is focused on wells in the C, E, and F-Wellfields and any impacts to shallow ground water sources there. Cameco documents the progress of the investigation in annual reports submitted to the WDEQ in accordance with an AOC.

3.2.5 Ecological Resources

Ecological-resource conditions have been evaluated in previous NEPA documents that have supported NRC licensing and BLM permitting decisions (NRC, 2006; NRC, 2007; and BLM, 2011). The licensee completed updated vegetation and wildlife surveys at the Smith Ranch site in 2011 to support the ER (Cameco, 2014, Appendix A.1 to the ER). Numerous previous vegetation and wildlife surveys were referenced, dating back to 1976, and are appended to the WDEQ/LQD's Smith Ranch Permit to Mine (Cameco, 2012a). Current ecological conditions, as documented by the licensee, are consistent with those documented in previous NEPA documents and the GEIS, as described in the following sections.

3.2.5.1 Vegetation

The Powder River Basin ecoregion generally has less precipitation than other ecoregions in the WEUMR, and the vegetation is primarily composed of mixed-grass prairie dominated by blue grama (*Bouteloua gracilis*), western wheatgrass (*Pascopyrum smithii*), junegrass (*Koeleria macrantha*), fringed sage (*Artemisia frigida*), and other forbs, as noted in GEIS Section 3.3.5.1 (NRC, 2009a). At the Smith Ranch site, vegetation surveys have been performed at various times throughout the time of ISR activities at the site (Cameco, 2014, ER Appendix A.1). In 2011, Cameco contracted for updated vegetation surveys. These surveys found that (1) sagebrush-grassland, grassland, and disturbed/reclaimed land were the most common

vegetation types, comprising 90 percent of the permit area; (2) a number of state-listed and county-listed noxious weeds were present; and (3) five selenium accumulator species were identified (Cameco, 2014, ER Appendix A.1).

3.2.5.2 Wildlife

The Smith Ranch site is in the high-elevation, grass-dominated prairie of central Wyoming (BLM, 2011). Abundant wildlife occurs in this region, including pronghorn antelope (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), small game, non-game, predators, songbirds, amphibians, and reptiles (NRC, 2009a; BLM, 2011; Cameco, 2014, ER Section 3.5.2). Cameco contracted for updated wildlife surveys in the spring of 2011, with the permit area to be surveyed for greater sage-grouse (*Centocerus urophasianus*) leks, raptor nests, black-tailed prairie dogs (*Cynomys ludovicianus*), bald eagle (*Haliaeetus leucocephalus*) winter roosts, and wetlands (Cameco, 2014, ER Appendix A.1).

3.2.5.3 Protected Species

The U.S. Fish and Wildlife Service (FWS) includes nine Federally-listed threatened, endangered, or candidate species with potential to be impacted by projects in Converse County, Wyoming, (FWS, 2018a). These species are afforded specific protection under the Endangered Species Act of 1973 (ESA). Other protected species include migratory birds as protected by the Migratory Bird Treaty Act of 1918 (MBTA), and, in the case of bald and golden eagles, the Bald and Golden Eagle Protection Act of 1940.

As discussed in Sections 3.2.5.2 and 3.2.5.3, vegetation and wildlife surveys were performed in 2011. The vegetation survey found no presence of nor suitable habitat for Ute ladies'-tresses (*Spiranthes diluvialis*) or for blowout penstemon (*Penstemon haydenii*) at potential locations around the permit area (Cameco, 2014, ER Appendix A.1). The wildlife survey did not find black-tailed prairie dogs or black-footed ferrets (*Mustela nigripes*), but did identify the presence of other species of concern: greater sage-grouse, bald eagle, golden eagle (*Aquila chrysaetos*), ferruginous hawk (*Buteo regalis*), and Swainson's hawk (*Buteo swainsoni*) (Cameco, 2014, ER Appendix A.1).

3.2.6 Meteorology and Air Quality

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 (see Cameco, 2014, ER Figure 3.1.4 for location of the Fowler Ranch). The Converse County station is considered a long-term ambient monitoring station that collects meteorological data and measurements of ambient oxides of nitrogen (nitric oxide and nitrogen dioxide), ozone (O_3), total hydrocarbons, methane, and non-methane hydrocarbons , and continuous PM_{10} (i.e., particulate matter with diameters generally 10 micrometers and smaller). 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.

An onsite meteorological station was installed at the Smith Ranch site in November 2010. The closest station with a longer-term record (1997 to 2011) is at Glenrock, Wyoming. The data obtained at both sites are shown in Table 3.7.1. The average wind speed at the site is 4.69 m/s (10.5 mi/hr). The predominant wind direction is from the west-southwest (17 percent of the time). The average temperature at the Smith Ranch site is 7.2 degrees (°) Celsius (C) (45 °Fahrenheit (F)), and ranges from 34.2 °C (93.6 °F) in the summer to -29.2 °C (-20.9 °F) in the winter. The annual precipitation is approximately 290 mm (11 in). The maximum precipitation

generally falls in the spring months. The predominant atmospheric-stability class is "D" (i.e., relatively stable). These Smith Ranch site data are consistent with those presented in the GEIS (NRC, 2009a).

Because the newer data for the Smith Ranch site have been collected only for a short period of time, Cameco compared the site data with a longer data record measured at Glenrock. Cameco performed a statistical analysis and considers that the limited data from the Smith Ranch site is "substantially equivalent" to the longer-term record obtained at the Glenrock station (Cameco, 2014, Response to RAI 40).

No air-quality monitoring has been conducted at the Smith Ranch site. The data shown in Table 3.1 indicate compliance in the region with respect to particulate standards and for gaseous emissions. As shown on Table 3.2, nitrogen dioxide and ozone have been monitored near the site at a limited number of stations. The region is in compliance with the National Ambient Air Quality Standards (NAAQS) (NRC, 2009a).

Table 3.1 Meteorological Data Measured at the Smith Ranch Site and Glenrock

Parameter	Smith Ranch[1]	Glenrock[2]
Wind Speed (m/s and mi/h)	5.6 / 10.5	6.6 / 14.8
Predominant Wind Direction	WSW (17 percent of time)	WSW (20 percent of time)
Temperature (°C/ °F)	4.8 / 45	7.8 / 46
Precipitation (mm / in)	229 / 11.4	228 / 11.4
Season of Maximum Precipitation	Spring	Spring
Atmospheric Stability (Predominant)[3]	D (60 percent of time)	D (60 percent of time)

Source: Cameco, 2014, ER Appendix B; Uranium One, 2011.

[1] Data collected from December 2010 through May 2011.

[2] Data collected January 1997 through December 2011.

[3] The stability classes are defined by the Pasquill-Gifford, where A and B are unstable (excellent dispersion of pollutants); C is neutral; and D-F are considered stable (poorer for dispersion of pollutants).

Table 3.2 Ambient Air-Quality Monitoring Data (2006 – 2008)[a]

Pollutant[b]	Location of Monitoring Station				Averaging Time (Standard)
	Gillette	Campbell	Wright	Antelope	
Nitrogen Dioxide	NA	0.004 ppm	NA	NA	Annual (0.053 ppm)[c,d]
Particulate Matter: PM_{10} (annual)	20	17	17	NA	Not to be exceeded more than once per year on average over 3 years (50 µg/m^3).[d]
Particulate Matter: PM_{10} (24 hr)	0	0	0	N/A	Not to be exceeded more than once per year on average over 3 years (150 µg/m^3).[c, d]
Particulate Matter: $PM_{2.5}$ (Annual)	NA	NA	NA	4.1	Annual mean, over 3 years (15 µg/m^3).[c,d]
Particulate Matter: $PM_{2.5}$ (24 hour)	NA	NA	NA	10	98th percentile, averaged over 3 years (35 µg/m^3).[c, d]
Ozone	NA	0.067 ppm	NA	NA	Annual fourth highest daily maximum 8-hour concentration, averaged over three years (0.075 ppm).[c,d]

Source: NRC, 2011.

[a] Values reported are the 3-year average of annual averages unless otherwise specified.

[b] Only those pollutants that were measured by WDEQ at monitoring stations within 80 km (50 mi) of the proposed site are listed. No measurements were taken for sulfur dioxide and carbon monoxide at these monitoring stations. Values are in units of µg/m^3 unless other units are specified.

[c] NAAQS.

[d] Wyoming ambient air quality standards.

NA = Not Available.

In addition to ambient air quality, the monitoring for air-quality-related values of visibility and atmospheric deposition can be conducted. Currently, these values are not measured at the

Smith Ranch site. WDEQ operates two visibility stations in the Powder River Basin, the closest of which is 160 km (100 mi) from the site. Additional visibility data are collected nearby at the Bridger Wilderness Area, located 310 km (190 mi) away; these data indicate that visibility is excellent and that visibility trends show no significant change over the last 10 years (BLM, 2009).

With respect to Prevention of Significant Deterioration (PSD) requirements, there are no Class I areas in the WEUMR. Class I areas are areas of special national or regional natural, scenic, recreational, or historic value for which the PSD regulations provide special protection (EPA, 2018). The nearest Class I areas to the Smith Ranch site are the Northern Cheyenne Indian Reservation (in Montana) and Wind Cave National Park (in South Dakota), 240 km (150 mi) and 180 km (110 mi) away, respectively.

3.2.7 Noise

The Smith Ranch site is located more than 16 km (10 mi) from the larger communities in the region, and the 3-km- (2-mi-) radius area surrounding the site consists primarily of rangeland (Cameco, 2014). Noise levels for the Smith Ranch site therefore are consistent with undeveloped rural areas although ISR-related site activities (e.g., well drilling) lead to localized higher noise levels during those activities.

The Vollman Ranch, located within the site boundary area, and two other occupied ranch homes that are located in closest proximity to the site (the Sundquist and Fowler ranches) are the nearest noise receptors (see Figure 3.1.4 in Cameco, 2014).

3.2.8 Historic and Cultural Resources

Numerous historic and cultural resource surveys have been performed at and in the vicinity of the Smith Ranch site since the 1970s. As licensed ISR-related activities have expanded at the site, additional surveys have been performed, at times overlapping previous surveys boundaries and updating the previous survey results.

The NRC conducted the National Historic Preservation Act Section 106 process for the undertaking (i.e., the proposed license renewal action). This consultative process addresses the Smith Ranch site and the North Butte remote satellite site. BLM is the lead federal agency for the Section 106 process at the Gas Hills site. The results of the NRC's conduct of its Section 106 consultation process for the license renewal is discussed in section 7.0 of this EA.

3.2.9 Visual and Scenic Resources

The Smith Ranch Project lies within the boundaries of the BLM Buffalo, Casper, and Lander Field Offices. The BLM is responsible for identifying and protecting visual values on all public lands, including portions of the Smith Ranch Project. The BLM uses two processes to accomplish these goals: (1) a Visual Resource Inventory (VRI) and (2) Visual Resource Management (VRM).

The VRI process involves rating the visual appeal of a tract of land, measuring public concern for scenic quality, and a determining whether the land is visible from travel routes or observation points (Cameco, 2014, Section 3.9.2.1). This process determines the scenic values of an area at a specific point in time. There are three primary elements of the VRI process: (1) an evaluation of scenic quality; (2) an analysis of the sensitivity level, and (3) a delineation of distances zones.

Scenic-quality evaluations rate BLM lands using seven factors: landform, vegetation, water, color, influence of adjacent scenery, scarcity, and cultural modifications. Lands with 19 points or more are rated as Class A; 12-18 points are rated as Class B, and 11 points or fewer results in a Class C rating. Sensitivity analysis considers the types of users, amount of use, level of public interest in the area, adjacent land uses, special areas, and other factors (BLM, 2010). Distance zones consider the relative visibility and are categorized as foreground-middle ground, background, and seldom-seen.

After these factors are evaluated, public lands are placed into one of four VRI classes. Class I and II lands are the most valued scenery while Class III is moderately valued followed by Class IV which represents lands with the least visual value. These classes inform the BLM and are considered the baseline for existing conditions. They do not establish management direction, however. More information about the VRI can be found in BLM Manual No. H-8410-1: *Visual Resource Inventory* (BLM, 2010).

The VRM Class is determined by considering the VRI values in conjunction with other resources and resource use considerations such as recreation, energy development, and wildlife. See the text box for more information on VRM classifications.

Site-specific VRM evaluations were conducted at the Smith Ranch Project sites during 2011 using the methodology provided in BLM Handbook 8410-1 as well as a review of the factors contributing to the existing Class IV inventory for the Smith Ranch site, and Class II and III inventory for the North Butte and Gas Hills sites (Cameco, 2014, ER 3.9). Information regarding these evaluations is provided in below.

The landscape at the Smith Ranch site is characterized by gently rolling hills with large open expanses of grasslands, pasture, and sagebrush shrublands. The drainages that flow through the area have water on an intermittent basis depending on the seasonal rains and run-off. There are some cultural modifications or man-made structures in the area, including ranch residences, a wind-energy farm, oil production facilities and Cameco's uranium-recovery facilities, and associated infrastructure. There are no developed parks or recreation areas within the VRM study area, and the area is already an operating uranium-recovery

Depending on management objectives for an area, lands are placed into one of the four Visual Resource Management (VRM) classes:

Class I Objective: To preserve the existing character of the landscape. This objective provides for natural ecological changes but also does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.

Class II Objective: To retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of a casual observer. Any changes must repeat the basic elements of form, line, color and texture found in the predominant natural features of the characteristic landscape.

Class III Objective: To partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

Class IV Objective: To provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance and repeating the basic elements.

operation (Cameco, 2014). The Smith Ranch site is not visible beyond a distance of approximately 16 km (10 mi) in all directions due to the low-lying hills that surround the site (Cameco, 2014, Section 3.9.3).

Results of a recent site-specific Scenic Quality Inventory and Evaluation for the Smith Ranch site rated the area with a total score of 5 due to the very common scenic characteristics, lack of water, and the fact that there was little variety in vegetation and color. If the visual-resource evaluation rating score is less than 19, no further evaluation of existing scenic resources is required (NRC, 2003b). VRM Class III makes up approximately 2,451 ha (6,278 ac), or 15.7 percent of the Smith Ranch site, while 13,646 ha (33,719 ac), or 84.3 percent of the site, are classified as VRM Class IV (Cameco, 2014, Section 3.9.2).

3.2.10 Socioeconomics

In Converse County, the nearest communities are Rolling Hills (about 13 km (8 mi) from the Project Site), Glenrock (approximately 19 km (12 mi) away), and Douglas (approximately 24 km (15 mi) from the site). The city of Casper, in Natrona County, is the nearest urban area to the Smith Ranch Project; it is approximately 64 km (40 mi) to the southwest of the Project Site. Casper, the second largest city in Wyoming, would likely serve as a regional logistics hub as well as a source of personnel and supplies for the Smith Ranch Project.

Table 3.3 presents the 2000 and 2010 population data for the potentially affected jurisdictions in the Region of Influence (ROI). Natrona County is the second most populous county in the State after Laramie County. As noted previously in section 2.4 of this EA, the anticipated 170 employees who would work at the Smith Ranch site would live predominantly in three communities: Douglas (40% or 68 employees), Glenrock (40% or 68 employees), and Casper (20% or 34 employees).

ER Section 3.10.2 of Cameco's license renewal application (Cameco, 2014) provides more detailed information about the socioeconomic characteristics of the region surrounding the Smith Ranch site. That discussion addresses income and earnings, employment structure, housing, finance, education, and health and social services.

For the purposes of an environmental justice review, no minority or low-income populations have been identified in the 80 km (50 mi) region around the Smith Ranch site (Cameco, 2014, ER Sections 3.10.2.1.2 and 3.10.2.2.4). This region includes five Wyoming counties: Converse, Campbell, Johnson, Natrona, and Niobrara.

Table 3.3. Populations in Converse County, Natrona County, and State of Wyoming

Jurisdiction	2000	2010	Change	Total Change (percent)	Annual Average Change (percent)
Converse County	12,052	13,833	1,781	14.8	1.4
Douglas	5,288	6,120	832	15.7	1.5

Glenrock	2,231	2,576	345	15.5	1.4
Rolling Hills	449	440	-9	-2.0	-0.2
Natrona County	66,533	75,450	8,917	13.4	1.3
Bar Nunn	936	2,213	1,277	136.4	9.0
Casper	49,644	55,316	5,672	11.4	1.1
Edgerton	169	195	26	15.4	1.4
Evansville	2,255	2,544	289	12.8	1.2
Midwest	408	404	-4	-1.0	-0.1
Mills	2,591	3,461	870	33.6	2.9
TOTAL ROI	78,585	89,373	10,788	13.7	1.3
TOTAL WYOMING	493,782	563,626	69,844	14.1	1.3

Source: WEAD, 2012.

3.2.11 Public and Occupational Health and Safety

Existing Chemical Conditions

Section 2.4.1.1 of the GEIS describes the chemicals used in ISR, which uses an alkaline-based lixiviant (i.e., sodium carbonate/bicarbonate and oxygen or hydrogen peroxide) (NRC, 2009a). All current ISR facilities in Wyoming use an alkaline-based lixiviant. In addition, other hazardous chemicals used in the process can include chlorine, hydrogen peroxide, and caustic soda or ammonia (NRC, 2009a).

Section 1.10.2 of the Licensee's TR (Cameco, 2015) describes the process of recovering uranium from the subsurface ore body at the Smith Ranch site. This process mirrors the chemicals and techniques described in the GEIS and summarized in Section 2.1 of this EA. Section 3.5.3.1 of the Licensee's TR (Cameco, 2015) describes its use of the same chemicals described by the GEIS, but it includes the actual chemical concentrations used at the site, and these are at or below the lower range of the spectrum indicated in the GEIS. Lower concentrations will yield less use of these hazardous chemicals as well as will result in fewer chemicals stored at the site, both of which present fewer hazardous chemical conditions at the site.

Existing Radiological Conditions

Annual soil and vegetation sampling were performed at what is now the Smith Ranch site prior to 2000, but this sampling program was terminated in the year 2000 (Cameco, 2014, ER 3.11.5.1). However, Cameco performed background radiological sampling and analysis for specific portions of the Smith Ranch site pursuant to License Condition 9.13 of SUA-1548. These survey areas included MUs K, K-North, 7, 8 and 14, the Southwest Area, and the Reynolds Ranch property, and Cameco submitted and NRC approved these surveys (NRC, 2008a, 2008b, 2008c). Soil samples were taken at 5 cm (2 in) and 15 cm (6 in) depths and

analyzed for radium-226, natural uranium, throrium-230, and lead-210, and direct gamma radiation levels were recorded. Historical gamma readings at the site ranged between 10 and 17 micro-R/hr (Cameco, 2014; ER 3.11.5.2). To put this background radiation level in perspective, exposure at 20 micro-R/hr would result in an annual dose of approximately 175 millirem and the average individual in the U.S. receives a dose of about 300 millirem from all sources of natural radiation, including contributions from radioactive material in soil.

3.3 North Butte Remote Satellite Site

Some aspects of the affected environment at the North Butte site have been previously described in the NRC's EA (NRC, 1990). Therefore, brief discussions of those resource areas are provided in this EA, and the reader is referred to the prior EA for a more detailed description.

3.3.1 Land Use

Surface ownership at the North Butte remote satellite site consists entirely of privately owned land, although Federal and State governments own small amounts of the underlying mineral rights. Within 5 km (3 mi) of the site, the lands are 92 percent privately owned, 6 percent State owned, and 2 percent Federally owned (Cameco, 2014, ER 3.7.1.1). Rangeland is the predominant land use in Campbell County, and the majority of the North Butte site is grassland available for cattle and sheep grazing. Most of the lands in and around the site are shrub land, with pockets of fallow or idle cropland and other hay lands to the east (Cameco, 2014, ER 3.7.1.1).

There are three occupied ranch residences within 8 km (5 mi) of the site; the closest, the Pfister Ranch, is located just south of the southern North Butte license boundary. The locations of the three ranch residences are provided in ER Figure 3.1.6 of (Cameco, 2014).

As discussed previously, Cameco commenced ISR operations at the North Butte site in May 2013. Two wellfields are currently in production, and loaded IX resins are transported to the Smith Ranch CPP for further processing (NRC, 2016). Wellfield MU-1 encompasses approximately 27 ha (66 acres) and has 2.7 km (1.7 mi) of access roads, 10 header houses, and 539 production and injection wells, while wellfield MU-2 encompasses approximately 25.7 ha (63.5 ac) and has 6.1 km (3.8 mi) of access roads, 9 header houses, and 516 production and injection wells (Cameco, 2015).

Coal bed methane (CBM) production is limited in the area adjacent to the North Butte site, with wells present south and northwest of the site. The North Butte site does include portions of planned CBM development (i.e., the Dry Willow Phases I and II), but CBM production does not currently occur on the site (Cameco, 2014, ER 3.1.7.1).

Permission to hunt mule deer and antelope requires the consent of the respective private landowner. The same landowners limit recreational uses of Federal and State parcels near the site by controlling access to those parcels (Cameco, 2014, ER 3.1.7.1).

The North Butte site consists of approximately 3.4 km (2.1 mi) of access roads that disturbed approximately 2 ha (6 ac). The UIC Class I deep disposal well (Federal BY-2) and a 45-m^2 (480-ft^2) building (Cameco, 2014a) are also present at the North Butte site.

3.3.2 Transportation

The North Butte remote satellite site can be accessed from Gillette, Wyoming, by traveling south on SH 50 to just south of Savageton, Wyoming, and then west on Van Buggenum Road to Christensen Road. After approximately 10 km (6 mi) on Christensen Road, the site is accessed via an existing oil field road owned by the T-Chair Ranch (Cameco, 2014, ER 3.2.2). For those living near Wright, Wyoming, one would take SH 387 west to SH 50 north to the turn onto Van Buggenum Road.

The Van Buggenum Road is a 7.4 m (24 ft) wide crowned-and-ditched road that is wide enough to handle two tractor trailers passing one another. The speed limit is posted at 72 km/hr (45 mph). The Van Buggenum Road leading to Christiansen Road (east of the North Butte entrance) sees 57 cars per day (Campbell County, 2012). Ranch roads on the T-Chair Livestock Company property are also gravel crowned-and-ditched roads. These roads range from 4.6 to 6.0 m (15 to 20 ft) wide and are constructed and maintained by the landowner and nearby mining interests. The speed limit for the ranch roads is 40 to 48 km/hr (25 to 30 mph) (Cameco, 2014, ER 3.2.2).

The monthly average daily traffic count in January 2015 for SH 387 east of Pine Creek Junction was 1,611 vehicles, with an annual average daily traffic count of 1,645 vehicles in 2014 at this location (WYDOT, 2015). For SH 50 near Savageton, Wyoming, the estimated annual average daily traffic count in 2013 was 1,303 vehicles (WYDOT, 2013). According to the WYDOT Monthly Automatic Traffic Recorder Report for 2012, SH 50 leading to the North Butte project saw 11,140 cars per day (WYDOT, 2012).

3.3.3 Geology, Seismology, and Soils

Geology

The ore zone geology at the North Butte site was described previously in the NRC's 1990 EA (NRC, 1990). The target uranium ore zone horizon is in the lower part of the Eocene-aged Wasatch Formation, at an approximate average depth of 150 to 200 m (500 to 650 ft) from the surface (Cameco, 2014, ER 3.3.2.2.2). Cameco identified three primary mineralized sandstone layers , in descending order from the ground surface, as the "C", "B", and "A" sands, and the primary ore-bearing interval is the B sand (Cameco, 2014, ER 3.3.2.2.2). Stratigraphically continuous shale units (the FC Shale above and the A1 shale below) bound the mineralized sandstone layers (Cameco, 2014, ER 3.3.2.2.2).

Seismology

The North Butte project area is located in a relatively quiet seismic region that could expect minor disturbances from distant earthquakes. The most probable source of earthquakes affecting the site would be a moderate seismic risk belt that extends along the Wyoming-Idaho border, more than 322 km (200 mi) west of the permit area (NRC, 1990). There are no known exposed active faults with a surficial expression in the vicinity of the North Butte site, and evidence of structural instability at the site, such as faulting, has not been observed during field observations or through correlation via drill holes (Cameco, 2014, ER 3.3.2.2.3).

Soils

Uranerz, the former NRC site licensee, conducted a soils study at the North Butte site in the late 1980s, and Cameco performed a confirmatory study in 2010 (Cameco, 2014, ER 3.3.4.2). The study results are summarized below.

The site topography consists of flat to gently sloping terrain with two moderate to large drainages in the western portion and three moderate to small drainages in the east. All the drainages generally trend from the north to the south, eventually entering Willow Creek near the southern North Butte site boundary (Cameco 2014, ER 3.4.3.1.1). In the western portion of the site, closer to North Butte, the terrain is more steeply sloped and the drainages are more incised (Cameco, 2014, ER 3.3.2.2.1).

3.3.4 Water Resources

3.3.4.1 Surface Water

The North Butte site is located in the Willow Creek drainage, which is a tributary to the Powder River and, ultimately, to the Yellowstone and Missouri Rivers. Willow Creek and its tributaries generally flow only in response to heavy snow melt and large rainstorms and so are classified as "ephemeral" streams (Cameco, 2014, ER 3.4.3.1.1). While Willow Creek can flow intermittently in the spring and early summer, it remains dry for the rest of the year except during major storms.

The State of Wyoming has designated Willow Creek's use as Class "2C surface water," which corresponds to nongame fishery, aquatic life, wildlife, agriculture, industry, and scenic value (WDEQ, 2013). Typical uses of surface water at and near the North Butte site are for livestock and wildlife watering (Cameco, 2014, ER 3.4.3.1.1).

Cameco collected surface water samples from 12 locations, in August 2010 and again in June and September 2011; most of the samples came from surface water impoundments. The water quality of these samples exhibited wide variability due to the different sources of the water sampled and the degree of evaporation through the summer and fall (Cameco, 2014, ER 3.4.3.1.1).

There are 16 adjudicated rights for surface-water use located within a 5-km (3-mi) radius of the North Butte site, according to the Wyoming State Engineer's Office (WSEO) records. All are for either reservoirs or stock reservoirs that contain water during a wet spring and/or following a significant rainfall/runoff event (Cameco, 2014, ER 4.4.1.1.2). There are no surface-water rights for diversion of direct flows from Willow Creek or its tributaries within 5 km (3 mi) of the site boundary (Cameco, 2014, ER 3.4.3.1.1).

3.3.4.2 Wetlands

Cameco conducted site surveys in 2010 to update the delineation of wetland areas and identified one wetland (a small stock pond encompassing an area of 0.02 ha (0.05 ac)) in the northeast corner of Section 24 Appendix D11 of the North Butte WDEQ Permit to Mine. The USACE has verified the wetland delineation (Cameco, 2011a; Appendix D11).

3.3.4.3 Ground Water

Aquifers

As discussed in section 3.3.3 of this EA, the host uranium-ore horizons are located in the Wasatch Formation, and the mineralized sandstone layers identified by Cameco, in descending order, are the "C", "B", and "A" sands, with the primary ore-bearing interval being the B sand. These three sand layers are directly connected at some locations under the North Butte site and are considered the production-zone sands at those locations (i.e., the ore-zone aquifer). These water-bearing sands have been found to be confined and to flow generally to the northwest (Cameco, 2014, ER 3.4.3.2.6)

The Fort Union Formation, underlying the Wasatch Formation, is comprised typically of lenticular fine- to coarse-grained sandstone with interbedded claystone, siltstone, and coal. This aquifer, which can be up to 900 m (3,000 ft) thick, is an important water-supply source in the Powder River Basin of Wyoming (Cameco, 2014, ER 3.4.3.2.1).

Below the Fort Union Aquifer are the Lance and Fox Hills Aquifers. These aquifers are at a depth and have a low ground water yield (less than 400 L/min (100 gal/min)) that make them unlikely to be tapped for water supplies in the future (Cameco, 2014, ER 3.4.3.2.1).

Water Quality

Baseline ground water quality data for the uranium-ore horizon sands were collected by the original site owners in the 1980s and then compared by Cameco to samples it collected in 2010 (Cameco, 2014, ER 3.4.3.2.7). Cameco found that the 2010 data compared favorably with the 1980s data. Additionally, the 2010 data indicates that the ore zone water quality is dominated by calcium-sodium bicarbonate-sulfate water, and that radium-226 and gross alpha concentrations exceed the WDEQ Water Quality Division (WQD) Class III standards, making these waters unsuitable for livestock use (Cameco, 2014, ER 3.4.3.2.7).

Ground water standards for drinking-water use and agricultural use are exceeded in the ground water sampled in the ore-zone sands at the North Butte site. TDS concentrations exceed WDEQ's drinking-water standard and the EPA's secondary MCL for drinking water in the A, B, BC, and C Sands. Sulfate concentrations consistently exceed the standards for drinking-water and agricultural uses. Dissolved concentrations of iron and manganese are occasionally greater than the drinking-water standards.

The licensee sampled water from seven private stock wells located within 2 km (1.2 mi) of the North Butte site. These data are reported in Table 3.4-9 of the ER (Cameco, 2014). The TDS concentrations exceed WDEQ's drinking-water standard and EPA's secondary MCL for drinking water. Sulfate concentrations consistently exceed the standards for drinking water and agricultural uses. In one well, the concentration of dissolved manganese is greater than the drinking-water standards, and in another well, the dissolved selenium concentration exceeds the drinking-water and agricultural standards. The uranium concentration exceeds the EPA's primary MCL for drinking water in three wells. Gross alpha radioactivity is consistently detected at levels greater than the standards for drinking-water and agricultural uses.

High levels of TDS characterize the water quality of the deep aquifers targeted for a Class I UIC Permit for waste disposal (NRC, 1990). TDS concentrations range from 11,500 – 20,000 mg/L in water from wells in the Teckla, Teapot, and Parkman Formations at a location within 80 km (50 mi) southwest of the North Butte site. Because the TDS generally increases with distance

into the Powder River Basin, the NRC concluded that the TDS of water in these Formations at the North Butte site would likely be about 10,000 mg/L (NRC, 1990).

Uses

There are 778 ground water rights within a 5-km (3-mi) radius of the North Butte site, with approximately half of these which are related to CBM production wells (Cameco, 2014, ER 3.4.3.2.8). The remaining water wells are primarily used for industrial purposes (e.g., exploration drilling, water-quality monitoring, ISR-related hydrologic studies), and a limited number (approximately 39) are dedicated to livestock watering and domestic use. Three of these wells are within the North Butte site boundary and are used by the T-Chair Land Company for stock watering. Five permitted domestic wells are within 5 km (3 mi) of the North Butte site. One non-permitted domestic well is located just south of the site at the Pfister Ranch (the "Beck Well"). This well is used for lawn and stock watering. Water for household consumption is brought to the ranch by truck (Cameco, 2014, ER 3.4.3.2.8).

3.3.5 Ecological Resources

As with the Smith Ranch site, the North Butte site is located within the Powder River Basin of the Wyoming Basin ecoregion as described in GEIS Section 3.3.5 (NRC, 2009a). Ecological studies were conducted as part of the original licensing of the site, and Cameco updated those survey results with its own in 2010 (Appendix A.1 to Cameco, 2014, Section 2).

3.3.5.1 Vegetation

The vegetation communities at the North Butte site are sagebrush-grassland (62.2 percent), grassland (34.5 percent), bottomland (2.5 percent), and juniper-sagebrush (0.8 percent) (Cameco, 2014, ER Appendix A.1). Cameco's 2010 survey identified 25 noxious weeds and one selenium indicator species – two-grooved milkvetch (Cameco, 2014, ER Appendix A.1)

3.3.5.2 Wildlife

Wildlife surveys were conducted for the initial licensing of the North Butte site, and Cameco partially updated the survey results with its own survey in 2010. The 2010 surveys found 27 raptor nests and relocated 4 known greater sage-grouse (*Centocercus urophasianus*) leks, but did not find mountain plovers (*Charadrius monfanus*), black-tailed prairie dogs (*Cynomys ludovicianus*), or swift foxes (*Vulpes velox*) (Cameco, 2014, ER Appendix A1).

3.3.5.3 Protected Species

The FWS includes nine Federally-listed threatened, endangered, or candidate species with potential to be impacted by projects in Campbell County, Wyoming, (FWS, 2018b). These species are afforded specific protection under the Endangered Species Act of 1973 (ESA). Other protected species include migratory birds as protected by the Migratory Bird Treaty Act of 1918 (MBTA), and, in the case of bald and golden eagles, the Bald and Golden Eagle Protection Act of 1940.

Through a habitat assessment and desktop/field-based plant species inventory, Cameco identified the potential for Ute ladies'-tresses and blowout penstemon to occur at the North Butte site. However, a subsequent field study did not identify habitat suitable for Ute ladies'-tresses orchids or blowout penstemon on the site, and neither of these plants was observed during the study (Cameco, 2014, ER Appendix A.1).

As discussed under the "Wildlife" section for this site, Cameco's contractor did not identify mountain plovers, black-tailed prairie dogs, or swift foxes at the North Butte sites. Bald eagles were observed at Pumpkin Buttes during the winter months and the buttes provide roosting sites; however, the 2010 survey did not identify any bald eagle nests at the North Butte site. Peregrine falcons (*Falco pergrinus)* are rare visitors to the area and no peregrine falcon nests were identified in the 2010 survey. Three State species of concern (Brewer's sparrow (*Spizella breweri*), lark bunting (*Calamospiza melanocorys*), and golden eagle (*Aquila chrysaetos*)) were observed (Cameco, 2014, ER Appendix A.1).

Additionally, individual greater sage-grouse have been observed on the North Butte site, but no leks have been identified on the site. A survey of four identified leks within 3.2 km (2 mi) of the site found only one lek in use (Cameco, 2014, ER Appendix A.1).

3.3.6 Meteorology and Air Quality

The licensee installed an on-site meteorological station at the North Butte site in December 2010 and operated the station until 2013 (Cameco, 2014, ER 3.6.3.1). Meteorological data collected included: wind speed, wind direction, temperature at 2 m (6.6 ft) height, relative humidity, precipitation, solar radiation, and temperature at 10 m (32.8 ft) height (Cameco, 2014, ER Appendix C). Cameco compared the data from the first year of the station's operation with the longer data record measured at Antelope Mine, which is located 58 km (36 mi) southeast of the North Butte site (Cameco, 2014, ER Appendix C). Based on that comparison, Cameco considers the North Butte meteorological data for that first year of operation to be representative of long term data at the site. Data for the North Butte and Antelope Mine sites are shown in Table 3.4. No air-quality monitoring has been conducted at the North Butte site itself.

Table 3.4 Meteorological Data Measured at the North Butte Site and Antelope Mine

Parameter	North Butte Site[1]	Antelope Mine[2]
Average Wind Speed (m/s / mi/hr)	4.8 / 10.7	5.1 / 11.3
Wind Direction (Predominant)	SW (17 percent of time)	W (15 percent of time)
Average Annual Temperature (°C/ °F)	7.9 / 46.2	7.2 / 44.9
Average Annual Precipitation (mm / in)	300 / 11.8	282 / 11.1

Table 3.4 Meteorological Data Measured at the North Butte Site and Antelope Mine

Parameter	North Butte Site[1]	Antelope Mine[2]
Season of Maximum Precipitation	Spring	Spring
Atmospheric Stability (Predominant)[3]	D (60 percent of time)	D (60 percent of time)

Source: Cameco, 2014, ER Appendix C.

[1] Data collected from December 2010 through January 2012.

[2] Data collected January 1997 through December 2011.

[3] The atmospheric stability is defined by the Pasquill-Gifford stability classes, where A and B are unstable (excellent dispersion of pollutants); C is neutral; and D-F are considered stable (poorer for dispersion of pollutants).

3.3.7 Noise

The area within the 3-km- (2-mi-) radius surrounding the North Butte site is predominantly rangeland, in addition to some CBM-production operations and other uranium-recovery operations in the general area (i.e., Nichols Ranch and Willow Creek) (Cameco, 2014, ER 3.7.2). At the North Butte site, ambient noise levels are more dominated by these nearby energy-related operations (PRI, 2014). The Pfister Ranch house, located approximately 1 km (0.5 mi), south of the North Butte site, is the nearest occupied residence (i.e., noise receptor) to ISR activities at the site.

3.3.8 Historic and Cultural Resources

Class III cultural-resource inventories were conducted at the North Butte site in 2005, 2006, 2007, and 2010. The 2005, 2006, and 2007 surveys were conducted in support of planned CBM activities, while the 2010 survey was conducted in support of Cameco's mine permit update with the WDEQ. By these four surveys, the entire North Butte remote satellite site has been inventoried for historic resources. These surveys did not identify within the direct Area of Potential Effect (APE) any sites that are recommended for eligibility under the National Register of Historic Places (NRHP), but did identify several sites that are recommended for eligibility within the larger license area boundary for the North Butte site. Section 7.0 of this EA provides details about the NRC's NHPA Section 106 consultation process for the proposed license renewal.

3.3.9 Visual and Scenic Resources

The licensee's North Butte remote satellite site is characterized by gently rolling hills and low ridges, and the Pumpkin Buttes are the most important visual resource in the area (Cameco,

2014, ER 3.9.4). Willow Creek and its associated drainages near the southern boundary of the North Butte site contain running water only seasonally and not necessarily every year. Man-made modifications or structures include Cameco's recently constructed ISR-related features, as well as oil-production and CBM facilities, ranches, overhead utility lines, roads, fences, and stock-watering tanks (PRI, 2014). The remote satellite site is not visible from 16 km (10 mi) in all directions due to the low-lying hills that surround the site, but it is visible from a distance of approximately 8 km (5 mi) in all directions except from the north (Cameco, 2014, ER 3.9.4).

Cameco's North Butte site is located in prairie landscape of the Powder River Basin southwest of Gillette, Wyoming, and near the Pumpkin Buttes. Approximately 90 percent (370 ha (915 ac)) of the site has been rated as VRM Class III, with the remaining approximately 10 percent (38 ha (95 ac)) rated as VRM Class IV (Cameco, 2014, ER Figure 3.9.2A). The site lies at the base of North Butte, which is one of the Pumpkin Buttes.

Results of a site-specific Scenic Quality Inventory and Evaluation rated the site with a total score of 17 due to the water that was present in the area, the variation in color, and the adjacent scenery, with its distinctive buttes that greatly enhance the visual quality (Cameco, 2014, ER 3.9.4).

3.3.10 Socioeconomics

The nearest communities to the North Butte site are Wright, a small incorporated town in Campbell County located northwest of the site on Highway 387, and the towns of Edgerton and Midwest, located in Natrona County southwest of the site. Other nearby towns are Kaycee, located in Johnson County west of the site at the junction of Highway 192 and Interstate-25 (I-25), and Gillette, located in Campbell County northeast of the site at the junction of Highway 59 and I-90 (Cameco, 2014, ER 3.10.3.1.1). As noted previously in section 2.4 of this EA, Cameco anticipates that of the expected average of 40 operational staff for the facility, 75% (30 employees) would be traveling from the Gillette area and 25% (10 employees) would travel from the Casper area.

Table 3.5 presents the 2000 and 2010 population data for these potentially affected jurisdictions. Campbell County is the third most populous county in the State after Laramie County and Natrona County, respectively.

Table 3.5. Populations in Campbell County, Johnson County, and State of Wyoming

Jurisdiction	2000	2010	Change	Total Change (percent)	Annual Average Change (percent)
Campbell County	33,698	46,133	12,435	36.9	3.2
Gillette	19,646	29,087	9,441	48.1	4.0
Wright	1,347	1,807	460	34.1	3.0
Johnson County	7,075	8,569	1,494	21.1	1.9
Buffalo	3,900	4,585	685	17.6	1.6

Kaycee	249	263	14	5.6	0.5
Natrona County	66,533	75,450	8,917	13.4	1.3
Casper	49,644	55,316	5,672	11.4	1.1
TOTAL ROI	107,306	130,152	22,846	21.3	2.1
TOTAL WYOMING	493,782	563,626	69,844	14.1	1.3

Source: WEAD, 2012.

ER Section 3.10.3 of Cameco's license renewal application provides more detailed information about socioeconomic characteristics of the region surrounding the North Butte remote satellite site (Cameco, 2014). That discussion addresses income and earnings, employment structure, housing, finance, education, and health and social services.

No minority or low-income populations have been identified in the 80 km (50 mi) region around the North Butte site (Cameco, 2014; ER Section 3.10.3.1.2). This region includes four Wyoming counties: Campbell, Converse, Johnson, and Natrona).

3.3.11 Public and Occupational Health and Safety

Cameco conducted a background gamma radiation survey in 2010, on portions of the North Butte site; 423 readings were taken at four locations (Cameco, 2014, ER 3.11.6.3). Elevated gamma readings were not found during the survey, with an overall mean of 15 micro-R/hr and a maximum reading of 20 micro-R-hr. To put this background radiation level in perspective, exposure at 20 micro-R/hr would result in an annual dose of approximately 175 millirem and the average individual in the U.S. receives a dose of about 300 millirem from all sources of natural radiation, including contributions from radioactive material in soil. Cameco also conducted radionuclide analyses of soil samples collected from the top 15 cm (6 in) and found the results of the analyses to be in general agreement with the results of similar analyses performed in the 1980s (Cameco, 2014, ER 3.11.6.3).

3.4 Gas Hills Remote Satellite Site

The affected environment at the Gas Hills remote satellite site has been previously described in the NRC's EA (NRC, 2004) and more recently in the BLM's Final EIS (BLM, 2013). Therefore, summary discussions of the resource areas are provided in this EA, and the reader is referred to these prior environmental documents for a more detailed description.

3.4.1 Land Use

Located in eastern Fremont and western Natrona Counties, Wyoming, the Gas Hills site encompasses approximately 3,400 ha (8,500 ac). Surface ownership consists predominantly of Federally-owned lands (94 percent) managed and leased by the BLM for cattle and sheep grazing, with interspersed privately-owned (4 percent) and State-owned lands (2 percent) (BLM, 2013; Table 3.4-1). BLM manages the surface ownership and the subsurface mineral rights for all but 24.7 ha (61 ac) at the Gas Hills site (BLM, 2013; Section 3.4.2). Within 8 km (5 mi) of the Gas Hills site, surface ownership is 85 percent Federal, 8 percent private, and 7 percent State (Cameco, 2014, ER 3.1.8.1).

Some features at the site and in the surrounding region remain from open-pit and underground uranium mining that was conducted at the site and in the surrounding region from the 1950s to the early 1980s (BLM, 2013; Executive Summary). Approximately 15 percent of the site (approximately 526.1 ha of the 3439.8 ha (1,300 ac of the 8,500 ac) site has been disturbed by historical operations, including land disturbed by the uranium mining and by exploration drillholes and associated roads. Vegetation has been re-established on approximately 900 ac of the previously disturbed lands, and currently, the existing infrastructure, consisting of roads, utilities, and structures, result in approximately 131 acres of disturbance (BLM, 2013; Executive Summary).

Portions of the Gas Hills site have been disturbed in connection with prior underground and surface mining activities, including access-road construction and exploration drilling. As of 2010, the existing area of disturbance in connection with these activities is 624 ha (1,541 ac) (Cameco, 2014, ER 3.1.8.2). Disturbance associated with activities under SUA-1548, which include the Carol Shop, access roads, and monitor well installation, total approximately 40 ha (98 ac) (Cameco, 2014, ER 3.3.4.3). Several stockpiles of topsoil that occupy approximately 1.2 ha (3 ac) are distributed throughout the Gas Hills site for the purpose of reclamation of disturbed areas. Two main roads within the site area, along with smaller exploration and grazing roads, disturb approximately 45 km (28 mi) and 28 ha (69 ac) (BLM, 2013).

The nearest occupied residence to the Gas Hills remote satellite site, the JE Ranch, is located approximately 8 km (5 mi) from the site boundary (Cameco, 2014, Figure 3.1.8).

3.4.2 Transportation

Access to the Gas Hills site is primarily by Wyoming State Route 136, which starts south of Riverton, Wyoming and ends just west of the site where it becomes Ore Road (Fremont County Road (CR) 5). Additionally, the site can be accessed from the north by Castle Garden Road (CR 507), Buck Camp Road (CR 508), and Gas Hills Road (CR 212), all starting from U.S. Highway 20/26. From the south, one travels on Ore Road (CR 5), which originates from U.S. Highway 287/789. Finally, the Gas Hills Road also can be reached from the east at the Waltman exit off US 20/26. Figure 3.12-1 in BLM's Final EIS (BLM, 2013) shows the transportation routes around the Gas Hills remote satellite site.

Between 2005 and 2015, total traffic along SR 136 (recorded at its junction with Castle Garden Road) increased 59 percent, while U.S. Highway 20/26 at Moneta (near the Castle Garden Road exit) and at Waltman showed a 6.8 percent increase and a 3.5 percent decrease, respectively, over the same period.

3.4.3 Geology, Seismology, and Soils

Geology

The ore-bearing sandstones targeted for uranium recovery at the Gas Hills site are within the Wind River Formation, which is a sequence of alternating sandstone and shale layers (Cameco, 2014). The sand units in the Wind River Formation are numbered by even increments of 10 starting with the deepest sand unit designated as 10 Sand. Production-zone sands targeted by Cameco at the Gas Hills site include the 30, 40, 50, 60, 70, 80 and 90 intervals, depending on the area intended for ISR recovery. Confining units for the production-zone sandstones are layers of interbedded shale, mudstone, claystone, and siltstones.

Cameco has identified five areas (mine units) for uranium recovery: MUs 1, 2, 3, 4, and 5. The stratigraphy of the Gas Hills site is complicated by extensive inter-bedding of various layers, and by faulting. Due to this complexity, Cameco's exploration drilling and interpretation of ore-zone geology have been pursued on an area-by-area basis and would be refined with data it acquires during further delineation drilling and hydrologic testing (Cameco, 2014, ER 3.3.2.3.3).

Traceable faults (i.e., faults that are continuous, mappable, and have enough displacement to offset sand layers) are known to be present in all of the Mine Units except MU 1 (NRC, 2004, PRI, 2009). Geologic exploration has identified two traceable faults, the Bountiful Fault (12-15 m (40-50 ft) of displacement) and the Uranium Point Fault Zone (UPZ) (up to 15 m (50 ft) of displacement), through the proposed MU 2. The PCH, Jasper, and Lucky Mc faults have been mapped through or near the proposed MU 3. MU 4 would intersect the Buss Fault, which has approximately 15 m (50 ft) of displacement. One unnamed traceable fault, with approximately 46 m (150 ft) of displacement and marking the southern side of the Thunderbird Graben, intersects MU 5.

The licensee reported that the geology at the Gas Hills site has been affected by a long and complicated history of open pit and underground uranium mining within and near the license area. A description of the prior mining disturbances, including name, location, and reclamation status was presented by the licensee in Table D6-1-1 of Appendix D6 of the Gas Hills WDEQ permit application (Cameco Resources, 2012c). The locations of the disturbances were also shown in Plates D6-1 and D6-3 of the same permit application (Cameco Resources, 2012c).

Seismology

Since 1973, there have been 25 earthquakes greater than a 2.0 Richter Scale magnitude within approximately 100 km (60 mi) of the site (BLM, 2013; Section 3.3.3.1). The two strongest of these, both of 4.8 magnitude, took place in 1973 and 1975 approximately 15 miles west and southwest of the site (Case et al. 2003, 2002; (USGS), 2011a).

The USGS ground motion hazard mapping indicates that potential ground motion hazard in the Gas Hills site is low. The hazard map indicates that the site is located within an area with a predicted 10-percent probability of experiencing a peak ground acceleration of less than 0.06 g (less than 6 percent of the force of gravity) in in 50 years (Petersen et al. 2008). A peak ground acceleration of 0.06 generally corresponds to a perceived moderately shaking and potential light structural damage (USGS, 2003)

Soils

A variety of soils occur at the Gas Hills site, stemming primarily from a variety of parent materials influenced by topography, aspect, elevation, vegetation, and differential rates of mineral weathering. Additionally, approximately 526 ha (1300 ac) of the site have been either disturbed or disturbed and reclaimed (BLM, 2013, Section 3.11.2).

Approximately 44 percent of the soils at the site are highly erodible by water, while soils susceptible to wind erosion are not present (BLM, 2013; Figure 3.11-1). However, exposed or loose soils may be prone to wind erosion even if they are not erosion prone.

3.4.4 Water Resources

3.4.4.1 Surface Water

Surface water within the Gas Hills site flows primarily to the northwest to West Canyon Creek, whose tributaries drain approximately 70 percent of the site (Cameco, 2014, ER 3.4.4.1.1). West Canyon Creek is tributary to Canyon Creek, which drains to Deer Creek, and subsequently enters Poison Creek, which empties into Boysen Reservoir on the Wind River (BLM, 2013; Section 3.15.1). Fraser Draw and its tributaries drain approximately 25 percent of the southwest portion of the site. Fraser Draw is a tributary to Muskrat Creek, but is impounded by a reclaimed waste pile at Pathfinder Mine Corporation's Central Gas Hills surface mine (Cameco, 2014, ER 3.4.4.1.1). A small southern area of the site drains to Upper Diamond Springs, and a small southeastern area along the Gas Hills site boundary drains to West Sage Hen Creek. Both of these drainages are in the Sweetwater River Basin (BLM, 2013; Figure 3.15-1).

Surface water exists in various forms within the project site. These include a number of springs, West Canyon Creek (spring-fed), reservoirs and ponds that are remnant of previous mining activity at the site. Surface flows are ephemeral in nature and drainage areas are usually dry. Stream beds and ponds may develop from intense thunderstorms or melting snow, but these waters dissipate through percolation, runoff, and evaporation. The quality of the surface waters can vary significantly in terms of their chemical, physical, and radionuclide characteristics (NRC, 2004, Section 2.7.1).

The WDEQ/WQD use classification of 3B applies to the surface water within the Gas Hills site. The 3B use classification corresponds to aquatic life, recreation, wildlife, agriculture, industry, and scenic value (WDEQ/WQD, 2001; WDEQ/WQD, 2007). There are no surface-water bodies at the site that are listed by the State of Wyoming as being either a threatened or impaired stream (WDEQ/WQD, 2012; BLM, 2013; Section 3.15.1.2).

In general, the surface-water sources at the Gas Hills site are acceptable for wildlife and livestock consumption (Cameco, 2014, ER 3.4.4.1.2). Iron, manganese, arsenic, and zinc are frequently present in detectable levels, but they generally do not exceed livestock standards. The TDS concentrations are consistently below the livestock standard of 5,000 mg/L. Uranium and radium-226 are generally below the livestock standards of 5 mg/L and 0.19 Bq/L (5 pCi/L), respectively; however, these levels are occasionally exceeded (Cameco, 2014, ER 3.4.4.1.2).

In November 2011, WSEO recorded eight surface-water rights within 2 km (1.2 mi) of the Gas Hills site. Seven rights are for stock watering or wildlife maintenance uses and one right is for industrial use associated with the B-Spoils Reservoir (Cameco, 2014, ER 3.4.4.1.3 and Figure 3.4.6).

3.4.4.2 Wetlands

Cameco identified and mapped approximately 11 ha (28 ac) of potential wetlands at the Gas Hills site, based upon the presence of potential wetland vegetation (NRC, 2004, Section 2.8.3). Most of the observed vegetation was along or within the West Canyon Creek stream channel or along the margins of Cameron Spring Reservoir; however, wetland vegetation was also identified at several small seeps originating from the base of the Beaver Divide near the southern boundary of the Gas Hills site (Cameco, 2014, ER 3.5.5).

3.4.4.3 Ground Water

Aquifers

The Wind River Formation contains the aquifers of primary importance within the project area. It consists of alternating layers of sandstone, siltstone, claystone, and conglomerate. The water bearing sands and conglomerate units are collectively referred to as the Wind River Aquifer. Ground water flow within this aquifer at the Gas Hills site is generally to the west and southwest but is influenced by past mining activities.

The Wind River Aquifer is underlain by a thick sequence of aquifers and aquitards. The primary aquifers in this sequence are the Cloverly Formation, the Nugget Formation, and the Tensleep Formation. The Chugwater and Sundance Formations compose the primary aquitards underlying the Wind River Formation beneath approximately 90 per cent of the project area (NRC, 2004). The Wind River Aquifer is overlain by the Wagon Bed, White River, and Split Rock Formations; the primary aquifer is the Split Rock Formation, which is a significant ground-water resource south of the project area (NRC, 2004, Section 2.7.2.1).

Water Quality

The average uranium concentration measured in the uranium-bearing sands is 0.04 mg/L with a maximum of 0.320 mg/L. Uranium concentrations measured in a few wells slightly exceed the EPA's drinking-water standard of 0.3 mg/L. Radium-226 values in the Wind River Aquifer under the Gas Hills site are generally greater than EPA's drinking-water standard for radium-226 + 228 of 0.19 Bq/L (5 pCi/L). The measurements range from 0.19 Bq/L – 1.8 Bq/L (5 – 50 pCi/L) in the non-ore areas, and from 2.4 – 26.1 Bq/L (65 – 705 pCi/L) in the ore zones (NRC, 2004).

Trace-metal concentrations in both ore and non-ore zones are typically low; most constituents are below their respective detection limits. However, in ground water affected by past mining activities, some trace metals, including iron, manganese and arsenic, are routinely elevated.

Uses

The Licensee identified 177 ground water rights within and adjacent to the Gas Hills site by reviewing WSEO files (Cameco, 2014, ER 3.4.4.2.6). Nearly all of these wells were installed for hydrologic monitoring or industrial purposes. Seven of the ground water rights are associated with wells installed for livestock watering.

There are no domestic-use ground water rights (or wells) within 2 km (1 mi) of the Gas Hills site according to the WSEO. The closest public-water system to the site is the WYDOT's Waltman Rest Area, which is located 37 km (23 mi) northeast of the site (Cameco, 2014, ER 3.4.4.2.6). There is currently a well at the Carol Shop, but it does not meet current drinking-water standards. The Licensee plans to obtain water for project-related, non-industrial uses from an external, bulk potable-water supplier or from a new well completed in a non-uranium-bearing sand unit in the Wind River Formation (Cameco, 2014, ER 3.4.4.2.6). Cameco estimates that, as for the Smith Ranch site, approximately 3.8 million liters (1 million gallons) per year would be used at the Gas Hills site for these purposes. Additionally, the licensee expects to obtain drinking water for the site from a commercial water bottling supplier (Cameco, 2014, ER 3.4.4.2.6).

3.4.5 Ecological Resources

3.4.5.1 Vegetation

Five native vegetation types occur within the project area — mixed sagebrush grassland, rough breaks, bottomland sagebrush, upland grassland, and wetlands. Combined, these vegetation

communities occupy 86 per cent (2,962.3 ha (7,320 ac)) of the approximately 3,439.8 ha (8,500 ac) of the Gas Hills remote satellite site. The remaining 14 per cent of the site is occupied by reclaimed land, disturbed land, and reservoirs (NRC, 2004, Section 2.8.1.1; BLM, 2013, Section 3.13.1). Figure 3.13-1 in BLM's Final EIS (BLM, 2013) shows the distribution of the vegetation cover types at the site.

3.4.5.2 Wildlife

Mixed sagebrush grassland is the most common vegetation community, and a variety of wildlife species associated with that habitat type are found within the Gas Hills site (BLM, 2013; Section 3.17). Big game species (i.e., pronghorn, mule deer, and elk) have been documented at the Gas Hills site in surveys conducted in 2010 and 2011 (BLM, 2013; Section 3.17.1.1).

3.4.5.3 Protected Species

The FWS lists 19 Federally-listed threatened, endangered, or candidate species with a potential to be impacted by projects in Fremont County (FWS, 2013c) and Natrona County, Wyoming (FWS, 2013d). Additionally, individual greater sage-grouse have been observed on the Gas Hills site; however, no leks have been identified on the site. With the exception of the greater sage-grouse, none of these species are known to occur on the Gas Hills site.

Protected species, including special-status species, were most recently discussed in Section 3.17.2 of the BLM's Final EIS (BLM, 2013). Twenty-seven special status species, including Federally-listed, Federally-proposed, Federal candidate, and BLM sensitive species were identified as potentially occurring within the Gas Hills site. Of those, the BLM determined that the following 14 species have high potential for occurrence within the Gas Hills site: the white-tailed prairie dog (*Cynomys leucurus*) (BLM sensitive species), Townsend's big-eared bat (*Corynorhinus townsendii*) (BLM sensitive species), spotted bat (*Euderma maculatum*) (BLM sensitive species), ferruginous hawk (*Buteo regalis*) (BLM sensitive species), burrowing owl (*Athene cunicularia*) (BLM sensitive species), greater sage-grouse (Federal candidate species)[8], Brewer's sparrow (*Spizella breweri*) (BLM sensitive species), loggerhead shrike (*Lanius ludovicianus*) (BLM sensitive species), sage sparrow (*Amphispiza belli*) (BLM sensitive species), mountain plover (*Charadrius montanus*) (BLM sensitive species), northern leopard frog (*Rana pipiens*) (BLM sensitive species), and Great Basin spadefoot (*Spea intermontana*) (BLM sensitive species). The BLM's rationale for determining which species have the likelihood for occurring at the Gas Hills site is provided in Appendix H of the EIS (BLM, 2013).

3.4.6 Meteorology and Air Quality

Cameco operated an on-site meteorological station at the Gas Hills site from November 2010 to 2013 (Cameco, 2014, ER 3.6.4). Data collected at this station included wind speed and direction, temperature, relative humidity, precipitation and solar radiation. Meteorological data for the Gas Hills site comes from a National Weather Service (NWS) station located approximately 1.6 km (1 mi) north of the site, named Gas Hills 4E (BLM, 2013; Section 3.1.1). Regional data are presented from the NWS stations at the Natrona County International Airport in Casper, Wyoming, located approximately 105 km (65 mi) east of the site, and at the Riverton, Wyoming Regional Airport in the BLM EIS (BLM, 2013) and the license renewal application (Cameco, 2014, ER Appendix D).

[8] On October 2, 2015, the U.S. Fish and Wildlife Service found that listing the Greater sage grouse was not warranted (80 FR 59857).

The average wind speed at the Casper station is 5.23 m/s (11.7 mph), while the average wind speed was (14 mph) during the 13 months of Gas Hills site monitoring (Cameco, 2014, ER Appendix D). The highest monthly average temperature at the Gas Hills site was 21.1 °C (70.0 °F) in July and the lowest monthly average temperature of -8.2 °C (17.2 °F) was recorded in February. The average annual precipitation recorded at the Gas Hills 4E site was 240 mm (9.3 in) (Cameco, 2014, ER Appendix D). The predominant atmospheric-stability class is D (i.e., relatively stable).

No air-quality monitoring has been conducted at the Gas Hills site. Criteria-pollutant monitoring data for Fremont and Natrona Counties are presented in Section 3.1.2 of the BLM EIS (BLM, 2013), and levels above the NAAQS and the Wyoming Ambient Air Quality Standards (WAAQS) have not been detected.

The closest Class I PSD areas to the Gas Hills site are the Bridger National Wilderness Area, approximately 128 km (80 mi) to the west, and Wind Cave National Park in South Dakota, approximately 350 km (220 mi) to the east-northeast (BLM, 2013; Section 3.1.2).

3.4.7 Noise

The Gas Hills site is rural, with noise from wind and wildlife, as well as from cattle and ranch vehicles (BLM, 2013; Section 3.6). Other sources of noise in the area include traffic along SH 136 and Dry Creek Road, and from ongoing mine-land reclamation activities within 3 to 6 km (2 to 4 mi) of the Gas Hills site. The nearest occupied residence is the JE Ranch, which is located approximately 8 km (5 mi) northeast of the site boundary (Cameco, 2014, Figure 3.1.8). Cameco has not performed a noise study within the site boundary area (BLM, 2013; Section 3.6).

3.4.8 Historical and Cultural Resources

Historic and cultural resources at and in the vicinity of the Gas Hills site were most recently described and discussed in Section 3.2 of the BLM EIS (BLM, 2013). Based on cultural resources inventories conducted at the site, a total of 78 prehistoric cultural resources are located within the site boundaries. Of these, 23 are eligible for listing on the NRHP and 55 are not eligible. A total of 9 NRHP-eligible sites and 16 ineligible sites are located in proposed disturbance areas and could be directly affected by ground-disturbing activities associated with the proposed action. For the sites located in proposed disturbance areas, nine sites required Native American consultation to determine their eligibility, and all were determined to be eligible for listing on the NHRP (BLM, 2013, Section 3.2.1.4).

The NRC's NHPA Section 106 consultation process for the Gas Hills site was conducted during and in support of the NRC's review and approval of the addition of this site to NRC License SUA-1548 in 2004. The discussion in the preceding paragraph is associated with the BLM's Section 106 process, conducted as part of BLM's review of Cameco's 2010 Plan of Operations for the Gas Hills site.

3.4.9 Visual and Scenic Resources

The landform in the Gas Hills site vicinity is generally low, rolling hills cut in places by drainages, and there are no major water features in the study area of sufficient quality or scale to have a notable effect on the visual environment (BLM, 2013; Section 3.14). The effects of prior mining activities in the area (e.g., pits, waste rock piles, access roads) are visible, along with fence lines, corrals, and stock tanks associated with ranching in the area (BLM, 2013; Section 3.14).

Cameco conducted a site-specific Scenic Quality Inventory and Evaluation for the Gas Hills site and rated the site with a total score of 10, largely due to Beaver Rim, which dominates the local landscape. With that low total score, Cameco did not further evaluate the existing scenic resources. Approximately 92.5 percent of the Gas Hills site (approximately 3,180 ha (7859 ac)) is categorized as VRM Class IV, while the remaining 7.5 percent of the site (approximately 261 ha (646 ac)) is classified as VRM Class V, during reclamation after prior mining activity.

3.4.10 Socioeconomics

The Gas Hills site is on the Fremont/Natrona county line, and approximately 80 percent of the project area is located in Fremont County (BLM, 2013; Section 3.10). The three largest communities and most likely to be affected by potential employment and population changes associated with activity at Gas Hills are Lander, Riverton, and Casper (BLM, 2013; Section 3.10). Population data, income, housing, employment, finance, education, and health and social services are discussed in detail in the BLM EIS.

No minority or low-income populations have been identified in the immediate region around the Gas Hills site (BLM, 2013). Within the BLM's study area counties (Converse, Fremont, and Natrona), the BLM noted that these counties generally are less racially and ethnically diverse than the State of Wyoming as a whole (Table 3.10-2 in BLM, 2013). The only notable exception to this is Fremont County, which contains a large portion of the Wind River Indian Reservation, located 29 miles northwest of the Gas Hills site. Fremont County's population is 20 percent Native American. The percentage of Fremont County's population with incomes below the poverty level was much greater than the state average of 9.8 percent, while the percentages of Natrona and Converse counties' populations below the poverty level were notably lower than the state average. Fremont County also had median household income that was nearly 14 percent lower than the state average. Natrona County's median household income was slightly below the state average while Converse County's was slightly above the state average. The presence of the Wind River Indian Reservation influences the low median household income and higher level of poverty in Fremont County (BLM, 2013; Section 3.10.8.2).

3.4.11 Public and Occupational Health and Safety

Cameco performed a pre-operational radiological survey and soil sampling program to establish the background radiological environment over the proposed project site, including those areas anticipated to be disturbed by ISR operational activities and those areas previously disturbed by conventional uranium mining activities in the Gas Hills area (NRC, 2004, Section 2.11.
In general, the gamma exposure rates in the undisturbed areas of the project site averaged approximately 20 microroentgen per hour (micro-R/hr). To put this background radiation level in perspective, exposure at 20 micro-R/hr would result in an annual dose of approximately 175 millirem (mrem) and the average individual in the U.S. receives a dose of about 300 mrem from all sources of natural radiation, including contributions from radioactive material in soil. Gamma exposure rates, however, in those areas disturbed by previous mining activities

(including areas containing ore and waste stock piles) generally exhibited significantly higher levels of exposure with readings in a few isolated areas were as high as 900 micro-R/hr (NRC, 2004).

The licensee also established a pre-operational air monitoring program at four locations across the Gas Hills site to monitor ambient gamma exposure and radon concentrations. Gamma measurements resulted in average exposure rates of approximately 170 mrem/yr and the average radon concentration was 1.6 pCi/l (NRC, 2004, Section 2.11.4).

4.0 ENVIRONMENTAL IMPACTS

4.1 Introduction

As discussed in this EA, NRC previously evaluated the potential generic environmental impacts of ISR projects on a regional basis (NRC, 2009a). The Smith Ranch Project sites are located in two of the regions evaluated in the GEIS: the WEUMR (Wyoming East Uranium Milling Region) and the WWUMR (Wyoming West Uranium Milling Region). Additionally, the NRC and the BLM have assessed the potential environmental impacts of ISR operations at the various Project sites (see Table 1.1 and Section 1.6.3 of this EA). The NRC staff therefore has used these generic and site-specific environmental evaluations to provide a baseline for the purposes of evaluating impacts from the Proposed Action (i.e. renewal of the NRC license for 10 more years of ISR operations).

Additionally, with respect to the Gas Hills remote satellite site, the BLM issued its Final EIS (BLM, 2013). Given the recent nature of this analysis and the NRC staff's determination that the Proposed Action as identified in that EIS is consistent with the Proposed Action for this EA with regards to the Gas Hills site, the NRC has adopted the BLM's environment impact conclusions, as appropriate, for the respective environmental resource areas (see EA Section 4.4).

In performing its site-specific impact analyses of the Proposed Action and No-Action alternative, the NRC staff used the previous environmental documents, WDEQ permits, and Cameco's license renewal application (Cameco, 2014, Cameco 2015). The NRC staff has also compiled related information from publicly available sources. Citations for these documents are provided in Section 10 (References) of this EA.

NRC has established standards of significance for assessing environmental impacts in Environmental Impact Statements. With the standards of the Council on Environmental Quality's regulations as a basis, NRC assigns each impact one of the following three significance levels:

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

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

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

When presenting impact conclusions from the GEIS (NRC, 2009a), this document will use these three significance levels. However, as discussed in this section, the evaluations in this EA will assess whether the potential impacts from the proposed action are significant or not.

As stated in NRC's regulations at 10 CFR 51.31(a), an EA is used to "determine whether to prepare an environmental impact statement or a finding of no significant impact on the proposed action." According to the U.S. Council on Environmental Quality (CEQ), the significance of impacts is determined by an evaluation of both context and intensity (40 (CFR) Part 1508.27). Context is related to the affected region, the affected interests, and the locality, while intensity refers to the severity of the impact. Section 3.4.6.3 of NUREG-1748 (NRC, 2003) provides the following considerations in determining significance:

- Are there undesirable public health or safety effects?
- Are there unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild/scenic rivers, or ecologically critical areas?
- Are the impacts on the quality of the human environment controversial?
- Are the impacts on the human environment highly uncertain, or do they involve unique or unknown risks?

The following sections of this chapter of the EA discuss potential environmental impacts at the Smith Ranch site and the North Butte and Gas Hills remote satellite sites and the significance of those impacts. This impact assessment assumes that Cameco would operate its facilities at the Smith Ranch Project as proposed in its license renewal application even though on February 5, 2018, Cameco decided to cease production at its U.S. facilities due to continued low uranium prices (see section 1.1 of this EA for further discussion of this decision). The staff's assessment of the No-Action Alternative reflects its evaluation of potential impacts under denial of the proposed license renewal and thus a cessation of uranium production at the Project sites. Depending on the price of uranium over the proposed renewal period and Cameco's actions in response to the price, the NRC staff considers that the potential impacts will range between these two assessments.

With respect to the Ruth remote satellite site, Cameco has stated that it has no plans to develop the site or to conduct ISR operations there under the Proposed Action during the license renewal period (Cameco, 2014, ER 1.4.2). Further development of the Ruth site for ISR activities would require an additional license amendment. By license condition 10.2.2 of SUA-1548, the licensee is required to perform and document, on a quarterly basis, visual inspections of the evaporation pond embankments, fences, and liners, as well as measurements of pond freeboard. The Proposed Action would continue to require these activities, which are protective of the environment and entail only occasional personnel entrance to the site. For these reasons, the NRC staff finds that impacts at the Ruth site would be minor and not significant during the proposed 10-year renewal period. No further discussion of impacts for the Ruth site is presented in this EA.

4.2 Smith Ranch Site

4.2.1 Land Use

Land use impacts from the Project have been previously evaluated for the Smith Ranch site (NRC, 1995, NRC, 2001, NRC, 2006; NRC, 2007; and BLM, 2011). These evaluations addressed impacts from the construction and operation of the Smith Ranch and Highland projects, and from the Reynolds Ranch and SR-2 satellites. In those assessments, the staff addressed the impacts from the fencing of wellfields to deter livestock and wildlife foraging, from landowner controls on hunting, and from surface spills of ISR process-related solutions, and determined that such impacts would be temporary and not significant. In the GEIS, the NRC staff also determined that generic land use impacts from an ISR facility in the WEUMR (where the Smith Ranch site is located) would be SMALL for most construction, operation, and aquifer restoration impacts (e.g., changes to land use, effects on mineral rights, grazing, and recreation activities) (NRC, 2009a). Additionally, SMALL to MODERATE impacts due to earth-disturbing impacts would be expected during the ISR decommissioning phase (NRC, 2009a).

4.2.1.1 Impacts from the Proposed Action

Construction planned under the Proposed Action would impact an additional 190 ha (470 ac) beyond the approximately 570 ha (1,410 ac) previously disturbed by ISR-related activities at the site (Cameco, 2014, ER Section 4.1.1.1). This additional disturbance would increase the percentage of the site disturbed by ISR-related activities from approximately 3.5 percent to 4.7 percent. Cameco also plans to conduct interim restoration of the drilling areas and the wellfields following construction, and to restrict livestock entering the wellfield areas by the use of fencing during ISR operations and aquifer restoration. Due to the interim restoration, Cameco estimates that approximately 99 ha (244 ac) would be long-term disturbance, remaining until final site decommissioning (Cameco, 2014a; ER Section 4.1.1.1). Given the limited additional disturbance resulting from the Proposed Action and Cameco's actions consistent with its WDEQ/LQD permit to conduct interim surface restoration, the NRC staff concludes the impacts during construction, operation, and aquifer restoration would not be significant.

The NRC staff concludes the impacts of site-wide decommissioning would be consistent with those identified in the GEIS (NRC, 2009a), given that the types of activities and equipment used in decommissioning would be similar to those used during construction. The impacts would be expected to be noticeable but localized to the specific areas undergoing decommissioning, due to the widespread nature of the activities across the site, with such impacts decreasing as decommissioning progresses. The overall impacts would be mitigated by Cameco's goal consistent with its WDEQ/LQD permit of returning the site to its pre-ISR uses as wildlife habitat and for livestock grazing (Cameco, 2014, ER Section 4.1.1.1). Therefore, the NRC staff concludes that impacts from site-wide decommissioning are not expected to be significant.

The Proposed Action would allow the continuation of ISR activities on-site. Unrelated to the Proposed Action, existing oilfields and some oil and gas drilling in the general vicinity, as well as nearby existing and proposed renewable-energy projects would continue. The NRC staff does not expect direct or indirect conflicts between ISR activities and these existing or proposed minerals and energy projects. The Proposed Action potentially could delay or preclude exploration and development of other mineral resources potentially present on those portions of the Smith Ranch site that are actively being used for uranium recovery. As noted in GEIS Section 4.2.1 (NRC, 2009a), it is possible that other exploration or recovery operations could co-exist with the Proposed Action, because large portions of the Smith Ranch site would not be affected by any of the ISR phases of the Smith Ranch Project. Overall, the NRC staff concludes that impacts to exploration or production of these minerals or natural resources under the Proposed Action would not be significant.

The Smith Ranch site consists primarily of privately-owned rangeland; therefore public access to the site for hunting and recreation is limited. These restrictions would not be expected to change under the Proposed Action. Limited hunting of deer and antelope occurs on BLM-managed lands, which comprise approximately 6.0 percent of the total site area (Cameco, 2014, ER Section 3.1.6.1). BLM concluded that impacts to big-game hunting would include a temporary loss of approximately 19 ha (46 ac) within and adjacent to areas being developed for the Smith Ranch site, and game could be disturbed by human activities and traffic (BLM, 2011). Hunting opportunities would return, however, once uranium recovery is complete and the disturbed areas are restored and reclaimed. Thus, impacts to hunting and non-hunting recreation resources under the Proposed Action would not be significant.

The Vollman Ranch is the only inhabited residence located on the Smith Ranch site. Construction and operation of new wellfields under the Proposed Action would not directly affect continued use of the ranch. No direct impacts to residential land uses would occur as a result of any of the Smith Ranch Project phases. The Proposed Action would have similar residential land use impacts similar to those of the currently licensed activities at the site, and they would not be significant.

Overall, the NRC staff concludes that impacts to land use from the Proposed Action would be SMALL and not significant.

4.2.1.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, Cameco would cease uranium production at the Smith Ranch site, and transition to aquifer restoration and site-wide decommissioning. Land use at the site would not change during these activities; facility access and other restrictions (e.g., hunting) would be expected to continue. Livestock grazing may increase as individual wellfields are restored and decommissioned and surrounding fencing is removed. Following the completion of site decommissioning, land use should return to its pre-ISR use as livestock grazing and wildlife habitat. The NRC staff therefore concludes that land use impacts from the No-Action Alternative would be SMALL and not significant.

4.2.2 Transportation

Transportation impacts from the Project have been previously evaluated for the Smith Ranch site (NRC, 2006; NRC, 2007; NRC, 2009b; and BLM, 2011). These evaluations addressed impacts from the construction and operation of the Reynolds Ranch and SR-2 satellites and from the PRI's proposal to process third party IX resins. The staff determined that impacts from these actions on local roads and related to accidents would not be significant. The NRC staff also determined that generic transportation impacts from an ISR facility in the WEUMR (where the Smith Ranch site is located) would be SMALL to MODERATE due to (1) higher traffic counts on less-traveled roads, and (2) dust and noise impacts to residents in the vicinity of unpaved roads used by the ISR project (NRC, 2009a).

4.2.2.1 Impacts from the Proposed Action

Under the Proposed Action, Cameco estimates that the number of workers at the Smith Ranch site during operation is anticipated to increase from 153 to 170 (Cameco, 2014, ER Section 4.10.1.2). Additionally, Cameco estimates that there would be a combined two shipments per day of uranium-loaded IX resins from the North Butte and Gas Hills remote satellite sites to the Smith Ranch CPP and one additional third-party resin shipment to the Highland CPF (Cameco, 2014, ER Section 4.2.1.1). Trucks with empty IX resin columns would be expected to return to the original shipping site at about the same rate and using the same roads. This expected increase in traffic on the affected roads is less than 1.0 percent. Cameco anticipates approximately three shipments of ISR-related chemicals and fuel every couple of days at the Smith Ranch site (Cameco, 2014, ER Table 3.2-1). The projected transportation impacts during the aquifer restoration and decommissioning phases are expected to be less than during operation, because Cameco expects the number of workers to decrease during restoration (85 workers) and final site decommissioning (50 workers) (Cameco, 2014, ER Sections 3.2.1 and 4.10.1.3). Based on the changes in workforce levels, incoming shipments, and IX resin-related transportation, the impacts would not differ substantially from those impacts identified in

previous environmental documents, and therefore, the NRC staff finds such impacts are not expected to be significant.

Since the last license renewal in 2001, two transportation incidents have occurred, both involving shipments of byproduct material to the White Mesa uranium mill site in Blanding, Utah (Utah, 2016). Both incidents (the first on August 20, 2015, and the second on March 29, 2016) involved leaks from intermodal containers that were carrying barium sulfate sludge from the Smith Ranch site to the White Mesa mill site for disposal of the material. The NRC conducted inspections at the Smith Ranch in response to these incidents in June 2016 and in November 2016 and issued a Confirmatory Action Letter (CAL) in August 2016 (NRC, 2016b). By letter dated June 29, 2017 (NRC, 2017b), the NRC issued to Cameco nine violations of regulatory requirements, five of which were collectively categorized as a Severity Level III problem given the same root cause, and the remaining four were categorized at Severity Level IV. In the same letter, the NRC stated that Cameco had partially completed implementation of the corrective actions in response to the CAL.

Given the limited number of transportation incidents since the last renewal, Cameco's implementation of corrective actions in response to the two incidents that did occur, and the small increase in anticipated workers at the Smith Ranch site over the next license term period, the NRC staff concludes the potential for impacts to the transportation system from the Proposed Action would be SMALL and not significant.

4.2.2.2 Impacts from the No-Action Alternative

Under the No-Action alternative, the decreasing number of employees during aquifer restoration and site decommissioning and the number of offsite shipments would be reduced over time. Shipments of loaded IX resin to the site from third parties or from the other Project sites would not occur, and yellowcake shipments from the site would be substantially reduced. As Cameco completes final site decommissioning, waste shipments would be expected to be reduced. As with the Proposed Action, there is the potential for transportation incidents; however, Cameco has implemented corrective actions to reduce the likelihood of further incidents occurring. Therefore, transportation impacts under the No-Action alternative would be less than impacts under the Proposed Action, and these impacts would be SMALL and not significant.

4.2.3 Geology, Seismology, and Soils

Project-related impacts on geology and seismology have not been previously assessed for the Smith Ranch site. However, impacts to soils from the Project have been previously evaluated for the Smith Ranch site (NRC, 1995, NRC, 2001; NRC, 2006; NRC, 2007; NRC, 2009a; and BLM, 2011). These evaluations addressed soil impacts from the construction and operation of the Smith Ranch and Highland projects, the Reynolds Ranch and SR-2 satellites, and from the PRI's proposal to process third party IX resins. The staff determined that impacts from these actions on local roads and related to accidents would not be significant.

The NRC staff also evaluated the generic impacts to geology, seismology, and soils from an ISR facility in the WEUMR, where the Smith Ranch site is located (NRC, 2009a). The staff determined that that it is unlikely that (1) geochemical alteration of the ore zone would result in any compression or subsidence that would be translated to the ground surface, and (2) ISR process-related changes in fluid pressure would reactivate faults or trigger or induce earthquakes. For these reasons, the NRC staff determined that potential generic impacts to geology and seismology would be SMALL.

With respect to generic soils impacts, the NRC staff evaluated the increased potential for (1) erosion due to the removal of vegetation and the physical disturbance from vehicle and heavy equipment traffic, and (2) surface runoff and sedimentation in local drainages and streams outside disturbed areas due to soil compaction and vegetation removal. The staff determined that such impacts would be SMALL, temporary, and commonly mitigated using accepted best management practices (BMPs). Short-term effects on soils impacted by spills of ISR process-related fluids would be SMALL to LARGE depending on the volume of soil affected; these impacts would be mitigated over the long-term by the operator's required immediate responses, spill recovery actions, and routine monitoring programs (NRC, 2009a).

Numerous environmental studies were conducted for the Smith Ranch site over the years. Impacts to soils, were evaluated in the initial Highland EIS (NRC, 1978), and in the NRC's EA for commercial-scale operations at the Highland property (NRC, 1987). These evaluations concluded there would be no significant impact to soils associated with construction of the processing plant, excavation of pipelines, or construction of wellfields and access roads. In addition, the proposed land application of liquid byproduct waste would be carefully monitored and controlled to maintain concentrations of toxic and radioactive constituents below allowable-release standards in the soils. The EA for renewal of the Highland uranium project (NRC, 1995) provided the same evaluation for soil impacts.

The BLM also evaluated impacts to soils from ISR activities on the BLM-administered surface areas of the Reynolds Ranch satellite site (BLM, 2011). BLM found that such activities would affect an estimated 18.5 ha (45.6 ac) of the BLM-managed portions of the Reynolds Ranch site (BLM, 2011; Section 4.1.4). In its analysis, BLM noted that revegetation of the affected areas may be difficult "due to the limited soil suitability as a plant-growth medium" (BLM, 2011; Section 4.1.4). BLM identified other issues that may affect the success of revegetation, including climatic changes, land use, and compliance with reclamation and weed control efforts (BLM, 2011; Section 4.1.4).

GEIS Section 4.3.3 identified and evaluated the impacts to soils at ISR projects in the WEUMR (NRC, 2009a), where the Smith Ranch site is located. In summary, construction activities at the Smith Ranch site have the potential to increase both wind and water erosion because of the Cameco's removal of vegetation and the physical disturbance to soils by vehicle and equipment traffic. The NRC concluded that these impacts would be SMALL if the disturbed area would be less than approximately 15 percent (NRC, 2009a).

4.2.3.1 Impacts from the Proposed Action

Impacts to Geology

During uranium-recovery operations, the lixiviant dissolves the uranium-mineral coatings on the sandstones in the targeted ore zone. This geochemical change results in mineralogical changes to the ore zone, but it does not affect the rock matrix nor rock structure. Cameco reported that no significant rock-matrix compression or ground subsidence has been observed during the 25 years of operation at Smith Ranch (Cameco, 2014, ER Section 4.3.1.1). Therefore, the NRC staff concludes the impacts to geologic resources by the Proposed Action would be SMALL and not significant.

Impacts to Seismology

Cameco has conducted additional uranium ore zone delineation drilling at Smith Ranch and has not identified any information that would change substantially its geological understanding of the site (Cameco, 2014, ER Section 3.3.2.1). In its evaluation of impacts from permitting operations at the Reynold Ranch satellite site, the BLM concluded that the Proposed Action would not affect the basic geology of the Reynolds Ranch area and the project would not initiate landslides, mudslides, debris flows, slumps, or other forms of mass movement (BLM, 2011, Section 4.1.2.1). The BLM also concluded that due to the low seismic activity in the Project area, the potential for damage to ISR-related facilities is low, and that it was highly unlikely that ISR construction and operations would initiate seismic activity (BLM, 2011; Section 4.1.2.1).

In its application (Cameco, 2015, TR 3.10.4.3), the licensee addressed the potential for induced seismicity associated with the injection of waste waters at depth. Cameco noted that major folds and faults are not found at depth at the Smith Ranch site, and that seismicity has not been observed during the operation of deep disposal wells over the past 27 years at the site. Additionally, Cameco considers that the likelihood of seismic events induced by operation of its deep disposal wells is minimal due to its control of the injection flow and pressure (Cameco, 2015, TR 3.10.4.3). Injection flow rates and pressures for the deep disposal wells at the site are set by conditions in the applicable WDEQ permit.

Based on this determination, the NRC staff concludes that seismological impacts from the Proposed Action at the Smith Ranch site would be SMALL and not significant.

Impacts to Soils

Under the Proposed Action, Cameco expects that an additional 190 ha (470 ac) of land would be disturbed, beyond the existing disturbance of 570 ha (1,410 ac). Cameco also would conduct interim restoration of disturbed lands, such that long-term (greater than one year) disturbances would affect 99 ha (244 ac) or less than 1 percent of the approximately 16,100 ha (40,000 ac) Smith Ranch site (Cameco, 2014, ER Section 4.1.1.1).

As discussed in section 3.2.3 of this EA, land application of treated waste waters at the PSR-1 area resulted in an increased concentration of selenium in the affected soil. In response, Cameco constructed a selenium treatment plant just southwest of Satellite 2, and selenium concentrations from the treatment system are now much reduced (see section 2.2.1 of this EA).

As discussed in section 2.5 of this EA, Cameco also has experienced 89 spills of process-related fluids from June 2001 to October 2017. In response to each event, the licensee conducted mitigative actions (e.g., collection of spilled liquids, radiological surveys of the affected soils, soil sampling and analysis as needed) and documented the affected area for future assessment during site decommissioning. The licensee also conducts a program of continuous wellfield monitoring by roving wellfield operators and periodic inspections of each well that is in service (Cameco, 2015, TR 7.5.1.3). This monitoring, along with operational pipeline monitoring, aids in the identification of spills and leaks. None of these events met the NRC's criteria for reporting found in Subpart M to 10 CFR part 20 or 10 CFR 40.60.

Given that (1) less than 5 percent of the Smith Ranch site would be disturbed during the Project's lifecycle, (2) Cameco employs WDEQ/LQD-required erosion-control mitigation measures, such as soil salvage and prompt re-vegetation, and (3) the licensee's monitoring

program, the NRC staff concludes that impacts to soils at the Smith Ranch site would be SMALL and not significant.

4.2.3.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, Cameco would cease active uranium-recovery at the site and would transition to aquifer restoration and site decommissioning activities. The impacts to geology, seismology, and soils from the No-Action Alternative at the Smith Ranch site during its lifecycle are summarized below.

Impacts to Geology

As a result of the immediate decommissioning of the Smith Ranch site as part of the No-Action Alternative, the extent of uranium extraction would be diminish substantially over time, and impacts to geologic resources would consequently be smaller than for the Proposed Action. As a result, the impacts to geologic resources at the Smith Ranch-Highlands-Reynolds Ranch site under the No-Action Alternative would be less than for the Proposed Action, and they would be SMALL and not significant.

Impacts to Seismology

Under the No-Action Alternative, activities at the site would transition from uranium production to aquifer restoration and the continued use of deep disposal wells for the disposal of liquid effluents. As discussed for the Proposed Action, injection flow rates and pressures for the deep disposal wells are set by WDEQ permit condition, and kept below pressures at which induced seismicity could be expected to occur. Cameco's experience using deep disposal wells at the Smith Ranch site has not resulted in seismicity induced as a result of its activities. With the completion of aquifer restoration over time, the likelihood of seismic activity induced by these activities would decrease. Therefore, the NRC staff concludes the potential impacts from the No-Action Alternative on seismic activity would be comparable to impacts from the Proposed Action, and therefore would be SMALL and not significant.

Impacts to Soils

As a result of the site-wide decommissioning under the No-Action Alternative, the extent of uranium production would be diminish substantially over time, and site activities would transition to aquifer restoration. The potential for pipeline breaks and leaks would remain, along with the potential for these incidents and land application of treated waste waters to affect soils. Cameco would be expected to continue its site inspection activities to observe potential spills and to continue pressure monitoring of various pipelines. The licensee's use of the Selenium Treatment Facility would be expected to continue, thereby mitigating the effect of selenium deposition in the soils affected by land application.

Additionally, during and following aquifer restoration, site decommissioning activities would occur. In restored wellfields, these activities would include: (1) the plugging, sealing and abandoning of production and injection wells; (2) the de-installation of pipelines and trunklines; and (3) the removal of header houses and their foundations. Other site-wide decommissioning activities expected to affect soils would include de-construction of the Smith Ranch CPP and the Highland CPF and of site and wellfield access roads; resurvey and possible additional soil cleanup of areas affected by spills, leaks, and land application; removal of evaporation pond liners and berms, and activities meant to restore the topography of the site.

As a result of these activities, the impacts to soils at the Smith Ranch site from the No-Action Alternative would be similar to the construction and operational impacts of the Proposed Action and therefore the NRC concludes the impacts would be SMALL and not significant.

4.2.4 Water Resources

Impacts to water resources from the Project have been previously evaluated for the Smith Ranch site (NRC, 1995, NRC, 2001; NRC, 2006; NRC, 2007; BLM, 2011). Impacts to surface water resources were determined to be minor due to (1) the ephemeral flow in the streams present; and (2) best management practices and required mitigation measures employed by Cameco to limit the effect of soil erosion. Potential ground water impacts included those resulting from (1) degradation of the ore zone water quality due to the ISR process; (2) excursions (i.e., the movement of lixiviant outside the mine unit boundary, either in a horizontal or vertical direction); (3) evaporation and storage pond leaks into shallow aquifers; (4) consumptive use of the resource; and (5) effects on local domestic use and animal stock wells. The previous evaluations have found these impacts to be temporary and not significant due to actions required of and taken by the Licensee.

The NRC staff also evaluated the generic impacts to surface water and ground water resources from an ISR facility in the WEUMR, where the Smith Ranch site is located (NRC, 2009a). The staff expected that generic surface water impacts would be SMALL due to anticipated licensee compliance with applicable federal and state regulations and permit conditions and the licensee's use of best management practices and required mitigation measures.

Regarding generic ground water impacts, the NRC staff determined that (1) SMALL impacts would be expected from consumptive use during construction and decommissioning, shallow aquifer effects from fuel and lubricant spills, water quality changes in the uranium-bearing ore zone, and well plugging and abandonment; (2) SMALL to MODERATE impacts would be expected from consumptive use during operations and aquifer restoration, and (3) SMALL to LARGE impacts would be expected from impacts from horizontal and vertical excursions during ISR operations (NRC, 2009a).

4.2.4.1 <u>Impacts from the Proposed Action</u>

<u>Impacts to Surface Water</u>

Cameco does not use surface water for either uranium production or non-production uses nor does it discharge treated waste waters into local streams (Cameco, 2014, ER 4.4.1.1.1). Spills of process-related solutions at the Smith Ranch site have minimally affected surface water at the site (Cameco, 2014, ER 4.4.1.1). The licensee would continue to implement best management practices, along with erosion control measures (see Cameco, 2015, TR 3.8.2), interim revegetation, and the use of culverts, to minimize the potential for site runoff to affect surface water. Additionally, Cameco regularly analyzes samples taken from surface water locations around the site to monitor any impacts to surface water at the Smith Ranch site.

As discussed in section 2.5 of this EA, 89 spills have occurred at the Smith Ranch site between June 2001 and October 2017. At the time of the spills, Cameco took corrective actions, including radiological surveys of the affected soils and soil sampling and analysis as needed. The licensee conducts a program of continuous wellfield monitoring by roving wellfield operators and periodic inspections of each well that is in service (Cameco, 2015, TR 7.5.1.3). This

monitoring, along with operational pipeline monitoring, aids in the identification of spills and leaks.

For these reasons, the NRC staff concludes that impacts to surface water from the Proposed Action would be SMALL and not significant.

Impacts to Wetlands

As discussed in section 3.2.4 of this EA, a 2011 wetlands survey conducted for Cameco identified 11 potential wetlands from 19 locations visited at the Smith Ranch site. If Cameco seeks to develop wellfields that could affect these potential wetland areas, a more detailed delineation of the affected wetland would be required, and, if necessary, the licensee would need to obtain the necessary permits from the USACE to comply with Section 404 of the Clean Water Act (CWA). Based upon the mitigation measures this permitting process requires, the NRC staff concludes that the impacts to wetlands from the Proposed Action would be SMALL and not significant.

Impacts to Ground Water

Ground Water Quality

The GEIS established that water quality in the ore-zone aquifer becomes degraded during uranium-recovery operation (NRC, 2009a). However, the Licensee is required by its NRC license to restore the aquifer to NRC-approved background concentrations, if possible. If the aquifer cannot be returned to preoperational conditions, the NRC requires that the aquifer meet the MCLs provided in 10 CFR Part 40, Appendix A, Table 5C or alternate concentration limits (ACLs) approved by the NRC (10 CFR Part 40; NRC, 2009a). For these reasons, the NRC determined that potential impacts to water quality of the uranium-bearing aquifer (i.e., ore zone, production zone or unit, or mineralized zone) as a result of ISR operation would be SMALL and temporary (NRC, 2009a).

GEIS Section 4.2.4 discussed the potential for vertical and horizontal excursions of degraded ground water outside of the uranium-recovery zone. The impact of horizontal excursions could be MODERATE or LARGE, if a large volume of contaminated water moves out of the uranium-bearing aquifer and moves downgradient. This movement could impact an area outside the uranium-bearing zone which is being used for consumptive water use (NRC, 2009a). Since 2001, 37 excursions have occurred at the Smith Ranch Project sites (i.e., at Smith Ranch, Highland, and North Butte), and certain monitoring wells have been placed on excursion status more than once (see Section 2.5 of this EA). Upon identification of an excursion, Cameco has taken actions required under SUA-1548 and actions to contain and control each excursion (see Section 6.4.1 of this EA).

To reduce the likelihood and consequences of potential excursions, licensees take preventive measures before starting uranium-recovery operation, such as proper plugging of abandoned drillholes and wells according to methods established by WDEQ/LQD (2005). During the operation and aquifer-restoration phases, the licensee creates an inward-flow gradient to minimize the potential for horizontal excursions and also conducts pre-operation aquifer testing to ensure the integrity of the confining geologic units with the goal of minimizing the potential for vertical excursions. The NRC requires Cameco to install monitoring wells for the detection of both horizontal and vertical excursions out of the wellfields.

Impacts to ground-water quality have been previously evaluated for the Smith Ranch Project (e.g., NRC, 1995, NRC, 2001; NRC, 2006; NRC, 2007). The NRC assessed the excursion experience at the Highland facility and determined that the degree of monitoring and corrective action being implemented there is sufficient such that excursions result in minimal environmental impacts (NRC, 1995). Based upon the history of successful aquifer restoration at Smith Ranch wellfields, the NRC determined that impacts to ground water are localized and temporary (NRC, 2006); thus these impacts would be SMALL and not significant.

Ground water quality could also be potentially impacted by the drilling fluids and muds introduced into aquifers during well construction (NRC, 2009a). Construction of wells according to WDEQ/LQD's rules would minimize the potential for impacts associated with well construction (Cameco, 2014; WDEQ/LQD, 2005, WDEQ/WQD, 2012). Potential impacts to ground water quality during aquifer restoration and site reclamation would be associated with the abandoned monitoring, injection, and recovery wells (GEIS, 2009). Abandonment of the wells according to the WDEQ requirements would isolate the wells from the flow regime beneath the site (NRC, 2009a; WDEQ/LQD, 2005, WDEQ/LQD, 2000; Cameco, 2014); thus, the potential impacts associated with well construction would be SMALL.

Under these conditions and requirements, the NRC staff concludes that potential impacts of Cameco's continued ISR operations under the Proposed Action on ground water quality would be MODERATE during uranium recovery and SMALL after the aquifer is restored.

Ground Water Use

Cameco evaluated the effects of uranium production and aquifer restoration on the availability of ground water to local users (Cameco, 2014, ER Appendix E). This evaluation addressed the effect of ground water withdrawals on 287 stock and domestic well locations within 16 km (10 mi) of the Smith Ranch site facilities over the proposed 10-year license term, and found that drawdown in the shallow water-table aquifer would be less than 3 m (10 ft) at stock and domestic well locations over the Project life. The evaluation also found that drawdown of up to 6 m (22 ft) could occur in one stock watering and domestic supply well completed in deeper ore-zone production aquifers and located nearest to the Smith Ranch site facilities (Cameco, 2014, ER 4.4.2.2.1 and ER Appendix E). The NRC staff considers that, while drawdown in the affected wells would be recognizable, the wells would continue to provide the necessary amounts of water for the permitted uses.

Therefore, the NRC staff concludes that impacts to ground water use at the Smith Ranch site from the Proposed Action would be SMALL to MODERATE and not significant.

4.2.4.2 Impacts from the No-Action Alternative

The impacts to water resources from the No-Action Alternative at the Smith Ranch site are described below.

Impacts to Surface Water

Under the No-Action Alternative, Cameco's onsite activities would turn to aquifer restoration and site-wide decommissioning. Existing wells and pipelines would continue to be used, although the extent of usage would be expected to decrease over time as the ground water in individual wellfields is restored. The potential for leaks and spills would remain, but Cameco would be

expected to continue its wellfield monitoring program and spill prevention and mitigation programs.

As wellfields are restored and site-wide decommissioning proceeds, the licensee would be expected to properly abandon drillholes and wells in accordance with WDEQ-approved procedures. Any land disturbance during decommissioning activities, and the concomitant potential for increased sedimentation in local surface water, would be less than those in the Proposed Action. Therefore, the impacts to surface-water quality would be SMALL. Only nominal amounts of water would be used for abandonment of drillholes and wells, and the impacts on water quantity (i.e., water use) would also be SMALL and not significant.

Impacts to Wetlands

Under the No-Action Alternative, Cameco's activities at the site would transition away from uranium production to aquifer restoration and site-wide decommissioning. As a result, new wellfields would not be constructed and installed, thus reducing the likelihood of impacting identified wetland areas. If a proposed surface-disturbing activity has the potential to affect a wetland area, Cameco would need to obtain the necessary permits from the USACE to comply with Section 404 of the CWA. Therefore, the NRC staff concludes that impacts to wetlands from the No-Action Alternative would be SMALL and not significant.

Impacts to Ground Water

Under the No-Action Alternative, Cameco would cease uranium production and pursue aquifer restoration. The licensee would continue to monitor wellfields under restoration for the possibility of vertical or lateral excursions. Additionally, as discussed under the Proposed Action ground water impacts, Cameco's restoration of the affected ground water in each wellfield would be required to meet NRC-approved background concentrations for the individual monitored constituents, or the MCLs in Table 5C of 10 CFR Part 40, Appendix A, or the ACLs approved by the NRC. Therefore, during aquifer restoration, ground water quality would increase over time until the approval of final restoration by the relevant regulatory agency (i.e., NRC or WDEQ).

During aquifer restoration, consumptive use of ground water would continue , because treated waste waters would be disposed via Cameco's approved methods (i.e., land application, solar evaporation, into approved UIC Class I deep disposal wells at the site). The NRC staff expects that the volume of consumptively used ground water under the No-Action Alternative would be greater than the volume consumed under the Proposed Action. This is because, under the No-Action Alternative, the focus of activities would be aquifer restoration of the portions of the exempted aquifer within the existing wellfields. Techniques such as ground water sweep and reverse osmosis with reinjection are ground water consumptive, and Cameco estimates that for each wellfield, the consumed ground water is approximately nine pore volumes of the affected wellfield portion of the exempted aquifer.

Consumptive use also would result in drawdown in domestic use and stock wells that are completed in the ore zone aquifer. Cameco has estimated drawdown can range from approximately 3 to 6 m (10 to 22 ft) at the wells located within 16 km (10 mi) of the Smith Ranch site due to the combination of uranium production and aquifer restoration during the Proposed Action. However, following the completion of aquifer restoration at the Smith Ranch site, water elevations at the affected wells would be expected to recover.

Additionally, following the completion of aquifer restoration in a wellfield, Cameco would abandon injection and production wells in accordance with WDEQ permit requirements and thereby prevent any future contamination of the aquifers above and below the ore zone aquifer.

Therefore, the NRC staff expects that, under the No-Action Alternative, impacts to ground water quality and quantity impacts would be greater than those in the Proposed Action due to the increase in consumptive use and degraded water quality during active restoration. However, as the portions of the exempted aquifer in each wellfield are restored, water quality would improve and consumptive use would decrease. These impacts would be felt over an extended period of time, and so would be MODERATE, but with the completion of aquifer restoration at the Smith Ranch site, impacts would be SMALL. Overall, the NRC staff concludes that impacts on ground water due to the No-Action Alternative would not be significant.

4.2.5 Ecological Resources

Environmental impacts to ecological resources have previously been assessed for the Smith Ranch site (NRC, 1995, NRC, 2001; NRC, 2006; NRC, 2007; BLM, 2011). These evaluations, performed for the Highland and Smith Ranch properties and for the Reynolds Ranch and SR-2 satellites, focused on the impacts to (1) soils and vegetation due to construction activities and operational spills; (2) range management and livestock grazing; and (3) terrestrial and aquatic wildlife populations and threatened and endangered species and their critical habitat from construction and operation. The NRC and BLM staffs determined that these impacts predominantly would be minor and of short-term duration and would not constitute a significant impact to the resource.

The NRC staff also evaluated the generic impacts to ecological resources from an ISR facility in the WEUMR, where the Smith Ranch site is located (NRC, 2009a). The staff determined that impacts would be greatest during the construction phase, when impacts would be SMALL to MODERATE on vegetation and terrestrial wildlife and SMALL to LARGE on threatened and endangered species, depending on site-specific conditions.

4.2.5.1 <u>Impacts from the Proposed Action</u>

<u>Vegetation</u>

Uranium-recovery activities at the Smith Ranch site could impact vegetation during all phases of the Project lifecycle. GEIS Section 4.2.5.1 determined that the impacts to vegetation resulting from land disturbances below 1 to 20 percent in relation to the total license area and surrounding plant communities would be SMALL. The Smith Ranch license area totals approximately 16,187 ha (40,000 ac). As discussed in section 3.2.1 of this EA, the estimated total surface disturbances for the life of the project are expected to be approximately 761 ha (1,880 ac), or less than 5 percent of the total license area, and approximately 570 ha (1,410 ac) are already disturbed. Under the Proposed Action, the expected increase in surface disturbance would be approximately 190 ha (470 ac), or approximately 1 percent of the total Smith Ranch license area.

Vegetation would be impacted by surface-disturbing activities, including access road construction, pipeline laying, header house foundation clearing, and well installation activities. As discussed in Section 7.2.4.2 of the TR (Cameco, 2015), Cameco is required by WDEQ/LQD regulations to protect topsoil and subsoil from excessive compaction, degradation, and wind and water erosion where stockpiling of topsoil and subsoil is necessary. The licensee salvages

suitable topsoil and places it in long-term stockpiles that are posted as "Topsoil" and provided with sediment and erosion controls (Cameco, 2015, TR 7.2.4.2). This topsoil is used by Cameco for reclamation; it is spread over disturbed areas, contoured to transition into undisturbed areas, and seeded with an approved WDEQ seed mix (Cameco, 2015, TR 6.2.4). Seeding also will occur in areas affected by site operations (e.g., within wellfields) where no topsoil is needed (Cameco, 2015, TR 6.2.4).

Vegetation also could be impacted by surface releases (i.e., spills and leaks) of injection and production fluids during operation and aquifer restoration (NRC, 2006; NRC, 2007). From 1996 through 2010, Cameco estimates that approximately 6.9 ha (17 ac) at the Smith Ranch site have been impacted by leaks from header houses and pipelines (Cameco, 2014, ER 4.3.1.2). Following the repair of a leak or spill, Cameco surveyed the affected soils for radioactivity, documented the area of the spill, and removed impacted soils as needed. Affected areas would be reseeded using WDEQ-approved seed mixes.

Based on the small percentage of land disturbance required under the Proposed Action, coupled with prompt reseeding of disturbed lands with a WDEQ-approved seed mix, and demonstrated successful mitigation at the Smith Ranch site during past operations, impacts to vegetation under the Proposed Action would be SMALL and not significant.

Wildlife

The NRC previously determined that construction and operational impacts to wildlife populations under the existing license would not result in long-term decreases in those populations (NRC, 2001; NRC, 2006). The proposed additional disturbance under the Proposed Action would be an additional 190 ha (470 ac), or approximately 1 percent of the total Smith Ranch license area (16,000 ha (40,000 ac)). The estimated total surface disturbances for the life of the project are expected to be approximately 761 ha (1,880 ac), or less than 5 percent of the total license area.

In accordance with WDEQ/LQD regulations, Cameco consults with the FWS and the Wyoming Game and Fish Department (WGFD), and with BLM when applicable, to create a wildlife monitoring plan to provide proper protection and mitigation measures to ensure wildlife is not negatively impacted (Cameco, 2014, ER 4.5.1.1.4). The following wildlife protection measures have been implemented at Smith Ranch:

- Reflective marking of power lines near PSR-2 and the land application pivot site to minimize collisions by waterfowl;
- FWS-recommended seasonal and spatial protection buffers for raptor nests and bald eagle winter roost sites;
- Conformance with the Wyoming Governor's Sage-grouse Executive Order which includes spatial and seasonal protection buffers;
- WGFD-recommended protective buffers around active swift fox dens; and
- Waste water disposal site monitoring (Cameco, 2014, ER 4.5.1.1.4).

Additionally, as discussed in the preceding section of this EA, the licensee works to reseed areas disturbed by site operations to restore vegetation, thus restoring potential habitat for wildlife.

Over the extended period of the time of uranium recovery at the Smith Ranch site (i.e., approximately 40 years), local wildlife have become accommodated to site operations, and Cameco reports that pronghorn antelope are frequently seen grazing within the operational wellfield areas at Smith Ranch (Cameco, 2015, TR 7.2.9.2).

Therefore, the NRC staff concludes that based on (1) the small percentage of land disturbance expected under the Proposed Action, (2) reseeding of disturbed lands with a WDEQ-approved seed mix, and (3) an active wildlife monitoring plan with associated protection measures, the impacts to wildlife under the Proposed Action would be SMALL and not significant.

Protected Species

As discussed in section 3.2.5 of this EA, 2011 vegetation and wildlife surveys of the permit area (1) did not find the presence of nor suitable habitat for Federally-listed vegetative species, and (2) did not find the presence of Federally-listed wildlife species. Cameco also has committed to periodically updating vegetation maps and identifying the potential for threatened vegetative species in the permit area, as annually conducting surveys for raptor and bald eagle roosting site, greater sage-grouse leks, black-tailed prairie dog colonies and mountain plover habitat (Cameco, 2014, ER Appendix A.1). Therefore, the NRC staff concludes that the potential impact to Federally-threatened or endangered species and to listed species of concern would be SMALL and not significant (FWS, 2018).

4.2.5.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, site activities would transition from uranium production to aquifer restoration and eventual site-wide decommissioning. The impacts to the ecological resources from the No-Action Alternative at the Smith Ranch site are described below.

Vegetation

As discussed for the Proposed Action, Cameco would take actions to reseed and revegetate areas disturbed by uranium recovery operations and affected by leaks and spills. Stockpiles of topsoil would be used as needed, along with WDEQ-approved seed mixes, to restore vegetation at the site, with the eventual goal of returning the land use to livestock grazing and wildlife habitat. Efforts to reseed and restore the vegetation would move across the site as aquifer restoration is completed in wellfields, including the resulting removal of header houses, pipelines, and trunklines, as well as the abandonment of injection and production wells in accordance with WDEQ regulations. Final vegetation efforts would focus on areas affected by decommissioning of the larger site structures (e.g., the administrative buildings, the Smith Ranch CPP, and the Highland CPF) and on wellfield and site access roads. The NRC staff concludes that, under the No-Action Alternative, vegetation impacts would be localized and MODERATE until the vegetation is re-established after several growing seasons and SMALL and not significant over the long-term with the completion of site decommissioning and the re-establishment of vegetation suitable for livestock grazing and wildlife habitat. These impacts would not be significant.

Wildlife

Impacts to wildlife under the No-Action Alternative would be similar to impacts expected under the Proposed Action. Site activities would continue under aquifer restoration and site-wide decommissioning, and wildlife would tend to avoid the areas then affected while the activities were taking place. Otherwise, wildlife would remain accustomed to general activity at the Smith Ranch site. Cameco would continue to implement its wildlife monitoring plan and the associated mitigation measures. Over the long term, as aquifer restoration and site decommissioning is completed, increasing portions of the site may be made available for livestock grazing and wildlife habitat. Therefore, the NRC concludes that impacts to wildlife from the No-Action Alternative would be SMALL and not significant.

Protected Species

The No-Action Alternative would result in the aquifer restoration and decommissioning of the Smith Ranch site. As discussed for the Proposed Action, surveys conducted in 2011 did not identify the presence of threatened or endangered vegetative or wildlife species at the site. Additionally, Cameco has committed to annual and periodic surveys for such species and for species of concern. Therefore, the NRC staff concludes that impacts from the No-Action Alternative to protected species are SMALL and not significant.

4.2.6 Meteorology and Air Quality

Air quality impacts from the Project have been previously evaluated for the Smith Ranch site (NRC, 1995, NRC, 2006; NRC, 2007; and BLM, 2011). These evaluations addressed impacts from the renewal of the Highland Uranium Project license and from the construction and operation of the Reynolds Ranch and SR-2 satellites. The NRC staff determined that impacts due to diesel emissions from construction and drilling equipment, from fugitive dust on local roads and from disturbed soils in wellfields, and due to radon and non-radiological releases would be SMALL and not significant. The NRC staff also determined that generic air quality impacts from an ISR facility in the WEUMR (where the Smith Ranch site is located) would be SMALL due to (1) the temporary nature of fugitive dust, and vehicle emissions; and (2) the low levels of airborne effluents released that subsequently would be readily dispersed (NRC, 2009a).

4.2.6.1 Impacts from the Proposed Action

Under the Proposed Action, air quality impacts would be present throughout the phases of uranium recovery activities at the Smith Ranch site. These impacts would be associated with (1) earth-disturbing activity during wellfield construction (e.g., clearing well pads for the installation of injection, production, and monitoring wells, digging trenches for pipelines and trunklines, clearing for access road construction, emissions from well drilling rigs and support vehicles); (2) exhaust emissions from employee vehicles, supply trucks, and maintenance and delivery vehicles; (3) fugitive dust from those vehicles when traveling on secondary access and wellfield roads; and (4) radioactive airborne effluents (primarily Radon-222) that would be released from the Smith Ranch CPP, the Highland CPF, the Reynolds Ranch and other onsite satellite facilities, header houses, and the well fields.

Cameco estimates that approximately 71 tonnes (metric tons (MT)); 78 T) of fugitive dust per year results from the current level of Smith Ranch site operations, and that this estimate would

increase to approximately 141 MT (156 T) per year under the Proposed Action (Cameco, 2014, ER 5.6). Cameco would seek to reduce fugitive dust by implementing speed limits around the site properties, using periodic watering and chemical treatment of unpaved roads, and reclaiming and revegetating disturbed areas as soon as possible following the disturbance (Cameco, 2014, ER 5.6).

The NRC staff concludes that impacts to air quality at the Smith Ranch site from the Proposed Action would be SMALL and not significant.

4.2.6.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, air quality impacts would be similar to those expected under the Proposed Action. Site-wide decommissioning would be expected to produce fugitive dust as earth-disturbing activities occur, along with travel along unpaved roads to and from the decommissioning locations. Equipment used to reseed disturbed areas would produce vehicle emissions and fugitive dust, while the revegetation would reduce fugitive dust from the disturbed areas. Emission levels would be expected to be periodic but temporary as decommissioning of individual wellfields occurs, and levels would be expected to decrease over the long-term as the site is reclaimed.

Therefore, the impacts from particulate emissions and gaseous emissions would be less than the Proposed Action, and these impacts would be SMALL and not significant.

4.2.7 Noise

Noise impacts from the Project have been previously evaluated for the Smith Ranch site (NRC, 2007; BLM, 2011). These evaluations, which addressed impacts from the construction and operation of the Reynolds Ranch and SR-2 satellites, determined that impacts due to dirt work, drilling and infrastructure construction equipment-related noise were temporary and those from operations-related traffic were minimal. The NRC staff also determined that generic noise impacts from an ISR facility in the WEUMR (where the Smith Ranch site is located) would be SMALL to MODERATE (NRC, 2009a). Potential noise impacts during construction would be SMALL to offsite receptors beyond 300 m (1,000 ft) and MODERATE to site workers such as the well drillers. Noise impacts during the operation and the aquifer-restoration phases would be similar or less than those for the construction phase; thus, the impacts from noise would also be SMALL during these phases. Noise impacts during the decommissioning phase would be similar to those during the construction phase, so that noise impacts would be SMALL (NRC, 2009a).

4.2.7.1 Impacts from the Proposed Action

Under the Proposed Action, noise impacts at the Smith Ranch site would be greater relative to the existing conditions, which includes the current level of ISR activities. The increase in noise at the site would be due to (1) the construction of new wellfields, which includes excavation for pipelines and trunklines, drilling of new injection, production, and monitoring wells for the proposed wellfields, and the grading for and construction of header houses in the wellfields; (2) restart of operations at the Highland CPF; (3) the increase in employee vehicles, supply trucks, and waste shipments in support of Highland CPF and the Reynolds Ranch satellite operations; and (4) grading and construction of needed wellfield access roads.

In 2010, Cameco conducted a noise study at six locations around the Smith Ranch site (Cameco, 2014, ER 4.7.1). The results of that study (documented in Table 4.7-1 of the ER (Cameco, 2014)) found that the highest noise levels were generated by a wood chipper (125 A-weighted decibels or dBA). It is generally recognized that noise level decreases with distance from the noise generating equipment (see NRC, 2009a, Section 4.2.7.1). Cameco estimated that, due to the sound drop-off, the noise level from the wood chipper would be approximately 77 dBA at 3 km (2 mi) from the site boundary. As discussed in Section 3.2.1 of this EA, there are 12 ranch residences within 8 km (5 mi) of the site boundary and 1, the Vollman Ranch, located within the boundary approximately 6 km (4 mi) east of the Smith Ranch CPP. Site noise would be recognizable at certain residences, although such noises would be intermittent and of short-term duration. Additionally, ISR activities at the Smith Ranch site have been ongoing for several decades, and the residences would be expected to be accommodated to the various site noises. The relative increase in the occurrence in noises associated with the Proposed Action may be noticeable at the residences, but the noise levels would be consistent with those already experienced. Therefore, the NRC staff expects that noise impacts to offsite receptors (i.e., the nearby residents) from the Proposed Action would be SMALL and not significant.

Impacts would be experienced by site workers using and in the vicinity of the noise-generating equipment. Cameco would employ appropriate mitigation to comply with the Occupational Safety and Health Administration (OSHA) Hearing Conservation regulations in 29 CFR 1910.95 (OSHA, 2002, 2008). With this mitigation, impacts to onsite receptors (i.e., the site workers) would be MODERATE and short-term.

The impact on wildlife would be MODERATE during the construction activities of the Proposed Action because wildlife would likely avoid the area during the high noise levels and increased noise generated by traffic during peak employment periods (NRC, 2009a). However, as discussed in Section 4.2.5.1 of this EA, the wildlife would return to wellfield areas following construction and reseeding.

The NRC staff therefore expects that noise impacts from the Proposed Action would be of short-term duration and MODERATE for onsite receptors and for wildlife and SMALL for offsite receptors. For both, the NRC concludes these noise impacts on local receptors would not be significant.

4.2.7.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, noise levels at the site would be expected to rise as site-wide decommissioning activities increased. However, these activities would affect the site in a phased manner as aquifer restoration of the wellfields progresses and is completed in a phased manner (see water balance Tables 3-10 to 3-14 in the TR (Cameco, 2015). During decommissioning, Cameco would employ heavy construction equipment (e.g., bulldozers, scrapers, loaders, drill rigs, PVC chippers, and seeding equipment) in the reclamation of existing buildings, the restoration of operating mine units, well abandonment and reclamation of well fields, and the removal of all ponds, treatment plants and roads (Cameco, 2014, ER 4.7.2). The types of decommissioning activities anticipated are detailed in ER Section 4.7.2 of (Cameco, 2014). Noise levels for the equipment associated with these activities would range between approximately 74 dBA and 125 dBA (Table 4.7-1 in Cameco, 2014).

The NRC staff concludes that noise impacts from the No-Action Alternative would be similar to impacts under the Proposed Action. Given the decrease in noise levels with distance, offsite receptors (i.e., nearby residents) would experience SMALL short-term impacts, while onsite

receptors (workers) and wildlife would experience MODERATE short-term impacts. Cameco would employ appropriate hearing protection for workers to mitigate hearing effects. Therefore, the NRC staff concludes these impacts to be not significant.

4.2.8 Historical and Cultural Resources

Historical and cultural resource impacts from the Project have been previously evaluated for the Smith Ranch site (NRC, 2001). The Wyoming State Historic Preservation Office (WY SHPO) has reviewed sites: 48CO352, 48CO1289, 48CO1291, 48CO2462, 48CO2463, and 48CO2464, these sites were determined to be not eligible for the National Register of Historic Places (WY SHPO, 2018a). Because these sites were found to be not eligible, they will be removed from License SUA-1548 condition 9.9. One site (48CO1288) currently listed as eligible will remain in the license, and if Cameco develops the areas where the historic and cultural resources have been identified as eligible for the National Register of Historic Places (NRHP), they would be required to propose mitigation measures, for NRC review and approval, which will preserve the integrity of these sites. If an inadvertent discovery of historic or cultural resources is made, then Cameco would be required to cease work and all appropriate state, tribal, and federal parties must be contacted. Any discovered artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800. Based on the license condition and commitments made by the licensee, the NRC staff concludes that historical and cultural resources would be protected from destruction or disruption by the proposed activities. Therefore, the NRC staff concludes that historic and cultural resources, although present, would not be adversely effected by the undertaking (i.e., the Proposed Action) at the Smith Ranch site.

4.2.9 Visual and Scenic Resources

Visual and scenic impacts were previously evaluated for the construction and operation of the Reynolds Ranch satellite (BLM, 2011). The BLM determined that impacts resulting from the visual contrast of construction drilling rigs would be temporarily high, but with surface reclamation, this contrast would be reduced. Additionally, wind energy projects in the vicinity "dominate the landscape, catch the eye, and compromise the VRM classification of the area" (BLM, 2011). The NRC staff determined that generic visual and scenic impacts from an ISR facility in the WEUMR (where the Smith Ranch site is located) would be SMALL given the anticipated locations of ISR facilities and through the implementation of best management practices such as dust suppression (NRC, 2009a).

4.2.9.1 Impacts from the Proposed Action

Under the Proposed Action, Cameco anticipates constructing additional wellfields at the Smith Ranch site, which includes the excavation and laying of pipelines and trunklines; the grading and installation of injection, production, and monitoring wells; the grading and construction of header houses; the installation of power lines; and the grading and construction of wellfield access roads as needed. Cameco would reclaim disturbed areas following wellfield installation, install approximately 30,500 m (100,000 ft) of fencing around the new wellfields to keep out livestock and paint wellhead covers in a neutral color to reduce visual contrast (Cameco, 2014, ER 4.9.1). Additionally, the existing visual contrast at the site due to the current structures (e.g., the Smith Ranch CPP, the Highland CPF, header houses in existing wellfields) as well as supporting infrastructure (e.g., fencing, power poles and lines, parking areas) would continue during the renewal licensing period. The nighttime impacts of exterior lighting, both continuous and intermittent, around the site would be reduced by topography, landforms, and vegetation, and by the relative rural nature of the site.

As discussed in section 3.2.9 of this EA, the Scenic Quality Inventory and Evaluation for the Smith Ranch site rated the area with a total score of 5 due to the very common scenic characteristics, lack of water, and the fact that there was little variety in vegetation and color. If the visual-resource evaluation rating score is less than 19, no further evaluation of existing scenic resources is required (NRC, 2003b).

Therefore, the NRC staff concludes that impacts to visual and scenic resources from the Proposed Action at the Smith Ranch site would be SMALL and not significant.

4.2.9.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, Cameco would conduct phased site-wide decommissioning activities as aquifer restoration in individual wellfields is completed over time. As discussed in previous sections of this chapter, decommissioning activities can involve substantial ground disturbance and the visual contrast caused by these activities would be obvious but localized to the areas being disturbed. Additionally, the visual contrast of the existing structures and infrastructure at the Smith Ranch site would continue until these structures and infrastructure are decommissioned and demolished. Impacts from lighting and fencing at the site would be reduced by topography, landforms, and vegetation, and by the relative rural nature of the site.

As discussed under impacts from the Proposed Action, the scenic quality of the site is low. The NRC staff concludes that impacts from the No-Action Alternative would not increase or substantially modify the characteristics that led to that rating (i.e., the very common scenic characteristics, lack of water, and the fact that there was little variety in vegetation and color).

As site-wide decommissioning comes to completion, visual impacts would be reduced as structures are removed, disturbed areas are revegetated, and the site is returned to its original land uses for livestock grazing and wildlife habitat.

Therefore, the NRC staff concludes that impacts to visual and scenic resources from the No-Action Alternative at the Smith Ranch site would be SMALL and not significant.

4.2.10 Socioeconomic Resources

The socioeconomic impacts of the Project have been previously evaluated for the Smith Ranch site (BLM, 2011). The previous evaluation addressed impacts from the construction and operation of the Reynolds Ranch satellite. The BLM determined that impacts would include (1) slight increases in overall employment rates, income, and earnings for local workers; and (2) limited effects on housing in the surrounding communities. There would be no effects on educational systems, social services, or the existing cultural, social, and economic viability of local and regional communities (BLM, 2011). The NRC staff also determined that generic socioeconomic impacts from an ISR facility in the WEUMR (where the Smith Ranch site is located) would be SMALL to MODERATE given the anticipated rural locations of ISR facilities and supporting communities (NRC, 2009a).

4.2.10.1 Impacts from the Proposed Action

Under the Proposed Action, Cameco anticipates little change in the numbers of employees at the Smith Ranch site (an additional 17 employees), because most of the site is currently in operation (Cameco, 2014, ER 4.2.1.1 and 4.10.1.2). Therefore, the NRC staff concludes that impacts to local socioeconomics from the Proposed Action at the Smith Ranch site would be minimal. This assessment includes impacts to demographics, income levels, housing, local finance, and educational needs. Beneficial impacts may accrue due to the increased uranium production at the site, resulting from the Reynolds Ranch satellite coming online, along with additional proposed wellfields at the site. Impacts would be SMALL and not significant.

Minority and low-income populations are not found within 80 km (50 mi) of the Smith Ranch site. For this reason and because impacts are SMALL and not significant, the NRC staff concludes there would be no disproportionate human-health and environmental impacts to these populations.

4.2.10.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, site activities would transition from uranium production to aquifer restoration and site-wide decommissioning. Initially, the number of site employees would be cut approximately in half compared to uranium production levels (from 170 employees to 85 employees), but over time, Cameco estimates 50 employees would be required for decommissioning activities (Cameco, 2014: ER 4.10.1.3). The economic benefits and socioeconomic impacts under operations would be reduced as activities under this alternative proceeded. By the time of the completion of site-wide decommissioning, the final site workers would be released with the resulting final decreases in: population; housing demand; demand for education, health and social services; tax revenue for local jurisdictions; and local income levels. Thus, the NRC staff concludes that the socioeconomic impacts of the No-Action Alternative would be SMALL to MODERATE, with MODERATE impacts the result of the absence of tax revenues that would have been generated from the Proposed Action. These impacts would not be significant.

Minority and low-income populations are not found within 80 km (50 mi) of the Smith Ranch site. For this reason and because impacts are SMALL and not significant, the NRC staff concludes there would be no disproportionate human-health and environmental impacts to these populations.

4.2.11 Public and Occupational Health and Safety

Public and occupational health and safety impacts from the Project have been evaluated previously for the Smith Ranch site (NRC, 1995, NRC, 2001; NRC, 2006; NRC, 2007). These evaluations addressed impacts from the construction and operation of the Smith and Highland properties and the Reynolds Ranch and SR-2 satellites.

The NRC staff also determined that generic radiological and non-radiological impacts to public and occupational health and safety from an ISR facility in the WEUMR (where the Smith Ranch site is located) would be SMALL during construction, normal operations, aquifer restoration, and decommissioning. However, MODERATE radiological and non-radiological impacts to workers could result from accidents during operations if the effects of such accidents were not mitigated (NRC, 2009a).

4.2.11.1 Impacts from the Proposed Action

Under the Proposed Action, Cameco would continue the types of uranium recovery activities it has conducted at the Smith Ranch site over the previous license renewal period. These activities are consistent with those presented and analyzed in the NRC GEIS (NRC, 2009a). Cameco has implemented standard operating procedures for handling, processing, storing, transporting or disposing of source and byproduct and hazardous materials (Cameco, 2014, ER 4.12.1).

Potential radiological impacts would result primarily from the release of radon-222 from IX facilities, the Smith Ranch CPP, the Highland CPF, mine unit well fields and header houses, and any potentially adverse impact associated with a spill or accident (Cameco, 2014, ER 5.12). Cameco has implemented procedures, training, and Management Actions designed to mitigate the risk of radiation exposure to the public and the employees. These include process designs such as the use of vacuum driers as opposed to calciner dryers and using down-flow pressurized IX columns instead of open columns. Additionally, all of the facilities provide ventilation systems that remove any released radon-222 from the buildings to the atmosphere (Cameco, 2014, ER 5.12).

Cameco has committed to keep radiological doses as low as reasonably achievable (ALARA), and conducts annual ALARA audits, and daily, weekly, and monthly radiation inspections of its facilities and site (Cameco, 2014, ER 5.12.1). Radiological doses to workers and the members of the public are expected to be a small fraction of the limits in 10 CFR Part 20 that have been established for the protection of public health and safety.

Potential non-radiological impacts would be related primarily to exhaust and diesel emissions from employee vehicles, construction equipment, and field vehicles and also from fugitive dust derived from travel along access roads and from the grading and construction in wellfields. These impacts would be experienced daily at the site, although they would be temporary and of short-term duration.

Therefore, the NRC staff concludes that radiological and non-radiological impacts from the Proposed Action would be SMALL and not significant.

4.2.11.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, while uranium production would decrease substantially, a relatively limited amount of uranium would be processed at the site as part of aquifer restoration activities. Cameco would continue to conduct the same standard operating procedures, ALARA policy, and radiological monitoring programs under this alternative as it does under the Proposed Action. Radiological doses to workers and to the public would be reduced due to the reduction in uranium processing, and would comply with the annual dose limits in 10 CFR Part 20.

Non-radiological impacts related to site-wide decommissioning activities would be greater than those experienced under the Proposed Action. This is due to the focus on decommissioning and demolition of existing structures and access roads, excavation of buried pipelines and trunklines, reseeding and revegetation of disturbed areas, and regrading to restore site topography. Exhaust and emissions from the various equipment involved would also be increased over the levels under the Proposed Action. These impacts would be temporary,

because the decommissioning activities are phased over time to address wellfields that have completed aquifer restoration.

Therefore, the NRC staff concludes that radiological impacts would be SMALL and not significant, and that non-radiological impacts would be MODERATE over the short-term and SMALL over the long-term as site-wide decommissioning is completed. These impacts would not be significant.

4.2.12 Waste Management

The NRC determined that the generic impacts of waste management associated with an ISR facility in the WEUMR (where the Smith Ranch site is located) would be SMALL (NRC, 2009a). During construction, waste volumes would be limited to construction wastes. Process-related operational wastes (i.e., byproduct solid and liquid wastes and gaseous emissions) would be disposed or discharged to meet NRC license conditions and EPA and State regulatory standards. Non-byproduct solid wastes would be disposed at appropriately permitted disposal sites, while non-byproduct liquid wastes (e.g., bathroom wastes, storm water) would be handled in accordance with State permits. Aquifer restoration wastes would be similar to those during operations, and decommissioning wastes would be similar to those during construction.

4.2.12.1 Impacts from the Proposed Action

Under the Proposed Action, byproduct material and non-byproduct material solid and liquid waste volumes would be increased due to the start of operations at the Reynolds Ranch satellite and in the proposed additional wellfields, the restart of the Highland CPF, and the increase in employees. Cameco would continue to manage these wastes in accordance with its existing NRC license and relevant State permits. The NRC staff concludes that waste management impacts from the Proposed Action would be SMALL and not significant.

4.2.12.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, site activities would transition to aquifer restoration and site-wide decommissioning. Cameco would continue to manage solid and liquid byproduct and non-byproduct wastes from aquifer restoration in accordance with its NRC license and relevant State permits. During site-wide decommissioning, solid waste volumes would be greater than construction phase waste volumes, but the sites receiving the decommissioning wastes would be expected to have the needed capacity for their disposal. Therefore, the NRC staff concludes that waste management impacts from the No-Action Alternative would be SMALL and not significant.

4.3 North Butte Remote Satellite Site

In its 1990 EA, the NRC evaluated the potential environmental impacts of ISR-related activities (predominately impacts to ground water, from evaporation pond leaks and spills, and radiological impacts). At that time, the then licensee, Uranerz, proposed that the North Butte remote satellite site complete all the steps of uranium recovery and up to yellowcake production, with the Ruth site to act as a satellite to the North Butte site (NRC, 1990). Uranerz proposed nine mine units at North Butte, with an approved production flow rate of 11,355 lpm (3,000 gpm)[9]. Uranerz also proposed to use three evaporation ponds and deep well injection to

[9] Uranerz proposed to operate the Ruth site at 3,785 lpm (1,000 gpm) (NRC, 1990).

handle production wastewaters, and surface discharge during restoration (NRC, 1990; Section 3.6.3).

In the current license renewal application, Cameco proposes that the North Butte site be a remote satellite to the central Smith Ranch site, and that uranium-laden IX resins would be shipped from North Butte to the CPP at Smith Ranch for final processing into yellowcake. Cameco also proposes to increase the production flow rate from the planned five mine units at North Butte to 22,710 lpm (6,000 gpm) and to use deep well injection to dispose of process-related wastewaters, using a two-celled surge pond to temporarily store the wastewaters prior to their injection (Cameco, 2015, Section 4.2.2.4).

4.3.1 Land Use

Land use impacts from the Project were not addressed in NRC's 1990 EA for the North Butte remote satellite site (NRC, 1990). However, as discussed in Section 4.2.1 of this EA, the NRC staff has evaluated the generic land use impacts from an ISR facility in the WEUMR, where the North Butte site is located (NRC, 2009a). These impacts were determined to be SMALL, because (1) the amount of area disturbed by construction would be small in comparison to the available lands; (2) the majority of the site would not be fenced; (3) potential conflicts over mineral access would be expected to be negotiated and agreed upon; (4) only a small portion of the available land would be restricted from grazing; and (5) the open spaces for hunting and off-road vehicle access would be minimally impacted by the associated fencing. SMALL to MODERATE effects were expected during decommissioning (NRC, 2009a; Section 4.3.1).

4.3.1.1 <u>Impacts from the Proposed Action</u>

The 409 ha (1,010 ac) North Butte site consists primarily of privately-owned rangeland that is used for sheep and cattle grazing. The primary land-use impact resulting from the Proposed Action would be to restrict grazing during construction activities and then from inside fenced portions of the North Butte site (i.e., the mine units and the administrative and IX buildings). Cameco anticipates that a total of approximately 162 ha (400 ac) would be disturbed at the site, although at any point in time, the amount of surface disturbance would be less given that Cameco would construct the mine units sequentially (Cameco, 2014, Section 4.1.1.2). Interim and final surface reclamation of disturbed areas, including revegetation, would return areas to grazing once fencing is removed.

The grazing restrictions would be in place during the period the time currently anticipated for operations and aquifer restoration, and may be relaxed as mine units are decommissioned and reclaimed.

These impacts are consistent with the impacts identified in GEIS Section 4.3.1 for the WEUMR (NRC, 2009a). Therefore, the impacts from ISR activities at the North Butte site would be minor and not significant.

As discussed in EA Section 3.3.1, CBM development and extraction are occurring near to the North Butte site, and portions of the North Butte site area are included within planned CBM development areas. Cameco does not expect direct conflicts between its ISR operations and these existing or future mineral extraction or energy-related projects, in part because subsurface uranium deposits are located at depths stratigraphically separated from the CBM resources. Licensing of the Proposed Action could, however, potentially delay or preclude the exploration and development of other, currently unknown mineral resources that could be present on those

portions of the North Butte site that would be used for uranium recovery. As noted in GEIS Section 4.2.1, it is possible that other explorations for minerals and uranium-recovery operations could co-exist within the Proposed Action (NRC, 2009a). Overall, however, the potential impacts to the exploration or production of minerals or the extraction of energy-related fuels (e.g., natural gas and oil) as a result of the Proposed Action would not be significant.

The North Butte site is mostly privately owned and some recreational hunting could occur if allowed by the respective landowners. There are no developed recreational areas located within the North Butte site. Consequently, impacts to hunting and recreation from the Proposed Action would not be significant.

The nearest inhabited private residence, the Pfister Ranch, is located just south of the permit boundary for the North Butte site. Cameco's North Butte operations would not affect the land use of the ranch.

Therefore, the NRC staff concludes that land use impacts from the Proposed Action would be SMALL and not significant.

4.3.1.2 No-Action Alternative

Under the No-Action Alternative, the potential impacts to land use at the North Butte site would be similar to impacts under the Proposed Action. Site activities would transition to aquifer restoration and site-wide decommissioning, and no change in overall land use would occur until license termination. Private land ownership would remain, and the site would return to sheep and cattle grazing. Therefore, the NRC staff concludes that impacts to land use at the North Butte site would be SMALL and not significant under the No-Action Alternative.

4.3.2 Transportation

Transportation impacts from the Project were not previously evaluated for the North Butte remote satellite site (NRC, 1990). However, as discussed in Section 4.2.2 of this EA, the NRC staff determined that generic transportation impacts from an ISR facility in the WEUMR (where the North Butte site is located) would be SMALL to MODERATE due to (1) higher traffic counts on less-traveled roads, and (2) dust and noise impacts to residents in the vicinity of unpaved roads used by the ISR project (NRC, 2009a).

4.3.2.1 Impacts from the Proposed Action

Under the Proposed Action, Cameco's operations at the North Butte site would continue with the eventual installation of five mine units. Cameco estimates that an average of 40 workers would be employed during operations (Cameco, 2014, ER Section 3.2.2), although this number would likely be somewhat higher during periods of new wellfield construction. The licensee anticipates that these workers would commute predominantly from areas around Gillette, WY (75 percent), with others coming from the areas around Wright, WY (20 percent) and Casper, WY (5 percent) (Cameco, 2014, ER Section 3.2.2). Cameco expects site employment levels to decrease to approximately 16 workers during aquifer restoration and 10 workers during final decommissioning and reclamation (Cameco, 2014, ER Section 4.10.1.3).

In addition to traffic due to commuting workers, Cameco would be transporting uranium-loaded IX resins from North Butte to the Smith Ranch CPP during ISR operations and returning unloaded resin trucks back to North Butte. Cameco estimates an average of approximately 230

such round trips annually (Cameco, 2014, ER Table 3.2-2). Cameco also estimates that there would be approximately 135 shipments annually of chemicals (e.g., oxygen, carbon dioxide, hydrochloride acid, sodium bicarbonate) and fuel to the North Butte site (Cameco, 2014, ER Table 3.2-2).

Thus, the total vehicles per day associated with the North Butte site operations would be approximately 40. This represents an increase of at most 3 percent of the traffic on the sections of SH 387 and 50 in the vicinity of the site. Local roads used to access the North Butte site are also used for oil-field services, and Cameco's activities at the North Butte site would not be expected to result in an increase in traffic that would approach the road system's design capacity (Cameco, 2015). Therefore, the NRC staff concludes that impacts to the transportation system around the North Butte site from the Proposed Action would be SMALL and not significant.

Cameco's ISR activities at the North Butte site would involve (1) the transport of uranium-loaded IX resins from and uranium-barren IX resins to the site; (2) the shipment of chemicals and fuel to the site; and (3) the transport of byproduct materials offsite for disposal at a licensed facility. Traffic accidents may occur during these activities. Given the relative slight increase in traffic levels on affected roads near the North Butte site, accident probabilities on those roads would be expected to be nearly the same as without the additional traffic load associated with the licensee's activities at the site. Additionally, Cameco handles, packages, and ships IX resins and byproduct material in accordance with NRC and the U.S Department of Transportation (DOT) regulations, and the licensee has in place an emergency response plan for transportation accidents (Cameco, 2014, ER 5.2.2). Therefore, the NRC staff concludes the potential consequences from traffic accidents to be SMALL and not significant.

4.3.2.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, the number of workers needed for aquifer restoration and site-wide decommissioning would initially drop from operational levels to 16 workers and then to 10 workers as decommissioning is completed at the site (Cameco, 2014, ER 4.10.1.3). Uranium production and therefore IX resin shipments from the North Butte site would be substantially reduced compared to operational levels. Cameco would be expected to make shipments of byproduct materials in accordance with NRC and DOT regulation and to implement its emergency response plan. The licensee's shipments of byproduct and non-byproduct solid materials to licensed or permitted disposal facilities would increase over time relative to the Proposed Action due to site-wide decommissioning, but the total number of vehicle trips to and from the North Butte site would be expected to be less than during the Proposed Action. Transportation under the No-Action Alternative would make use of the same road system used under the Proposed Action, and accident probabilities would be less compared to the Proposed Action probabilities. Therefore, the NRC staff concludes that impacts to transportation near the North Butte site from the No-Action Alternative to be SMALL and not significant.

4.3.3 Geology, Seismology, and Soils

Geology, seismology, and soil impacts from the Project have not been previously evaluated for the North Butte remote satellite site (NRC, 1990). However, as discussed in Section 4.2.3 of this EA, the NRC staff has evaluated the generic impacts to geology, seismology, and soils from an ISR facility in the WEUMR, where the North Butte site is located (NRC, 2009a). The NRC staff determined that potential generic impacts to geology and seismology would be SMALL,

and that impacts to soils would be SMALL for most impacts, but SMALL to LARGE for soils impacted by spills of ISR process-related fluids.

4.3.3.1 Impacts from the Proposed Action

Impacts to Geology

As discussed in section 4.2.3.1 of this EA, during uranium-recovery operation, the injected lixiviant dissolves the uranium-mineral coatings on the sandstones in the targeted ore zone. This geochemical change results in mineralogical changes to the ore zone, but it does not affect the rock matrix nor rock structure. Cameco reported that no significant rock-matrix compression or ground subsidence has been observed during the 25 years of operation at the Smith Ranch site (Cameco, 2014, ER Section 4.3.1.1). Cameco's operations and use of lixiviant at the North Butte site would be similar to those at the Smith Ranch, the impacts of which the NRC staff concluded would be SMALL. Therefore, the NRC staff concludes that the impacts to geologic resources at the North Butte site from the Proposed Action would be SMALL and not significant.

Impacts to Seismology

Based upon the data compiled during historical uranium-recovery operations in the WEUMR, as discussed in GEIS Section 4.3.3, reactivation of geologic faults would not be anticipated (NRC, 2009a). As discussed in section 3.3.3 of this EA, earthquake activity in the area of the North Butte site is very low; the likely source of earthquakes is located approximately 321.9 km (200 mi) from the site. Additionally, Cameco has not identified subsurface faulting at the site, either through field observations or drillhole correlation. Cameco also considers that the likelihood of seismic events induced by operation of deep disposal wells at the North Butte site is minimal due to its control of the injection flow and pressure (Cameco, 2015, TR 3.10.4.3). Injection flow rates and pressures for the deep disposal wells at the site are set by conditions in the applicable WDEQ permit (WDEQ, 2016).

Therefore, the NRC staff concludes that impacts to seismology at the North Butte site from the No-Action Alternative would be SMALL and not significant.

Impacts to Soils

Impacts to soils were not evaluated in the earlier EA prepared by the NRC for the North Butte site (NRC, 1990). The NRC identified and evaluated generic impacts to soils at ISR projects in the WEUMR (NRC, 2009a; Section 4.3.3), where the North Butte site is located. Most soil impacts would be SMALL, but SMALL to LARGE for soils impacted by spills of ISR process-related fluids.

Construction activities at the North Butte site have the potential to increase erosion as a result of both wind and water due to the Licensee's removal of vegetation during construction activities and the physical disturbances of soils by vehicle and equipment traffic. Cameco estimates that up to 162 ha (400 ac) of the overall site's 409 ha (1,010 ac), or about 40 percent of the site, would be disturbed during the lifecycle of the Smith Ranch Project (Cameco, 2014, ER 4.3.1.2). However, due to the licensee's proposed sequencing of the construction and operation of the planned five mine units, and the use of interim stabilization and seeding of affected soil areas, soil disturbance at any one time would be less than the maximum of 162 ha (400 ac).

The mitigation measures described in Appendix D7 of the North Butte WDEQ/LQD Permit to Mine include the salvage of suitable topsoils and subsoils from permanently disturbed areas or areas where long-term disturbance would occur at the site (i.e., disturbances that would last longer than one year) (Cameco, 2012b). Such areas would include structures, paved storage or parking areas, access roads, and surface impoundments. Suitable soil-salvage depths would range from 15 – 150 cm (6 – 60 in) in depth. Salvaged soils would be used during site reclamation and restoration. Although considerably more than 15 percent of the North Butte site would be disturbed over the time of ISR activities at the North Butte site, Cameco's implementation of WDEQ/LQD-required erosion-control mitigation measures, such as soil salvage, would minimize potential soils loss and sediment transport.

Soils at the North Butte site also would be affected by spills of process-related fluids. The licensee conducts mitigative actions at the time of each spill (e.g., radiological surveys of the affected soils, soil sampling and analysis as needed). Cameco also conducts a program of continuous wellfield monitoring by roving wellfield operators and periodic inspections of each well that is in service (Cameco, 2015, TR 7.5.1.3). This monitoring, along with operational pipeline monitoring, aids in the identification of spills and leaks.

Given that (1) much less than 15 percent of the North Butte site would be disturbed, (2) Cameco would implement WDEQ/LQD-required erosion-control mitigation measures, such as soil salvage and prompt re-vegetation, and (3) the licensee's monitoring program, the NRC staff concludes that impacts to soils at the North Butte site would be SMALL and not significant.

4.3.3.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, Cameco would cease active uranium-recovery operations at the site and would transition to aquifer restoration and site decommissioning activities. The impacts to geology, seismology, and soils from the No-Action Alternative at the North Butte remote satellite site during its lifecycle are summarized below.

Impacts to Geology

Under the No-Action Alternative, the extent of uranium extraction would be diminished substantially as activity at the North Butte site transitions to aquifer restoration. Additionally, as discussed in section 4.3.3.1 of this EA, Cameco's experience with uranium recovery has not shown a marked impact on subsurface geologic structure. As a result, the NRC staff concludes that impacts to geologic resources at the North Butte site from the No-Action Alternative would be SMALL and not significant.

Impacts to Seismology

Under the No-Action Alternative, activities at the site would transition from uranium production to aquifer restoration and the continued use of deep disposal wells for the disposal of liquid effluents. As discussed for the Proposed Action, injection flow rates and pressures for the deep disposal wells are set by WDEQ permit condition, and kept below pressures at which induced seismicity could be expected to occur. Cameco's experience using deep disposal wells at the Smith Ranch site has not resulted in seismicity induced as a result of its activities, and the licensee believes that it will find the same at the North Butte site (Cameco, 2015, TR 3.10.4.3). With the completion of aquifer restoration over time, the potential for seismic activity induced by these activities would decrease. Therefore, the NRC staff concludes the impacts from the No-Action Alternative on seismic activity would be SMALL and not significant.

Impacts to Soils

Under the No-Action Alternative, uranium production would be diminish substantially over time, and site activities would transition to aquifer restoration. The potential for pipeline breaks and leaks would remain, along with the potential to affect soils by these incidents. Cameco would be expected to continue its site inspection activities to observe potential spills and to continue pressure monitoring of various pipelines.

Additionally, during and following aquifer restoration, site decommissioning activities would occur. In restored wellfields, these activities would include: (1) the plugging, sealing and abandoning of production and injection wells; (2) the de-installation of pipelines and trunklines; and (3) the removal of header houses and their foundations. Other site-wide decommissioning activities expected to affect soils would include de-construction of the North Butte satellite facility and administrative buildings and of site and wellfield access roads; resurvey and possible additional soil cleanup of areas affected by spills and leaks; removal of evaporation pond liners and berms, and activities meant to restore the topography of the site. Cameco would be expected to conduct these activities in sequence as wellfield aquifers are restored, and to implement reapplication of topsoils with interim and final revegetation and seeding.

As a result of these activities, the impacts to soils at the North Butte site from the No-Action Alternative would be SMALL and not significant.

4.3.4 Water Resources

Ground water impacts from the Project have been previously evaluated for the North Butte remote satellite site (NRC, 1990). The NRC staff evaluated the potential impacts on ground water quality due to excursions of process-related solutions during uranium-recovery operations, surface-impoundment seepage and spills, and aquifer-restoration techniques (NRC, 1990). Based upon this EA evaluation, the NRC concluded that the North Butte site would have minimal impacts on ground water quality. Surface-water impacts were not evaluated in the 1990 EA.

Additionally, as discussed in EA Section 4.2.4, the NRC staff also evaluated the generic impacts to surface water and ground water from an ISR facility in the WEUMR, where the North Butte site is located (NRC, 2009a). The staff expected that generic surface water impacts would be SMALL due to anticipated licensee compliance with applicable federal and state regulations and permit conditions and the licensee's use of best management practices and required mitigation measures.

Regarding generic ground water impacts, the NRC staff determined that (1) SMALL impacts would be expected from consumptive use during construction and decommissioning, shallow aquifer effects from fuel and lubricant spills, water quality changes in the uranium-bearing ore zone, and well plugging and abandonment; (2) SMALL to MODERATE impacts would be expected from consumptive use during operations and aquifer restoration, and (3) SMALL to LARGE impacts would be expected from impacts from horizontal and vertical excursions during ISR operations.

4.3.4.1 Impacts from the Proposed Action

Impacts to Surface Waters

Cameco would not make use of surface water for either production or non-production uses nor would it discharge treated waste waters into local streams at the North Butte site (Cameco, 2014, ER 4.4.1.1.2). The licensee would continue to implement best management practices (BMPs), along with erosion control measures (see Cameco, 2015, TR 3.8.2), interim revegetation, and the use of culverts, to minimize the potential for site runoff to affect surface water. Cameco would implement a Surface Water Pollution Prevention Plan (SWPPP) to address storm-water runoff. The SWPPP would describe the management of surface drainage at the site and would include the BMPs that would be used to control runoff and sediment (Cameco, 2014, ER 5.4.1). Additionally, Cameco regularly analyzes samples taken from surface water locations around the site to monitor any impacts to surface water at the North Butte site.

During the operation phase at the North Butte site, Cameco would be discharging liquid byproduct material wastes to UIC Class I deep disposal wells. Furthermore, because surface water drainages within the North Butte site are generally ephemeral and flow only in response to snow-melt or large rain events, it is unlikely that a spill or leak would reach surface water. These factors, in addition to the monitoring and inspection program to be implemented by the licensee at the North Butte site, would increase the likelihood that any spills or leaks would be contained and cleaned up upon discovery (Cameco, 2014, ER 4.4.1.1.2).

Therefore, the NRC staff concludes that impacts to surface water from the Proposed Action would be SMALL and not significant.

There is one wetland at the North Butte site, and it is associated with a small stock pond with an area of 0.02 ha (0.05 ac) (see section 3.3.4.2 of this EA). If this wetland cannot be avoided by construction and operations at the site, then Cameco would obtain the necessary permits from the USACE to comply with Section 404 of the CWA before any disturbance to the wetland occurs. Based on the mitigation requirements in the USACE 404 permitting process, the NRC staff concludes that impacts to the wetland would be SMALL and not significant.

Impacts to Ground Water

Ground Water Quality

As discussed in section 4.2.4.1 of this EA, water quality in the ore-zone aquifer becomes degraded during uranium-recovery operation (NRC, 2009a). However, Cameco is required by its NRC license to restore the aquifer to NRC-approved background concentrations, if possible. If the aquifer cannot be returned to preoperational conditions, the NRC requires that the aquifer meet the MCLs provided in 10 CFR Part 40, Appendix A, Table 5C or the ACLs approved by the NRC (10 CFR Part 40; NRC, 2009a). For these reasons, the NRC determined that potential impacts to water quality of the uranium-bearing aquifer (i.e., ore zone, production zone or unit, or mineralized zone) as a result of ISR operation would be SMALL and temporary (NRC, 2009a).

GEIS Section 4.2.4 discussed the potential for vertical and horizontal excursions of degraded ground water outside of the uranium-recovery zone. The impact of horizontal excursions could be MODERATE or LARGE, if a large volume of contaminated water moves out of the uranium-

bearing aquifer and moves downgradient. Since operations began at the North Butte site in 2013, 3 monitoring wells were placed on excursion status (Cameco, 2016b; Cameco, 2017b). Upon identification of the excursion at the wells, Cameco took actions required under License SUA-1548 and actions to contain and control each excursion (Cameco, 2016a; Cameco, 2017a). These actions included excursion control pumping and regular monitoring until the excursions were resolved.

To reduce the likelihood and consequences of potential excursions, licensees take preventive measures before starting uranium-recovery operations, such as properly plugging abandoned drillholes and wells according to methods established by WDEQ/LQD (2005). During the operation and aquifer-restoration phases, the licensee creates an inward-flow gradient to minimize the potential for horizontal excursions and also conducts pre-operation aquifer testing to ensure the integrity of the confining geologic units with the goal of minimizing the potential for vertical excursions. The NRC requires Cameco to install monitoring wells for the detection of both horizontal and vertical excursions out of the wellfields.

Based upon these actions and the history of successful aquifer restoration at Smith Ranch wellfields, the NRC concludes that impacts to ground water would be localized (i.e., within the site boundary area) and temporary; therefore, these impacts would be SMALL and not significant.

Ground water quality could also be potentially impacted by the drilling fluids and muds introduced into aquifers during well construction (NRC, 2009a). Construction of wells according to WDEQ/LQD's rules would minimize the potential for impacts associated with well construction (Cameco, 2014; WDEQ/LQD, 2005, WDEQ/WQD, 2012). Potential impacts to ground water quality during aquifer restoration and site reclamation would be associated with the abandoned monitoring, injection, and recovery wells (NRC, 2009a). Abandonment of the wells according to the WDEQ requirements would isolate the wells from the flow regime beneath the site (NRC, 2009a; WDEQ/LQD, 2005, WDEQ/LQD, 2000; Cameco, 2014); thus, the potential impacts associated with well construction would be SMALL.

Under these conditions and requirements, the NRC staff considers that potential impacts of Cameco's continued ISR operations under the Proposed Action on ground water quality would be MODERATE during uranium recovery and SMALL after the aquifer is restored.

The Proposed Action includes deep-injection wells for the disposal of waste water (Cameco, 2015). The deep-well disposal of waste water would be conducted in accordance with the requirements of an approved UIC Permit from the WDEQ/Water Quality Division (WQD) for Class I deep-disposal wells (Cameco, 2012b). Permit requirements would be established to protect "underground sources of drinking water" in the vicinity of the deep-disposal well. In addition, the UIC Permit would also require the Licensee to control effluent injection pressures at the wellhead to ensure that the fracture pressure of the respective formation is not exceeded. The conditions of the UIC Permit would mitigate ground water impacts; thus, the impacts of the Proposed Action's operation to ground water quality in deep aquifers would be SMALL. In addition, operation-phase impacts to deep aquifers due to the deep-well injection of waste water would be SMALL due to the poor water quality and low yields of the deep aquifers targeted for deep-well injection.

Overall, the NRC staff concludes that impacts to ground water quality would not be significant.

Ground Water Use

The Licensee conducted ground water modeling of the production zones at the North Butte site and concluded that impacts to the F-Sand aquifer would be negligible (Cameco, 2012b). Stock- and domestic-water wells in the B-Sand aquifer were found to be most likely to be impacted during the 16-year modeling period. The projected maximum drawdown would likely occur at the Pfister Ranch, southeast of the North Butte site, and the drawdown would be approximately 6.7 m (22 ft). Wells completed in the A and C Sands at the North Butte site were predicted to reflect maximum drawdowns of approximately 3 m (10 ft). These drawdowns would not impact the usability of nearby wells. If problems are identified with any domestic well within 2 km (1 mi) of the license boundary, the Licensee has committed to providing an alternate source of water to the well user(s). Thus, impacts to ground water use at the North Butte site would be SMALL during the Proposed Action and not significant.

4.3.4.2 Impacts from the No-Action Alternative

Impacts to Surface Water

Under the No-Action Alternative, Cameco would be expected to continue to implement best management practices and to implement an SWPPP to minimize the potential for storm-water runoff to affect surface water at the North Butte site. Additionally, the licensee would be expected to not make use of surface water nor to discharge treated waste waters into local streams at the North Butte site and to continue surface water monitoring at the site.

During the aquifer restoration, Cameco would be discharging liquid byproduct material wastes to UIC Class I deep disposal wells. Furthermore, given Cameco's monitoring and inspection program and the ephemeral nature of surface water drainages within the North Butte site, it is unlikely that a spill or leak would reach surface water.

Therefore, the NRC staff concludes that impacts to surface water from the Proposed Action would be SMALL and not significant.

As for the Proposed Action, if the one wetland cannot be avoided by site-wide decommissioning, then Cameco would obtain the necessary permits from the USACE to comply with Section 404 of the CWA before any disturbance to the wetland occurs. Based upon the mitigation requirements in this permitting process, the NRC staff concludes that impacts to the wetland would be SMALL and not significant.

Impacts to Ground Water

As discussed for the Proposed Action, ground water quality and use would be affected by activities under the No-Action Alternative. As site activities transition from uranium production to aquifer restoration, consumptive use of ground water would be expected to increase. This effect would be experienced over the period of restoration of the two active mine units at the North Butte site. Ground water quality would be expected to increase as aquifer restoration proceeds and is completed. Drawdown in nearby stock and domestic wells, as discussed for the Proposed Action, would continue until the completion of restoration, at which time the water levels in affected wells would be expected to recover.

Cameco would abandon injection, production, and monitoring wells in accordance with WDEQ requirements. This would minimize the likelihood of future impacts to ground water quality.

Therefore, the NRC staff considers that impacts to ground water from the No-Action Alternative at the North Butte site would be MODERATE during aquifer restoration, but SMALL following the completion of restoration. Overall, the NRC staff concludes that impacts to ground water at the North Butte site would not be significant.

4.3.5 Ecological Resources

Project impacts to ecological resources have not been previously evaluated for the North Butte site (NRC, 1990). However, as discussed in Section 4.2.5 of this EA, the NRC staff has evaluated the generic impacts to ecological resources from an ISR facility in the WEUMR, where the North Butte remote satellite site is located (NRC, 2009a). The staff determined that impacts would be greatest during the construction phase, when impacts would be SMALL to MODERATE on vegetation and terrestrial wildlife and SMALL to LARGE on threatened and endangered species, depending on site-specific conditions.

4.3.5.1 Impacts from the Proposed Action

Vegetation

The existing North Butte license area consists of 409 ha (1,010 ac), of which up to approximately 160 ha (400 ac), or approximately 40 percent, would be disturbed during the lifecycle of the Smith Ranch Project (Cameco, 2014). Due to the proposed sequencing of construction, operation, aquifer restoration, and site reclamation and decommissioning activities, the Licensee would disturb less than the 160 ha (400 ac) at any given time. Most disturbances would occur during the construction phase at the site and during site restoration. As described in EA Section 4.2.5.1, Cameco would spread topsoil as needed and reseed as soon as possible following construction activities and during decommissioning. Additionally, following the repair of a leak or spill, Cameco would survey the affected soils for radioactivity, document the area of the spill, and remove impacted soils as needed. Affected areas would be reseeded using WDEQ-approved seed mixes.

Based on the sequencing of Project operations, prompt reseeding of disturbed lands with a WDEQ-approved seed mix, and demonstrated successful mitigation at the Smith Ranch site during past operations, the NRC staff concludes that impacts to vegetation under the Proposed Action at the North Butte site would be SMALL and not significant.

Wildlife

The NRC previously determined that construction and operational impacts to wildlife populations under the existing license would not result in long-term decreases (NRC, 2001; NRC, 2006). As discussed under “Vegetation,” up to 40 percent of the North Butte site may be impacted by ISR activities; however, disturbance at any one time would be expected to be much less than the full 40 percent (Cameco, 2014, ER 4.3.1.2). The results of Cameco’s 2010 updated wildlife survey at the North Butte site are discussed in sections 3.3.5.2 and 3.3.5.3 of this EA.

In accordance with WDEQ/LQD regulations, Cameco consults with the FWS and the WGFD, and with BLM when applicable, to create a wildlife monitoring plan to provide proper protection and mitigation measures to ensure wildlife is not negatively impacted (Cameco, 2014, ER 4.5.1.1.4). Cameco’s monitoring plan for the North Butte site is discussed in its permit with the WDEQ (see Addendum D9-1 of Cameco, 2011a). Additionally, as discussed in the preceding

section of this EA, the licensee works to reseed areas disturbed by site operations to restore vegetation, thus restoring potential habitat for wildlife.

Given the small percentage of land disturbed, Cameco's commitment to interim and final revegetation and to an ongoing wildlife monitoring and if needed, a mitigation plan, the NRC staff concludes that impacts to wildlife resources under the Proposed Action at the North Butte site would be SMALL and not significant.

Protected Species

Surveys in 2010 at the North Butte site did not find the presence of Federally-listed threatened or endangered vegetative or wildlife species at the North Butte site. Cameco's wildlife monitoring plan for the site includes annual and opportunistic monitoring for these species (Cameco, 2011a; Addendum D9-1), and its goal is to avoid impacts to them within areas of planned activity. Where an impact to a species or nest is unavoidable, the Licensee would coordinate appropriately with the WDEQ/LQD, BLM, USFWS, and WGFD to develop appropriate mitigation plans (Cameco, 2014, ER 5.5.2).

Therefore, the NRC staff concludes that impacts to protected resources under the Proposed Action at the North Butte site would be SMALL and not significant.

4.3.5.2 Impacts from the No-Action Alternative

Vegetation

Under the No-Action Alternative, Cameco's activities at the site would transition to aquifer restoration and site-wide decommissioning. Impacts to vegetation, therefore, would results from header house and pipeline spills and leaks and also from surface-disturbing and restoring activities. As for the Proposed Action, Cameco would take timely action to address soils affected by a spill or leak, with reseeding with approved seed mixes, and also use salvaged topsoils and approved seed mixes to address the disturbed areas. Impacts would be expected to be temporary and to be phased as site-wide decommissioning proceeds. For these reasons, the NRC staff concludes that impacts to vegetation from the No-Action Alternative would be SMALL and not significant.

Wildlife

Wildlife impacts from the No-Action Alternative would be similar to those under the Proposed Action. Cameco would be expected to perform interim and final reseeding to restore vegetation for wildlife consumption, conduct annual and opportunistic monitoring for wildlife, and develop mitigation plans, as needed, to avoid impacts. Therefore, the NRC staff concludes that impacts to wildlife from the No-Action Alternative would be SMALL and not significant.

Protected Species

As discussed previously in this section, Cameco's 2010 surveys did not identify the presence of or habitat for Federally-listed threatened and endangered vegetative or animal species at the North Butte site. However, Cameco would be expected to implement a wildlife monitoring plan that includes annual and opportunistic monitoring for these species and to develop mitigation plans, as needed, to avoid impacts to the species. For these reasons, the NRC staff concludes

that impacts to protected species under the No-Action Alternative would be SMALL and not significant.

4.3.6 Meteorology and Air Quality

Air quality impacts from the Project have not been previously evaluated for the North Butte remote satellite site (NRC, 1990). However, as discussed in Section 4.2.6, the NRC staff has evaluated the generic air quality impacts from an ISR facility in the WEUMR, where the North Butte site is located (NRC, 2009a). The staff determined that such generic impacts would be SMALL due to (1) the temporary nature of fugitive dust, and vehicle emissions; and (2) the low levels of airborne effluents released that subsequently would be readily dispersed (NRC, 2009a).

4.3.6.1 Impacts from the Proposed Action

As discussed in section 4.2.6.1 of this EA, particulate emissions would be expected to result during all Project phases at the North Butte site. These impacts would be expected to come predominantly from employee travel along unpaved roads and from drilling support (e.g., drilling rigs, water trucks, pipe trucks) in the wellfields (Cameco, 2015, TR 7.2.1). Cameco estimates that site operations at the North Butte site would produce approximately 97 MT (107 T) of fugitive dust per year (Cameco, 2014, ER 5.6). As for the Smith Ranch site, Cameco would employ mitigation measures, as needed, such as periodic watering of unpaved roads, speed limits on the roads, and reclamation and revegetation of disturbed areas (Cameco, 2014, ER 5.6)

Diesel emissions and exhaust from employee and company vehicles also would occur during all phases at the North Butte site as well, with emission levels expected to be highest during the construction and decommissioning phases. As outlined in GEIS Section 4.3.6.1 (NRC, 2009a), gaseous-emission levels from an ISR facility are expected to comply with applicable regulatory limits and restrictions. These emissions are not expected to reach levels that would result in the ISR facility's being classified as a major source under the operating (Title V) permit process. Therefore, impacts to air quality from ISR facilities would be SMALL (NRC, 2009a).

4.3.6.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, air quality impacts would be similar to those expected under the Proposed Action. Site-wide decommissioning would be expected to produce fugitive dust as earth-disturbing activities occur, along with travel along unpaved roads to and from the decommissioning locations. Equipment used to reseed disturbed areas would produce vehicle emissions and fugitive dust, while the revegetation would reduce fugitive dust from the disturbed areas. Emission levels would be expected to be periodic but temporary as decommissioning of individual wellfields occurs, and levels would be expected to decrease over the long-term as the site is reclaimed.

Therefore, the impacts from particulate emissions and gaseous emissions would be less than the Proposed Action, and these impacts would be SMALL and not significant.

4.3.7 Noise

Noise impacts from the Project have not been previously evaluated for the North Butte remote satellite site (NRC, 1990). However, as discussed in Section 4.2.7, the NRC staff has evaluated

the generic noise impacts from an ISR facility in the WEUMR, where the North Butte site is located (NRC, 2009a). The staff determined that generic noise impacts would be SMALL for offsite receptors beyond 300 m (1,000 ft) and MODERATE for site workers such as the well drillers (NRC, 2009a).

4.3.7.1 Impacts from the Proposed Action

The nearest occupied residence (i.e., the Pfister Ranch house) is located approximately 1 km (0.5 mi) away (Cameco, 2014, ER 3.7.2). While residents may experience increased noise levels, especially during wellfield construction, the distance of the Pfister Ranch house from these activities is beyond the 300 m (1,000 ft) distance described by the GEIS as producing SMALL noise impacts. Site workers would still be expected to experience MODERATE noise impacts. Overall though, such impacts are temporary and would be mitigated by personal hearing protection (Cameco, 2015, TR 7.2.2). Therefore, the noise impacts at the North Butte site from the Proposed Action would be not significant.

4.3.7.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, noise predominantly would be associated with equipment used in site-wide decommissioning. Residents at the Pfister Ranch would be greater than 300 m (1,000 ft) from the equipment, and which the GEIS determined would ensure SMALL impacts. Therefore, the NRC staff concludes that the noise impact to offsite receptors would be SMALL and not significant. Noise impacts to onsite workers would be MODERATE, but would be reduced through the use of personal hearing protection. Therefore, the NRC staff concludes that noise impacts at the North Butte site from the No-Action Alternative would not be significant.

4.3.8 Historical and Cultural Resources

As discussed in EA Section 3.3.8, the North Butte site has been inventoried for cultural resources. All of the sites identified as recommended for eligibility under the NRHP at the North Butte site are located outside the direct APE; therefore, the NRC staff concludes that these historic resources would not be adversely affected by the undertaking (i.e., the Proposed Action). If Cameco would want to develop the areas outside the direct APE where historic and cultural resources have been identified as eligible for the NRHP, the licensee would be required to propose mitigation measures, for NRC review and approval, which would preserve the integrity of these sites. If an inadvertent discovery of historic or cultural resources is made, Cameco would be required to cease work and all appropriate state, tribal, and federal parties must be contacted. Any discovered artifacts would be inventoried and evaluated in accordance with 36 CFR Part 800. Based on the license condition and commitments made by the licensee, the NRC staff concludes that historical and cultural resources would be protected from destruction or disruption by the proposed activities. Therefore, the NRC staff concludes that historic and cultural resources would not be adversely affected by the undertaking.

4.3.9 Visual and Scenic Resources

Visual and scenic impacts from the Project have not been previously evaluated for the North Butte remote satellite site (NRC, 1990). However, as discussed in EA Section 4.2.9, the NRC staff determined that generic visual and scenic impacts from an ISR facility in the WEUMR (where the North Butte site is located) would be SMALL given the anticipated locations of ISR

facilities and through the implementation of best management practices such as dust suppression (NRC, 2009a).

4.3.9.1 Impacts from the Proposed Action

Due to low-lying hills and the North Butte, the North Butte remote satellite site is not visible from 16 km (10 mi) in all directions, but the site is visible from a distance of approximately 8 km (5 mi) in all directions except from the north (Cameco, 2014, ER 3.9.4). Impacts to regional visual resources from the Proposed Action would include drilling rigs and surface disturbance associated with wellfield construction, fencing around wellfields and administrative buildings, and night lighting. Cameco would seek to reseed disturbed areas as soon as possible following the disturbance, and would paint wellhead covers and process and administrative buildings in non-contrasting colors as compared with the surrounding topography. These activities also would help to mitigate visual and scenic impacts to North Butte, one of the Pumpkin Buttes. Visual contrasts due to the buildings, fencing and lighting would remain throughout operations at the site.

Cameco's North Butte site is located in the prairie landscape of the Powder River Basin southwest of Gillette, Wyoming, and near the Pumpkin Buttes. Approximately 90 percent (370 ha (915 ac)) of the site has been rated as VRM Class III, and the remaining approximately 10 percent (38 ha (95 ac)) is rated as VRM Class IV (Cameco, 2014, ER Figure 3.9.2A).

Results of a site-specific Scenic Quality Inventory and Evaluation rated the site with a total score of 17 due to the water that was present in the area, the variation in color, and the adjacent scenery, with its distinctive buttes that greatly enhance the visual quality (Cameco, 2014, ER 3.9.4). However, if the visual-resource evaluation rating score is less than 19, no further evaluation of existing scenic resources is required (NRC, 2003b).

Therefore, the NRC staff concludes that visual and scenic impacts from the Proposed Action at the North Butte site would be SMALL to MODERATE and not significant.

4.3.9.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, Cameco would transition site activities to aquifer restoration and site-wide decommissioning. Impacts would be expected to be similar to those under the Proposed Action. Process and administrative buildings, fencing, and lighting would remain throughout aquifer restoration and the majority of decommissioning. Decommissioning equipment would be present in the wellfields and would provide a visual contrast, along with soils and areas disturbed due to decommissioning activities. These impacts would be of short-term duration and temporary in that decommissioning would be phased as individual wellfields are restored and as disturbed areas would be reclaimed and reseeded. The contrast provided by fencing and lighting would be reduced over time as reclaimed wellfields are returned to livestock grazing and wildlife habitat.

Therefore, the impacts to visual and scenic resources from the Proposed Action at the North Butte site would be SMALL to MODERATE and not significant.

4.3.10 Socioeconomic Resources

Socioeconomic impacts from the Project have not been previously evaluated for the North Butte remote satellite site (NRC, 1990). However, as discussed in Section 4.2.10, the NRC staff has

determined that generic socioeconomic impacts from an ISR facility in the WEUMR (where the North Butte site is located) would be SMALL to MODERATE given the anticipated rural locations of ISR facilities and supporting communities (NRC, 2009a).

4.3.10.1 Impacts from the Proposed Action

Under the Proposed Action, Cameco anticipates approximately 32 employees would be working at the North Butte site during operations, with additional temporary construction workers onsite during wellfield construction (Cameco, 2014, ER 4.10.1.1 and 4.10.1.2). Construction workers would be drawn from the local construction labor pool, and operational employees would be expected to come from Gillette, Wyoming (24 employees) and Casper, Wyoming (8 employees) (Cameco, 2014, ER 4.2.1.2). Because there any change in living arrangements would be temporary and more likely for the construction work force, the NRC staff concludes that impacts to local socioeconomics from the Proposed Action at the North Butte site would be minimal. This assessment includes impacts to demographics, income levels, housing, local finance, and educational needs. Beneficial impacts may accrue due to the increased uranium production at the site, as operations at the North Butte site come fully online. Therefore, the NRC staff concludes that socioeconomic impacts from the Proposed Action at the North Butte site would be SMALL and not significant.

Minority and low-income populations are not found within 80 km (50 mi) of the North Butte site. For this reason and because impacts are SMALL and not significant, the NRC staff concludes there would be no disproportionate human-health and environmental impacts to these populations.

4.3.10.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, Cameco would transition site activities from uranium production to aquifer restoration and site-wide decommissioning. Initially, the number of site employees would be cut approximately in half as compared with uranium production levels (32 to 16 employees), but over time, Cameco estimates 10 employees would be required for decommissioning activities (Cameco, 2014: ER 4.10.1.3). The economic benefits and socioeconomic impacts during operations would be reduced as activities under this alternative proceeded. By the time site-wide decommissioning is completed, the final site workers would be released accompanied by the resulting final decreases in: population; housing demand; demand for education, health and social services; tax revenue for local jurisdictions; and local income levels. Thus, the NRC staff concludes that the socioeconomic impacts of the No-Action Alternative at the North Butte site would be SMALL to MODERATE, and MODERATE impacts would result from the absence of tax revenues that would have been generated from the Proposed Action. These impacts would not be significant.

Minority and low-income populations are not found within 80 km (50 mi) of the North Butte site. For this reason and because impacts are SMALL and not significant, the NRC staff concludes there would be no disproportionate human-health and environmental impacts to these populations.

4.3.11 Public and Occupational Health and Safety

Public and occupational health and safety impacts from the Project have been previously evaluated for the North Butte remote satellite site (NRC, 1990). Radiological impacts to workers

and the public were determined to fall well below the dose limits in 10 CFR Part 20, and for this reason, the impacts were deemed not significant.

Additionally, as discussed in Section 4.2.11, the NRC staff determined that public and occupational health and safety impacts from an ISR facility in the WEUMR (where the North Butte site is located) would be SMALL during construction, normal operations, aquifer restoration, and decommissioning. However, MODERATE radiological and non-radiological impacts to workers could result during operations if the effects of such accidents were not mitigated (NRC, 2009a).

4.3.11.1 Impacts from the Proposed Action

Cameco has implemented standard operating procedures for handling, processing, storing, transporting or disposing of source and byproduct and hazardous materials (Cameco, 2014, ER 4.12.1). Additionally, Cameco has implemented procedures, training, and Management Actions designed to mitigate the risk of radiation exposure to both the public and the employees. These include process designs such as the use of vacuum driers as opposed to calciner dryers and using down-flow pressurized IX columns instead of open columns. Additionally, all of the facilities provide ventilation systems that remove any released Radon-222 from the buildings to the atmosphere (Cameco, 2014, ER 5.12).

Cameco has committed to keeping radiological doses as low ALARA, and conducts annual ALARA audits, and daily, weekly, and monthly radiation inspections of its facilities and site (Cameco, 2014, ER 5.12.1). Radiological doses to workers and the members of the public are expected to be a small fraction of the limits in 10 CFR Part 20 that have been established for the protection of public health and safety.

Potential non-radiological impacts would be related primarily to exhaust and diesel emissions from employee vehicles, construction equipment, and field vehicles and also from fugitive dust derived from traveling along access roads and from the grading and construction in wellfields. These impacts would be experienced daily at the site, although they would be temporary and of short-term duration.

Therefore, the NRC staff concludes that radiological and non-radiological impacts at the North Butte site from the Proposed Action would be SMALL and not significant.

4.3.11.2 Impacts from the No-Action Alternative

As discussed in section 4.2.11.2 of this EA, while uranium production would decrease substantially under the No-Action Alternative, a relatively limited amount of uranium would be processed at the site as part of aquifer restoration activities. Cameco would continue to conduct the same standard operating procedures, ALARA policy, and radiological monitoring programs under this alternative as it does under the Proposed Action. Radiological doses to workers and to the public would be reduced due to the reduction in uranium processing, and would comply with the annual dose limits in 10 CFR Part 20.

Non-radiological impacts related to site-wide decommissioning activities would be greater than those experienced under the Proposed Action. This is due to the focus on decommissioning and demolition of existing structures and access roads, excavation of buried pipelines and trunklines, reseeding and revegetation of disturbed areas, and regrading to restore site topography. Exhaust and emissions from the various equipment involved would also be

increased over the levels under the Proposed Action. These impacts would be temporary, however, because the decommissioning activities are phased over time to address wellfields that have completed aquifer restoration.

Therefore, the NRC staff concludes that radiological impacts would be SMALL and not significant, and that non-radiological impacts would be MODERATE over the short-term and SMALL over the long-term as site-wide decommissioning is completed.

4.3.12 Waste Management

Waste management impacts from the Project have been previously evaluated for the North Butte remote satellite site (NRC, 1990). Additionally, as discussed in Section 4.2.12, the NRC staff determined that generic waste management impacts from an ISR facility in the WEUMR (where the North Butte site is located) would be SMALL. This is due to federal and state requirements that ISR facilities have sufficient disposal capacity available for both radiological and non-radiological solid and liquid wastes.

4.3.12.1 Impacts from the Proposed Action

Under the Proposed Action, byproduct material and non-byproduct material solid and liquid waste volumes would be increased due to the continued operations of two mine units at the North Butte site, the planned construction and opening of three additional mine units, and operations to an increased flow rate of 22,710 lpm (6,000 gpm). As discussed in section 2.2.2 of this EA, Cameco is disposing of process-related liquid byproduct materials by injection down WDEQ-approved UIC Class I deep disposal wells, and disposing of solid byproduct material waste at an offsite facility licensed to accept this material for disposal. Cameco would continue to manage these wastes in accordance with its existing NRC license and relevant State permits. The NRC staff concludes that waste management impacts from the Proposed Action would be SMALL and not significant.

4.3.12.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, activities at the North Butte site would transition to aquifer restoration and site-wide decommissioning. As for the Proposed Action, during aquifer restoration, Cameco would be expected to continue to use UIC Class I deep disposal wells and offsite licensed facilities for the disposal of liquid and solid byproduct material, respectively. Additionally, Cameco would be expected to continue to manage solid and liquid byproduct and non-byproduct wastes from aquifer restoration in accordance with its NRC license and relevant State permits. During site-wide decommissioning, solid waste volumes would be greater than construction phase waste volumes, but the sites receiving the decommissioning wastes would be expected to have the needed capacity for their disposal. Therefore, the NRC staff concludes that waste management impacts from the No-Action Alternative would be SMALL and not significant.

4.4 Gas Hills Remote Satellite Site

As discussed in Section 4.1, the NRC staff is adopting in this EA the BLM's environmental impact conclusions, as appropriate, for respective resource areas from the BLM's 2013 EIS for the Gas Hills site (BLM, 2013). In determining to do so, the NRC has concluded that the

Proposed Action for this EA is consistent with the Proposed Action analyzed by the BLM in its EIS.

In the following sections, the NRC staff summarizes the BLM's analysis and environmental conclusions for the Proposed Action. The NRC also provides impact conclusions from the GEIS and NRC's 2004 EA. In a separate section, the staff also evaluates potential impacts from the No-Action Alternative.

4.4.1 Land Use

Land use impacts from the ISR activities have been previously evaluated for the Gas Hills remote satellite site (NRC, 2004; BLM, 2013). These evaluations addressed impacts from the fencing of wellfields to deter livestock and wildlife foraging, from landowner controls on hunting, and from surface spills of ISR process-related solutions, and determined that such impacts would be temporary and not significant. The NRC staff also determined that generic land use impacts from an ISR facility in the WWUMR would be SMALL for most construction, operation, and aquifer restoration impacts (e.g., changes to land use, effects on mineral rights, grazing, and recreation activities) (NRC, 2009a). Additionally, SMALL to MODERATE impacts due to earth-disturbing impacts would be expected during the ISR decommissioning phase (NRC, 2009a).

4.4.1.1 Impacts from the Proposed Action

In the BLM's site-specific analysis (BLM, 2013; Section 4.5.2), the impacts from the Proposed Action to livestock grazing primarily would be long-term, due to Cameco's placement of fencing around each mine unit. This would mean a loss of forage and Animal Unit Months (AUMs)[10], limiting access to water sources, and interference with livestock management. Cameco would fence each individual mine unit at the start of construction to keep out livestock, and the fencing would remain during operations and reclamation. During reclamation, the fence would remain for a period of at least 2 years, or until the vegetation is capable of renewing itself with properly managed grazing and without supplemental irrigation or fertilization. Outside of the mine units, impacts to livestock resources would result from the surface-disturbing activities associated with construction and operation of roads, evaporation ponds, above-ground facilities, and overhead power lines.

BLM's analysis of grazing impacts assumed the maximum amount of land disturbance while recognizing that Cameco's construction, operation, and reclamation of each mine unit could take several years depending on market and environmental issues (BLM, 2013; Section 4.5.2). BLM estimated 532 ha (1,315 ac; 62 AUMs) of available forage would be lost during ISR activities at the Gas Hills site due to Cameco's construction of surface facilities and fencing of the mine units (BLM, 2013; Table 4.5-1). This would represent slightly more than 2 percent of the total active AUMs.

Additional long-term effects from construction and operation activities would result from surface-disturbing activities outside the mine units, increased vehicle traffic, and increased road and utility networks.

[10] An Animal Unit Month represents the quantity of forage necessary to sustain 1 cow-calf pair or 5 sheep for 1 month (BLM, 2013).

BLM also evaluated impacts to recreational uses of the Gas Hills site (BLM, 2013; Section 4.9.2). BLM determined that there would be minor impacts from noise and traffic associated with construction and drilling activities and from the presence of the above-ground facilities. However, BLM also noted that there were more appealing recreational areas in the vicinity, and that in the long term, there would be better access to the area from improved roads and more area available for recreation following final site decommissioning and reclamation.

The NRC staff, therefore, concludes impacts to land use from the Proposed Action at the Gas Hills site to be SMALL and not significant.

4.4.1.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, ISR activities would not occur and no new facilities would be constructed. Cameco would reclaim approximately 4.8 km (3 mi) of roads within the Gas Hills site area, decommission existing facilities (e.g., the Carol Shop), and reclaim previous disturbed lands. These activities would result in additional forage becoming available (BLM, 2013; Section 4.5.1). Reclamation of 4.8 km (3 mi) of roads would slightly limit recreational access, but after facility decommissioning and subsequent reclamation, more acreage would be open to recreational activities. In the short term, impacts to recreational uses would not change from current levels (BLM, 2013; Section 4.9.1).

Therefore, the NRC staff concludes impacts to land use from the No-Action Alternative at the Gas Hills site to be SMALL and not significant.

4.4.2 Transportation

Transportation impacts from the Project have been previously evaluated for the Gas Hills remote satellite site (NRC, 2004, BLM, 2013). These evaluations addressed transportation impacts from construction and operation activities. Additionally, the NRC staff determined that generic transportation impacts from an ISR facility in the WWUMR (where the Gas Hills site is located) would be SMALL to MODERATE due to (1) higher traffic counts on less-traveled roads, and (2) dust and noise impacts to residents in the vicinity of unpaved roads used by the ISR project (NRC, 2009a).

4.4.2.1 Impacts from the Proposed Action

Under the Proposed Action, Cameco could construct and operate the Gas Hills site. Transportation impacts would be greatest during construction with an estimated 22 heavy truck round trips and 7.4 light truck round trips each day during the construction period. During ISR operations, light truck trips would involve commuting personnel, while the heavy truck trips would include deliveries to support resin operation, commercial delivery service, waste transportation, slurry disposal, resin transportation, and brine wastes from evaporation ponds. These activities could involve an average of 6.6 heavy truck trips and 46 light truck trips each day to and from the site. Cameco expects 80 percent of its workers would come from Riverton and 20 percent from Casper (BLM, 2013; Section 4.12.2).

Assuming 80 percent of personnel and construction material traffic would come from Riverton, BLM determined that would increase traffic along Wyoming SR 136 by 11 percent. BLM determined that traffic would increase 23 percent along Wyoming SR 136 due to operation-

related traffic. Neither of these traffic levels would be expected to exceed the capacity of the road (BLM, 2013; Section 4.12.2).

Therefore, the NRC staff concludes that transportation impacts from the Proposed Action at the Gas Hills site would be SMALL and not significant.

4.4.2.2 Impacts from the No-Action Alternative

Under the No-Action alternative, no ISR-related construction or operation activities would occur at the site. Cameco would reclaim 4.8 km (3 mi) of roads that when completed may increase recreational access to the site vicinity. Due to these minor changes, the NRC staff concludes the transportation impacts from the No-Action Alternative at the Gas Hills site would be SMALL and not significant.

4.4.3 Geology, Seismology, and Soils

The potential impacts to geology, seismology, and soils of the Proposed Action at the Gas Hills site during the Smith Ranch Project's lifecycle are summarized below.

4.4.3.1 Impacts from the Proposed Action

Impacts to Geology

The NRC previously determined that the construction and operation of the Gas Hills site would have no impacts on regional or local geology (NRC, 2004). The NRC also determined the generic impacts to geology from ISR activities and found those impacts would be SMALL, because construction would affect surficial geology only locally and operation would not cause ground subsidence (NRC, 2009a).

BLM determined that Cameco's construction of MU 2 would affect landslide deposits at the Gas Hills site, but that the likelihood of landslides would be reduced through mitigation measures committed to by Cameco (BLM, 2013; Section 4.3.2.1).

Therefore, the NRC staff concludes that impacts to geology from the Proposed Action at the Gas Hills site would be SMALL and not significant.

Impacts to Seismology

As discussed in EA Section 3.4.3, the USGS ground motion hazard mapping indicates that potential ground motion hazard in the Gas Hills site is low, and that earthquake activity in the vicinity of the site has been limited. The likelihood of landslides would be reduced through Cameco's mitigation measures.

Additionally, the NRC generically determined that the reactivation of faults or the triggering of earthquakes in response to fluid pressure changes from ISR-related operations is unlikely (NRC, 2009a). BLM determined that the risk of induced seismicity from deep disposal waste injection is low (BLM, 2013; Section 4.3.2.1). Therefore, the NRC staff concludes the Proposed Action's impact on seismology at the Gas Hills site is SMALL and not significant.

Impacts to Soils

Impacts to soils were evaluated in the EA prepared by NRC for the operation of the Gas Hills site (NRC, 2004). That EA addressed the respective soil types within the Gas Hills site, the associated wellfields, the disturbed areas at the site, and the percentage of total areas disturbed. This analysis concluded that out of the total 3,440 ha (8,500 ac) within the Gas Hills site, about 440 ha (1,080 ac) would be disturbed (i.e., 13 percent). The NRC concluded that, because the disturbed area was relatively small relative to the total land-area at the Gas Hills site and the soils would be replaced, the impacts to the soils would be minor (NRC, 2004).

In its EIS, BLM provided a detailed evaluation of impacts to soils from the Proposed Action (BLM, 2013; Section 4.11.2). BLM analyzed impacts during construction, operation, and decommissioning activities and Cameco's proposed mitigation measures to further avoid, minimize, or mitigate the impacts to soils. BLM determined that construction activities under the Proposed Action would result in new disturbance to 532 ha (1315 ac) of soils, but that the disturbance would not occur all at once, given Cameco's planned phased development of the Gas Hills site. Operation-related impacts to soils would affect approximately half the construction-related disturbance (270 ha or 667 ac), and decommissioning would disturb the same total acreage as construction (BLM, 2013; Section 4.11.2.3). Under BLM Preferred Alternative, Cameco's mitigation measures and BLM-required mitigation could further reduce the intensity of the impacts to soils, and with these measures implemented, BLM determined that impacts to soil resources would be reduced to less than significant (BLM, 2013; Section 4.11.4).

Based on NRC's 2004 analysis and BLM's 2013 detailed evaluation of the Proposed Action's impacts to soils, the NRC finds that such impacts would be SMALL and not significant.

4.4.3.2 Impacts from the No-Action Alternative

Under the No-Action alternative, Cameco would decommission the Carol Shop and reclaim 3 miles of road and existing topsoil stockpiles. There would be no activity that would affect landslide deposits or that could have an effect on seismology. Soils affected by continued exploration drilling would be reclaimed within the same calendar year as the disturbance. Erosion, fire, grazing, and recreation would continue to affect soils (BLM, 2013; Section 4.11.1).

Therefore, the NRC staff concludes impacts to geology, seismology, and soils from the No-Action Alternative at the Gas Hills site would be SMALL and not significant.

4.4.4 Water Resources

Impacts to water resources during all phases of uranium-recovery activities have been assessed previously in NRC's site-specific analysis (NRC, 2004) and generic analysis (NRC, 2009a). Additionally, BLM recently documented its evaluation of impacts to water resources (BLM, 2013). These analyses examined impacts to surface water, wetlands, and ground water resources.

4.4.4.1 Impacts from the Proposed Action

Surface Water

As described in GEIS Sections 4.3.4.1 (NRC, 2009a), potential impacts to surface-water quality would result from land disturbance during all ISR-project phases, and would be SMALL due to expected licensee's compliance with the applicable Federal and State regulations, permit conditions, and license conditions as well as the licensee's implementation of best management practices. Similar regulations and permit and license conditions would govern Project activities at the Gas Hills site. Additionally, the NRC previously determined that the site-specific potential for contaminating surface water by spills and leaks would be minimized by protective features of the wellfield design (NRC, 2004).

In its EIS, the BLM identified various ways in which project-related activities could affect surface water resources (i.e., quality and use). These included the (1) increased potential for runoff and erosion as a result of removed vegetation and damaged soil structure; (2) increased stream channel instability from road crossings; (3) potential for increased sedimentation within ephemeral and perennial drainages at the site; and (4) potential degradation of surface water quality due to spills of hazardous materials from construction equipment (BLM, 2013; Section 4.15.1.2). Cameco would reduce the potential for these impacts by implementing a WDEQ-required SWPPP and company commitments that include erosion control and channel stabilizing measures (e.g., ditches and berms, conveyance channels, rock/rip rap, outlet protection, sediment traps or basins, straw bale barriers, silt fence, and check dams).

Additionally, Cameco would reduce the potential for impacts from leaks and spills by using pressure and flow meters in the header houses and controls that would automatically shut down the flow in pipelines and wells in the event of non-routine conditions, in addition to using leak-detection and containment systems in the design of the surface impoundments (Cameco, 2015). The BLM determined that impacts to surface-water resources are not expected to be significant (BLM, 2013; Section 4.15.1.2).

Therefore, the NRC staff concludes that impacts to surface water from the Proposed Action at the Gas Hills site would be SMALL and not significant.

Wetlands

The BLM determined that the Proposed Action could impact potentially 6.1 ha (15 ac) of wetlands along West Canyon Creek in proposed MU. 4, including the perennial reaches of the creek during construction of the proposed wellfield, the access road, and pipeline rights of way (BLM, 2013; Sections 4.13.2.1 and 4.15.1.2). In its Plan of Operation submitted for the BLM permit application, Cameco states that wetland areas generally would be avoided although delineation drilling, access roads, and powerlines may require the crossing of wetlands (Cameco, 2012c). Cameco would consult with the USACE prior to MU 4 development to determine the jurisdiction of the wetlands, and if needed, develop a mitigation plan for impacts to jurisdictional wetlands; the plan would be approved by the WDEQ, BLM, and USACE.

The BLM determined that Cameco's avoidance of wetlands, along with the implementation of erosion and sedimentation control measures near wetlands, would minimize impacts to the wetlands (BLM, 2013; Section 4.13.2.1).

Therefore, the NRC staff concludes impacts to wetlands from the No-Action Alternative at the Gas Hills site would be SMALL and not significant

Ground Water

Ground Water Quality

The potential impacts to the ground water quality in the ore-body aquifer and the overlying and underlying aquifers from the ISR process have been evaluated previously by the NRC (NRC, 2004, NRC, 2009a) and the BLM (BLM, 2013). Such impacts could result from (1) movement of lixiviant outside of the production zones, (2) cross-connection of aquifers through improperly abandoned exploration wells or characteristics of ore-zone aquifer confining units, (3) discontinuities caused by faults, (4) contaminated waters from nearby historic mining and milling areas being pulled into the production aquifers during ground water restoration, and (5) incomplete restoration of affected ore-body aquifers after ISR extraction activities. NRC's generic analysis concluded that ground water quality impacts could be MODERATE to LARGE from these situations, but that such impacts would be reduced to SMALL by the licensee's pre-operational testing of the ore-zone aquifer and its confinement, pre-operational ground water sampling and analysis to determine excursion monitoring criteria and ore-zone aquifer restoration standards, excursion monitoring in the ore-zone aquifer outside the extraction process and in overlying and possibly underlying aquifers, and the requirement for the licensee to meet ground water restoration standards in 10 CFR Part 40 Appendix A (NRC, 2009a; Section 4.3.4.2.2.2).

In its site-specific 2004 EA, the NRC analyzed the potential impacts to ground water quality from these various situations and concluded that such impacts would be both temporary and localized (NRC, 2004). The BLM concluded that impacts from the Proposed Action would be minimal given the permits, plans, and other management tools that would be required by the NRC and the WDEQ, (BLM, 2013; Section 4.15.2.2).

Based upon these reviews, both generic and site-specific, the NRC staff concludes that the potential impacts to ground water quality from the Proposed Action at the Gas Hills site would be SMALL and not significant.

Ground Water Availability and Use

As for ground water quality impacts, the potential impacts to other ground water users within and in the vicinity of the Gas Hills site have been previously analyzed both generically and on a site-specific basis (NRC, 2004, NRC, 2009a; BLM, 2013). These evaluations examined the impacts to ground water levels from consumptive use of ground water from ISR operation and restoration activities. Both site-specific analyses determined that the lowering of water levels would be localized around the site mine units and would be temporary (i.e., occur during the 10-year anticipated period of ISR operation and restoration). Additionally, there are no public water supply wells within the Gas Hills site boundary area; the currently permitted uses are restricted to livestock and wildlife watering and to mining-related uses (BLM, 2013; Section 3.15.3).

The NRC staff therefore concludes that potential impacts to ground water availability and use from the Proposed Action at the Gas Hills site would be SMALL and not significant.

4.4.4.2 Impacts from the No-Action Alternative

Under the No Action Alternative, surface water resources and wetlands could be impacted from land disturbance during the decommissioning and demolition of the Carol Shop, removal of the access road, use of heavy equipment to abandon existing drill holes and wells, and subsequent site-restoration and site-reclamation activities. Surface water resources could also be impacted by on-going delineation drilling activities that would be allowed to continue at a reduced rate (BLM, 2013; Section 4.15.1.1). These impacts would be short in duration, temporary, and reversible. Therefore, the NRC staff concludes the potential impacts of the No-Action Alternative to surface water would be SMALL and not significant.

With respect to ground water resources, injection and production wells would not be drilled or pumped, nor would lixiviant be injected into the sub-surface ore body, under the No-Action Alternative. Therefore, no ore-body aquifer contamination could occur and ground water users in the Gas Hills area would not be affected by drawdown caused by ISR activities. Therefore, the NRC staff concludes the potential impacts of the No-Action Alternative to ground water resources at the Gas Hills site to be SMALL and not significant.

4.4.5 Ecological Resources

4.4.5.1 Impacts from the Proposed Action

Vegetation

Impacts to vegetation were most recently evaluated in BLM's site-specific EIS (BLM, 2013; Section 4.13.2.1). Under the Proposed Action, approximately 532 ha (1,315 ac) of the approximately 3,400 ha (8,500 ac) Gas Hills site are expected to be disturbed. The BLM expected that Cameco would disturb the entire surface area within a mine unit during construction activities, and then conduct interim reclamation of approximately 95 percent of that disturbed area before beginning operations. The BLM further expected that approximately 50 percent of the mine unit would remain disturbed during operations due to continued travel between wells in the mine unit (BLM, 2013; Section 4.13.2.1). Final reclamation would take place after ISR operations and aquifer restoration were completed. During final reclamation, facilities would be removed, wells plugged and abandoned, and access roads reclaimed. Cameco would scarify, rip, and/or disk all disturbed surfaces as appropriate, and then grade and contour the affected surfaces to their approximate original contours.

Existing vegetation communities would be modified by these activities; the mixed sagebrush-grassland and rough breaks (east) communities would be most affected (BLM, 2013; Table 4.13-1). The affected communities would recover at different rates, but the final goal of reclamation is to restore the land to a condition that would sustain the current land use of livestock grazing and wildlife habitat in accordance with WDEQ guidelines (BLM, 2013; Section 4.13.2.1).

Cameco would take measures to reduce the potential for the spread of noxious weeds and invasive species of vegetation (e.g., cheatgrass). Cameco would conduct annual spraying for noxious weeds during operations and following surface reclamation (BLM, 2013; Section 4.13.2.2).

Therefore, the NRC staff concludes the potential impacts of the Proposed Action to vegetation at the Gas Hills site would be SMALL and not significant.

Wildlife

The BLM indicated that impacts to wildlife resources under the Proposed Action would include surface disturbance or alteration of habitats, habitat fragmentation, animal displacement, changes to plant species composition, and direct loss of wildlife (BLM, 2013; Section 4.17). Impacts to big-game species (mule deer, pronghorn antelope, and elk) would be minor and localized, and limited primarily to the displacement of these species from areas of human activity and temporary habitat loss and alteration. Impacts to small game and nongame species would result from death or displacement related to construction and operation activities; habitat loss, habitat alteration and fragmentation; exposure to potentially toxic wastewater in evaporation ponds; and increased levels of noise, activity, and human presence (BLM, 2013; Section 4.17.2.1). Waterfowl may be more affected due to the loss of 6 ha (15 ac) of wetlands and exposure to wastewater in the evaporation ponds. The BLM is requiring Cameco, in consultation with BLM, WDEQ, FWS, and the WDFG, to install a deterrent system (e.g., bird-exclusion netting) over evaporation ponds to minimize bird exposure to potentially toxic constituents in the waste water (BLM, 2013; Section 4.17.2.4).

Protected Species

The BLM described impacts to protected species as well as related mitigation measures in Sections 4.17.2.2 and 4.17.2.4 of its EIS (BLM, 2013). The BLM noted issues related to nesting sites and breeding seasons for the many raptor species present at and in the vicinity of the Gas Hill site (e.g., golden eagle, ferruginous hawk, prairie falcon, red-tailed hawk, Swainson's hawk, and great-horned owl), and the potential for entrapment of wildlife (including species of concern) in uncapped metal and plastic pipes (BLM, 2013; Section 4.17.2.4). The BLM also identified the potential for migratory birds to collide with power lines, but indicated that Cameco had committed to follow relevant guidelines to reduce this potential (BLM, 2013; Section 4.17.2.4).

The BLM evaluated impacts to BLM sensitive species (i.e., white-tailed prairie dog, pygmy rabbit, Townsend's big-eared bat, spotted bat, ferruginous hawk, burrowing owl, greater sage-grouse, Brewer's sparrow, loggerhead shrike, sage sparrow, sage thrasher, mountain plover, northern leopard frog, and Great Basin spadefoot). In general, impacts to these species would be expected to be minor, but some impacts would be expected due to habitat fragmentation, direct mortalities resulting from construction, human presence, and increased noise. However, Cameco would apply numerous mitigation measures to avoid, minimize, and/or mitigate impacts, including the phasing and timing construction and deconstruction, avoiding nesting sites, installing a deterrent system over evaporation ponds, installing visibility markers on power lines in key locations, and completing appropriate preconstruction surveys (BLM, 2013; Section 4.17.2.4). By taking these mitigation measures, the BLM determined that adverse impacts from Cameco's proposed action to wildlife and protected species would be minimized.

Based on Cameco's commitments and BLM's permit requirements that serve to reduce impacts to wildlife and protected species, the NRC staff concludes that impacts from the Proposed Action would be SMALL and not significant.

4.4.5.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, the Project would not be approved. Current land use and surface-disturbing activities would continue as currently authorized. Under this alternative the Carol Shop, portions of the AML Road, and previously disturbed lands would be reclaimed,

resulting in the reclamation of approximately 16 ha (40 ac). Exploratory drilling would continue at the rate of approximately 2 ha/yr (5 ac/yr). Reclamation would be expected to occur within the same calendar year as the disturbance (BLM, 2013; Section 4.13.1).

Vegetation, wildlife, and protected species would be minimally affected by this activity. Any impacts would be expected to be temporary and localized given the nature of the activity. Therefore, the NRC staff concludes the potential impacts of the No-Action Alternative to vegetation, wildlife, and protected species at the Gas Hills site would be SMALL and not significant.

4.4.6 Meteorology and Air Quality

Air quality impacts from proposed Project activities at the Gas Hills site were previously evaluated (NRC, 2004). This site-specific evaluation determined that impacts to ambient air quality from emissions and fugitive dust would not be significant (NRC, 2004, Section 5.2.1). Additionally, the NRC staff evaluated the generic air-quality impacts from an ISR facility in the WWUMR, where the Gas Hills site is located (NRC, 2009a). The staff determined that such generic impacts would be SMALL due to (1) the temporary nature of fugitive dust, and vehicle emissions; and (2) the low levels of airborne effluents released that subsequently would be readily dispersed (NRC, 2009a). The BLM evaluated impacts to air quality in its site-specific EIS (BLM, 2013).

4.4.6.1 Impacts from the Proposed Action

Particulate and gaseous emissions would result during all ISR phases at the Gas Hills site, and the greatest potential for impacts would occur during mine unit construction due to the operation of drill rigs (BLM, 2013; Section 4.1.2). Emissions of PM_{10} and particulate matter 2.5 micrometers or less in diameter ($PM_{2.5}$) would result from travel on unpaved access roads, wind erosion at disturbed areas, and from drilling activities. Trucks, light duty vehicles, drilling rigs, natural gas and propane-fired heating units would emit nitrous oxide, volatile organic compounds, carbon monoxide, and sulfur dioxide during ISR activities at the site. Construction-related emissions of PM_{10} would be less than the NAAQS, but BLM notes that the NAAQS standard for PM_{10} could be exceeded if construction, operation, and reclamation occur in close proximity and at the same time. The BLM noted Cameco's mitigation measures along with the permit requirements from the WQEQ-LQD would reduce PM_{10} emissions such that a NAAQS exceedance would not be expected (BLM, 2013; Section 4.1.2.2).

Based on these analyses, the NRC concludes that air quality impacts from the Proposed Action at the Gas Hills site would be SMALL and not significant.

4.4.6.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, approximately 16 ha (40 ac) of land would be reclaimed (the Carol Shop, one access road, and previously disturbed land), and limited exploratory drilling would likely continue (BLM, 2013; Section 4.1.1). Additionally, the No-Action Alternative would require the proper abandonment of all drillholes and wells then present at the site. The BLM estimated that these activities would result in the potential to release about 110.7 MT (122 T) of PM_{10} and12 tons of $PM_{2.5}$ during the first year, and about 63.5 MT/yr (70 T/yr) thereafter (BLM, 2013; Section 4.1.1.1). These activities would result in fewer emissions than those anticipated from the Proposed Action; therefore, the NRC staff concludes the potential impacts to air quality from the No-Action Alternative at the Gas Hills site would be SMALL and not significant.

4.4.7 Noise

Site-specific noise impacts from the Proposed Action have been previously evaluated for the Gas Hills site (NRC, 2004, BLM, 2013). Additionally, the NRC staff has evaluated the generic noise impacts from an ISR facility in the WWUMR, where the Gas Hills site is located (NRC, 2009a). The staff determined that generic noise impacts would be greatest during construction activities, SMALL for offsite receptors beyond 300 m (1,000 ft) and MODERATE for site workers such as the well drillers, and that generic impacts from the other ISR phases would be SMALL (NRC, 2009a).

4.4.7.1 Impacts from the Proposed Action

In its EIS, the BLM determined that hunters and hikers near the Gas Hills site could be affected by construction-related noise if hiking within 488 m (1,600 ft) of the site, and that there were no nearby residents who could be affected by construction-related noise (BLM, 2013; Section 4.6.2). The BLM also found that noise from operations at the site (related to intermittent truck traffic and process equipment housed within structures) would be negligible given the lack of nearby receptors. Based on the limited extent of this effect and the isolated nature of the site, the NRC staff concludes that noise impacts at the Gas Hills site from the Proposed Action would be SMALL and not significant.

4.4.7.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, noise would be generated by reclamation and decommissioning activities at the Gas Hills site. In its EIS, the BLM determined that noise from reclamation and decommissioning would be of similar intensity as, but of shorter duration than, construction-related noise. The BLM found that noise impacts from reclamation and decommissioning, therefore, would be less than impacts from construction. Therefore, the NRC staff concludes that noise impacts at the Gas Hills site from the No-Action Alternative would be SMALL and not significant.

4.4.8 Historical and Cultural Resources

In its GEIS (NRC, 2009a), the NRC evaluated the potential generic impacts to historical and cultural resources from ISR activities in the WWUMR (where the Gas Hills remote satellite site is located) and determined that impacts would be greatest during facility construction if the facility was located on a known resource(s). More recently, BLM analyzed the site-specific impacts on historic and cultural resources as part of its permitting action for the Gas Hills site (BLM, 2013).

The BLM determined, in consultation with Native American tribes and the Wyoming SHPO, that certain identified sites would be adversely affected by Cameco's ISR planned activities at the Gas Hills site. Cameco would need to develop treatment plans in cooperation with the BLM for the identified sites prior to proceeding with construction activities for each of the mine units. BLM's determination of the need for treatment plans came from recommendations of the Wyoming SHPO (WY SHPO, 2016).

Each treatment plan would address the historic property adversely affected and set forth the means to mitigate the undertaking's effects on the property (NRC, 2003c; BLM, 2012). For this

reason, the NRC concludes that impacts to historic and cultural resources from the Proposed Action at the Gas Hills site would be SMALL and not significant.

Under the No-Action Alternative, approximately 16 ha (40 ac) of land would be reclaimed (the Carol Shop, one access road, and previously disturbed land), and limited exploratory drilling would likely continue (BLM, 2013; Section 4.1.1). Additionally, the No-Action Alternative would require the proper abandonment of all drillholes and wells then present at the site.

The NRC staff expects that the treatment plans to be developed would be applicable under the No-Action Alternative, and for this reason, potential effects to identified sites of cultural interest would be mitigated. Therefore, the NRC staff concludes that impacts to historic and cultural resources at the Gas Hills site from the No-Action Alternative would be SMALL and not significant.

4.4.9 Visual and Scenic Resources

Site-specific visual and scenic impacts from the Project have been previously evaluated for the Gas Hills remote satellite site (NRC, 2004, BLM, 2013). Additionally, the NRC staff determined that generic visual and scenic impacts from an ISR facility in the WWUMR (where the Gas Hills site is located) would be SMALL given the anticipated remote locations of ISR facilities and through the implementation of best management practices such as dust suppression (NRC, 2009a).

4.4.9.1 Impacts from the Proposed Action

In its evaluation, the BLM noted that the greatest visual contrast would exist during construction and decommissioning activities when the greatest amount of surface disturbance occurs, and that the contrast would be reduced over three to five years as Cameco reestablishes vegetation under interim and final reclamation (BLM, 2013; Section 4.14.2). To further reduce effects, Cameco would paint structures in colors consistent with the landscape, and although Project-related infrastructure and layout would attract the attention of casual viewers, such structure and layout would not dominate the view (BLM, 2013; Section 4.14.2).

Based on this evaluation, the NRC staff concludes that impacts to visual and scenic resources from the Proposed Action at the Gas Hills site would be SMALL and not significant.

4.4.9.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, Cameco would decommission the Carol Shop and reclaim one access road and other previously disturbed areas, while exploratory drilling may continue at the site. Impacts would occur over the one year anticipated for decommissioning and reclamation activities, and reclamation of drilling sites would take place typically within the season the drilling occurred. However, after decommissioning and reclamation activities were completed, the impacts to visual and scenic resources would be eliminated. Therefore, the NRC staff concludes that impacts to visual and scenic resources from the No-Action Alternative at the Gas Hills site would be SMALL and not significant.

4.4.10 Socioeconomics

Socioeconomic impacts from the Project have been previously evaluated for the Gas Hills remote satellite site (NRC, 2004, BLM, 2013). These evaluations determined that impacts would

include (1) slight increases in overall employment rates, income, and earnings for local workers; and (2) limited effects on housing in the surrounding communities. There would be minimal effects on educational systems, social services, or the existing cultural, social, and economic viability of local and regional communities (NRC, 2004, Section 5.5, BLM, 2013, Section 4.10.2). Additionally, the NRC staff determined that generic socioeconomic impacts from an ISR facility in the WWUMR (where the Gas Hills site is located) would be SMALL to MODERATE given the anticipated rural locations of ISR facilities and supporting communities (NRC, 2009a).

4.4.10.1 Impacts from the Proposed Action

The BLM evaluated impacts to socioeconomics and environmental justice from the Proposed Action at the Gas Hills site (BLM, 2013). In that evaluation, BLM considered that Cameco would employ approximately 20 contract workers and 20 Cameco employees at the start of ISR activities, and then increase the number of Cameco employees to 65 (with 7 more at the Smith Ranch site) for the next 18 years of construction and operation, before reducing Cameco employees to 45 with no contractor support during the last year of production. These employment levels would only slightly affect the overall employment levels for the region around the site (BLM, 2013; Section 4.10.2.2). Indirectly, the Proposed Action would add an estimated 92 additional jobs, but the majority of the directly and indirectly-related employees would live locally.

Housing is available in the cities nearby (Riverton and Casper), so the Project should have a minimal effect on the housing market. Additionally, hotels, motels, and campgrounds are available for temporary site workers and those relocating to the area (BLM, 2013; Section 4.10.2.2).

Personal income levels for the Cameco site employees would exceed the average level for the region, and much of this income would be spent on items (e.g., food, clothing, rent, fuel) that would benefit the local economy. Cameco's ISR operations at the Gas Hills site also would contribute to public revenues in the study area through mineral severance taxes, county property (ad valorem) taxes, and sales and use taxes (BLM, 2013; Section 4.10.2.6).

The additional workers coming to the region would not have a measureable effect on the demand for public services and facilities, and the school systems have the capacity to accommodate the estimated seven school children that would be associated with workers at the Gas Hills site (BLM, 2013; Section 4.10.2.4 and 4.10.2.5).

The NRC staff concludes that impacts to socioeconomics from the Proposed Action at the Gas Hills site would be SMALL and not significant.

BLM's analysis of environmental justice is presented in Section 4.10.28 of its EIS (BLM, 2013). Given that (1) impacts to the majority of resource areas would be confined to the Gas Hills site, and (2) impacts that could occur at a greater distance from the site (e.g., air quality, traffic) would affect all populations equally, the BLM determined that there would be no disproportionate and adverse impacts to minority and low-income populations near the Gas Hills site. The NRC staff reviewed BLM's analysis in light of NUREG-1748 (NRC, 2003) and the NRC policy statement on environmental justice (NRC, 2004c) and adopts BLM's determination with respect to environmental justice.

4.4.10.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, Cameco would decommission and reclaim the Carol Shop, one access road, and previously disturbed areas. Cameco could continue with exploratory drilling. One company employee would work at the site to provide for property management and oversight (BLM, 2013; Section 4.10.1). Therefore, the NRC staff concludes that socioeconomic impacts at the Gas Hills site from the No-Action Alternative would be SMALL and not significant, and given that lack of minority and low-income populations near the site, the NRC staff concludes that there would be no disproportionate and adverse impacts to these populations.

4.4.11 Public and Occupational Health and Safety

Site-specific public and occupational health and safety impacts from the Project have been previously evaluated for the Gas Hills remote satellite site (NRC, 2004). That analysis concluded that radiological impacts to workers and the public were determined to fall well below the dose limits in 10 CFR Part 20; the highest estimated dose from radon exposure was 7 mrem/yr to a hypothetical individual at the eastern boundary of the Gas Hills site. For this reason, the NRC determined that impacts were not significant. Non-radiological impacts in NRC's 2004 EA focused on machinery and vehicle emissions, and found these impacts also not to be significant. Additionally, the NRC staff determined that generic public and occupational health and safety impacts from an ISR facility in the WWUMR (where the Gas Hills site is located) would be SMALL during the ISR phases. However, MODERATE radiological and non-radiological impacts to workers could result during operations if the effects of such accidents were not mitigated (NRC, 2009a).

4.4.11.1 Impacts from the Proposed Action

As discussed in section 4.2.11.1 of this EA, Cameco has implemented standard operating procedures for handling, processing, storing, transporting or disposing of source and byproduct and hazardous materials (Cameco, 2014, ER 4.12.1). Additionally, Cameco has implemented procedures, training, and Management Actions designed to mitigate the risk of radiation exposure to both the public and the employees. These include process designs such as the use of vacuum driers as opposed to calciner dryers and using down-flow pressurized ion exchange columns instead of open columns. Additionally, all of the facilities provide ventilation systems that remove any released Radon-222 from the buildings to the atmosphere (Cameco, 2014, ER 5.12).

Cameco has committed to keeping radiological doses ALARA, and conducts annual ALARA audits, and daily, weekly, and monthly radiation inspections of its facilities and site (Cameco, 2014, ER 5.12.1). Radiological doses to workers and the members of the public are expected to be a small fraction of the limits in 10 CFR Part 20 that have been established for the protection of public health and safety.

Potential non-radiological impacts would be related primarily to exhaust and diesel emissions from employee vehicles, construction equipment, and field vehicles and also from fugitive dust derived from traveling along access roads and from the grading and construction in wellfields. These impacts would be experienced daily at the site, although they would be temporary and of short-term duration.

Therefore, the NRC staff concludes that radiological and non-radiological impacts at the Gas Hills site from the Proposed Action would be SMALL and not significant.

4.4.11.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, approximately 16 ha (40 ac) of land would be reclaimed (the Carol Shop, one access road, and previously disturbed land), and limited exploratory drilling would likely continue (BLM, 2013; Section 4.1.1). Additionally, the No-Action Alternative would require the proper abandonment of all drillholes and wells then present at the site. Cameco would be expected to follow OSHA guidelines for the protection of workers during these activities. Therefore, the NRC staff concludes that public and occupational health and safety impacts from the No-Action Alternative at the Gas Hills site would be SMALL and not significant.

4.4.12 Waste Management

Waste management impacts from the Project have been previously evaluated for the Gas Hills remote satellite site (NRC, 2004). This evaluation focused on the disposal of materials contaminated with byproduct material and on the evaporation ponds with liners that store production bleed generated by uranium recovery. Impacts were found to be minor, because contaminated materials would be disposed in a facility licensed by the NRC or an NRC Agreement State (NRC, 2004, Section 5.13).

Additionally, the NRC staff determined that generic waste management impacts from an ISR facility in the WWUMR (where the Gas Hills site is located) would be SMALL. This is due to Federal and State requirements that ISR facilities have sufficient disposal capacity available for both radiological and non-radiological solid and liquid wastes.

4.4.12.1 Impacts from the Proposed Action

Under the Proposed Action, byproduct material and non-byproduct material solid and liquid waste volumes would be related to the construction of and commencement of operations in up to five mine units at the Gas Hills site and operations at the increased flow rate of 51,095 lpm (13,500 gpm). As discussed in section 2.2.4 of this EA, Cameco plans to dispose of process-related liquid byproduct materials either in evaporation ponds or by injection down WDEQ-approved UIC Class I deep disposal wells, and to dispose of solid byproduct material waste at an offsite facility licensed to accept this material for disposal. Cameco would be expected to manage these wastes in accordance with its existing NRC license and relevant State permits. Therefore, the NRC staff concludes that waste management impacts from the Proposed Action at the Gas Hills site would be SMALL and not significant.

4.4.12.2 Impacts from the No-Action Alternative

Under the No-Action Alternative, approximately 16 ha (40 ac) of land would be reclaimed (the Carol Shop, one access road, and previously disturbed land), and limited exploratory drilling would likely continue (BLM, 2013; Section 4.1.1). Cameco would be expected to dispose of demolition wastes and building materials at an appropriately licensed facility for facilities. Therefore, the NRC staff concludes that waste management impacts from the No-Action Alternative at the Gas Hills site would be SMALL and not significant.

5.0 CUMULATIVE IMPACTS

The Council on Environmental Quality's (CEQ's) regulations define cumulative impacts as "the impact on the environment which results from the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (40 CFR 1508.7, "Cumulative Impact"). The NRC adopted this definition into its NEPA-implementing regulations at 10 CFR 51.14(b).

In Chapter 5 of NRC's GEIS for uranium in situ recovery facilities (NRC, 2009a), the NRC identified a process for identifying cumulative effects, using the CEQ's 1997 guidance document on the topic (CEQ, 1997). This process includes: (1) establishing an appropriate geographic and temporal scope within which to identify other past, present, and reasonably foreseeable future actions; (2) describing the affected environment; and (3) determining the cumulative environmental consequences or impacts (NRC, 2009a). Additionally in the GEIS, the NRC determined that, while it could not conduct a detailed, site-specific cumulative impact assessment, if a uranium in situ recovery facility was in compliance with applicable federal and state laws and policies (e.g., the Endangered Species Act) and if the expected impacts to a specific resource area were small, then a less intensive site-specific cumulative effects analysis would be appropriate (NRC, 2009a; Section 5.4). For those resource areas where, for example, sustainability or continuing quality were at issue due to the proposed action, the NRC found that a more detailed cumulative impact analysis was appropriate (NRC, 2009a).

Of the various resource areas for which the NRC staff evaluated potential impacts in this EA (see Section 4.0), only impacts to ground water and to historic and cultural properties were found to have greater than SMALL impacts without mitigation, and impacts to all resource areas were determined to be not significant with mitigation. Additionally, of the resource areas, the NRC staff determined that impacts to ground water, transportation, air quality, visual and scenic resources, and socioeconomics could extend beyond the permit boundary for the Smith Ranch site and the North Butte remote satellite site (see Section 4.0 of this EA). Finally, in terms of a temporal scope, Cameco has requested renewing its NRC license for 10 years, and therefore the timeframe considered for the cumulative effects analysis extends to 2025, unless otherwise noted.

5.1 Identifying Past, Present, and Reasonably Foreseeable Future Actions

With respect to identifying past and present actions and their impacts on the affected environment, these impacts are necessarily part of the current affected environment as discussed in section 3.0 of this EA. For the Smith Ranch site, as previously discussed, ISR activities have been on-going for the past 40 years. The resultant impacts to the environment have been evaluated as part of NRC's original licensing action and in its periodic re-licensing actions, as well as through NRC period site inspections over that time, the licensee's environmental monitoring programs with semi-annual reporting to the NRC, and in BLM permitting actions. For the remote satellite sites, the current affected environment at the Gas Hills site reflects the history of prior uranium mining efforts in the area, the North Butte site reflects both the current ISR activities plus coal bed methane activities in the surrounding area, and the Ruth site reflects pilot ISR activities from the 1980s. For all of the Project sites, other uses such as livestock grazing and wildlife habitat have continued.

To identify reasonably foreseeable future actions in the vicinity of the Project sites, the NRC staff checked (1) land use plans and maps for Converse, Campbell, Johnson, Fremont, and Natrona Counties in Wyoming; (2) the BLM's 2018 Converse County oil and gas project Draft EIS; (3) the BLM's 2013 Gas Hills Final EIS; and (4) other publicly available information about future projects within the five Wyoming counties. These documents are referenced as they are cited here in this section; and the full references are provided in Chapter 10 of this EA.

5.1.1 Smith Ranch Site

In January 2018, the BLM issued for public comment a draft EIS that addresses the potential environmental impacts of and alternatives to proposed oil and gas exploration and development by an Operator Group composed of Anadarko Petroleum Company (Anadarko), Chesapeake Energy Corporation (Chesapeake), Devon Energy (Devon), EOG Resources, Inc., and SM Energy. The Converse County Project Area (CCPA) for the proposed exploration and development encompasses approximately 607,208 ha (1.5 million ac) of land in Converse County, Wyoming (BLM, 2018).

Under the proposed action analyzed by that EIS, up to 5,000 new oil and gas wells would be drilled on 1,500 single and multi-well pads within the CCPA over a period of 10 years. Additionally, approximately 3,170 km (1,970 mi) of new access and primary collector roads, 1,500 miles of buried gas gathering pipelines, 805 ha (500 mi) of buried oil and gas main trunk lines, 900 miles of surface water pipelines, 2,414 ha (1,500 mi) of electrical power lines, 455 other well pads (i.e., production, water source, and disposal well pads), and other infrastructure and facilities as detailed within the draft EIS would be constructed to support the proposed development. Total new surface disturbance under the Proposed Action would be approximately 21,313 ha (52,667 ac), or 3.5 percent of the total CCPA.

BLM evaluated the cumulative impacts from past, present, and reasonably foreseeable development in its draft EIS (BLM, 2018). In doing so, BLM developed a cumulative impact study area (CISA) appropriate relative to the geographical extent of anticipated cumulative impacts. BLM determined that, for some resources (e.g., land use, lands and realty, soils, and vegetation), the CISA was the same as the CCPA, while for other resources (e.g., air quality, groundwater, socioeconomics, visual, and wildlife), the CISA was much larger than the CCPA.

A potential uranium-recovery project, Uranium One's Ludeman Project, would be located approximately 15 km (9 mi) south of the Smith Ranch site. Uranium One Americas proposes this project as an amendment area to the company's Willow Creek ISR Project in Johnson and Campbell Counties, Wyoming. The Ludeman Project would encompass approximately 7,200 ha (18,000 ac) in Converse County (Uranium One, 2011).

5.1.2 North Butte Remote Satellite Site

The North Butte Remote Satellite is approximately 8 kilometers (5 miles) north of Energy Fuels Inc.'s Hank and Nichols Ranch uranium projects and approximately 16 kilometers (10 miles) southeast of Uranium One Americas' Willow Creek (formerly the Irigaray and Christenson Ranch) uranium project.

The cumulative-impacts study area for the North Butte site was defined as that area of Campbell County, Wyoming, which is 80 km (50 mi) from the North Butte site. The County, which is also located within the Powder River Basin and the WEUMR defined in the GEIS,

encompasses 12,440 km^2 (4,802 mi^2), which includes the 3.9-km^2 (1.5-mi^2) North Butte site. The North Butte site, therefore, represents approximately 0.03 percent of the land-use CISA.

As noted in EA Section 3.3.1, Campbell County is rural and agricultural in character, with widely dispersed ranches and a low population density. Rangeland is the predominant land use in Campbell County as it is on the North Butte site as well as within the surrounding 80-km (50-mi) radius of the North Butte site. Most rangeland is privately owned and is used for grazing of cattle and sheep; there are limited opportunities for hunting and fishing by the public.

As noted in EA Section 4.3.1.1, the primary impact from all Project phases (construction, operation, aquifer restoration, and decommissioning) on the North Butte site would be restricted access to portions of the North Butte site for livestock grazing and wildlife movement because of Project-related fencing of structures, infrastructure components and wellfields. This impact is considered to be SMALL to MODERATE and would be temporary and reversible; decommissioning would return the North Butte site to its preconstruction condition. A portion of the North Butte site (12 ha (30 ac)) has been disturbed in connection with currently licensed uranium-recovery activities. The area of disturbance from the construction of the North Butte site for roads, structures, and wellfields is estimated to be 206 ha (508 ac) and would represent approximately one-half of the total North Butte site.

5.1.3 Gas Hills Remote Satellite Site

The CISA for land use for the Gas Hills site was defined as the area of Fremont and Natrona Counties, Wyoming that is 80 km (50 mi) from the Gas Hills site. The Counties, which are located within the Wind River Basin and within the WWUMR (Wyoming West Uranium Milling Region) defined in the GEIS, encompass 37,908 km^2 (14,636 mi^2), which includes the 34-km^2 (13-mi^2) Gas Hills site. The Gas Hills site, therefore, represents approximately 0.09 percent of the cumulative-impacts study area.

In contrast to Converse and Campbell Counties, where most rangeland is privately owned, the majority of rangeland on Fremont and Natrona Counties is owned by State and Federal agencies. The more extensive public ownership provides greater opportunities for hunting and fishing. As noted in EA Section 3.4.1, the primary impact from all Project phases (construction, operation, aquifer restoration, and decommissioning) on the Gas Hills site would be restricted access to approximately 15 percent of the Gas Hills site for livestock grazing and wildlife movement as a result of fencing of structures, infrastructure components and wellfields. This impact would be minor and temporary; decommissioning would return the Gas Hills site to its preconstruction condition.

5.2 Transportation

Local highways, existing county roads, and access roads were the focus of this analysis. In the "transportation CISA," transportation would be impacted by ongoing and reasonably foreseeable future activities; these activities include impacts from livestock grazing, uranium exploration and mining, and oil and gas exploration and development.

As described in EA Section 4.3, daily traffic due to the operation at the Smith Ranch site would increase less than 1 percent; at North Butte, the traffic would increase by approximately 3 percent; and at Gas Hills, the traffic would increase between 11 and 23 percent. As outlined in Section 4.3 of this EA, all of these increases would have a SMALL incremental impact on the

local transportation system at the three Project sites. Given the small increases in traffic associated with the each project site, cumulative impacts on transportation at each sites would also be SMALL, including impacts from other past, present, and RFFAs.

5.3 Geology and Soils

5.3.1 Smith Ranch Site

The BLM recently completed an EA for the Reynolds Ranch portion of the Smith Ranch site (BLM, 2011). The NRC staff used the information in that EA for assessing the cumulative impacts to geology and soils by the Proposed Action. The BLM's EA defined a "geology and soils cumulative-impacts study area," which the NRC staff modified for application in this EA. In it's EA, the BLM defined a 10-km- (6-mi-) radius area around the boundary of the Smith Ranch site (BLM, 2011); however, in this EA's evaluation, this area was enlarged slightly (and irregularly) to include the proposed Ludeman Project located approximately 3 km (5 mi) south of the Smith Ranch site (Uranium One, 2011). The NRC's considers the use of this geology and soils CISA appropriate in this case, because the geology and soil impacts are limited to only the areas where they occur and do not occur over any distance. Therefore, this study allowed the NRC to study another, specific ISR project in conjunction with the Smith Ranch site.

Past uranium-recovery activities in the area include conventional open-pit and underground mining, conventional milling, R&D uranium-recovery projects, and ongoing licensed uranium-recovery projects (Cameco, 2012). In the late 1960s, uranium deposits were identified and characterized in the southern portion of the Powder River Basin at what is now the part of the Smith Ranch Project (i.e., at the Highland Satellite portion of the now Smith Ranch site) (Exxon, 2011). Open-pit mining of uranium ore began there in 1970 (NRC, 1973). NRC issued License SUA-1139 in 1972 authorizing the operation of the Highland Uranium Mill (NRC, 1973, 1978). By 1977, the Licensee was engaging in underground mining at the site as well (Exxon, 2011). Conventional underground uranium mining was continued until 1982 and open-pit uranium mining until 1984 (Exxon, 2011). The uranium-bearing ore was processed at the Highland mill until mid-1984 (Exxon, 2011). A mill tailings impoundment and a lake in the former open-pit mine currently exist within the site.

A pilot-scale ISR test was conducted from 1972 – 1979 within the Highland Satellite area (NRC, 1978; Exxon, 2011). This R & D project was later developed into a commercial-scale operation (NRC, 1987). The former Highland license for uranium recovery was renewed in 1995, and existing and proposed wellfields cover approximately 600 ha (1,500 ac) at the Highland portion of the site (NRC, 1995).

Uranium-recovery began in 1981 at the Smith Ranch portion of the overall Smith Ranch with an R & D project under Source Material License SUA-1387 (NRC, 1981). The ISR activities took place near the underground "Bill Smith shaft" developed in the 1970s (NRC, 1981; NRC, 1992). The license for theR& D project, known as the "O-Sand/Q-Sand Project," was renewed by NRC in 1988 (NRC, 1991). In 1992, the R&D project was expanded by the Licensee to a commercial scale with existing surface facilities from the R&D project and the existing mine shaft. This operation disturbed approximately 200 ha (500 ac) of land (NRC, 1992). The license for this area was renewed for the Smith Ranch Project in 2001 by the NRC (NRC, 2001).

Uranium exploration and groundwater characterization was conducted on the Reynolds Ranch portion of the Smith Ranch site in the 1980's (Cameco, 2012). The Reynolds Ranch Project

was added to PRI's then-Smith Ranch-Highland Uranium Project by the NRC's License SUA-1548 in 2006but, no uranium-recovery activities have occurred there yet.

A pilot ISR test was conducted in 1980 at the Leuenberger Satellite area within the Ludeman Project, which is in the defined study area for cumulative impacts, but no further uranium-recovery activities have occurred in that area either (Uranium One, 2011). In other areas of the Ludeman Project, uranium-recovery activities have been limited to ore-body exploration and aquifer testing.

Soil impacts associated with uranium-recovery activities at the Smith Ranch site are discussed in EA Section 4.4.1.1. These impacts include soil loss and soil compaction associated with construction of processing facilities; wellfields and other drillholes; and roads, pipelines, and other infrastructure. Other impacts include potential soil contamination associated with leaks and spills. The identified potential impacts on soils are SMALL due to erosion-control practices, and rapid cleanup of leaks and spills if they occur. In addition, soil impacts are limited in duration due to site-reclamation activities that would follow construction and decommissioning. Soil impacts associated with the Smith Ranch site would be present only until revegetation in all disturbed areas is complete, currently believed to be approximately 2025.

None of the previous EAs prepared by the NRC for the Smith Ranch site have addressed cumulative impacts to soils, although the BLM EA for Reynolds Ranch did address cumulative impacts to soils for the Reynolds Ranch Satellite area (BLM, 2011). The BLM EA for Reynolds Ranch identified the following projects with soil impacts within the cumulative-impacts study area:

- Wind-energy development on the reclaimed Dave Johnson shaft area (80 ha (200 ac) of long-term disturbed land)
- The Hornbuckle horizontal-well project (20 ha (50 ac) of short-term disturbance)

The soil disturbance at the Smith Ranch site and these other projects in the study area would impact less than 0.2 percent of the total area within the Smith Ranch site (BLM 2010). Large areas of land would remain undisturbed. Due to the dispersed nature of these disturbances, the Licensee's implementation of mitigating BMPs, and site-reclamation regulatory requirements, the proposed Smith Ranch Project would have a SMALL incremental impact on the SMALL cumulative impacts to soils in the soils cumulative-impacts study area.

5.3.2 North Butte Satellite Site

The geographic area, in which this assessment of cumulative impacts related to geology and soils at the North Butte site was conducted, was the same as the area used by the BLM in its recent EA for Reynolds Ranch (BLM, 2011). This area was defined as a 10-km- (6 mi-) radius area around the North Butte site. This study area includes two operating uranium-recovery projects: the northern boundary of the Hank Unit of the Nichols Ranch Project is approximately 0.8 km (0.5 mi) south of the Smith Ranch Project at the North Butte site, and the southeast boundary of the Christensen Ranch Project is within 5 km (3 mi) of the northwest corner of the North Butte site. This CISA is appropriate because geology and soil impacts are limited to the area in which they occur and are not propagated over distance.

The ore-zone sands at Christensen Ranch and North Butte are likely the same stratigraphic units (NRC, 2013). At the Hank Unit, the ore-zone sand is stratigraphically above the ore-zone

sands at North Butte and Christensen Ranch. None of the geologic units, however, would be impacted by uranium recovery by PRI. Because there are no other uranium-recovery operations in the study area, and there are no open-pit or underground uranium-extraction operations in the area either (Cameco, 2014), the SMALL impacts to the geology at the North Butte site would not incrementally add to the cumulative impacts in the study area. Thus, the cumulative impacts would be SMALL.

Soil impacts associated with the North Butte site are discussed in EA Section 4.2.3.1 and generally include the same as listed above for the Smith Ranch site.

None of the previous EAs prepared for the North Butte site have addressed cumulative impacts to soils.

The soil disturbance associated with the North Butte site and other past, present, and reasonably foreseeable future actions (RFFAs) projects in the study area would impact less than 40 percent of the total area within the North Butte study area. Therefore, a large area with over 60 percent of the land would remain undisturbed. As described in Section 3.1.1, activities such as coal bed methane (CBM) production is limited in the area adjacent to the North Butte site. However, due to the dispersed nature of these disturbances, the Licensee's implementation of mitigating BMPs, and site-reclamation regulatory requirements, the proposed Smith Ranch Project at the North Butte site would have a SMALL incremental impact on the SMALL cumulative impacts to soils in the respective study area.

5.3.3 Gas Hills Satellite Site

The geographic area used in this assessment of cumulative impacts related to geology and soils at the North Butte site was the same as that used by the BLM in its recent EA for Reynolds Ranch (BLM, 2011). This study area was defined as a 10-km- (6-mi-) radius area around the North Butte site. This study area encompasses the Gas Hills site and extends from the Beaver Rim to the (south), to U.S. Highway 20/26 (north), and from Road 135 north to Moneta (west). This area includes the past uranium-exploration and uranium-recovery projects where both open-pit and underground mining methods were employed as well as conventional milling (BLM. 2012). Most of the mines and processing facilities involved in the past activities have been, or are currently being, decommissioned and sites are being reclaimed (Cameco, 2012).

Within and adjacent to the Gas Hills site, the Lucky Mc mine operated between 1957 – 1988 as both an open-pit and underground mine. Restoration of this site began in 1991; the ore-processing facility was demolished in 1993. In 2006, the NRC determined that reclamation of the Gas Hills North mill-tailings site was complete (NRC, 2018c). The historic uranium-mining operation of Gas Hills East is located within and adjacent to the Gas Hills site in the proposed Smith Ranch Project and includes a reclaimed tailings pile. The lake formed in the Buss 1 Pit is now an impoundment at the Gas Hills site. Other, smaller pits and areas of ground disturbance are also located within the Gas Hills site.

Within the Gas Hills site, approximately 20 percent of the total site area has been previously disturbed by either open-pit or underground mining activities (Cameco, 2012). In addition, past uranium-exploration programs have disturbed the majority of the portion of the Gas Hills site that would be disturbed by the proposed Smith Ranch Project wellfields (Cameco, 2012).

Soil impacts associated with the Gas Hills site are discussed in EA Section 4.4.3.2 and generally include the same as those listed above for the Smith Ranch and North Butte sites.

None of the previous EAs prepared for the Smith Ranch Project sites have addressed cumulative impacts to soils.

The BLM EIS for Gas Hills assumed that the study area for soils would be limited to the Project area itself because soil impacts are generally limited to the immediate area of soil disturbance (BLM, 2013). The BLM EIS for Gas Hills identified the following projects with soil impacts within the study area:

- Reclamation of the Buss 1-Pit lake (i.e., impoundment)
- Presence of existing roads

According to the BLM EIS for Gas Hills, the total soil disturbance within the study area would be 760 ha (1,877 ac), or approximately 22 percent of the total area within the study area. Large areas of land would remain undisturbed. Due to the dispersed nature of these disturbances, the Licensee's implementation of mitigating BMPs, and site-reclamation regulatory requirements, the proposed Smith Ranch Project at the Gas Hills site would have a SMALL incremental impact on the SMALL cumulative impacts to soils in the study area.

5.4 Water Resources

The individual geographic areas identified for the "water-resource CISA" at the Smith Ranch, North Butte, and Gas Hills sites are defined in the individual site sections below. The timeframe for the analyses of water-resource cumulative impacts is 20 years, extending from the anticipated license period of 2015 – 2025, through 2035. Twenty years was chosen to account for the license period (10 years), and to allow for maturity of mitigation measures related to water resources. It will take some time for the uranium-bearing aquifer to recover after facility decommissioning and site restoration.

5.4.1 Smith Ranch Site

The geographic area for this evaluation of water-resources cumulative impacts for the Smith Ranch site is modified from the area used by the BLM in its recent EA for Reynolds Ranch. The BLM study area was defined as a 10-km- (6-mi-) radius around the boundaries of the Smith Ranch Project site (BLM, 2011). The study area for this cumulative impacts analysis was defined to include the proposed Ludeman Project, which is located approximately 3 km (5 mi) south of the site (Uranium One, 2011). There is a mill tailings impoundment associated with the historical operation of the Highland uranium mine and milling operation (Exxon, 2011) located in this study area. The study area was also developed to include the surface-water drainages to the North Platte and Little Cheyenne Rivers.

<u>Surface-Water Quality</u>

As discussed in EA Section 3.2.4, streams within the Smith Ranch site flow intermittently in response to heavy thunderstorm or snow melt, and have wide variability in quality. Cameco does not discharge to surface water at the Smith Ranch site and mitigates unplanned spills to minimize impacts to surface water quality (see EA Section 4.2.4.1). Therefore, the NRC staff concluded that impacts to surface water from the Proposed Action at the Smith Ranch site would be SMALL. With respect to past, present, and RFFAs, the tailings impoundment in the study area has not impacted the Smith Ranch site's surface-water quality (Exxon, 2011). Although byproduct constituents have seeped from the tailings impoundment into groundwater

and migrated into the associated open-pit's lake, the lake itself does not impact the other surface water at the Smith Ranch site (NRC, 2011). Therefore, the NRC staff concludes that the Proposed Action would have a SMALL incremental effect when added to the cumulative SMALL impact on surface water quality near the Smith Ranch site. .

Surface-Water Use

Impacts on surface-water quantity associated with the Smith Ranch area are discussed in EA Section 4.2.4.1. These impacts were considered SMALL given that surface water would not be used at the site and groundwater is not hydraulically connected to the surface water. Given the absence of surface-water use associated with the Project, cumulative impacts on surface-water quantity associated with the Smith Ranch Project would also be SMALL.

Wetlands

Impacts on wetlands associated with the Smith Ranch site are discussed in EA Section 4.2.4.1. These impacts would be SMALL, because any construction activities in and near wetlands would be avoided to the extent feasible. If construction activities were needed in and/or near wetlands, all impacts would be mitigated as part of the Section 404 permitting process through the USACE. The NRC staff concludes that the the Smith Ranch Project would contribute a SMALL incremental effect when added to the SMALL cumulative impacts on wetlands associated with the proposed Project.

Ground Water Quality

The cumulative-impacts study area appropriately encompassed the portions of the aquifers that are affected by other resource-recovery activities in the area; however, because ground water flows into the Powder River Basin, the depths to these aquifers make them inaccessible. This is the case with potential impacts from hydrofracking used to produce natural gas. Natural gas is captured from the Niobrara Formation, which is more than 6,200 m (10,000 ft) below the aquifers currently used for uranium recovery or proposed for future uranium-recovery operation. Therefore, hydrofracking would not be anticipated to affect water quality in the uranium-bearing aquifers at the Smith Ranch-Highlands-Reynolds Ranch site.

Unlike surface water, however, the tailings impoundment associated with the historical Highland uranium mine has affected ground water quality due to seepage from the impoundment (Exxon, 2011). Byproduct constituents have seeped from the impoundment into the ground water and migrated into ground water of the "southeast drainage" as well as into the lake formed in the open pit of the historical mine, west of the impoundment (NRC, 2011).

In addition, aquifer restoration in spent wellfields at the Smith Ranch site itself has not proceeded in a timely manner, and the ground water continues to be contaminated by uranium-recovery fluids (NRC, 2012). The NRC staff concludes that the Smith Ranch Project would contribute a SMALL incremental effect when added to the SMALL cumulative impacts to groundwater resources resulting from other past, present, and RFFAs.

Ground Water Use

Impacts on groundwater levels associated with the Smith Ranch site are discussed in EA Section 4.2.4.1. These impacts would be SMALL, because there are no local water users who draw from the aquifer where uranium recovery would take place. Moreover, localized drawdown

near the wellfields would dissipate after lixiviant pumping has stopped. Further, the upper aquifer used by the local water users is separated from the uranium-bearing aquifer at the Smith Ranch site by a low-permeability aquitard.

The Licensee evaluated the cumulative impacts on ground water using a ground water model, and the results are presented in Appendix E of the ER (Cameco, 2014). The hydrologic assessment considered the impacts of Smith Ranch operation and development of the Niobrara Shale oil-well drilling and fracking operations over a period of 33 years, which is Cameco's estimated operational life at the Smith Ranch site. The model results were used to estimate the drawdown at 287 stock and domestic well locations situated within a 16-km (10-mi) radius of the Smith Ranch site. The 16-km (10-mi) radius is a reasonably conservative groundwater cumulative-impacts study area because drawdowns at most of wells were less than 0.003 m (0.01 ft). Results indicated that only one well would have cumulative drawdown over 3 m (10 ft) and that any loss in ground water flow could be mitigated by the Licensee's lowering the pump or its installing a new water-supply well for the affected well. Therefore, the cumulative impacts of the Proposed Action on ground water use would be SMALL.

5.4.2 North Butte Satellite Site

The geographic area for the evaluation of cumulative impacts for water resources at the North Butte site was defined according to the methodology used by the BLM in its recent EA for Reynolds Ranch (BLM, 2011): a 10-km (6-mi) radius around the Project boundary of the site. This "water-resources CISA" includes two operating uranium-recovery projects, the Nichols Ranch and Christianson Ranch Projects. The northern boundary of the Hank Unit of the Nichols Ranch Project is about 0.8 km (0.5 mi) south of the North Butte site. The southeast boundary of the Christensen Ranch Project is within 5 km (3 mi) of the northwest corner of the North Butte site. The cumulative-impacts assessment of this area is appropriate because the activities potentially impacting the Willow Creek drainage are included. This area is also within the study area evaluated by the NRC in 2011 for cumulative impacts to water resources by the Nichols Ranch Project (NRC, 2011).

<u>Surface-Water Quality</u>

The NRC determined previously that the cumulative impacts on surface water within the study area for the Nichols Ranch Project (which includes the Hank Unit) resulting from past, present, and RFFAs is MODERATE due to CBM development, oil and gas production, and ISR facilities (NRC, 2011). The NRC concluded that an additional ISR project with no surface-water discharges would have a SMALL incremental effect when added to the MODERATE cumulative impact from other past and present actions, and RFFAs. For the Proposed Action, the NRC staff concludes that this conclusion would apply to the Cameco's operations at the North Butte site, because there are no plans for surface-water discharge from those activities at the site under the Proposed Action (see EA Section 4.3.4.1).

<u>Surface Water Use</u>

Impacts on surface-water quantity and use associated with the Proposed Action at the North Butte site are discussed in EA Section 4.3.4.1. The NRC staff concluded that these impacts would be SMALL, because surface water would not be used by the licensee at the North Butte site and that groundwater is not hydraulically connected to any surface-water features. Past, present and RFFAs concerning surface water use involve livestock and wildlife watering (see EA Section 3.3.4.1). CBM activities in the vicinity of the North Butte site may impact surface

water use if associated impoundments overtop their banks due to natural precipitation; however, these impacts would be expected to be intermittent and largely limited to the area and stream beds surrounding the overtopped impoundments. These impacts, as a result, would be SMALL. Therefore, the Proposed Action at the North Butte site would contribute an incremental SMALL impact to the cumulatively SMALL impact on surface water use.

Wetlands

Impacts on wetlands associated with the North Butte site are discussed in EA Section 4.3.4.1. There is one wetland within the proposed area of disturbance at the North Butte site and, consequently, construction in and near that wetland would be avoided to the extent feasible. As discussed in EA Section 4.3.4.1, if construction does occur in and/or near this wetland, all impacts would be mitigated as part of the Section 404 permitting process by the U.S. Corps of Engineers (USACE). Given the low potential for impacts associated with the Smith Ranch Project at the North Butte site, cumulative impacts on nearby wetlands would be SMALL.

Ground Water Quality

The NRC determined that the cumulative impacts on surface water within the study area for Nichols Ranch resulting from past, present, and RFFAs is MODERATE due to CBM development, oil and gas production, and uranium-recovery facilities (NRC, 2011). The NRC concluded that an additional uranium-recovery project with no surface-water discharges would have a SMALL incremental effect when added to the MODERATE cumulative impact from other past and present actions, and RFFAs. This conclusion would apply to the effects of the Proposed Action at the North Butte site, because there would be no surface-water discharge during the Proposed Action. The ground water model prepared by the Licensee confirmed NRC's conclusion that the uranium-recovery activities at the North Butte site and the nearby Willow Creek, Hank Unit, and Nichols Ranch Projects will not interfere with containment of uranium-recovery fluids within their respective wellfields (Cameco, 2014).

CBM-produced water discharges to impoundments or to the surface may infiltrate into groundwater and potentially impact baseline and operational water quality in the aquifer overlying and the ore-zone sands (NRC, 2013). However, the thick aquitard under the CBM impoundments reduce the potential for infiltration (Uranium One, 2011). Due to the mitigating measures afforded by the aquitard, the potential for water-quality impacts would be SMALL. In addition, the chloride concentrations typically found in water from CBM wells are much lower than chloride concentrations in lixiviant, which would allow differentiation between releases of CBM-produced water from uranium-recovery-fluid releases and excursions (NRC, 2013). The potential for impacts to ground water quality from oil and gas production would be confined to aquifers much deeper than the Wasatch Formation, and they would be SMALL.

Thus, the incremental impacts to ground water quality of the Smith Ranch Project at the North Butte site would be SMALL when added to the SMALL ground water-quality cumulative impacts in the study area.

Groundwater Use

Impacts on groundwater levels associated with the North Butte site are discussed in EA Section 4.3.4.1. Although some wells would experience ground water drawdowns due to development of the North Butte site, these drawdowns would not impact the usability of nearby wells and any impacts would be mitigated by the user's establishing a new water supply.

Cumulative impacts on ground water were evaluated using a ground water model, and the results were presented in Appendix E of the ER (Cameco, 2014). The hydrologic assessment considered the impacts of ISR development at the North Butte site, and the Nichols Ranch, Willow Creek, and Hank Unit Projects. In addition, the hydrologic impact of existing and future CBM development was considered in the model. Hydrologic impacts due to ISR and CBM development were simulated using a three-dimensional ground water-flow model over an estimated 16-year uranium-recovery development and restoration period. The drawdown computed by the ground water-flow model was evaluated at 81 stock and domestic well locations located within a 4.8-km (3-mi) radius of the ISR Projects.

In general, the maximum hydrologic impacts occurred in wells closest to uranium-recovery facilities and those completed within ore-bearing sands (A- through F-Sands). Cumulative drawdown impacts greater than 6 m (20 ft) were predicted in two wells (Pfister Ranch and Brown #5), which are located near the North Butte site and Hank Unit. Cumulative drawdown greater than 3 m (10 ft) is predicted in 23 of the 81 wells included in this effort. Drawdown in shallow water-table wells (G/H-Sand) is predicted to be negligible (less than 0.06 m (0.2 ft)) over the lifecycle of uranium recovery and CBM production.

Predicted hydrologic impacts associated with uranium recovery and CBM development are not significant; predicted drawdown due to these activities is less than 10 percent of the available water column in wells having more than 3 m (10 ft) of predicted drawdown. In the worst case, a small decrease in well yield could be observed due to a decreased pumping level in the wells that have the highest potential drawdown impacts. If this became a significant concern, the Licensee would lower the pump in the well or, in the worst case, it would install an additional water-supply well (and pump) to make up for needed production. Given this commitment on the part of the Licensee, the impacts would be mitigated and the cumulative impact to groundwater use would be SMALL at the North Butte site.

5.4.3 Gas Hills Satellite Site

Cumulative impacts to water resources and wetlands during all phases of uranium-recovery activities were discussed in the BLM EIS (BLM, 2013), but were not evaluated in the NRC's 2004 EA prepared for PRI's original Gas Hills license (NRC, 2004). The water-resources assessment and cumulative impacts evaluated in the BLM EIS are directly applicable to the cumulative impact analysis conducted in this EA.

The geographic area for the evaluation of cumulative impacts to surface-water quality follows the methodology for defining the CISA used by the BLM in its EIS (BLM, 2013). This area encompasses the Upper Canyon Creek-Deer Creek and Fraser Draw sub-watersheds.

This area included the past uranium-exploration projects and restoration projects employing open-pit and underground uranium-extraction methods as well as conventional milling with mill-tailings impoundments (BLM, 2013). Other projects in the "water-resources CISA" include: Rock Hill, Bullrush Tables Stakes, George/Ver Property, and South Black Mountain; the Burrrush/North Spoils/George Highwall uranium mine reclamation sites; and the RSMP WD Bentonite mine.

Surface-Water Quality

BLM determined that increased ground disturbance due to future projects, including expansion of the road network, could have adverse impacts similar to those of the Proposed Action (BLM, 2012). These impacts could include temporary increases in storm-water runoff and increases in suspended- and dissolved-solids concentrations. The potential impacts would be mitigated by the WDEQ/WDQ's requirement for a construction storm-water-discharge permit and adherence to a SWPPP. After these mitigation measures, the impacts to surface-water quality would be SMALL.

Surface-Water Use

Impacts on surface-water quantity associated with the Gas Hills site are discussed in EA Section 4.4.4.1. These impacts would be SMALL, given that surface water would not be used at the site and groundwater is not hydraulically connected to any surface water at the site. Given the absence of surface-water use associated with the Smith Ranch Project, cumulative impacts on surface-water quantity at the Gas Hills site would be SMALL.

Wetlands

The geographic area for this assessment of cumulative impacts to groundwater at the Gas Hills site follows the same methodology for definition of "ground water-resources CISA" used by the BLM in EIS for Gas Hills site (BLM, 2013). The study area was a 17-km (10-mi) radius around the Gas Hills site. The cumulative-impacts assessment in this area is appropriate because this study area includes the geographic areas where the aquifers are tapped for resource development.

The only cumulative impacts to wetlands within the Gas Hills site cumulative-impacts assessment area would be from the Proposed Action as described in EA Section 4.4.4.1, Wetlands. These wetlands are currently not affected by other activities in the area. The Proposed action is not expected to have any impacts on these wetlands, and, therefore, there would be no cumulative impacts.

Ground Water Quality

Projects within the study area include mine reclamation, mine exploration, ongoing oil and gas production, long-term management of uranium tailings, and a bentonite mine. However, the BLM determined that these projects would not have an impact on ground water quality (BLM, 2013).

The BLM identified a potential impact on ground water quality due to historic mines in the Gas Hills vicinity (BLM, 2013). Migration of groundwater contaminated by past mining and milling activities could be affected during post-mining ground water restoration. In particular, MU 4 is located in close proximity to the Buss-Pit lake, which contains water impacted with high TDS concentrations from past uranium mining activities. MU 5 is located next to several historic mines. During uranium-recovery operation and aquifer restoration, when the volume of water withdrawn is greater than the volume injected, the pumping in the proposed wellfields could draw in or displace contaminated ground water from these past mining and milling activities.

The BLM concluded, however, that the mitigation measures required by the NRC would prevent greater impacts from the historic long-term impacts to ground water quality. Therefore, the

impacts to ground water quality from the Proposed Action would be a SMALL increment to SMALL cumulative impacts.

Ground Water Use

Projects within the ground water-resources CISA include mine reclamation, mine exploration, ongoing oil and gas production, long-term management of uranium tailings, and a bentonite mine (BLM, 2013). The BLM's assessment regarding cumulative impacts to groundwater use at the Gas Hills site indicated that these projects would not impact groundwater quantity at the Gas Hills site itself (BLM, 2013). Likewise, the Smith Ranch Project would not affect other groundwater users due to the limited quantity of groundwater that would be withdrawn during operation and aquifer restoration. Thus, the cumulative impacts related to groundwater use (i.e., flow and volume) would be SMALL.

The BLM further described how water rights are administered by the WSEO, which dictates the water rights that take precedence over others. The WSEO ensures that new water users would not impact current water users or any interstate agreements; therefore, the Smith Ranch Project at the Gas Hills site would be constrained from impacting other water users within the study area. Based upon the current review of groundwater resources and the cumulative impact analysis conducted by the BLM (2013), the NRC concludes that the incremental impacts on groundwater use would be SMALL.

5.5 Ecological Resources

The geographic area selected for this analysis of cumulative impacts for the Smith Ranch and North Butte sites was the entire Powder River Basin (the "ecology CISA"), because grassland and sagebrush shrubland habitats are important features of the landscape of the basin, and these habitats occur on the these Project sites.

For the Gas Hills site, the geographic area considered in this cumulative impacts analysis was the entire Wind River Basin, because grassland and sagebrush shrubland habitats are important to this Basin's landscape, and these habitats occur on the Gas Hills site.

The timeframe for the ecological-resource cumulative-impacts analysis is from 2015 – 2030, although some older data have been considered to reveal historical trends. These years were chosen to allow impacts to ecology of the Smith Ranch Project area and its vicinity to mature. It will take some time (the NRC assumed 5 years) for the flora and fauna to recover after site restoration.

This cumulative-impacts analysis is focused on the incremental impact of the Proposed Action on ecological resources at the Smith Ranch Project sites, which includes the Licensee's proposed amendments from the current license as described in EA Section 2 related to past, present, and RFFAs.

5.5.1 Smith Ranch Site

Vegetation

Vegetation at the Smith Ranch site is primarily grassland composed of mixed-grass prairie. As discussed in EA Section 4.2.5.1, the impacts to vegetation at the Smith Ranch site resulting

from the Proposed Action would be SMALL. The proposed additional disturbance under the Proposed Action would be an additional 191 ha (472 ac), or less than 1.2 percent of the total Smith Ranch license area (i.e., 16,000 ha (40,000 ac)) (Cameco, 2012).

Land disturbance resulting from other past, present, and RFFAs (e.g., oil and gas development, wind-energy projects, other uranium-recovery projects) in the vicinity of the Smith Ranch site would have ecological impacts similar to those described in EA Section 4.6.1.1 and they would be small and localized therefore the impacts would be SMALL if mitigation measures discussed in EA Section 4.2.5.1 were to be employed. Operational history collected at the Smith Ranch site demonstrates that impacts to vegetation are of short term duration and reversible. Impacts to vegetation would be a SMALL incremental impact because the area of disturbed land would be a small percentage of the Project area and a small percentage of the Powder River Basin, the Licensee's demonstrated operational history, and mitigation that would be required under provisions of the NRC license and the WDEQ Permit.

Wildlife

The Smith Ranch site has abundant wildlife, as discussed in EA Section 3.2.5.2. As discussed in EA Section 4.2.5.1, the impacts to wildlife at the Smith Ranch site resulting from the Proposed Action would be SMALL.

Cumulative impacts to wildlife resources would be directly and indirectly related to habitat loss, habitat fragmentation, animal displacement, and direct mortalities. Loss and degradation of native sagebrush-shrubland habitats has affected much of this ecosystem type as well as sagebrush-obligate species such as the greater sage-grouse. Most of the sagebrush shrublands in the Powder River Basin have already been significantly changed by land uses such as livestock grazing, agriculture, or resource extraction. These land uses can influence habitats either directly or indirectly. For example, an indirect effect would be the alteration of the natural regime, which could change the frequency of land-clearing fires (Naugle, et al., 2009).

However, the impact to sagebrush-shrubland communities at the proposed Smith Ranch site would be SMALL because only an additional 191 ha (472 ac), or 1.2 percent of the total Smith Ranch license area (16,000 ha (40,000 ac)) would be disturbed under the Proposed Action (Cameco, 2012). Potential impacts (e.g., habitat loss, habitat fragmentation, and noise disturbance) would also likely occur at mines as well as oil and gas facilities throughout the Powder River Basin, and would potentially impact other localized wildlife populations. The impacts to other species, and required mitigation, would be similar. Other past, present, and RFFAs in the Powder River Basin could result in the disturbance of tens of thousands of acres. However, site-reclamation requirements and BMP for these projects (e.g., from State and/or Federal permits or licenses) would mitigate these impacts, and, thus, the cumulative impacts on ecological resources would be SMALL in the Powder River Basin.

Protected Species

The presence of protected floral and faunal species at the Smith Ranch site is discussed in EA Section 3.2.5.3. As discussed in EA Section 4.2.5.1, the impacts to protected species at the Smith Ranch site resulting from the Proposed Action would be SMALL. Cumulative impacts within the Powder River Basin would be similar to impacts to wildlife as discussed above in EA Section 5.5.1, and they would be SMALL.

5.5.2 North Butte Satellite Site

The Proposed Action would not result in any additional land disturbances at the North Butte site relative to what is currently licensed; therefore, there would be no incremental increase of impacts to ecological resources resulting from the Proposed Action at the North Butte site. Therefore, the cumulative impacts within the Powder River Basin to vegetation, wildlife, and protected species would be SMALL.

5.5.3 Gas Hills Satellite Site

The Proposed Action would not result in any additional land disturbances at the Gas Hills site from what is currently licensed; therefore, there would be no incremental increase of impacts to ecological resources resulting from the Proposed Action at the Gas Hills site. Therefore, the cumulative impacts within the Wind River Basin to vegetation, wildlife, and protected species would be SMALL.

5.6 Climate Change and Air Quality

The cumulative impacts for each of the Smith Ranch Project sites for both air quality relating from nonradiological and radiological emissions (non-greenhouse-gas), as well as greenhouse-gas (GHG) emissions and related climate changes, are discussed below.

The Smith Ranch site cumulative impacts to air quality were assessed within an 80-km (50-mi) radius of the site. This area, the "air- quality CISA," covers all of Converse County and includes portions of Johnson, Campbell, Natrona, and Niobrara Counties as well as small northern portions of Albany, Carbon, and Platte Counties. In addition, significant air-pollution contributors (e.g., oil and gas and other energy development projects) and PSD-sensitive areas up to approximately 160 km (100 mi) were included, as appropriate, in this analysis.

The North Butte Satellite site's cumulative impacts to air quality were also assessed, primarily within an 80-km (50-mi) radius of the Satellite. This air-quality study area included the majority of Johnson and Campbell Counties, the western portion of Weston County, and a northern portion of Converse and Natrona Counties. Again, significant air-pollution contributors and PSD-sensitive areas up to approximately 160 km (100 mi) were included, as appropriate, in this analysis.

The Gas Hills Satellite's cumulative impacts to air quality were assessed within an 80-km (50-mi) radius of the proposed remote satellite site, as with the other project sites. Additionally, the information in the BLM EIS (BLM, 2013) was also reviewed.

5.6.1 Smith Ranch Site

Non-radiological air-quality impacts primarily involve combustion-engine emissions from both the equipment that would be used predominantly during the construction and decommissioning phases of the Project at the Smith Ranch site as well as the combustion-engine emissions associated traffic over paved and unpaved roads during all phases of the Project. In addition, fugitive-dust emissions could result during land-disturbing activities, especially during the construction and decommissioning Project phases at the site. However, because most of the emissions are particulate emissions from ground-level sources, any immediate air-quality impacts of the Smith Ranch would dissipate over distance and would not be transported long

distances downwind (NRC, 2013b). As discussed in EA Section 4.2.6.1, the increase in all air emissions from the Proposed Action, compared to current operations, would be negligible.

The air quality in the vicinity of the Smith Ranch area is currently in compliance with the NAAQS for all criteria air pollutants, including combustion-engine and fugitive-dust emissions (see EA Section 3.2.6). Also, as noted in EA Section 4.2.6.1, the potential impacts to air quality from the Smith Ranch would be SMALL during each phase of the Project.

The proposed activities at the Smith Ranch site would have a SMALL contribution to the SMALL cumulative impacts resulting from past, present, and RFFAs.

Global Climate Change

Although uncertainty remains in the rise and fall of temperatures, as well as the magnitude of those changes, the Center for Climate Strategies (CCS) evaluated Wyoming temperature and precipitation data for the period 1895 – 2010 in order to estimate cumulative climate change (CCS, 2007). On average, the temperature in Wyoming has increased approximately 0.09 °C (0.16 °F) per decade during this time period (NCDC, 2011a). In its report, the U.S. Global Change Research Team (USGCRT) indicated that the temperatures in the 15 years at the end of that study period rose at an even faster rate (i.e., 0.83 °C [1.5 °F] for the Great Plains), most of which is attributed to warmer winters (GCRP, 2009). The projected change in temperature over the period from 2000 – 2020, which encompasses the period that the Smith Ranch would be licensed and operated, ranges from a decrease of approximately 0.28°C (0.5 °F) to an increase of approximately 1.1 °C (2 °F) (GCRP, 2009).

For the same period (i.e., 1895 – 2010), a slight downward trend in precipitation (0.30 cm (0.12 in) per decade) has been measured (NCDC, 2011b). Nevertheless, the USGCRT has predicted that the Great Plains region would receive increased precipitation in future decades. Most of the precipitation is expected to fall during the colder months (i.e., winter and spring), and the summer and fall are predicted to become drier. In addition, with the colder months expected to warm over the next several decades, more precipitation would fall in liquid form, resulting in less snow pack in the higher elevations (GCRP, 2009).

The small predicted increases in temperatures and precipitation over the next decade would have no effect on any of the phases of the proposed Smith Ranch Project. Because the most significant activities at the Smith Ranch sites would be below ground, the effects of the surficial and atmospheric environments are not expected to significantly impact uranium recovery.

Greenhouse-Gas Emissions

The Global Change Research Program (GCRP) has calculated the annual carbon-dioxide emissions (GCRP, 2009), on a global scale. NRC staff has concluded that the cumulative impacts of GHG emissions around the world, as presented in the GCRP report, are noticeable and that these emissions are a basis for its evaluation of cumulative impacts on climate change. They have concluded that the cumulative impacts of GHG emissions, including carbon dioxide, could contribute to climate change, and that the carbon footprint is a relevant factor in the evaluation of potential impacts of alternatives.

The CCS prepared a report for the WDEQ that provides an inventory and forecast of Wyoming's GHG emissions (CCS, 2007). Emissions are reported as carbon-dioxide equivalents (CO_2e); this conversion renders all of the various gases emitted (e.g., methane or nitrous oxides) during

an operation or activity into an equivalent GHG effect compared to carbon dioxide (BLM, 2008). Gross CO_2e emissions in 2005 for Wyoming were 56 million t (62 million T); these account for less than 1 percent (i.e., 0.8 percent) of the total U.S. GHG emissions. This total is reduced to 36 million MT (40 million T) CO_2e as a result of annual sequestration (i.e., removal) due to forestry and other land uses (CCS, 2007). It is estimated that Wyoming gross GHG emissions will be 69 million MT (76 million T) by 2020 (EPA, 2008).

For a typical ISR project, the NRC has conservatively estimated, that the total annual GHG emissions would be 11,872 MT (13,087 T) (NRC, 2013a). The Smith Ranch GHG contribution equates to approximately 0.03 percent of the net total GHGs produced in Wyoming in 2005 (after accounting for sequestration). If there has been an increase in GHG emissions, or a decrease in sequestration since 2005, the effect of the Smith Ranch Project *in toto* would be even less. Therefore, the incremental impact of GHGs from the proposed Smith Ranch Project would be SMALL, and the cumulative impacts of GHG within the cumulative-impacts study area would also be SMALL.

5.6.2 North Butte Satellite Site

The proposed North Butte site could contribute to air-quality cumulative impacts when its environmental impacts overlap with those of other past, present, or RFFAs.

Similar to the Smith Ranch site, the incremental GHG impacts of the North Butte Satellite site would be a SMALL contribution to SMALL cumulative impacts resulting from past, present, and RFFAs.

5.6.3 Gas Hills Satellite Site

The BLM evaluated the cumulative impacts to air quality for the Gas Hills site (BLM, 2013). In that analysis, the “air-quality CISA” encompassed activities within 5 km (3 mi) outside of the Gas Hills site boundary. The primary impacts occurred as a result of particulate emissions. The other projects within the study area considered in this analysis of cumulative impacts to air quality included mining exploration projects, Cameco’s revised Plan of Operations for reclamation of the Buss Pit Lake (one site), two U.S. Department of Energy long-term management projects, and two abandoned mine land (AML) projects. The BLM concluded that cumulative impacts from the Gas Hills Satellite site would not be anticipated, and thus, in this EA, the cumulative impacts would be SMALL (BLM, 2013).

5.7 Noise

Cumulative noise impacts of current activities and RFFAs were assessed for this EA within a 300-m (1,000-ft) distance from all points of the Smith Ranch Project sites (the “noise CISA”). No past activities were considered because past activities do not continue to generate noise (i.e., when a project is over, so is the noise it generated). Although some noises would be able to be detected beyond the Project boundaries, this distance was considered appropriate because noise quickly dissipates with distance from the source. As noted in GEIS Section 4.4.7, noise would not be discernible to an offsite person at distances of greater than 300 m (1,000 ft) from the site (NRC, 2009a).

5.7.1 Smith Ranch Site

EA Section 4.2.7.1 describes anticipated noise impacts associated with the Smith Ranch Project at the Smith Ranch site; these impacts would all be SMALL, for all human receptors, to MODERATE for wildlife during the construction phase. During all other phases, noise impacts would be SMALL.

The following activities, as specified in GEIS Table 5.3-2, would be anticipated to contribute to the cumulative noise impacts for this area: railroad-infrastructure development for local mines; coal and other natural-resource conventional mining and milling; mine reclamation; oil and CBM development; continued construction and operation of uranium-recovery facilities; and sand, gravel, and scoria mining (NRC, 2009a). As noted in the Licensee's *Environmental Report (*ER) wind-farming activities are also occurring in the 3-km- (2-mi-) radius area surrounding the Smith Ranch site (Cameco, 2014). The majority of these surrounding activities produce much greater sound than would the Proposed Action, and the SMALL noise impacts of the Proposed Action would not be discernible above the noise produced by these other activities. Thus, the cumulative impacts of the Smith Ranch Project in the area of the Smith Ranch site would be SMALL.

5.7.2 North Butte Satellite Site

As discussed in EA Section 4.3.7.1, noise impacts generated by the Proposed Action at the North Butte site overall would not be significant, with SMALL impacts to nearby residents, but temporary MODERATE impacts for site workers, who would wear protection to mitigate those impacts. Additionally, the local land use is for cattle and sheep grazing, with limited CBM production around the site (EA Section 3.3.1). These uses have a SMALL noise impact. Therefore, due to the rural nature of the North Butte site and limited impact from RFFAs in the area, the cumulative noise impacts at the North Butte site would be SMALL.

5.7.3 Gas Hills Satellite Site

As stated in EA Section 4.4.7.1, noise impacts at the Gas Hills site from the Proposed Action would be SMALL and not significant. Noise impacts from other activities in the vicinity of the site include noise from cattle and ranch vehicles, from traffic along SH 136 and nearby roads, and from wind and wildlife (EA Section 3.4.7). These impacts would be temporary and SMALL. Therefore, due to the rural nature of the Gas Hills site and limited impact from RFFAs in the area, the cumulative noise impacts at the site would be SMALL.

5.8 Historical and Cultural Resources

Cumulative impacts to historic, cultural, and paleontological resources would result from the combined effects of regional energy development, construction, and other man-made processes as well as atmospheric changes, erosion, and other natural processes over time. Increased populations as a result of local, energy-development workforce expansion increases the potential for indirect impacts of unauthorized and illegal artifact collection, vandalism, and excavation.

Hundreds of archaeological sites are discovered and recorded each year as the result of cultural-resource investigations associated with energy-development projects. As the demand

for Federally-owned minerals increases, there would be an expansion of development activities in areas where pristine cultural resources are located. One of the greatest potential cumulative impacts to cultural resources would be from development activities occurring on private or State lands where no Federal jurisdiction applies protecting historic and cultural properties.

Cumulative impacts to cultural resources include effects on Native American burials and ceremonial use sites. Native American and some early pioneer Euroamerican human remains are not concentrated in designated "cemeteries" but are, rather, dispersed across the landscape. The cumulative effect of regional energy development could cause more unmarked human burials to be disturbed or destroyed. In addition, the spiritual practices of many modern Native Americans include use of high vantage points that offer a large and natural pristine viewshed. Several large, visually prominent Traditional Cultural Properties have been documented in the region of the Smith Ranch Project, including Devil's Tower National Monument (Bear Lodge), the Pumpkin Buttes, Bear Butte, and portions of the Black Hills. As energy development increases, unobstructed viewsheds would diminish, impacting the ongoing cultural use of those locations.

Cameco commits to stop work and notify the NRC, the WY SHPO, and other appropriate agencies if previously unidentified sites are encountered during any phase of the project. As stated in Chapter 4, the NRC staff concludes that for all Smith Ranch Project sites, historical and cultural resources would not be adversely affected by the undertaking (i.e. the Proposed Action).

Based on this information, the NRC staff concludes that the Proposed Action's impacts to historical and cultural resources of the project would have a SMALL incremental effect on the SMALL cumulative impacts resulting from other past, present, and RFFAs.

5.9 Visual and Scenic Resources

Cumulative impacts to visual and scenic resources were evaluated within a 3.2-km (2-mi) radius ("visual-resources cumulative-impacts study area") of the proposed Smith Ranch Project site.

The Smith Ranch Project sites are located in remote areas that are primarily on private and/or BLM-administered lands. Because there is limited access and visitor activity in these areas, visual impacts to the user experience would be SMALL. On a cumulative basis, the adjacent existing landscape already includes features associated with other energy-development enterprises including wind-energy generators, CBM wellfields, conventional oil- and gas-drilling pads and impoundments, and previous uranium-recovery facilities as well as ancillary roads and buildings (Cameco, 2014).

Development of ISR facilities includes construction of wellfields, processing facilities, surface impoundments, access roads, infrastructure components, and so forth. Construction to this degree has transformed the land to a more developed landscape. Depending upon the landform, vegetation type, and structure spacing, corresponding surface disturbance and completed facilities are evident to varying degrees. Development associated with ISR facilities is consistent with VRM Class III and IV management objectives. Surface-disturbing activities on lands that have a VRM Class II Designation may not be consistent with those objectives. In VRM II areas, disturbances would have to be mitigated to a level where they would not attract the attention of a casual observer.

5.9.1 Smith Ranch Site

Past ISR activity at the Smith Ranch site has disturbed 571 ha (1,410 ac) of land in the cumulative-impacts study area for visual resources, of which some of the area has been reclaimed. The additional surface disturbance proposed for the Smith Ranch site would be approximately 191 ha (472 ac). Other public-land uses, such as renewable-energy development, livestock and wildlife grazing, and off-highway vehicle (OHV) use have also affected the character of the landscape.

Any structures built for the purpose of the ISR operation under the Proposed Action are expected to have little impact on the overall visual quality of the surrounding area. Because there is already significant development within the study area, including presently licensed facilities, the additional visual impacts associated with the Proposed Action would not significantly impact the visual impacts in the overall study area; therefore, the cumulative visual-resource impacts would be SMALL at the Smith Ranch site.

5.9.2 North Butte Satellite Site

Past and present ISR activity at the North Butte site has disturbed approximately 54 ha (133 ac) of land in the cumulative-impacts study area. The total surface disturbance proposed at the North Butte site would be up to approximately 162 ha (400 ac). Other public-land uses, such as renewable-energy development, livestock and wildlife grazing, and OHV use have also affected the character of the landscape.

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. Since there is already development within the cumulative-impacts study area, the additional visual impacts associated with the Proposed Action would not significantly impact the visual impacts in the overall study area; therefore, the cumulative visual-resource impacts would be SMALL at the North Butte Satellite site.

5.9.3 Gas Hills Satellite Site

Past activities, particularly previous surface and underground mining for uranium, have disturbed 40 ha (98 ac) of land in the cumulative-impacts study area. The potential surface disturbance at the Gas Hills site under the Proposed Action would be approximately 532 ha (1,315 ac). Other public-land uses, such as renewable-energy development, livestock and wildlife grazing, and OHV use have also affected the character of the landscape.

The BLM determined in its EIS that the cumulative impacts of the Proposed Action would be of low significance (BLM, 2013). There would be minor and positive cumulative visual-resource impacts after the successful reclamation of the portion of the Gas Hills site that is located in an area already in need of visual rehabilitation due to prior mining activities (BLM, 2013). Moreover, because there is already development within the cumulative-impacts study area, the additional visual impacts associated with the Proposed Action would not significantly impact the visual impacts in the overall study area; therefore, the cumulative visual-resource impacts would be SMALL at the Gas Hills Satellite site.

5.10 Socioeconomics and Environmental Justice

5.10.1 Smith Ranch Site

The geographic scope of this socioeconomics cumulative-impacts analysis was chosen as the two-county area of Converse and Natrona Counties (the "socioeconomics CISA," or the ROI). The timeframe for the analysis starts in 2003, to account for both past and present projects that could contribute to cumulative impacts, and continues through 2025.

The potential socioeconomic impacts of the Proposed Action range from SMALL to MODERATE, and MODERATE impacts are associated with the benefits of the additional tax revenue projected to accrue to Converse County. Because the scope of the Proposed Action relative to existing employment levels in the two-county ROI is SMALL (EA Section 4.11), and the Licensee is committed to hiring locally, the population impacts and the associated increase in demand for public and private services also are expected to be SMALL.

GEIS Table 5-2-1 listed past, current, and potential energy projects in the ROI (NRC, 2009a). There are two currently operating coal mines in Converse County and one currently operating ISR site (Smith Ranch). In addition, two other uranium-recovery projects (Ludeman and Allemand-Ross) are under consideration in Converse County (Strata, 2014).

The coal mines have been operating since 2003; therefore the population increases and socioeconomic effects of these projects are reflected in the data through 2010 presented in Section 3.11. Population during the 2000 – 2010 period increased by 14.8 percent in Converse County and by 13.4 percent in Natrona County (EA Table 3.3), similar to population growth in Wyoming (14.1 percent) during the same period.

In this cumulative-impacts analysis, it is assumed the other planned ISR projects in the ROI have the same characteristics as the Smith Ranch Project, where peak operation-phase employment would be approximately 170 jobs at the Smith Ranch site. If these additional projects are online and operating through 2025, operation-phase employment levels, for the two ISR projects combined with the Smith Ranch site, would total approximately 510 jobs. If these other projects follow the Licensee's local hiring and purchasing patterns, population increases would amount to an additional 434 residents in the two-county ROI by 2025. The additional population would increase the projected two-county population in 2025 by less than 1 percent over 2010 levels, which would result in a SMALL impact on the demand for public and private services in the ROI and thus a SMALL cumulative socioeconomic impact.

Because no minority or low-income populations have been identified within 80 km (50 mi) of the project area and that impacts are SMALL to MODERATE and populations are affected equally, the NRC staff concludes there are no disproportionate human-health and environmental impacts. Therefore, there are no cumulative impacts expected in minority and low income populations near the Smith Ranch site.

5.10.2 North Butte Satellite Site

The geographic scope selected for this socioeconomics cumulative-impacts analysis at the North Butte site was the two-county area of Campbell and Johnson Counties. The timeframe

for the analysis starts in 2003, to account for both past and present projects as well as RFFAs that could contribute to cumulative impacts, and continues through 2025.

The potential socioeconomic impacts of the Proposed Action range from SMALL to MODERATE, and MODERATE impacts are associated with the benefits of the additional tax revenue projected to accrue to Campbell County. Because the scope of the Proposed Action at the North Butte site relative to existing employment levels in the two-county ROI is SMALL (EA Section 4.11), and the Licensee is committed to hiring locally, the population impacts and the associated increase in demand for public and private services also are expected to be SMALL.

A number of energy-related developments recently completed in the region as well as the proposed projects in the ROI have the potential to cause additional impacts to socioeconomic areas of study. The population increases and socioeconomic effects of the projects that have been operating since 2003 are reflected in the data through 2010 presented in EA Section 3.11. Population during the 2000 – 2010 period increased by 36.9 percent in Campbell County and by 21.1 percent in Johnson County (EA Table 3.5); higher rates of population growth than in Wyoming overall, which grew by 14.1 percent during the same period.

Proposed uranium-recovery projects under consideration in Campbell and Johnson Counties include Ross, Moore Ranch, Ruby Ranch, Willow Creek, Nichols Ranch, and Reno Creek (Strata, 2014). In this cumulative-impacts analysis, it is assumed the other planned ISR projects in the ROI have the same characteristics as the Smith Ranch Project, where peak operation-phase employment would be approximately 170 jobs at the largest site. If these additional projects are online and operating through 2025, operation-phase employment levels, for the six potential ISR projects combined with the Proposed Action at the North Butte site, would total approximately 1,070 jobs. If these other projects follow the Licensee's local hiring and purchasing patterns, population increases would amount to approximately 900 additional residents in the two-county ROI by 2025. The additional population would increase the projected two-county population in 2025 by less than 2 percent over 2010 levels, which would result in a SMALL impact on the demand for public and private services in the ROI and thus a SMALL cumulative socioeconomic impact.

Because no minority or low-income populations have been identified within 80 km (50 mi) of the project area and that impacts are SMALL to MODERATE and populations are affected equally, the NRC staff concludes there are no disproportionate human-health and environmental impacts. Therefore, there are no cumulative impacts expected in minority and low income populations near the North Butte site.

5.10.3 Gas Hills Satellite Site

The geographic scope chosen for this socioeconomics cumulative-impacts analysis of the Gas Hills site was the two-county area of Fremont and Natrona Counties. The potential socioeconomic impacts of the Proposed Action range from SMALL to MODERATE, and MODERATE impacts are associated with the benefits of the additional tax revenue projected to accrue to Fremont County. Because the scope of the Proposed Action at the Gas Hills site relative to existing employment levels in the two-county ROI are SMALL (EA Section 4.4.10.1), and the Licensee is committed to hiring locally, the population impacts and the associated increase in demand for public and private services also are expected to be SMALL.

An analysis of socioeconomic cumulative impacts at the Gas Hills site is contained in the BLM EIS (BLM, 2013). The current mining projects in the ROI are mainly reclamation projects or

projects in the exploration stage, and thus are estimated to have employment levels of fewer than 75 workers. The proposed Sheep Mountain Uranium Project in southern Fremont County is anticipated to have peak employment of approximately 250 workers (BLM, 2013). If these additional projects are online and operating through 2025, operation-phase employment levels would total approximately 700 jobs. If these other projects follow the Licensee's local hiring and purchasing patterns, population increases would amount to an additional 600 residents in the two-county ROI by 2025. The additional population would increase the projected two-county population in 2025 by less than 1 percent over 2010 levels, which would result in a SMALL impact on the demand for public and private services in the ROI and thus a SMALL cumulative socioeconomic impact.

Because impacts are SMALL to MODERATE and populations are affected equally, the NRC staff concludes there are no disproportionate human-health and environmental impacts. Therefore, there are no cumulative impacts expected in minority and low income populations near the Gas Hills site.

6.0 MONITORING

6.1 Introduction

NRC licensees develop monitoring programs for ISR facilities to verify compliance with the applicable standards and requirements for protection of worker health and safety in active uranium-recovery areas (i.e., both the facility and the wellfields) and for protection of the public and the environment within and beyond the licensed facility's boundary (NRC, 2009a; Section 8.1). These monitoring programs provide data on operating and environmental conditions so that the licensee can implement prompt corrective actions when adverse conditions are detected.

This section of the EA discusses the types of monitoring activities that Cameco undertakes throughout the proposed Smith Ranch Project, and any site-specific programs are also noted. The monitoring programs discussed include engineering-parameter and ground water and surface water monitoring, as well as radiological, environmental, meteorological, and ecological monitoring activities.

It is important to note that the actions Cameco takes in response to monitoring results (e.g., management of surface spills and pipeline leaks) are not considered part of a routine environmental monitoring program (NRC, 2009a). The spill and leak history for the project sites from 2000 to 2017 is discussed in section 2.5 of this EA, while the licensee's actions that are intended to detect and to minimize the impacts of spills and leaks are discussed in the relevant sections in Chapter 4 of this EA.

6.2 Wellfield and Pipeline Flow and Pressure Monitoring

Under the Proposed Action, Cameco would continue the procedures for monitoring wellfield and pipeline flow and pressure that are currently established for License SUA-1548 (Cameco, 2012). Installed pipelines would be pressure tested prior to closing the trench within which the pipeline is placed. Pipelines would be equipped with high- and low- pressure sensors and flow meters to provide notification in the event of abnormal operating conditions such as breaks or blockages. Down-hole injection pressures would be maintained below formation-fracture pressures as required by the WDEQ/LQD (WDEQ/LQD, 2005). To ensure that the formation fracture pressure is not exceeded, the Licensee calculates and posts the maximum injection pressure near the injection trunk line pressure gages. The pressure of the injection-trunk-line would be monitored daily in the header house of each recovery wellfield and reported quarterly to the WDEQ/LQD (Cameco, 2015, TR 3.5.3.4).

6.3 Pre-Operational Wellfield and Ground Water Quality

In advance of operating each wellfield, Cameco would determine baseline ground water quality from samples collected from wells installed in the ore-zone aquifer and, when present, in the aquifers overlying and underlying the ore zone. The baseline monitoring program would provide data to establish UCL parameter concentrations that would be used by the licensee to identify potential horizontal excursions of lixiviant outside of a wellfield and potential vertical excursions into the overlying or underlying aquifers (Cameco, 2015, TR 3.4.4).

6.4 Environmental Monitoring

6.4.1 Ground Water Monitoring

The proposed ground water-monitoring program would be designed to ensure that production fluids are contained within the defined production zone during operations (Cameco, 2015, TR 5.10.3.1). Monitoring wells would be installed around the perimeter of each wellfield according to the NRC license conditions in License SUA-1548.

In accordance with WDEQ/LQD Rules and Regulations Chapter 11, Section 6 and WDEQ/LQD Guideline 4, and associated Reference Documents 9 and 10, the location and spacing of wells used to monitor for lateral excursions will be determined by a technically sound method, which may include but is not limited to, hydrologic modeling, delineation drilling data, gradient consideration, dispersivity of recovery fluids, the calculated operational flare and the calculated excursion recoverability within 60 days.

Monitoring wells would be sampled twice each month at approximately 2-week intervals but not less than 10 days apart. Samples would be analyzed for UCL parameters and compared with UCL concentrations established from post-licensing, pre-operation baseline ground water quality. An excursion of lixiviant would be detected at a particular monitoring well if any ground water sample results exceed two of the three UCL values, and the result would then later be confirmed by additional sampling and analysis (Cameco, 2015, TR 5.10.3.1).

During an excursion, monitoring wells on excursion status will be sampled at least once every 7 days and analyzed for the UCL parameters and uranium. If an excursion is not controlled within 30 days following confirmation, each affected well will be sampled and analyzed for the parameters in Table Op-7 from the Smith Ranch WDEQ Operations Plan. WDEQ/LQD Rules and Regulations Chapter 11, Section 12(d)(i) require that excursion samples be analyzed for antimony, barium, beryllium, conductivity, copper, lead, mercury, nitrate, pH, and thallium. The WDEQ may waive the analysis of specific parameters if, based on historical groundwater sampling data, a parameter is not considered likely to occur as a result of ISR activities.

Routine excursion monitoring (every two weeks) for alkalinity, chloride and conductivity at perimeter, overlying and underlying monitor wells will continue until restoration is approved by the NRC (Cameco, 2015, TR 5.10.3.1)

In addition to monitoring wells within and around the perimeter of the wellfields, the licensee's ground water monitoring would include water supply-wells within the license boundaries at each site when uranium recovery is occurring (Cameco, 2012). Operating livestock and domestic wells within 1 km (0.6 mi) of wellfields at the Smith Ranch site have historically been sampled quarterly and analyzed for uranium and radium-226. Since the last license renewal in 2001, nine new mine units have begun operating, resulting in additional domestic and livestock wells being sampled by Cameco on a quarterly basis (Cameco, 2015, TR 5.10.3.2). The 18 wells sampled under this program at the Smith Ranch site are identified in Table 5-16 of (Cameco, 2015).

In 2011, the licensee sampled seven livestock wells within 2 km (1 mi) of the planned operations at the North Butte site to gather pre-operational data (Cameco, 2015, TR 5.10.3.3). These wells are identified in Table 5-18 of the TR (Cameco, 2015). Cameco would need to develop a groundwater sampling plan during operations for the Gas Hills site. Seven livestock wells or

springs are located within the licensed area or within 2 km (1 mi) of the license boundary (Cameco, 2015, TR 5.10.3.4).

6.4.2 Surface Water Monitoring

Figure 5.7 of (Cameco, 2015) shows the current 11 surface water monitoring locations at the Smith Ranch site, which consist of 10 livestock ponds within the site and Sage Creek that are sampled when water is present. For the Reynolds Ranch property, Cameco plans to sample five stock ponds and one spring, and samples will be analyzed from four quarters prior to the start of satellite operations (Cameco, 2015, TR 5.10.2.1). Natural uranium and radium-226 concentrations collected from these sampling locations are below the effluent concentration limits for these radionuclides in 10 CFR part 20 Appendix B.

Figure 5.8 of (Cameco, 2015) shows the surface water monitoring locations at the North Butte site. Monitoring locations at the site consist of stock reservoirs and upstream and ephemeral drainages within the site when water is present. Samples collected would be analyzed for natural uranium, radium-226, and lead-210. In June 2011, the licensee collected baseline surface water samples at 15 locations – the majority from standing water in ephemeral ponds and drainages (Cameco, 2015, TR 5.10.2.1). At the Gas Hills site, four surface water locations would be routinely sampled: (1) Cameron Spring, (2) the section 23 stock pond that is located between planned MU 1 and 2, and (3) two locations along West Canyon Creek. Cameco would analyze the surface water samples for uranium and radium-226 (Cameco, 2015, TR 5.10.2.1).

6.4.3 Radiation Monitoring

Cameco calculated the annual radiological dose to the public from operations during calendar year 2015, as required by 10 CFR 20.1302. The licensee, using 10 CFR 20.1302(b)(1), demonstrated that the annual total effective dose equivalent to a person at the nearest residence was less than 100 mrem. Cameco calculated the highest total effective dose equivalent to a member of the public in calendar year 2015 to be 10.2 mrem for the Smith Ranch site and 3.3 mrem for the North Butte site (NRC, 2016).

6.4.4 Air-Quality Monitoring

Figure 5.7 in Cameco's TR (Cameco, 2015) shows the locations of air-particulate monitoring stations at the Smith Ranch site. The licensee selected these locations in accordance with the guidance provided in Section 1.1.1 of NRC Regulatory Guide 4.14 (NRC, 1980). Regulatory Guide 4.14 provides the following factors to consider: (1) average meteorological conditions, including wind speed, wind direction and atmospheric stability; (2) prevailing wind direction; (3) site boundaries nearest to the satellite, wellfields, etc.; (4) direction of the nearest occupiable structure; and (5) location of estimated maximum concentrations of radioactive materials.

Cameco proposes to continue operating the air-particulate monitoring stations at the Smith Ranch site; three stations are currently operating and two stations associated with the Highland CPF are on standby until the CPF resumes operation. Additionally, Cameco expects to install and operate air-particulate monitoring stations at the Reynolds Ranch and Gas Hills sites when those sites become operational (Cameco, 2015, TR 5.10.1.1).

The environmental monitoring stations are equipped with high-volume air samplers that collect particulate samples for analysis for natural uranium, thorium-230, radium-226 and lead-210. A track-etch detector and an environmental dosimeter are placed at each monitoring station for

measurement of Radon-222 and gamma radiation exposure rates. The filters in the particulate samplers are normally changed at least monthly and composited quarterly (Cameco, 2015, TR 5.10.1.1).

Tables 5-10 through 5-12 of the TR (Cameco, 2015) provide summaries of radioactive air monitoring data gathered from 2000 to 2010 at the three operating stations: (1) the upwind background location; (2) downwind of the Smith Ranch CPP controlled area boundary fence line; and (3) downwind at the nearest resident location, the Vollman Ranch. The site monitoring results show airborne releases of radionuclides well below the effluent concentration limits in 10 CFR part 20 Appendix B that Cameco uses for compliance purposes, and the gamma exposure levels are well below the 0.05 rem/yr requirement contained in 10 CFR Part 20 Subpart D.

At the North Butte site, Cameco has six air monitoring stations at the following locations: (1) a background station; (2) the nearest public residence to the site; (3) the north site of the satellite facility; (4) downwind of the North Butte area and wellfields; (5) the south side of the satellite facility; and (6) the satellite pad next to the man camp. The sample results for natural uranium, radium-226, thorium-230, and lead-210 particulate monitoring indicated that airborne concentrations were at or near background conditions. Radon-222 concentrations at the sampling locations were lower than the 1E-08 microcurie per milliliter value approved in the Smith Ranch license (NRC, 2016).

At the North Butte site, Cameco also monitors for gamma radiation at two fence line locations in addition to the six air monitoring stations. Gamma radiation data are comparable to data collected at the background location and to the control badge (Cameco, 2018b).

6.4.5 Soil and Vegetation Monitoring

Annual soil and vegetation sampling was performed at the Smith Ranch and Highland sites prior to the program's termination in 2000 (Cameco, 2014). Currently, in response to an NRC request, the licensee is reevaluating the need to conduct soil and vegetation monitoring by taking three soil samples annually at a location estimated to be the point of maximum concentration, following NRC Regulatory Guide 4.14, Section 1.1.1. If soil samples show increasing concentrations, Cameco would evaluate the need for additional soil and/or vegetation sampling (Cameco, 2015, TR 5.10.1.2).

Cameco is conducting soil and vegetation monitoring at the two land application areas associated with Satellites 1 and 2. Cameco monitors for various constituents, including uranium and radium-226, and Tables 3-7 and 3-8 in the TR (Cameco, 2015) provide the monitoring programs for each area.

6.4.6 Ecological Monitoring

In consultation with State and Federal agencies, the licensee has prepared a Wildlife Monitoring Plan for each of the Project sites (Cameco, 2014, ER 6.2.6). These plans provide the methodology for and frequency of ecological monitoring and the targeted species. The licensee has reported that these plans are designed to obtain adequate information to allow it to evaluate the effects of uranium-recovery operations on wildlife species of concern and to develop mitigation plans for those effects (Cameco, 2014, ER 6.2.6).

7.0 AGENCIES AND PERSONS CONSULTED

The NRC staff consulted with other agencies regarding the Proposed Action in accordance with the *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs (*NUREG-1748) (NRC, 2003). These consultations are intended to ensure that the consultation requirements under ESA Section 7 and NHPA Section 106 are met.

7.1 U.S. Fish and Wildlife Service (FWS)

On June 22, 2018, NRC staff obtained a list of threatened and endangered species and critical habitats via the FWS Information, Planning, and Conservation (IPaC) system (FWS, 2018) to identify any species or habitat that could occur in or may be affected by actions associated with the Proposed Action. The FWS identified two threatened plant species (*Ute ladies'-tresses* (*Spiranthes diluvialis*) and the Western prairie fringed orchid *(Platanthera praeclara*)) that have the potential to be affected by the Smith Ranch Project. The FWS further indicated that the proposed project, may affect populations of three bird species: (1) endangered least tern (Sterna antillarum), (2) endangered whooping crane (Grus americana), and (3) threatened piping plover (Charadrius melodus); and one fish species, the endangered pallid sturgeon (Scaphirhynchus albus). Discussions of these species can be found in EA Sections 3.2.5, 3.3.5, 4.2.5, and 4.3.5.

7.2 Wyoming State Historic Preservation Office (WY SHPO)

By letter dated April 13, 2015, the NRC staff contacted the Wyoming SHPO and requested review of the staff's proposed direct and indirect Areas of Potential Effect (APEs) for the Smith Ranch Project (NRC, 2015b). The WY SHPO responded on June 4, 2015, with comments on the proposed direct and indirect APEs (WY SHPO, 2015b). The NRC staff revised the direct and indirect APEs and resubmitted it to the SHPO on August 18, 2015 (NRC, 2015a). On September 8, 2015, the WY SHPO concurred with the direct and indirect APEs (WY SHPO, 2015a). By letter dated August 8, 2018, the NRC provided the WY SHPO with relevant historic and cultural resources discussion from the draft EA for review and comment (NRC, 2018d). The WY SHPO responded on August 29, 2018, stating that the WY SHPO would not be commenting, considering its understanding that Section 106 consultation was completed during the original licensing for the project (WY SHPO, 2018b). Further discussion of cultural resources can be found in EA Sections 3.3.5, 4.2.8, and 4.3.8.

7.3 Native American Tribes

By letters dated December 20, 2012, the NRC initiated consultation under Section 106 of the NHPA with 27 Native American tribes (NRC, 2012a, 2012b). Due to delays in the project, the NRC reinitiated Section 106 consultation with the same 27 Tribes by letter dated May 13, 2016, updating the Tribes on progress on the NRC's review and on the WY SHPO's concurrence on the direct and indirect APEs (NRC, 2016d). In February 2018, the NRC staff held a webinar (NRC, 2018a, 2018b), providing to interested Tribes the background information on historic and cultural surveys performed at the Smith Ranch site and North Butte remote satellite site. The webinar also provided the Tribes with maps and supporting discussion on the WY SHPO-concurred direct and indirect APEs. On August 9, 2018, the NRC staff provided the 27 Tribes

with the historic and cultural discussions from the draft EA for review and comment (NRC, 2018f).

The Northern Arapaho tribe provided comments by letter dated August 16, 2018, including requests for (1) a phone call to discuss the project with tribal historic preservation officers (THPOs) and consulting parties; (2) government-to-government meetings; and (3) access to site forms (Northern Arapaho Tribe, 2018). In response, the NRC staff scheduled two conference calls on August 28 and 30, 2018, to discuss the staff's approach concerning protection of historic and cultural resources (NRC, 2018g); three THPOs indicated availability for the calls, but no THPOs attended these calls. On August 31, 2018, the NRC staff held a call with the THPO from the Northern Cheyenne Tribe, and based on that call, the Northern Cheyenne THPO was to provide comments to the NRC (NRC, 2018h); however, no comments were received.

With respect to the other issues raised by the Northern Arapaho tribe, licensing jurisdiction for the Smith Ranch Project and for other ISR projects in Wyoming is expected to transfer to the State of Wyoming under the Agreement State program at the end of September 2018, which does not allow sufficient time for the NRC staff to schedule the requested government-to-government meetings. The NRC staff did confirm with the WY SHPO that THPOs have access to the requested site forms (NRC, 2018i).

7.4 Public Participation

On August 9, 2018, the NRC staff made excerpts from the draft EA concerning historic and cultural resources available on the Project web page at https://www.nrc.gov/materials/uranium-recovery/license-apps/smith-ranch.html. The NRC staff provided the excerpts for public consideration and comment consistent with 36 CFR § 800.4(d)(1), seeking public comments by September 7, 2018. No comments were received.

7.5 Wyoming Department of Environmental Quality

By letter dated August 8, 2018, the NRC provided the draft EA to the WDEQ for its review and comment (NRC, 2018e). The WDEQ, by letter dated August 29, 2018, stated that it had no comment on the draft EA, but noted one typographical error in the NRC's transmittal letter (WDEQ/LQD, 2018).

8 CONCLUSION

Based on its review of the Proposed Action, and in accordance with the requirements in 10 CFR Part 51, the NRC staff has determined that Cameco's proposed 10-year renewal of NRC License SUA-1548 for the Smith Ranch Project would not significantly affect the quality of the human environment. Approval of the Proposed Action would not result in a significant radiological dose to workers or members of the public. The NRC staff has determined that pursuant to 10 CFR 51.31, preparation of an EIS is not required for the proposed action, and pursuant to 10 CFR 51.32, a FONSI is appropriate.

9.0 PREPARERS

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10.0 REFERENCES

10 CFR Part 20. *Code of Federal Regulations*, Title 10, Energy, Part 20, "Standards for Protection Against Radiation." Washington, DC: U.S. Government Printing Office.

10 CFR Part 40. *Code of Federal Regulations*, Title 10, Energy, Part 40, "Domestic Licensing of Source Material." Washington, DC: U.S. Government Printing Office.

10 CFR Part 51. *Code of Federal Regulations*, Title 10, Energy, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Washington, DC: U.S. Government Printing Office.

49 CFR 173.389. Title 49, "Transportation," *Code of Federal Regulations*, Part 173, "Shippers - General Requirements for Shipments and Packaging." Washington, DC: Government Printing Office. 2004, as amended.

Becker, J.M., C.A. Duberstein, J.D. Tagestad, and J.L. Downs. 2012. "Sage-Grouse and Wind Energy: Biology, Habits, and Potential Effects of Development." Prepared for the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Wind and Hydropower Technologies Program, Contract DE–AC05–76RL018302009. At http://www.pnl.gov/main/publications/external/technical_reports/pnnl-18567.pdf. As of December 8, 2012. ADAMS Accession No. ML13011A248.

U.S. Bureau of Land Management, U.S. Department of Interior (BLM), 2018. Environmental Impact Statement for Converse County Oil and Gas Project – Draft. Available at https://eplanning.blm.gov/epl-front-office/eplanning/docset_view.do?projectId=66551&currentPageId=95977&documentId=131874 (accessed on March 10, 2018). January 2018.

BLM, 2013. Final Environmental Impact Statement for the Gas Hills In-Situ Recovery Uranium Project. Lander, WY: BLM Lander Field Office, Wind River/Bighorn Basin District. October 2013.

BLM, 2012. "Amendment to the Programmatic Agreement Regarding the Gas Hills Uranium Recovery Project." ADAMS Accession No. ML12165A237. May 12, 2012.

BLM, 2011. Environmental Assessment for Cameco Resources/Power Resources Incorporated Reynolds Ranch In Situ Uranium Recovery Project, Converse County, Wyoming. Casper, WY: BLM, Casper Field Office.

CCS (U.S. Center for Climate Strategies). 2007. Wyoming Greenhouse Gas Inventory and Reference Case Projections 1990 – 2020. Washington, DC: CCS. ADAMS Accession No. ML13011A261.

Campbell County, 2013a. "Campbell County, Wyoming – 2013 Comprehensive Plan." Campbell County Division of Planning & Zoning. Passed, Approved, and Adopted September 4, 2013.

Campbell County, 2013b. "Future Land Use." Campbell County Division of Planning & Zoning. 2013.

Campbell County, 2013c. "City-County Joint Future Land Use Plan." Campbell County Division of Planning & Zoning. 2013.

Cameco (Cameco Resources), 2018a. “Source Material License SUA-1548; Notification of Cessation of Production for Smith Ranch-Highland Uranium Project and North Butte ISR Project, Cameco Resources.” ADAMS Accession No. ML18102A052. April 2, 2018.

Cameco Resources (Cameco), 2018b. Letter from L. Reimann, Cameco Resources, to NRC re: NRC License SUA-1548, Docket No. 40-8964, Semi-Annual Effluent and Environmental Monitoring Report, July 1 through December 31, 2017. ADAMS Accession No. ML18075A039. February 26, 2018.

Cameco Resources, 2018c, Letter from L. Reimann, Cameco Resources, to NRC, dated March 7, 2018, RE: Response to NRC Request for Additional Information for the License Renewal of Cameco Resources Smith Ranch Highland Uranium Project. ADAMS Accession No. ML18130A038.

Cameco Resources, 2018d, Letter from L. Reimann, Cameco Resources, to NRC, dated July 30, 2018, re: Response to NRC Request for Additional Information for License Renewal of Cameco Resources, Smith Ranch Highland Uranium Project, Source Material License SUA-1548 (TAC J00635). ADAMS Accession No. ML18293A084.

Cameco Resources, 2018e, email from D. Mandeville, NRC to L. Reimann, Cameco Resources, dated August 16, 2018, Re: Radiation Data for NB for 2012. ADAMS Accession No. ML18229A235.

Cameco Resources, 2018f, email from D. Mandeville, NRC to L. Reimann, Cameco Resources, dated August 16, 2018, Re: Updated Sat 2 and Selenium Plant DWG. ADAMS Accession No. ML18229A227.

Cameco, 2017a. “Notification of Excursion at Monitor Wells NB2M-059 and NB2M-60, North Butte ISR Project, Cameco Resources, Permit 632. Letter to M. Rogaczewski (WDEQ). ADAMS Accession No. ML17345A154. November 20, 2017.

Cameco, 2017b. “Email from K. Garoutte (Cameco) to D. Mandeville (NRC) re: excursion notification for wells NB2M-059 and NB2M-060 at North Butte Mine Unit 2.” ADAMS Accession No. ML17325B142. November 17, 2017.

Cameco, 2016a. “Cameco Resources October 2016 Excursion Report Summary for North Butte ISR Project.” Letter from K. Garoutte (Cameco) to M. Rogaczewski (WDEQ). ADAMS Accession No. ML16319A080. November 2, 2016.

Cameco, 2016b. “Cameco Resources, Notification of Excursion at Monitor Well NBM-031, North Butte ISR Project.” Letter to M. Rogaczewski, WDEQ. ADAMS Accession No. ML16279A081. September 27, 2016.

Cameco, 2015a, Letter from L. Reimann (Cameco) re: Corrective Action Plan for Purge Storage Reservoir 2. ADAMS Accession No. ML15317A079. November 9, 2015.

Cameco, 2015b. RE: NRC License SUA-1548 Smith Ranch-Highland Uranium Project Request For Information Concerning the Ponds at the Highland Facility. ADAMS Accession No. ML15251A158. September 2, 2015.

Cameco, 2015c. “Cameco Resources' Response to U.S. Nuclear Regulatory Commission Request for Additional Information for License Renewal of Cameco Resources Smith Ranch-

Highland Uranium Project Source Materials License SUA-1548." ADAMS Package Accession No.ML15147A417. April 21, 2015.

Cameco, 2015d. "Cameco Response to U.S. Nuclear Regulatory Commission Request for Additional Information for License Renewal of Cameco Resources Smith Ranch-Highland Uranium Project Source Materials License SUA-1548." ADAMS Accession No. ML15133A397. April 10, 2015.

Cameco, 2014a. "Cameco Response to U.S. Nuclear Regulatory Commission Request for Additional Information for License Renewal of Cameco Resources Smith Ranch-Highland Uranium Project Source Materials License SUA-1548." ADAMS Package Accession No. ML14353A314. November 18, 2014.

Cameco, 2014b. "Excursion Report Summary Update, Cameco Resources, Smith Ranch-Highland Uranium Project, Permit 603 and 633." Glenrock, WY: Cameco. ADAMS Accession No. ML14073A642. March 10, 2014.

Cameco, 2014c. "East Impoundment (Evaporation Pond) Leak Monthly Update, Cameco Resources, Smith Ranch-Highland Uranium Project, Permit to Mine No. 633." Glenrock, WY: Cameco. ADAMS Accession No. ML14041A320. February 5, 2014.

Cameco, 2013a. Highland Uranium Project, WDEQ Permit #603, 2012-2013 Annual Report. Glenrock, WY: Cameco. ADAMS Accession No. ML13303B099. July 31, 2013.

Cameco, 2013b. Smith Ranch Project, WDEQ Permit # 633, 2012-2013 Annual Report. Glenrock, WY: Cameco. ADAMS Accession No. ML13269A031. July 31, 2013.

Cameco, 2013c. Application for Alternate Concentration Limits for the Smith Ranch-Highland Mine Unit-B In-Situ Uranium Recovery Facility, Converse County, Wyoming. Prepared by Intera. ADAMS Accession No. ML13168A522. May 22, 2013.

Cameco Resources, 2012a. Wyoming Department of Environmental Quality Permit No. 633 for the Smith Ranch Project. ADAMS Accession No. ML12234A545. Added September 13, 2012.

Cameco Resources, 2012b. Wyoming Department of Environmental Quality Permit No. 632 for the North Butte Project ADAMS Accession No. ML12234A547. Added September 13, 2012.

Cameco Resources, 2012c. Wyoming Department of Environmental Quality Permit No. 687 for the Gas Hills Project ADAMS Accession No. ML12234A548. Added September 13, 2012.

Cameco Resources, 2012d. Wyoming Department of Environmental Quality for the Ruth Project ADAMS Accession No. ML12234A554. Added September 13, 2012.

Cameco Resources, 2012e. RE: Request for License Renewal of NRC License SUA-1548; Submittal of License Renewal Application in Response to Acceptance Review Comments. Letter from J. Leftwich, Cameco, to L. Camper, NRC. ADAMS Accession Nos. ML12234A537 and ML12234A539. February 1, 2012.

Cameco, 2011a. Purge Storage Reservoir, No. 2 Shallow Groundwater Characterization Plan, Smith Ranch – Highland Uranium Project. Prepared for Cameco Resources, Glenrock, WY: Golder and Associates, Inc. ADAMS Accession No. ML11293A036. September 29, 2011.

Cameco, 2011b. Letter from B. Berg (Cameco) to D. Mandeville (NRC), RE: Baseline Gamma Surveys for Mine Units K North, 7, 8, and 14, Smith Ranch-Highland Uranium Project, License SUA-1548. ADAMS Accession No. ML112590184. September 7, 2011.

Cameco, 2011c, Semi-Annual Effluent and Environmental Monitoring Report, Smith Ranch Highland Uranium Project, January 1 through June 30, 2011, Source Materials License SUA-1548, Docket No. 40-8964. ADAMS Accession No. ML11258A017. August 26, 2011.

Cameco, 2011d. Smith Ranch Project, WDEQ Permit #633, 2010 – 2011 Annual Report. Cheyenne, WY: Cameco. ADAMS Accession No. ML11217A132. June 30, 2011.

Cameco, 2011e, Semi-Annual Effluent and Environmental Monitoring Report, Smith Ranch Highland Uranium Project, July 1 through December 31, 2010, Source Materials License SUA-1548, Docket No. 40-8964. ADAMS Accession No. ML11222A040. February 28, 2011

Cameco Resources, 2010a. Semi-Annual Effluent and Environmental Monitoring Report, Smith Ranch Highland Uranium Project, January 1 through June 30, 2010, Source Materials License SUA-1548, Docket No. 40-8964, ADAMS Accession No. ML102430200. August 25, 2010.

Cameco Resources, 2010b. Letter to L. Camper (NRC) re: Request for Renewal of License SUA-1548 for Smith Ranch Highland Uranium Project. ADAMS Package Accession No. ML102360313. August 12, 2010.

Cameco Resources, 2010c. Semi-Annual Effluent and Environmental Monitoring Report, Smith Ranch Highland Uranium Project, July 1 through December 31, 2009, Source Materials License SUA-1548, Docket No. 40-8964. ADAMS Accession No. ML100700412. February 26, 2010.

Cameco Resources, 2009a. Semi-Annual Effluent and Environmental Monitoring Report, Smith Ranch Highland Uranium Project, January 1 through June 30, 2009, Source Materials License SUA-1548, Docket No. 40-8964. ADAMS Accession No. ML092600297. August 26, 2009.

Cameco Resources, 2009b. Semi-Annual Effluent and Environmental Monitoring Report, Smith Ranch Highland Uranium Project, July 1 through December 31, 2008, Source Materials License SUA-1548, Docket No. 40-8964. ADAMS Accession No. ML090620594. February 26, 2009.

Cameco Resources, 2008a. Semi-Annual Effluent and Environmental Monitoring Report, Smith Ranch Highland Uranium Project, January 1 through June 30, 2008, Source Materials License SUA-1548, Docket No. 40-8964. ADAMS Accession No. ML082590334. August 12, 2008.

Cameco Resources, 2008b. Semi-Annual Effluent and Environmental Monitoring Report, Smith Ranch Highland Uranium Project, July 1 through December 31, 2007, Source Materials License SUA-1548, Docket No. 40-8964. ADAMS Accession No. ML080650349. February 26, 2008.

Case, James C., et al., 2002. Basic Seismological Characterization of Converse County, Wyoming. Wyoming State Geological Survey. Available at http://www.wrds.uwyo.edu/wrds/wsgs/hazards/quakes/seischar/Converse.pdf (accessed on March 10, 2018. September 2002.

Case, James C., et al., 2003. Basic Seismological Characterization of Natrona County, Wyoming. Wyoming State Geological Survey. Available at http://www.wrds.uwyo.edu/wrds/wsgs/hazards/quakes/seischar/Natrona.pdf (accessed on June 18, 2018). January 2003.

Converse County, 2015. “Converse County, Wyoming – Land Use Plan.” Converse County Planning and Zoning Commission. Passed and Approved April 7, 2015. 2015.

Council on Environmental Quality, 1997. "Considering Cumulative Effects Under the National Environmental Policy Act." Available at https://www.energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/G-CEQ-ConsidCumulEffects.pdf (accessed on June 1, 2018). January 1997.

EPA (U.S. Environmental Protection Agency), 2018. "New Source Review (NSR) Permitting: Prevention of Significant Deterioration Basic Information." Available at https://www.epa.gov/nsr/prevention-significant-deterioration-basic-information (accessed on July 25, 2018.)

EPA, 2008. "U.S. EPA Region 8 Climate Change Strategic Plan, Appendix B," in *Summary of State Greenhouse Gas Emissions Inventories in EPA Region 8. Draft*. Washington, DC: EPA. ADAMS Accession No. ML13015A528.

Exxon (ExxonMobil). 2011. Letter from ExxonMobil to NRC Re: License No. SUA-1139, Highland Reclamation Project, License Amendment Application. ADAMS Accession No. ML11136A199. May 12, 2011.

Fremont County, 2018. "Proposed Revisions and Additions to FCLUP." http://fremontcountywy.org/commissioners/land-use-plan/. Accessed May 21, 2018.

Fremont County, 2004. "Fremont County, Wyoming – Land Use Plan." Fremont County Natural Resources Planning Committee. Approved September 7, 2004.

FWS, 2018a. Project Name: Smith Ranch Project License Renewal (Consultation Code: 06E13000-2016-SLI-0216). ADAMS Accession No. ML18183A007.

FWS, 2018b. Project Name: Smith Ranch Project License Renewal (Consultation Code: 06E13000-2016-SLI-0217). ADAMS Accession No. ML18183A008.

Johnson County, 2005. "Johnson County – Comprehensive Land Use Plan." Prepared by Pedersen Planning Consultants. March 2005.

Johnson County, 2014. "Johnson County, WY Zoning Map." Produced by Johnson County Planning Department. 2014.

Natrona County, 2016. "Natrona County Development Plan." Natrona County Board of County Commissioners and Planning & Zoning Commission. 2016.

Natrona County, 2014. "Natrona County 2040 – An Amendment to the 1998 Natrona County Development Plan." KLJ. July 2014.

Naugle, D.E, K.E. Doherty, B. Walker, M.J. Holloran, and H.E. Copeland. 2009. "Energy Development and Greater Sage-Grouse." Chapter 21 in *Ecology and Conservation of Greater Sage-Grouse: A Landscape Species and Its Habitats*. Washington, DC: Studies in Avian Biology. ADAMS Accession No. ML13024A344.

NCDC (National Climate Data Center). 2011a. "Wyoming Climate Summary, Temperature." At http://www.ncdc.noaa.gov/oa/climate/research/cag3/wy.html. As of November 9, 2011. ADAMS Accession No. ML13029A254.

NCDC. 2011b. "Wyoming Climate Summary, Precipitation." At http://www.ncdc.noaa.gov/oa/climate/research/cag3/wy.html. As of December 8, 2012. ADAMS Accession No. ML13029A270.

Northern Arapaho Tribe, 2018. Letter from Devin Oldman, Tribal Historic Preservation Officer to James Park, NRC re: Comments on Smith Ranch Historic and Cultural Resources. ADAMS Accession No. ML18247A229. August 18, 2018.

NRC (U.S. Nuclear Regulatory Commission), 2018a. Note to docket file re February 15, 2018 webinar. ADAMS Accession No. ML18054A402. February 22, 2018.

NRC, 2018b. 01/16/18 Email from J.Park (NRC) to D.Youpee of Fort Peck Assiniboine and Sioux Tribes. ADAMS Accession No. ML18036A136. February 6, 2018.

NRC, 2018c. Pathfinder–Lucky Mc Uranium Recovery Facility. Available at https://www.nrc.gov/info-finder/decommissioning/uranium/is-pathfinder-lucky-mc.pdf (accessed on August 7, 2018).

NRC, 2018d. Letter to Mary Hopkins: Request for Comments on Draft Environmental Assessment for the Cameco Resources Proposed License Renewal for the Smith Ranch-Highland Uranium Project. ADAMS Accession No. ML18211A383. August 8, 2018.

NRC, 2018e. Letter to Robin Jones. Request for Comments on Draft Environmental Assessment for the Cameco Resources Proposed License Renewal for the Smith Ranch-Highland Uranium Project. ADAMS Accession No. ML18211A379. August 8, 2018.

NRC, 2018f. Email from James Park, NRC to Tribal Historic Preservation Officers re: Solicitation of Comments on draft Smith Ranch Documents Pertaining to Section 106 of the National Historic Preservation Act. ADAMS Accession No. ML18243A022. August 9, 2018.

NRC, 2018g. Email from James Park, NRC to Tribal Historic Preservation Officers re: Conference Call(s) re: Solicitation of Comments on draft Smith Ranch Documents Pertaining to Section 106 of the National Historic Preservation Act. ADAMS Accession No. ML18243A262. August 27, 2018.

NRC, 2018h. Email Re: August 31, 2018 Call Re: Solicitation of Comments on draft Smith Ranch Documents Pertaining to NHPA Section 106. ADAMS Accession No. ML18260A046. September 10, 2018.

NRC, 2018i. Email Response Re Request to Confirm Determinations of Eligibility - Smith Ranch-Highland Uranium Project (SHPO Project #0499RLC034). ADAMS Accession No. ML18257A167. August 20, 2018.

NRC, 2017a. SECY-17-0086: Increasing License Terms for Uranium Recovery Facilities. ADAMS Accession No. ML17093A951. August 29, 2017.

NRC, 2017b. EA-16-262_Cameco Resources Power Resources, Inc. Notice of Violation and NRC Inspection Report 040-08964/2016-003. ADAMS Accession No. ML17151B102. June 29, 2017.

NRC, 2017c, NRC Inspection Report 040-08964/2016-003. ADAMS Accession No. ML17079A564. April 3, 2017.

NRC, 2016a. NRC Inspection Report 040-08964/2016-001. ADAMS Accession No. ML16328A121. November 23, 2016.

NRC, 2016b. Confirmatory Action Letter – Power Resources, Inc. ADAMS Accession No. ML16238A359. August 30, 2016.

NRC, 2016c. Amendment 24 to Source Materials License No. SUA-1548. Docket No. 40-8964. Washington, DC: NRC. ADAMS Accession No. ML15348A074. February 29, 2016.

NRC, 2016d. Letter to Tribes, Re-initiation of Formal Section 106 Consultation on Proposed Smith Ranch Project License Renewal. ADAMS Package Accession No. ML16125A168. May 13, 2016.

NRC, 2015a. Letter to Mary Hopkins: Revision to Proposed Direct and Indirect Areas of Potential Effect for the Smith Ranch Project Proposed License Renewal. ADAMS Package Accession No. ML15205A309. August 15, 2015.

NRC, 2015b. Letter to Mary Hopkins: Proposed Direct and Indirect Areas of Potential Effect for the Smith Ranch Project Proposed License Renewal. ADAMS Package Accession No. ML14030A307. April 13, 2015.

NRC, 2014a. Environmental Impact Statement for the Ross ISR Project in Crook County, Wyoming: Supplement to the Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities: Final Report (NUREG-1910, Supplement 5). Washington, DC: NRC. ADAMS Accession No. ML14056A096. February 2014.

NRC, 2014b. December 3, 2013, Summary of Public Meeting with Cameco Smith Ranch. Source Material License No. SUA-1548, Docket No. 40-8964. Washington, DC: USNRC. ADAMS Accession No. ML14010A162. January 14, 2014.

NRC, 2013a. Inspection Report Number 04008964-13-001. Source Material License No. SUA-1548, Docket No. 40-8964. Washington, DC: USNRC. ADAMS Accession No. ML13200A109. July 17, 2013.

NRC, 2013b. Letter to J. Leftwich re: Request for additional information on Smith Ranch Highland Uranium Project license renewal application, ADAMS Accession No. ML13098A040. May 2, 2013.

NRC, 2013c. Safety Evaluation Report, License Renewal of the Willow Creek Uranium In Situ Recovery Project, Johnson and Campbell Counties, Wyoming. Washington, DC: NRC. ADAMS Accession No. ML13015A356. March 7, 2013.

NRC, 2014. "Power Resources, Inc., Smith Ranch Highland Uranium Project; License Renewal Request, Opportunity to Request a Hearing and To Petition for Leave To Intervene, and Commission Order Imposing Procedures for Document Access." Federal Register: Volume 77, No. 182, pp. 58181-58185. ADAMS Accession No. ML12263A049. Washington, DC: U.S. Government Printing Office. September 19, 2012.

NRC, 2012a. Letter to Fort Belknap Tribe re Invitation for Formal Section 106 Consultation on Smith Ranch. ADAMS Accession No. ML12195A146. December 20, 2012.

NRC, 2012b. Letter to Tribes re Smith Ranch Section 106 Initiation Letter. ADAMS Package Accession Nos. ML12362A090, ML12461A138, ML12362A146, ML12361A370, ML12361A319, ML12362A088, ML12362A094, ML12362A246, ML12361A166, ML12362A102, ML12362A056, ML12361A396, ML12361A342, ML12361A124, ML12361A156, ML12361A406, ML12362A118, ML12362A224, ML12362A078, ML12361A084, ML12361A327, ML12362A183, ML12361A115, ML12361A161, ML12362A051, ML12361A311. December 20, 2012.

NRC. 2012c. "Acceptance Review for License Renewal Application for License SUA-1548, Smith Ranch Uranium In Situ Recovery Facility, Power Resources, Inc., Converse, Campbell, Johnson, Fremont and Natrona Counties, Wyoming." ADAMS Accession No. ML12159A511. Washington, DC: NRC. July 5, 2012.

NRC. 2011. Environmental Impact Statement for the Nichols Ranch ISR Project in Campbell and Johnson Counties, Wyoming: Supplement to the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities — Final Report (NUREG-1910, Supplement 2). Washington, DC: NRC. ADAMS Accession No. ML103440120. January 2011.

NRC, 2009a. Generic Environmental Impact Statement for In Situ Leach Uranium Milling Facilities. Volumes 1 and 2. NUREG-1910. Washington, DC: NRC. ADAMS Accession Nos. ML091480244 and ML091480188NRC.

NRC, 2009b. Environmental Assessment, Toll Milling of Third Party Ion Exchange Resins, Power Resources, Inc., Glenrock, Wyoming.. ADAMS Accession No. ML091420421. August 12, 2009.

NRC, 2008a. Letter from D. Mandeville, NRC, to J. McCarthy, PRI, dated July 5, 2008, RE: Review of Baseline Gamma Radiation Survey for Mine Unit K at the Smith Ranch Highland Uranium Project – Source Materials License SUA-1548 (TAC J00539). ADAMS Accession No. ML081400691.

NRC, 2008b. Letter from D. Mandeville, NRC, to J. McCarthy, PRI, dated July 5, 2008, RE: Review of Baseline Gamma Radiation Survey for the Southwest Area at the Smith Ranch Highland Uranium Project – Source Materials License SUA-1548 (TAC J00538). ADAMS Accession No. ML081400748.

NRC, 2008c. Letter from D. Mandeville, NRC, to J. McCarthy, PRI, dated July 5, 2008, RE: Review of Baseline Gamma Radiation Survey for Reynolds Ranch Satellite of the Smith Ranch Highland Uranium Project – Source Materials License SUA-1548 (TAC J00540). ADAMS Accession No. ML081400633.

NRC, 2008d. Letter from D. Mandeville, NRC, to J. McCarthy, PRI, dated July 5, 2008, RE: Review of Baseline Gamma Radiation Survey for Gas Hills Satellite of the Smith Ranch Highland Uranium Project – Source Materials License SUA-1548 (TAC J00541). ADAMS Accession No. ML081400788.

NRC, 2007. Environmental Assessment: Construction and Operation of In Situ Leach Satellite SR 2, Amendment No. 12 to Source Materials License SUA-1548, Power Resources, Inc., Smith Ranch-Highland Uranium Project (SR-HUP), Converse County, Wyoming. Washington, DC: NRC. ADAMS Accession No. ML073460801.

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. Washington, DC: NRC. ADAMS Accession No. ML062690386.

NRC, 2004. Environmental Assessment for the Operation of the Gas Hills Project Satellite In Situ Leach Uranium Recovery Facility. Docket No. 40-8857. Washington, DC: NRC. ADAMS Accession No. ML040070538.

NRC, 2004b. Review of Power Resources Inc.'s A-Wellfield Ground Water Restoration Report for the Smith Ranch-Highland Uranium Project (TAC LU0032). Source Material License No. SUA-1548, Docket No. 40-8964. Washington, DC: USNRC. June 2004. ADAMS Accession No. ML041840470.

NRC, 2004c. "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions." Accessible at https://www.nrc.gov/reading-rm/doc-collections/commission/policy/69fr52040.pdf. Accessed September 19, 2018.

NRC, 2003a. Environmental Review Guidance for Licensing Actions Associated with NMSS Programs. NUREG-1748. Washington, DC: NRC. ADAMS Accession No. ML032450279. August 2003.

NRC, 2003b. Standard Review Plan for In Situ Leach Uranium Extraction License Applications. NUREG-1569. ADAMS Accession No. ML031550302. June 2003.

NRC, 2003c. "Programmatic Agreement Among Wyoming State Historic Preservation Officer, U.S. Nuclear Regulatory Commission, U.S. Department of the Interior, Bureau of Land Management, Lander Field Office, and Wyoming State Office and Power Resources, Incorporated Regarding the Gas Hills Uranium Recovery Project." ADAMS Accession No. ML033361000. December 16, 2003.

NRC, 2001. "Environmental Assessment for Renewal of Source Material License No. SUA-1548, Rio Algom Mining Corporation Smith Ranch Uranium Project, Converse County, Wyoming." ML011290179. Washington, D.C.: NRC. April 2001.

NRC, 1995. Letter to W.F. Kearney, Power Resources, Inc. Re: Renewal of Source Material License SUA-1511, Power Resources Inc., Highland Uranium Project, Safety Evaluation Report and Environmental Assessment. ADAMS Accession No. ML12244A184. August 18, 1995.

NRC, 1992. "Environmental Assessment for Rio Algom Mining Corporation, Smith Ranch In Situ Leach Mining Project, Converse County, Wyoming: In Consideration of a Source and Byproduct Material License Application." ADAMS Accession No. ML112300692. Washington, D.C.: NRC. January 1992.

NRC, 1990. "Environmental Assessment Prepared by the Uranium Recovery Field Office in Consideration of an Application for Two Source Material Licenses For Uranerz U.S.A., Inc. Ruth And North Butte Commercial In-Situ Leach Operations Located in Johnson County and Campbell County, Wyoming." ADAMS Accession No. ML12244A186. Washington, D.C.: NRC. December 1990.

NRC, 1987. Memo to docket file 40-8857, re Safety Evaluation Report and Environmental Assessment for Everest Minerals Corporation, Highland Project, ADAMS Accession No. ML12244A282. July 1, 1987.

NRC, 1981. Environmental Impact Appraisal in consideration of the issuance of the Source Material License No SUA-1387 for the Kerr-McGee Nuclear Corporation, South Powder River Basin "Q" Sand Solution Mining Project. Docket No. 40-8768. Washington, DC: NRC. ADAMS Accession No. ML12244A172.

NRC, 1980. "Regulatory Guide 4.14, Revision 1 - Radiological Effluent and Environmental Monitoring at Uranium Mills." ADAMS Accession No. ML003739941. April 1980.

NRC, 1978. "Final Environmental Statement Related to the Operation of Highland Uranium Solution Mining Project, Exxon Minerals Company, U.S.A." NUREG-0489. Washington, D.C: NRC. November 1978.

NRC, 1973. Environmental Statement related to the Operation of the Highland Uranium Mill by the Exxon Company, U.S.A. (Formerly Humble Oil and Refining Company). Docket No. 40-8102. Washington, DC: NRC. ADAMS Accession No. ML102730143.

OSHA (Occupational Health and Safety Administration), 2008. "Occupational Noise Exposure." 29 CFR 1910. Title 29, "Labor," *Code of Federal Regulations*, Part 1910.95, Washington, DC: Government Printing Office. December 2008, as amended.

OSHA, 2002. "Occupational Noise Exposure." 29 CFR Part 1926. Title 29, *Code of Federal Regulations*, Part 1926.52, Washington, DC: Government Printing Office. July 2002, as amended.

Peterson, Mark et al., 2014. Documentation for the 2014 Update of the United States National Seismic Hazard Maps. U.S. Geological Survey Open-File Report 2014–1091, 243 p.

PRI, 2007. Semi-Annual Effluent and Environmental Monitoring Report, Smith Ranch Highland Uranium Project, July 1 through December 31, 2006, Source Materials License SUA-1548, Docket No. 40-8964, ADAMS Accession No. ML070520428. February 13, 2007.

PRI, 2006a. Semi-Annual Effluent and Environmental Monitoring Report, Smith Ranch Highland Uranium Project, January 1 through June 30, 2006, Source Materials License SUA-1548, Docket No. 40-8964, ADAMS Accession No. ML062400345. August 4, 2006.

PRI, 2006b. Semi-Annual Effluent and Environmental Monitoring Report, Smith Ranch Highland Uranium Project, July 1 through December 31, 2005, Source Materials License SUA-1548, Docket No. 40-8964, ADAMS Accession No. ML060610149. February 23, 2006.

PRI, 2005a. Semi-Annual Effluent and Environmental Monitoring Report, Smith Ranch Highland Uranium Project, January 1 through June 30, 2005, Source Materials License SUA-1548, Docket No. 40-8964, ADAMS Accession No. ML052520274. August 30, 2005.

PRI, 2005b. Semi-Annual Effluent and Environmental Monitoring Report, Smith Ranch Highland Uranium Project, July 1 through December 31, 2004, Source Materials License SUA-1548, Docket No. 40-8964, ADAMS Accession No. ML050470256. February 9, 2005.

PRI, 2004a. Semi-Annual Effluent and Environmental Monitoring Report, Smith Ranch Highland Uranium Project, January 1 through June 30, 2004, Source Materials License SUA-1548, Docket No. 40-8964, ADAMS Accession No. ML042380416. August 18, 2004.

PRI, 2004b. Semi-Annual Effluent and Environmental Monitoring Report, Smith Ranch Highland Uranium Project, July 1 through December 31, 2003, Source Materials License SUA-1548, Docket No. 40-8964, ADAMS Accession No. ML040650721. February 27, 2004.

PRI, 2003a. Semi-Annual Effluent and Environmental Monitoring Report, Smith Ranch Project, January 1 through June 30, 2003, Source Materials License SUA-1548, Docket No. 40-8964, ADAMS Accession No. ML032380651. August 18, 2003.

PRI, 2003b. Semi-Annual Effluent and Environmental Monitoring Report, Ruth and North Butte Projects, January 1 through June 30, 2003, Source Materials License SUA-1540, Docket No. 40-8981, ADAMS Accession No. ML032380646. August 18, 2003.

PRI, 2003c. Semi-Annual Effluent and Environmental Monitoring Report, Highland Uranium Project, January 1 through June 30, 2003, Source Materials License SUA-1511, Docket No. 40-8857, ADAMS Accession No. ML032380654. August 18, 2003.

PRI, 2003d. Semi-Annual Effluent and Environmental Monitoring Report, Smith Ranch Facility, July 1 through December 31, 2002, Source Materials License SUA-1548, Docket No. 40-8964, ADAMS Accession No. ML030640835. February 27, 2003.

PRI, 2003e. Semi-Annual Effluent and Environmental Monitoring Report, Highland Uranium Project, July 1 through December 31, 2002, Source Materials License SUA-1511, Docket No. 40-8857, ADAMS Accession No. ML030640906. February 27, 2003.

PRI, 2003f. Semi-Annual Effluent and Environmental Monitoring Report, Ruth and North Butte Projects, July 1 through December 31, 2002, Source Materials License SUA-1540, Docket No. 40-8981, ADAMS Accession No. ML030230688. January 13, 2003.

PRI, 2002a. Semi-Annual Effluent and Environmental Monitoring Report, Ruth and North Butte Projects, January 1 through June 30, 2002, Source Materials License SUA-1540, Docket No. 40-8981, ADAMS Accession No. ML022970022. October 16, 2002.

PRI, 2002b. Semi-Annual Effluent and Environmental Monitoring Report, Smith Ranch Facility, January 1 through June 30, 2002, Source Materials License SUA-1548, Docket No. 40-8964, ADAMS Accession No. ML022390648. August 23, 2002.

PRI, 2002c. Semi-Annual Effluent and Environmental Monitoring Report, Highland Uranium Project, January 1 through June 30, 2002, Source Materials License SUA-1511, Docket No. 40-8857, ADAMS Accession No. ML022390627. August 23, 2002.

PRI, 2002d. Semi-Annual Effluent and Environmental Monitoring Report, Highland Uranium Project, July 1 through December 31, 2001, Source Materials License SUA-1511, Docket No. 40-8857, ADAMS Accession No. ML020630134. February 26, 2002.

PRI, 2002e. Semi-Annual Effluent and Environmental Monitoring Report, Ruth and North Butte Projects, July 1 through December 31, 2001, Source Materials License SUA-1540, Docket No. 40-8981, ADAMS Accession No. ML020160149. January 11, 2002.

PRI, 2001a. Semi-Annual Effluent and Environmental Monitoring Report, Highland Uranium Project, January 1 through June 30, 2001, Source Materials License SUA-1511, Docket No. 40-8857, ADAMS Accession No. ML012390257. August 22, 2001.

PRI, 2001b. Semi-Annual Effluent and Environmental Monitoring Report, Highland Uranium Project, July 1 through December 31, 2000, Source Materials License SUA-1511, Docket No. 40-8857, ADAMS Accession No. ML010580472. February 22, 2001.

Ramirez, Jr., Pedro and Brad Rogers, 2000. “Selenium in a Wyoming Grassland Community Receiving Wastewater from an In Situ Uranium Mine.” U.S. Fish and Wildlife Service –

Region 6: Contaminants Program. Cheyenne, WY. Contaminant Report Number: R6/715C/00. September 2000.

Rio Algom Mining Corp., 2002. Semi-Annual Effluent and Environmental Monitoring Report, Smith Ranch Facility, July 1 through December 31, 2001, Source Materials License SUA-1548, Docket No. 40-8964, ADAMS Accession No. ML020650426. February 28, 2002.

Rio Algom Mining Corp., 2001a. Semi-Annual Effluent and Environmental Monitoring Report, Smith Ranch Facility, January 1 through June 30, 2001, Source Materials License SUA-1548, Docket No. 40-8964, ADAMS Accession No. ML012500108. August 29, 2001.

Rio Algom Mining Corp., 2001b. Semi-Annual Effluent and Environmental Monitoring Report, Smith Ranch Facility, July 1 through December 31, 2000, Source Materials License SUA-1548, Docket No. 40-8964, ADAMS Accession No. ML010660098. February 28, 2001.

Strata, 2012. Ross ISR Project USNRC License Application, Crook County, Wyoming, RAI Question and Answer Responses, Environmental Report, Volume 1 with Appendices. Docket No. 40-09091. Gillette, WY: Strata. ADAMS Accession No. ML121030465. March 30, 2012.

Uranium One (Uranium One USA, Inc.). 2011. *Replacement Pages for Uranium One's License Renewal Application SUA-1341, Uranium One USA, Inc.* Casper, WY: Uranium One. ADAMS Accession No. ML103280266.

Uranium One, 2011. Uranium One Americas SUA-1341 License Amendment, Ludeman Project, Converse County, Wyoming Environmental Report. Casper, WY: Uranium One. ADAMS Accession Nos. ML12014313, ML12014316, ML12014327, ML1212A333, ML12014329, ML1212A325, ML12014311, ML12014310, ML12014312, ML12014331, ML12014315, and ML12014328.

Utah, 2016. Re: Transportation Incident at the White Mesa Mill Involving an 11e.(2) Shipment. Letter to B. Tharakan, NRC Region IV. ADAMS Accession No. ML16238A359. August 30, 2016.

Wyoming, 2017. "State of Wyoming Application for Agreement State Status." State of Wyoming, Office of the Governor. ADAMS No. ML17319A921. November 14, 2017.

WDEQ/LQD (Wyoming Department of Environmental Quality/Land Quality Division), 2018. Letter from Ryan Schierman to Cinthya Roman, NRC re: Comments on the Smith Ranch-Highland Proposed License Renewal Environmental Assessment. ADAMS Accession No. ML18247A356. August 29, 2018.

WDEQ/LQD, 2013. Inspection Report, Ruth ISR Project, Permit No. 631. Sheridan, WY: WDEQ/LQD. August 2013. ADAMS Accession No. ML13260A311.

WDEQ/LQD, 2012. Inspection Report, Cameco Resources, Permits 603 & 633. WY: WDEQ/LQD. April 2012. ADAMS Accession No. ML12158A440.

WDEQ/LQD, 2005. "Hydrology, Coal and Non Coal." Guideline 8. Cheyenne, WY: WDEQ/LQD.

WDEQ/LQD, 2005. "Noncoal In Situ Mining Rules," *Rules and Regulations*, Chapter 11. Cheyenne, WY: WDEQ/LQD. 2005.

WDEQ, 2015. Water Quality. Chapter 27: Underground Injection Control Program. Reference No. 020.0011.27.09152015.

WDEQ/WQD (Wyoming Department of Environmental Quality/Water Quality Division), 2018. Gas Hills UIC Class I permit.

WDEQ, 2016. Class I Injection Well, Permit No. 11-468. January 31, 2016.

WDEQ/WQD, 2015. Water Quality. Chapter 2: Permit Regulations for Discharges to Wyoming Surface Waters. Effective Date: 3/23/2015 to Current.

WDEQ/WQD, 2013a. DRAFT Underground Injection Control Permit Number 11-468 Issued to Cameco Resources (North Butte Facility), Casper, WY. Cheyenne, WY: WDEQ/WQD. December 2013.

WDEQ/WQD, 2013b. DRAFT Underground Injection Control Permit Number 13-262 Issued to Cameco Resources (Gas Hills ISR Facility), Casper, WY. Cheyenne, WY: WDEQ/WQD. December 2013.

WDEQ/WQD, 2012. "Well Construction Standards," *Rules and Regulations,* Chapter 26. Cheyenne, WY: WDEQ/WQD. May 2012.

WDEQ/WQD, 2012. *Water Quality Rules and Regulations*, Chapter 12. Cheyenne, WY: WDEQ/WQD.

WDEQ/WQD, 2012. *Wyoming Water Quality Assessment and Impaired Waters List (2012 Integrated 305(b) and 303(d) Report)*. Cheyenne, WY: WDEQ/WQD.

WDEQ/WQD, 2009. "Guidelines, Chapter 3, Permit Requirements for CBM and Oil/Gas Produced Water Discharges." As of June 12, 2013.

WDEQ/WQD, 2001. "Wyoming Surface Water Classification List." *Water Quality Rules and Regulations*, Chapter 1. Cheyenne, WY: WDEQ/WQD.

WEAD (Wyoming Economic Analysis Division), 2012. Decennial Census Wyoming Data. Available at http://eadiv.state.wy.us/demog_data/pop2010/pop10.html (accessed July 10, 2018).

Whitcomb, Harold A., T. Ray Cummings, and Richard A. McCullough. 1966. *Ground-Water Resources and Geology of Northern and Central Johnson County, Wyoming*. USGS Water-Supply Paper 1806. Washington, DC: USGS.

WY DOT (Wyoming Department of Transportation), 2015. WYDOT Jan 2015 Monthly Automatic Traffic Recorder Report. ADAMS Accession No. ML18218A445. August 6, 2018.

WY DOT, 2013a. Wyoming 2013 Traffic Counts - Routes 93 95 #502 #504. ADAMS Accession No. ML18218A446. August 6, 2018.

WY DOT, 2013b. WYDOT 2013 Vehicle Miles Report. ADAMS Accession No. ML18218A444. August 6, 2018.

WY SHPO (Wyoming State Historic Preservation Office), 2018a. Smith Ranch-Highland Uranium Project (SHPO Project Number 499RLC034). ADAMS Accession No. ML18212A310.

WY SHPO, 2018b. Email from Richard Currit, WY SHPO to James Park, NRC re: Smith Ranch-Highland Uranium Project License Renewal. ADAMS Accession No. ML18242A349. August 29, 2018.

WY SHPO, 2016. WY SHPO Letter to BLM re Gas Hills site. ADAMS Accession No. ML18220B062. June 20, 2016.

WY SHPO, 2015a. WY SHPO 09082015 letter concurring on revised Area of Potential Effect. ADAMS Accession No. ML18218A472. September 8, 2015.

WY SHPO, 2015b. WY SHPO 06042015 Letter Concerning APE Determination. ADAMS Accession No. ML18218A471. June 4, 2015.