APPENDIX B

REYNOLDS RANCH SATELLITE FACILITY NUREG-1569 LICENSE RENEWAL ASSESSMENT

1.0 INTRODUCTION

This appendix (Appendix B) of the License Renewal submittal for Source Material License SUA-1548 has been prepared to respond to requirements identified in NUREG-1569, "*Standard Review Plan for In Situ Leach Uranium Extraction License Applications*" and, in particular, specific guidance in NUREG-1569 that applies to renewals of existing licenses. Specifically, this appendix follows the U.S. Nuclear Regulatory Commission (NRC) guidance in NUREG-1569 Appendix A for examining historical facility operations, providing documentation and review of historical information for the Reynolds Ranch Satellite Facility (RR) that is used to assess the effectiveness of the operations in minimizing any effects to public and occupational health and safety and the environment.

With respect to the RR status review, the RR has remained in a developmental mode with no active mining activities having taken place.

While a part of the NRC SUA-1548 License Renewal submittal, Appendix B is also meant to serve as a stand-alone document providing a review and update of the RR Application.

2.0 APPENDIX B CONTENT

NUREG-1569 states that "*if, after a review of the historical aspects of site operations, the staff* [NRC] *concludes that the site has been operated so as to protect health and safety and the environment and that no un-reviewed safety-related concerns have been identified, then only those changes proposed by the license renewal or amendment application should be reviewed using appropriate sections of this* [NUREG-1569] *standard review plan*". To provide the historical aspects of site operations and review of the effectiveness of operations in minimizing effects to health and safety and the environment, Appendix B of this report follows NUREG-1569 Appendix A. The contents of this appendix as it relates to the requirements of NUREG-1569 Appendix A (*in italics*) are provided below:

- *For License Renewals, U.S. Nuclear Regulatory Commission (NRC) inspection reports and license performance reports*:
  - Appendix B-1: Summary of NRC Inspection and License Performance Reports for Reynolds Ranch Satellite Facility
- *Amendments and changes to operating practices or procedures*:
  - Appendix B-2: Amendments and Changes to Operating Practices or Procedures for Reynolds Ranch Satellite Facility
- *License violations identified during NRC or Agreement State site inspections*:
  - Appendix B-3: License Violations Identified During NRC or Agreement State Site Inspections for Reynolds Ranch Satellite Facility

- *Excursions, incident investigations or root cause analyses, and resultant cleanup histories or status*:
  - Appendix B-4: Summary of Wellfield Excursions for Reynolds Ranch Satellite Facility
- *Exceedances of any regulatory standard or license condition pertaining to radiation exposure, contamination, or release limits*:
  - Appendix B-5: Exceedances of Any Regulatory Standard or License Condition Pertaining to Radiation Exposure, Contamination, or Release Limits for the Reynolds Ranch Satellite Facility
- *Exceedances of any non-radiation contaminant exposure or release limits:*
  - Appendix B-6: Exceedances of Any Non-radiation Contaminant Exposure or Release Limits for Reynolds Ranch Satellite Facility
- *Updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including site location and layout; uses of adjacent lands and waters; population distributions; meteorology; the geologic or hydrologic setting; ecology; background radiological or non-radiological characteristics; and other environmental features:*
  - Appendix B-7: Updates and Changes Site Characterization Information Important to the Evaluation of Exposure Pathways and Doses for Reynolds Ranch Satellite Facility
    - Appendix B-7.1: Site Location and Layout for Reynolds Ranch Satellite Facility
    - Appendix B-7.2: Use of Adjacent Lands and Waters for Reynolds Ranch Satellite Facility
    - Appendix B-7.3: Population Distribution for Reynolds Ranch Satellite Facility
    - Appendix B-7.4: Meteorology for Reynolds Ranch Satellite Facility
    - Appendix B-7.5: Geologic or Hydrologic Setting for Reynolds Ranch Satellite Facility
    - Appendix B-7.6: Ecology for Reynolds Ranch Satellite Facility
    - Appendix B-7.7: Transportation for Reynolds Ranch Satellite Facility
- *Environmental effects of site operations including data on radiological and non-radiological effects, accidents, and the economical and social effects of operations:*
  - Appendix B-8: Environmental Effects of Site Operations Including Data on Radiological and Non-radiological Effects, Accidents, and the Economic and Social Effects of Operations
    - Appendix B-8.1: Release and Accident History for Reynolds Ranch Satellite Facility
    - Appendix B-8.2: Historical Groundwater and Surface Water Monitoring Program for Reynolds Ranch Satellite Facility
    - Appendix B-8.3: Assessment of Occupational Radiation Exposure and Dose Data for Reynolds Ranch Satellite Facility
      - Appendix B-8.3-1: Historical Radiation Monitoring Program Assessment for Reynolds Ranch Satellite Facility

Appendix B-8.3-2: Historical Results of Radiation Dose Calculations for Reynolds Ranch Satellite Facility

Appendix B-8.3-3: Historical Bioassay Program Assessment for Reynolds Ranch Satellite Facility

Appendix B-8.3-4: Historical Occupational Exposure Rate Monitoring Assessment for Reynolds Ranch Satellite Facility

- Appendix B-8.4: Historical Airborne Effluent and Environmental Monitoring Program for Reynolds Ranch Satellite Facility
- Appendix B-8.5: Historical Quality Assurance Program Assessment for Reynolds Ranch Satellite Facility
- Appendix B-8.6: Cumulative Effects of Operations for Reynolds Ranch Satellite Facility

- *Updates and changes to factors that may cause reconsideration of alternatives to the proposed action:*
  - Appendix B-9: Updates and Changes to Factors that May Cause Reconsideration of Alternatives to the Proposed Action for Reynolds Ranch Satellite Facility
- *Updates and changes to the economic costs and benefits for the facility since the last application:*
  - Appendix B-10: Updates and Changes to the Economic Costs and Benefits for the Facility Since the Last Application for Reynolds Ranch Satellite Facility
- *For License Renewals, the results and effectiveness of any mitigation proposed and implemented in original license:*
  - Appendix B-11: Results and Effectiveness of Any Mitigation Proposed and Implemented in Original License for Reynolds Ranch Satellite Facility

3.0 APPROACH AND REGULATORY BASIS

NUREG-1569 states that license renewal submittals should include an environmental report that includes any new and significant information. Specifically, 10 Code of Federal Regulations (CFR) 40.31.a states that "information contained in previous applications, statements or reports filed with the Commission may be incorporated by reference ..." and 10 CFR 51.60(a) indicates that for a license renewal, "*for which the applicant has previously submitted an environmental report, the supplement to applicant's environmental report may be limited to incorporating by reference, updating or supplementing the information previously submitted to reflect any significant environmental change, including any significant environmental change resulting from operational experience or a change in operations or proposed decommissioning activities.*" NRC approved an amendment submittal No. 11) submitted by Power Resources Inc. (PRI) to include the RR under SUA-1548 (PRI, 2004e). The RR was added to SUA-1548 under the License Conditions described in Amendment No.11, approved in January 2007 (NRC, 2007c), after PRI provided satisfactory responses to NRC RAIs in 2005 and 2006 (PRI, 2005d; PRI, 2006c). The RR has been inactive since its inclusion under the Smith Ranch-Highland Uranium Project (SR-HUP) Source Material License SUA-1548 in 2007.

The assessment of the overall health and safety and environmental effects of RR operations provided in Appendix B-8 is limited to regulatory background and review of documentation that shows no "new or significant information" can be presented at this time. NUREG-1748 (Environmental Review Guidance for Licensing Actions Associated with NMSS Programs) has been used as guidance in Appendix B-8 for evaluating specific aspects of the environment that may have been impacted by operations.

NUREG-1569 Appendix A requires an update to new and significant site characterization data. Any new and significant changes to site characterization data is provided in Appendix B-7, if such changes have an impact on the environmental effects as discussed in Appendix B-8. This includes land use, transportation, geology and soils, water resources, ecological resources, air quality, noise, historical and cultural resources, visual/scenic resources, socioeconomic, public and occupational health, waste management and cumulative impacts. NUREG-1910 (Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities) provides guidance on the importance of each environmental category for the Wyoming region, and was also used when assessing environmental effects as discussed Appendix B-8. New and significant changes to site characterization data were evaluated and documented by comparing the latest site characterization data provided to the NRC to current data and evaluating which changes could have an impact on the environmental impacts discussed in Appendix B-8.

While RR is non-operational, a review of the historical operational items listed in NUREG-1569 Appendix A for the satellite operations is provided, for completeness.

APPENDIX B-1

SUMMARY OF NRC INSPECTION AND LICENSE PERFORMANCE REPORTS FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 BACKGROUND

This section provides a review of NRC inspections conducted as a matter of routine, to ensure that facilities are operating in accordance with their license renewal submittal and conditions in a safe and effective manner. Inspections typically consist of routine review of management and organization controls, site operations, radiation protection and environmental monitoring. An inspection may also be focused on "license performance", which examines activities conducted under the license as they relate to safety and compliance with the Commission's rules and regulations and the conditions of the license. The NRC inspector's findings are discussed with site staff in exit briefings. The official inspection report will identify those items that require a licensee's response to satisfactorily close the findings.

NRC inspection reports for Cameco Resources' Source Material License SUA-1548 covering the years 2000 through 2009 have been reviewed and the results of the review are presented in Appendix A-1. In January 2007, Amendment No. 11 to SUA-1548 was approved by the NRC, adding the RR for future development of *in situ* uranium recovery (ISR) operations. Amendment No. 11 allows for operation of RR as a satellite facility, under the requirements described in License Condition 10.4. (NRC, 2007c). Of note, while RR is a satellite facility, no Central Processing plant (CPP) will be located there. RR will have a satellite plant only, wherein only ion exchange (IX) loading of uranium occurs.

This appendix provides a brief description of activities on the RR licensed area that have occurred since incorporation under Source Material License SUA-1548, and the findings in NRC Inspection Reports that are specific to the RR. It should be noted here, that the RR has remained in a developmental mode with no active mining activities having taken place.

2.0 NRC INSPECTION REPORTS FOR THE RR, 2007 TO PRESENT

The scope of NRC inspections routinely covered the following topics: Management Organization and Controls; In-Situ Leach Facilities; Environmental Protection and Radioactive Waste Management; Radiation Protection; and Follow-up on previous findings. Additional details provided in each inspection report include the specific NRC inspection procedures used, the scope of the inspection, observations and findings, and conclusions. Supplemental information provided with every inspection includes a list of persons contacted and Items Opened, Close and Discussed.

There were six NRC inspections conducted on Cameco Resources facilities under license SUA-1548 in the time period from January 31, 2007 (the approval date for Amendment No. 11) through present, which could have potentially included records review or site tours on the RR Satellite facility. Review of the inspection "Observations and Findings" sections indicate that there were no observations or findings related to RR.

3.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC License Renewal guidance, Cameco Resources has examined the RR historical facility operations, including NRC Inspection and License Performance Reports, and has determined that no changes have taken place noting that RR is not presently, nor has been, in operation since incorporation into license SUA-1548. Consequently, all references cited within sections of this appendix are still relevant and are hereby incorporated by reference.

As noted throughout this Renewal submittal, this approach is consistent with NUREG-1569 (Page xvii) guidance that the renewal submittal need not resubmit a complete renewal submittal covering all aspects of facility operation and should instead only submit information containing changes from the currently accepted license. (NRC, 2003c).

APPENDIX B-2

AMENDMENTS AND CHANGES TO OPERATING PRACTICES OR PROCEDURES FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 BACKGROUND

Cameco Resources Source Materials License SUA-1548 is a "performance-based license". The basis for performance-based licenses is documented in "*A Baseline Risk-Informed Performance-Based Approach for In Situ Leach Uranium Extraction Licensees*", NUREG/CR-6733 (NRC, 2001f). NRC acknowledges in this document that "*existing...regulations are not specifically applicable to uranium mining facilities*".

Recognizing the significant differences between ISR and other Source Materials Licensees, NRC established the framework for performance-based uranium ISR licenses. The primary feature of the performance-based license is the licensee's capability to "self-regulate" through a Safety and Environmental Review Panel (SERP). Per NUREG/CR-6733:

> *"The purpose of this panel is to review proposed changes, tests or experiments to determine whether they require a license amendment. Changes, tests or experiments may be conducted without prior NRC approval if (i) they do not conflict with any requirements specifically stated in the license or impair the licensee's ability to meet all applicable NRC regulations, (ii) there is no degradation in the essential safety or environmental commitments in the license application or those provided in an approved reclamation plan, and (iii) they are consistent with NRC conclusions regarding actions analyzed and selected in the facility environmental assessment"* (NRC, 2001f).

The review criteria for determination of changes requiring the licensee to obtain a license amendment are provided in License Condition 9.4 (NRC, 2007c). In short, an amendment is required if the change, test or experiment increases risk of accident or malfunction of safety features, or creates a possibility of a different kind of accident or malfunction than those previously evaluated in the license renewal submittal. If the SERP finds that no increased risk of accident or malfunction of safety features would result from a "change", then a license amendment is not required. Thus, all "changes, tests, or experiments" are documented through either a SERP review or license amendment renewal submittal and approval. SERPs are routinely reviewed by NRC Inspectors during NRC inspections and submitted to the NRC in the required Semi-Annual Report.

2.0 REYNOLDS RANCH SERP RECORDS AND LICENSE AMENDMENTS

SERP records and License Amendments related to the RR since its inclusion in the SR-HUP license were reviewed, and no SERPs related to the RR were completed. No changes, tests, or experiments were conducted under the SERP review process without License Amendment, on the RR since its inclusion under the SR-HUP license as RR is still in a developmental phase.

The RR was amended into the SR-HUP Source Materials License SUA-1548 as Amendment No. 11 (NRC, 2007c). There have been no subsequent amendments related to changes, tests or experiments on the RR.

3.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569, Appendix A, Cameco Resources has examined the RR historical facility operations, including amendments and changes to operating practices or procedures, determining that no changes have taken place. Consequently, previously submitted information referenced in this Appendix relating to areas covered in this appendix is still relevant and is hereby incorporated by reference.

This approach is consistent with NUREG-1569 (Page xvii) guidance that the license renewal submittal need not resubmit a complete application covering all aspects of facility operation and should instead only submit information containing changes from the currently accepted license.

APPENDIX B-3

LICENSE VIOLATIONS IDENTIFIED DURING NRC OR AGREEMENT STATE SITE INSPECTIONS FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 BACKGROUND

NRC Inspection Reports for Source Material License SUA-1548 covering the years 2007 through 2009 were reviewed for occurrences of Notices of Violation (NOVs) and Non-Cited Violations (NCVs) related to the RR amendment area. The RR was included under License SUA-1548 by NRC approval of Amendment No. 11 (NRC, 2007c). A summary of the RR Site Characterization is presented in Section 2.0 of Appendix B-7.1.

1.1 Notices Of Violation

NOVs are categorized for severity by the NRC using levels I, II, III and IV, with I being the highest severity level and IV being the lowest. Severity Level IV is defined by NRC as follows: "*Violations at Severity Level IV involve noncompliance with NRC requirements that are not considered significant based on risk*" (NRC, 2005a). Cameco Resources has never been cited with an NOV of Severity Level I, II or III under License SUA-1548.

NOVs require response from the licensee in the form of a written statement or explanation to the NRC within sixty days of the effective NOV date. NOV replies must include "*(1) the reason for the violation, or, if contested, the basis for disputing the violation or severity level, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken to avoid further violations, and (4) the date when full compliance will be achieved*" (NRC, 2007d). Typically, the licensee's NOV reply is acknowledged by the NRC as "responsive," and the NOV will be documented as "closed" in a subsequent NRC Inspection Report.

1.2 Non-Cited Violations

NRC's "*Enforcement Policy*" describes NCVs "*as having very low safety significance*" (NRC, 2005a). The process for dispositioning an NCV is further described as follows:

> "*NCVs... are documented as violations in inspection reports (or inspection records for some materials licensees) to establish public record of the violations, but are not cited in Notices of Violation which normally require written responses from licensees. Dispositioning violations in this manner does not eliminate the NRC's emphasis on compliance with requirements nor the importance of maintaining safety. Licensees are still responsible for maintaining safety and compliance and must take steps to address corrective actions for these violations. While licensees are not required to provide written responses to NCVs, this approach allows licensees to dispute violations described as NCVs.*" (NRC, 2005a)

NCVs can be "opened" and "closed" within the duration of the on-site inspection in which they occurred. A single NRC Inspection Report typically provides documentation of the NCV, the corrective actions taken or planned by the licensee, and NRC's acceptance of the effectiveness of corrective actions, closing the NCV.

2.0 NOVs AND NCVs FOR REYNOLDS RANCH

Following the RR Amendment adding the satellite facility to NRC License SUA-1548 to present, there have been a total of six (6) inspections. With respect to RR, RR having remained in a developmental mode with no active mining activities occurring, none of the NRC inspections resulted in a NOV or NCV being issued for RR.

APPENDIX B-4

SUMMARY OF WELLFIELD EXCURSIONS FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 INTRODUCTION

This section is intended to provide a summary and review of wellfield excursions reported for. RR is currently an undeveloped area of the SR-HUP under Source Materials License SUA-1548. Potential impacts to groundwater resources can occur from excursions of leaching solutions from wellfields during production and/or restoration. The Groundwater Monitoring Program at SR-HUP, presented in Appendix A-8.2-1, is conducted to ensure that wellfields are being operated to minimize the potential of excursions and that any groundwater excursions are detected in a timely manner. The early detection of an excursion allows prompt corrective action to mitigate the excursion to prevent any groundwater quality degradation outside of the wellfields. When active mining is initiated for the RR, its wellfields will be included in the Groundwater Monitoring Program.

1.1 Definition of an Excursion

A migration of production fluids from a production aquifer into the overlying or underlying aquifers and/or detected at the monitor well ring is termed an excursion. Excursions are indicated from monitoring well sampling data, when two or more excursion parameters (i.e., alkalinity, chloride, and specific conductivity) exceed the upper control limits (UCLs) as determined from the approved baseline water quality data. When an excursion is first indicated by monitoring results, a confirming sample is collected within 24 hours of receiving the original analytical data. If the excursion is confirmed by the second sample, the NRC and Wyoming Department of Environmental Quality (WDEQ) are notified in accordance with the license, and subsequent sampling of the well is conducted at least every seven days for the UCL parameters and uranium. If the second sample does not confirm the excursion, a third sample is collected within twenty four hours of the second sample results to confirm or deny the excursion. If the excursion is confirmed, the appropriate agencies are contacted and sampling is conducted at least every seven days. Weekly monitor well sampling is continued until the excursion parameter exceedances are no longer detected in the analytical results. Excursion events do not necessarily result in environmental impacts, but just can be indicators of the unintended movement of production fluids (Miller, 2009).

1.2 Excursions for the Reynolds Ranch Property

There are no active wellfields within the boundaries of the RR. Thus, there have been no wellfield excursions since the RR amendment was approved in January 2007.

2.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569, Appendix A (NRC, 2003c), Cameco Resources has

examined the RR historical facility operations, including air and groundwater quality monitoring and compliance history with respect to groundwater excursion aspects, determining that no changes have taken place noting that the RR is not presently, nor has been, in operation since incorporation into license SUA-1548. Consequently, all references cited in this section are still relevant and are hereby incorporated by reference.

APPENDIX B-5

EXCEEDANCES OF ANY REGULATORY STANDARD OR LICENSE CONDITION PERTAINING TO RADIATION EXPOSURE, CONTAMINATION, OR RELEASE LIMITS FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 BACKGROUND

The purpose of this section is to provide a summary and review of radiation exposure, radioactive contamination, and radionuclide release data reported for the RR.

The following sections include review of the following, as applicable to RR:

- Section 2.0 - Historical Radiation Monitoring Program Assessment
- Section 3.0 - Historical Results of Radiation Dose Calculations
- Section 4.0 - Historical Bioassay Program Assessment
- Section 5.0 - Historical Occupational Exposure Rate Monitoring Assessment

2.0 HISTORICAL RADIATION MONITORING PROGRAM ASSESSMENT

The Radiation Monitoring Program involves periodic measurements of airborne concentration of natural uranium and radon-222 (Ra^{222}) progeny in various buildings associated with operations. At SR-HUP, header houses, satellite IX facilities, and the CPP are monitored. Since January 2007, when the RR was amended in to SUA-1548, no ISR operations buildings have been constructed on the RR. When indoor operations at the RR begin, the Radiation Monitoring Program (RMP) will be implemented and data collection necessary for future assessment of the RMP will initiate.

3.0 HISTORICAL RESULTS OF RADIATION DOSE CALCULATIONS

The NRC requires strict adherence to radiation worker monitoring requirements. A review of the historical results of radiation dose calculations for the SR-HUP is provided in Appendix A-8.3-2. In comparison to routine operations of active wellfields, satellite IX facilities and the CPP, the potential for radiation dose exposure being directly related to the RR is minimal. Dose history as documented in Appendix A-8.3.2 could be considered inclusive of natural background contribution from the minimal on-site RR activities that have occurred since 2007. The maximum Total Effective Dose Equivalent (TEDEs) reported for workers at SR-HUP are well below applicable standards that are summarized in Section A-8.3-2 and are consistent with doses the NRC indicates to be representative of uranium in situ recovery (ISR) facilities, and are stable over the 10-year period since the last License Renewal submittal. This demonstrates that Cameco Resources is committed to continually evaluating sources of worker exposures to ionizing radiation and implementing improvements in order to maintain occupational radiation doses at levels which are "as low as is reasonably achievable" (ALARA). With the non-operational status of the RR, the only source of exposure is from natural background radiation.

4.0 HISTORICAL BIOASSAY PROGRAM ASSESSMENT

NRC licensees are required to limit workers' intake in areas with airborne radionuclides by sequential application of the following:

- Engineering controls;
- Controlled access;
- Limiting exposure time; and
- Use of respiratory protection.

Cameco Resources has implemented a bioassay program to monitor the effectiveness of the respiratory program, and to provide a quantitative method for estimating intakes of radioactive material. A review of the historical bioassay program for SR-HUP workers is provided in Appendix A-8.3-3. With the non-operational status of the RR, there are no work areas in which workers could potentially be exposed to airborne radionuclides. When indoor work areas are established, the SR-HUP Bioassay Program will be implemented and data collection necessary for future assessment of the Bioassay Program will initiate.

5.0 HISTORICAL OCCUPATIONAL EXPOSURE RATE MONITORING ASSESSMENT

An assessment of the historical occupational exposure rate monitoring for the SR-HUP is provided in Appendix A-8.3-4. Once operational, similar exposure rates would be anticipated to occur at RR as at the existing satellite plants.

The RR has remained in a developmental mode with no active mining activities taking place since amendment into the SR-HUP Source Material License in 2007. Consequently, any assessment of historical occupational exposure to gamma radiation can only be performed when RR operations begin.

6.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569, Appendix A (NRC, 2003c), Cameco Resources has examined the RR historical facility operations, including air and groundwater quality monitoring and compliance history with respect to radiation exposure, radioactive contamination, and radionuclide release aspects, determining that no changes have taken place as the RR is not presently, nor has been, in operation since incorporation into license SUA-1548. Consequently, all references cited within this section are still relevant and are hereby incorporated by reference.

APPENDIX B-6

EXCEEDANCES OF ANY NON-RADIATION CONTAMINANT EXPOSURE OR RELEASE LIMITS FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 INTRODUCTION

The purpose of this section is to provide a summary and review of non-radiation contaminant exposure, or exceedances of release limits reported for the RR.

2.0 REGULATORY BACKGROUND

This appendix has been prepared in conformance to the guidance provided in NUREG-1569 Appendix A (NRC, 2003), which provides a list of "*specific areas where a compliance history or record of site operations and changes should be provided for review*" including "*exceedances of any non-radiation contaminant exposure or release limit*".

Cameco Resources' license SUA-1548 includes Condition 12.1 as follows:

> *"Until license termination, the licensee shall maintain documentation on spills of source or 11e.(2) byproduct materials (including mining solutions) and process chemicals. Documented information shall include, but not be limited to: date, spill volume, total activity of each radionuclide released, radiological survey results, soil sample results (if taken), corrective actions, results of post remediation surveys (if taken), and a map showing the spill location and the impacted area."* (NRC, 2007c)

License Condition 12.1 requires the licensee to maintain and follow procedures for evaluation of consequences of any spill and to determine if reporting to the NRC Operations Center is necessary. The timing of initial notification and written reports to the NRC and appropriate State agencies are also described in License Condition 12.1.

3.0 REVIEW OF NON-RADIATION CONTAMINANT EXPOSURE AND RELEASES FOR THE RR

Cameco Resources documents compliance with License Condition 12.1 through submittal of "Semi-annual Effluent and Environmental Monitoring Reports" to the NRC. These reports include review of all environmental releases to groundwater, surface water, land application, and air, inclusive of any non-radiation contaminant exposures. Semi-Annual Effluent Reports from 2007 to present were reviewed for occurrences of exposure or releases related to activities at RR. Minimal, non-mining related activities have taken place at RR since its inclusion under license SUA-1548 in 2007. Additionally, the extent of all spills of process solutions are mapped, radiologically assessed with a gamma meter, and/or soil sampled for radionuclides. Spills meeting reporting limits are submitted to the NRC and WDEQ, with all pertinent information maintained on site in a decommissioning file. There have been no reported exceedances of non-radioactive contaminants or release limits associated with the RR property.

Non-radiologic spills are managed in accordance with the Smith Ranch (SR)-Highland Operation, Environmental, Health and Safety Management System Operating Procedures Volume I-VIII.

4.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569, Appendix A (NRC, 2003c), Cameco Resources has examined the RR historical facility operations, including compliance history and record of site operations with respect to exceedances of non-radiation contaminant exposure and release limits, determining that no changes have taken place. The RR is not presently, nor has it been, in operation since incorporation into license SUA-1548. Consequently, previously submitted information referenced within this section relating to areas covered in this appendix is still relevant and is hereby incorporated by reference.

APPENDIX B-7

UPDATES AND CHANGES SITE CHARACTERIZATION INFORMATION IMPORTANT TO THE EVALUATION OF EXPOSURE PATHWAYS AND DOSES FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 INTRODUCTION

This appendix (Appendix B-7) of the License Renewal submittal for Source Material License SUA-1548 has been prepared in conformance to NUREG-1569, "*Standard Review Plan for In Situ Leach Uranium Extraction License Applications*" (NRC, 2003c). The approach to preparation of license renewal submittals as presented in NUREG-1569 Appendix A is streamlined, requiring the licensee to present "*compliance history or record of site operations and changes*" to the NRC for review. Further, NUREG-1569 Appendix A states that:

> *"Aspects of the facility and its operations that have not changed since the last license renewal or amendment should not be reexamined".*

The information and data presented in the license renewal submittal can therefore be optimized, to present:

- By reference, any previously submitted documentation in areas that have not changed;
- The record of site operations demonstrating that health, safety and environment have been protected throughout the previous license period; and
- Any "new or significant" information, describing aspects of facility or operations that have changed during the previous license period.

This approach allows for the NRC review to be keenly focused on "*only those changes proposed by license renewal or amendment application*" (NRC, 2003c).

2.0 APPENDIX B-7 CONTENT

Appendix B-7 has been prepared to conform with NUREG-1569, Appendix A guidance, specifically:

> *"Updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including site location and layout; uses of adjacent lands and waters; population distributions; meteorology; the geologic or hydrologic setting; ecology; background radiological or non-radiological characteristics; and other environmental features."* (NRC, 2003c)

Appendix B-7 is specifically focused on the RR which was included under Cameco Resources' Source Material License SUA-1548 by Amendment No. 11 (NRC, 2007c). Topics covered in Appendix B-7 include the following:

- B-7.1: Site Location and Layout for Reynolds Ranch Satellite Facility
- B-7.2: Use of Adjacent Lands and Waters for Reynolds Ranch Satellite Facility
- B-7.3: Population Distribution for Reynolds Ranch Satellite Facility
- B-7.4: Meteorology for Reynolds Ranch Satellite Facility
- B-7.5: Geologic or Hydrologic Setting for Reynolds Ranch Satellite Facility

- B-7.6: Ecology for Reynolds Ranch Satellite Facility
- B-7.7: Transportation for Reynolds Ranch Satellite Facility

The topics covered in Appendix B-7 are largely covered by reference to previously submitted documentation, due to the inactive status of the RR since its inclusion under SUA-1548.

APPENDIX B-7.1

SITE LOCATION AND LAYOUT FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 INTRODUCTION

This section provides a review of the site location and layout for the RR. RR is currently an un-mined area of the SR-HUP under Source Materials License SUA-1548. The NRC approved an amendment application submitted by PRI to include the RR under SUA-1548 (PRI, 2004e). RR was added to SUA-1548 under the License Conditions described in Amendment No. 11 (NRC, 2007c) after PRI provided satisfactory responses to NRC Requests for Additional Information (RAIs) in 2005 and 2006 (PRI, 2005d; PRI, 2006c).

NUREG 1569 Appendix A states that "*updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including ...site location and layout*" shall be included in a license renewal submittal. This section provides background, any changes to site locations and layout, and the importance of the changes to exposure pathways and doses. Figure 1 (included in the main body of the License Renewal Submittal) shows the general location of SR-HUP and the RR within the state of Wyoming, as well as the license boundary.

Since the RR was added to Source Materials License SUA-1548 via Amendment No. 11 (NRC, 2007c), minor changes to the site layout have occurred.

2.0 BACKGROUND

NUREG 1569, Section 2.1, describes the area of review for site location and layout for original license applications as follows:

> "*The reviewer should establish the validity and completeness of the basic data, to determine that the site location and proposed layout proposed in the application are complete and accurate, and that the site information is sufficient to evaluate the location of proposed facilities relative to key features and activities.*" (NRC, 2003c)

This requirement was met in the RR Amendment No. 11 submittal issued in December, 2007 (PRI, 2007c), which provides a comprehensive description of the site location and layout for SR-HUP and RR, and is summarized below.

The RR mineral and surface rights are controlled by Cameco Resources in the areas scheduled for uranium mining and development. The RR is immediately adjacent to and north of SR-HUP as illustrated on Figure B-7.1-1. Site characterization is fully documented in Section 2 of the License Amendment submittal, including: Site Location and Layout; Uses of Adjacent Lands and Waters; Population Distribution; Historic, Scenic and Cultural Resources; Meteorology; Geology and Seismology; Hydrology; Ecology; Background Radiological Characteristics; and Background Non-Radiological Characteristics. The site characterization for the RR is very similar to Cameco Resources' SR-HUP properties, due to the RR's immediately adjacent location.

RR property ownership is as follows:

- 7,135 acres privately held;
- 720 acres of federal land administered by the Bureau of Land Management (BLM);
- 640 acres owned by the State of Wyoming; and
- 240 acres directly owned by Cameco Resources (PRI, 2004e).

2.1 RR Proposed ISR Scope and Schedule

Proposed operations for RR include eight wellfields and one satellite IX facility. All proposed operations for RR from wellfield injection/production to uranium recovery via ion exchange are conventional ISR activities, already in practice on the SR-HUP properties (PRI, 2004e). The capacity of the satellite ion exchange facility was set by license condition at an average monthly flow rate of 4,500 gallons per minute, exclusive of restoration flow (NRC, 2007c). The original RR schedule, as proposed in the original amendment application, was revised in PRI's response to NRC's Requests for Additional Information. While the revised schedule showed production beginning in the latter part of 2008 and continuing into 2013, the actual start date for mining activities is dependent upon WDEQs and U.S. Bureau of Land approvals to commence mining activities at RR. Groundwater restoration was scheduled to occur from 2013 through 2017 and decommissioning was scheduled from 2017 through early 2019 (PRI, 2006c).

3.0 RR SITE ACTIVITIES

Previous land use (livestock grazing) has continued throughout the time period covered by the RR amendment. As noted above, livestock grazing is expected to continue during ISR activities with the exception of a minimal amount of land excluded for wellfields and the satellite ion exchange facility. During ISR activities, the land excluded from grazing use will be less than four percent of the RR licensed area (325 acres excluded, out of 8,700 acres under license).

4.0 CHANGES IN SITE LOCATION AND LAYOUT

There have been minor changes to the RR site layout as follows:

- Installation of the monitor well ring;
- Continuation of plug drilling to delineate the ore body;
- Installation of a deep disposal well and associated pumphouse; and
- Upgrades to the road leading to the drilling staging area.

Cameco Resources has also completed a pump test in MU-27 and the results are being analyzed by a consulting hydrologist. Baseline samples have been collected and analyzed to establish upper control limits for the mine unit. When the resulting data has been evaluated and a report submitted to the WDEQ for approval, a SERP will evaluate the wellfield package for completeness to begin mining activities.

5.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569, Appendix A (NRC, 2003c), Cameco Resources has examined the RR historical facility operations, including site location and layout, and has determined that only the minor changes listed above have taken place. The RR is not presently nor has it been in operation since incorporation into license SUA-1548. Consequently, previously submitted information relating to areas covered in this appendix is still relevant and is hereby incorporated by reference.

FIGURES FOR APPENDIX B-7.1

APPENDIX B-7.2

USE OF ADJACENT LANDS AND WATERS FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 INTRODUCTION

This section provides a review of uses of adjacent lands and waters for the RR. RR is currently an unmined area of the SR-HUP under Source Materials License SUA-1548.

NUREG 1569 Appendix A (NRC, 2003c) states that "*updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including ... uses of adjacent lands and waters*" shall be included in a license renewal application. Adjacent land and water use changes from the time of the previous license submittal to present for the SR-HUP (RAMC, 1999) are documented in Appendix A-7.2. The assessment of SR-HUP adjacent land and water use changes from 1999 to present are considered representative of the RR due to the following:

- The RR property is immediately adjacent to SR-HUP. Thus, the assessment of land and waters adjacent to the SR-HUP is directly applicable to the RR;
- Assessment of changes in uses of adjacent lands and waters from 1999 to present is inclusive of changes that have occurred since 2007, when the RR amendment was approved by NRC; and
- The RR amendment application (PRI, 2004e) provided updated data describing the uses of adjacent lands and waters, relevant to inclusion of RR under SUA-1548.

The following sections provide discussion of background, changes to uses of adjacent lands and waters, and the importance of the changes to exposure pathways and doses. Figure 1 (included in the main body of the License Renewal submittal) shows the general location of SR-HUP and RR within the state of Wyoming, as well as the license boundaries.

2.0 BACKGROUND

NUREG 1569, Section 2.1 (NRC, 2003c), describes the area of NRC review for uses of adjacent lands and waters for original license applications as follows: "*The staff should review descriptions of present and projected land use (e.g. agriculture, sanctuaries, hunting, mining, grazing, industry recreation, roads) and trends or changes in population or industrial patterns.*"

Further, NUREG 1569 states "*the staff should determine that the application contains the location of residences, ground-water supply wells, surface water reservoirs, and the estimated use of water in the lands surrounding the site of the proposed facility.*" These requirements were met most recently in the application for RR Amendment No. 11 in December 2007 (PRI, 2007c), which provides a comprehensive description of the uses of adjacent lands and waters and are incorporated here by reference. Current information on location of residences, groundwater supply wells, surface water reservoirs and the estimated use of water in lands surrounding the site was reviewed to assess whether "*any updates and changes important to the evaluation of the of exposure pathways and doses*" has occurred. This review is documented in the following section.

3.0 UPDATES TO USES OF ADJACENT LANDS AND WATERS

Lands within RR property and land adjacent to this property have historically been and continue to be used for sheep and cattle grazing (NRC, 2007a). In the past, homesteaders settled some areas for dry farming, but most of these farms are now abandoned. The area in and around RR is very sparsely populated by permanent residents and has remained that way since the RR Amendment No. 11. There is one home, the Vollman Ranch, located 4.2 miles east of the Smith Ranch (SR) CPP (NRC, 2007a). Other residential sites near the RR include the Reynolds, Hornbuckle, Lenzen and Baker Ranches, which are located outside the licensed area. .

In 2009, approximately 240 wind turbines were erected adjacent to and west of the licensed SR-HUP area. An additional 110 wind turbines are presently being installed to the west and southwest. The turbines are approximately 320' tall including a radius of 140' for the turning blades. Three blade diameters are required between turbines and approximately 1//4 mile safety zone around the perimeter of the field.

Major recreational activities within a fifty mile radius of the proposed mine site are mostly outdoor activities, such as camping, hunting, hiking, skiing and snowmobiling. Water sports, such as skiing, boating and fishing are popular in public use areas along the North Platte River and at Alcova Lake and Glendo Reservoir. These areas are located 20 miles or more to the south of the license area. Another area for recreational activities is Medicine Bow National Forest, approximately forty miles south of the site. No recreational areas have been added to the area adjacent to the license area since the last complete license application was prepared for the RR.

Groundwater wells in the vicinity of the SR-HUP license area, excluding those used in ISR process by Cameco Resources, are evenly distributed. Most of these wells are associated with windmills used for livestock watering. As such, these wells are shallow, typically less than 180 feet in depth. Only four wells in the current SR-HUP license area and adjacent lands are known to be used for domestic water supply. These wells include the water well at Sunquist (Smith) Ranch, located about 2.6 miles southwest of the SR-HUP CPP site, the Vollman Ranch well located approximately 1.5 miles east of Satellite No. 3, the Fowler Ranch well located just north of the license area approximately 2.5 miles north of the Highland CPF, and the Mason House (unoccupied) located near the Reynolds Ranch satellite facility. Water wells at the Satellite buildings, the Highland CPP and SR Main Office/CPP site only supply water for plant operations and washing purposes. These water supplies are not used for drinking as bottled water is supplied for this purpose. No additional wells or changes in use have occurred since the last complete license application was prepared for Reynolds Ranch (PRI, 2004e).

The four ranch wells are completed at depths stratigraphically above zones planned for ISR mining and are also located distant from planned wellfield areas. Residential well depths are:

- Sunquist Ranch – 105 feet;

- Vollman Ranch – 180 feet;
- Fowler Ranch well (used intermittently as fulltime residents do not reside at the site) – 212 feet and;
- Mason House (unoccupied) – 118 feet.

No mining is planned for the aquifers in which these wells are completed, as there is not uranium mineralization of economic significance in these aquifers within the licensed area. Since these wells are located laterally from proposed mine areas and are vertically separated by at least 300 to 400 feet of alternating layers of siltstone, shale and sandstone, the wells are physically isolated from mining activities and groundwater monitoring conducted during operations would detect any problems before these wells were affected. No known changes to the location and completion depth of these wells has occurred since the last complete license application was prepared for Reynolds Ranch (PRI, 2004e).

4.0 IMPORTANCE OF CHANGES TO EXPOSURE PATHWAYS AND DOSES

There have been no changes to the location of residences, groundwater supply wells, surface water reservoirs, or the estimated use of water in the lands surrounding the license area. As such, previous evaluations of exposure pathways (PRI, 2004e; NRC, 2007a) and doses are unaffected by the current uses of lands and waters adjacent to the SR-HUP and RR. Ongoing monitoring of groundwater in horizons above mined units in the SR-HUP has shown no excursions (see Appendices A-4.1 and A-8.2), indicating the ISR operation is not impacting shallow aquifers overlying deeper mined units. Since the few residential wells in the area are completed in units stratigraphically above the units being mined, this data indicates that no impacts to these residential wells are expected from continued operation of SR-HUP mine units or initiation of active ISR mining on the RR.

5.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, can be presented. Following NRC guidance relating to license renewals in NUREG-1569, Appendix A, (NRC, 2003c) Cameco Resources has examined the RR historical facility operations, including uses of adjacent lands and waters, and has determined that no changes have taken place. Consequently, previously submitted information relating to uses of adjacent lands and waters is still relevant and is hereby incorporated by reference.

APPENDIX B-7.3

POPULATION DISTRIBUTION FOR REYNOLDS RANCH SATELLITE FACILITY

Appendix B-7.3 Population Distribution for Reynolds Ranch Satellite Facility

1.0 INTRODUCTION

This section provides a review of population distribution data for the RR. RR is currently an unmined area of the SR-HUP under Source Materials License SUA-1548. NUREG 1569 Appendix A (NRC, 2003c) states that *"updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including ...population distribution"* shall be included in a license renewal application. Population distribution data changes from the time of the previous license application to present for the SR-HUP (RAMC, 1999) are documented in Appendix A-7.3. The SR-HUP population distribution changes from 1999 to present are considered representative of the RR due to the following:

- The RR property is immediately adjacent to SR-HUP. Therefore, evaluation of regional population distribution is sufficiently broad for coverage of the RR;
- Trending of population distribution data from 1999 to present is inclusive of changes that have occurred since 2007, when the RR amendment was approved by the NRC; and
- The RR amendment application (PRI, 2004e) provided updated population distribution data, relevant to inclusion of RR under SUA-1548.

2.0 BACKGROUND

NUREG 1569, Section 2.3, describes the area of review for population distribution for original license applications as follows:

> *"the staff should review population data based on the most recent census, including maps that identify places of significant population grouping, such as cities and towns within 80-km [50-mi] radius... from the approximate center of projected (life of facility) activities"* (NRC, 2003c).

The population distribution information presented in the previous License Renewal submittal (RAMC, 1999) and the RR amendment to the SR-HUP Source Materials License (PRI, 2004e) were reviewed as well as recent U.S. Census Bureau information (U.S. Census Bureau, 2000 and 2010) to assess whether there have been any updates or changes to population distribution data that might impact the evaluation of exposure pathways and doses.

3.0 POPULATION DISTRIBUTION

This section provides a summary of changes to the regional and local population distributions in the vicinity of the SR-HUP and RR sites. Section 3.1 provides regional population information, with updates to the population distributions in major cities surrounding the SR-HUP and RR sites. Section 3.2 provides a summary of the local population distribution within and near the SR-HUP and RR sites.

3.1 Regional Population Distribution

The population within fifty miles of the SR-HUP main office and CPP site and the RR is centered within the communities of Casper, Douglas and Glenrock, Wyoming. The following provides a summary of the

regional population distribution, as documented in Amendment No. 11 to include the RR under license SUA-1548 (NRC, 2007c):

> *"These urban areas [Casper, Douglas and Glenrock] are significant in that they provide the major locations of public services such as schools, churches, medical care facilities, and public parks. These communities also provide the majority of the cultural and scenic attractions for the residents of Converse and Natrona Counties.*
>
> *Casper, Wyoming is the County Seat of Natrona County. In 1986, Casper claimed to be the largest city in the state. Casper has developed into a regional retail trade center serving a 150 mile radius which includes all or part of seven counties... The Casper labor force and population peaked in Spring of 1982 and has declined since that time.*
>
> *Casper has doubled its acre size during the ten years between 1975 and 1985. This growth can be contributed to the energy boom in the late 1970s and early 1980s. From 1970 to 1980, the city experienced a 30% increase in its population. Decreases in the price and demand for both oil and uranium have contributed to a population loss between 1980 and 1990... After 1990, the Casper area began to recover from the energy-related population decline... another population decline has occurred between 1995 and 1999.*
>
> *Douglas is the County Seat of Converse County. Glenrock, also in Converse County, is the closest town to the SR-HUP/Reynolds Ranch site with the site being approximately 22 road miles northeast of the town. Between 1970 and 1980 both Glenrock and Douglas experienced phenomenal growth, 80.6% and 136.9%, respectively. However, with the change in energy demand, through 1984 Glenrock lost 27% of its population and Douglas lost 17% of its population. Although Glenrock and Douglas experienced population changes similar to those in Casper between the years 1970 and 1995, population growth continued in Glenrock and Douglas between 1995 and 1999."*

Table B-7.3-1 provides a summary of the population fluctuation in the cities of Casper, Glenrock and Douglas, as well as the counties of Converse and Natrona, between the years of 1980 through 2008. The U.S. Census Bureau conducts a census every 10 years, with a census currently underway for calendar year 2010. Therefore, the most recent comprehensive census data for the cities and counties of Wyoming is available for 2000. The U.S. Census Bureau provided estimates of the populations for major cities in Wyoming in 2006 or 2007, and population estimates for the counties of Natrona and Converse in 2008, also summarized in Table B-7.3-1. In addition, 2006-2007 Wyoming Department of Administration and Information population estimates are also included for Douglas and Glenrock, Wyoming populations at 5,625 and 2,373, respectively.

TABLE B-7.3-1

POPULATION TRENDS IN CONVERSE AND NATRONA COUNTIES 1980 THROUGH 2008

Location	1980	1990	1999	2000	2006 or 2007	2008
Casper, WY	51,016	46,742	48,283	49,644	52,089 (2006 data)	Not available
Glenrock, WY	2,736	2,153	2,357	2,231	2,373 (2007 data)	Not available
Douglas, WY	6,030	5,076	5,655	5,288	5,625 (2007 data)	Not available
Converse County	14,069	11,128	12,396	12,052	Not available	13,267
Natrona County	71,856	61,226	63,151	66,533	Not available	73,129

Sources: PRI (2004e); U.S. Census Bureau, 2000; U.S. Census Bureau, 2010.

Slow steady growth has generally occurred in the cities and counties within 50 miles of the SR-HUP project during the period of 1990 and 2000, with additional growth estimated for these areas through 2006 and 2008. Casper experienced 4.7 percent growth in population from 2000 through 2006, after a documented growth of approximately 5.8 percent during the period of 1990 through 2000. Glenrock and Douglas both experienced population growth of 6.4 percent from 2000 to 2007. The counties of Natrona and Converse experienced a growth in population of approximately 9.9 percent and 10.1 percent, respectively, during the period of 2000 through 2008. Similar growth (7.7 percent and 8.0 percent for Converse and Natrona counties, respectively) was experienced during the period of 1990 to 2000. Despite these more recent increases in population, the combined populations of Converse and Natrona Counties in 2008 shows only a 0.5 percent increase since 1980. Converse County remains sparsely populated outside the towns of Douglas and Glenrock. Excluding the populations of those two towns, the average population density in Converse County is 1.2 persons per square mile.

3.2 Local Population Distribution

The following provides a summary of the local site population distribution, as documented in the amendment application to include the RR under license SUA-1548 (PRI, 2004e):

> *"The only occupied dwelling within the permit area is the Vollman Ranch, which is located approximately 1.5 miles east of Satellite No. 3 and 4.2 miles east-northeast of the Smith Ranch Main Office/CPP site. The nearest dwelling to the Smith Ranch Main Office/CPP site is the Sundquist (Smith) Ranch located 2.6 miles to the southwest. A total of seven people normally reside at these ranch homes for an occupational density of 0.09 persons per square mile for the area within a five mile radius of the plant."*

The local population distribution in the vicinity of the SR-HUP has not changed since the application for the RR Amendment No. 11 was prepared (PRI, 2004e) or since the addition of Satellite SR-2 in Amendment No. 12 (NRC, 2007a).

4.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, can be presented. Following NRC guidance relating to license renewals in NUREG-1569, Appendix A, Cameco Resources has examined the RR historical facility operations, including population distribution and has determined that no changes have taken place. Consequently, previously submitted information relating to population distribution is still relevant and is hereby incorporated by reference.

APPENDIX B-7.4

METEOROLOGY FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 INTRODUCTION

This section provides a review of meteorological data for the RR. RR is currently in a developmental mode with no mining activities having yet occurred that is adjacent to the SR-HUP and included under Source Materials License SUA-1548.

NUREG 1569 Appendix A (NRC, 2003c) states that "*updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including ...meteorology*" shall be included in a license renewal submittal. The location of the nearest official weather station is Natrona County International Airport near Casper, Wyoming. The Casper data has been used for past License and Amendment Applications. It is considered representative of the SR-HUP and RR sites since there are no significant barriers between the sites that could alter weather patterns. Figure B-7.4-1 shows the general location of RR within the state of Wyoming, as well as the property boundaries in relation to the Natrona County International Airport.

2.0 BACKGROUND

NUREG 1569, Section 2.5, describes the area of review for meteorology for original license applications as follows:

> "*the staff should determine whether the application includes sufficient local and regional-scale meteorological information to support estimates of airborne radionuclide transport from the proposed in situ leach facility to the surrounding area and for determination of airborne pathway inputs to risk assessment models*" (NRC, 2003c).

The Casper meteorological data has been reviewed to assess whether there has been any changes that might impact the evaluation of exposure pathways and doses. The recent data collected through 2008 is provided in Attachment 1 to this appendix.

NUREG 1910, "*The Generic Environmental Impact Statement for In-situ Leach Uranium Milling Facilities*" (NRC, 2009e) indicates that "*radon gas is emitted from ISL well fields and processing facilities during operations and is the only radiological airborne effluent for those facilities that use vacuum dryer technology*", such as SR-HUP. The previous license application and amendments (as applicable), for SR-HUP and the RR satellite facility have used the MILDOS computer code to evaluate the average concentrations and doses at ranches around the site. The MILDOS code uses weather data in the form of the joint frequency of wind speed by direction and stability class collected by the National Oceanic and Atmospheric Administration for Casper, Wyoming.

NUREG 1910 (NRC, 2009e) and the Environmental Assessment Construction and Operation of In-Situ Leach SR-2 Amendment 12 (NRC, 2007a) documents that the highest estimated dose to a nearby resident from SR CCP is only 17.5 percent of the 10 CFR Part 20 annual radiation dose limit for the public

of 100 millirems (mrem) per year. Hence, it would take considerable changes to the average wind patterns to alter the conclusions. With this perspective, the following reviews recent data to assess overall climate of the area, and the precipitation, temperature and winds to evaluate whether changes have occurred and whether they would be likely to alter the previous evaluation of exposure pathways and doses.

3.0 GENERAL METEOROLOGY

The project license area is located in eastern Wyoming, where the climate has been generally classified under the Koppen System as semiarid and cool. The climate in the area is rather dry due to the effective barrier to moisture from the Pacific Ocean offered by the Cascades, Sierra Nevada, and the Rocky Mountains when winds are from the west and northwest. The mountain ranges in the west-central portion of the state, which are oriented in a general north-south direction, are perpendicular to the prevailing winds. These ranges also tend to restrict the passage of storms and thus restrict precipitation in the eastern part of Wyoming (NCDC, 2008).

Meteorological data (wind speed, wind direction, precipitation and temperature) for the project area are taken from the Natrona County International Airport near Casper, Wyoming. About 70 percent of the annual precipitation occurs during the growing season of late spring and summer, mostly as thunderstorms. Monthly snowfall amounts are unusually uniform from November through February, and a bit heavier in March and April. The site experiences large diurnal and annual temperature ranges. This is due to the advent of both warm and cold air masses and the relatively high elevation which permits rapid incoming and outgoing radiation. Windy days are quite frequent during winter and spring months. Usually the stronger winds are from the southwest and this tends to raise the temperature because the wind is moving downslope.

4.0 PRECIPITATION

The average annual precipitation for the area is approximately 11.9 inches, as demonstrated for precipitation data from the period of 1950 through 2008 (NCDC, 2008). From 2000 through 2008, the mean annual precipitation was 9.3 inches. A review of the precipitation record indicates that this was due to two unusually dry years, 2001 and 2002, when only 6.8 inches and 7.0 inches of precipitation were recorded, respectively (NCDC, 2008). These two years correspond to a well documented drought in Wyoming (NCDC, 2002). When these two years are excluded, the average precipitation since the last license renewal submittal in November 1999 was 11.7 inches, or within one percent of the long-term average, i.e., 1950-2008). These data indicate that outside of the extreme drought years of 2001 and 2002, precipitation amounts have not changed appreciably for the site and would not influence dispersion from potential sources at the site.

The average yearly total evaporation for the site vicinity is reported as 42 inches (from 1950 to 1985 [WWRC, 1985]). The average net evaporation for the area is taken as the difference between total evaporation and precipitation, and is calculated to be approximately 31 inches per year (WWRC, 1985). Given the small changes in average temperature and annual average precipitation, changes in net evaporation since 1985 are correspondingly small and have insignificant impact on overall predictions of dispersion from the site.

5.0 TEMPERATURE

The average temperature for the area is 45.5 degrees Fahrenheit (°F) from 1950 through 2008 (NCDC, 2008). From 2000 to 2008, the average temperature was 46.0 °F (NCDC, 2008). The mean average temperature is within one percent of the long-term mean average temperature.

6.0 WIND

Wind speed data from Natrona County International Airport has been used to estimate wind speed and direction for the project site. The mean annual wind speed for the years 1961 through 1990 was 13 miles per hour (mph), with winds originating primarily from the southwest. The highest average monthly wind speed from 1961 to 1990 occurred in January and was 16.4 mph from a west-southwesterly direction. The lowest average monthly wind speed occurred in July and was reported as 10.1 mph from a west-southwesterly direction. A wind rose for the 1961 to 1990 time period is shown in Figure B-7.4-2.

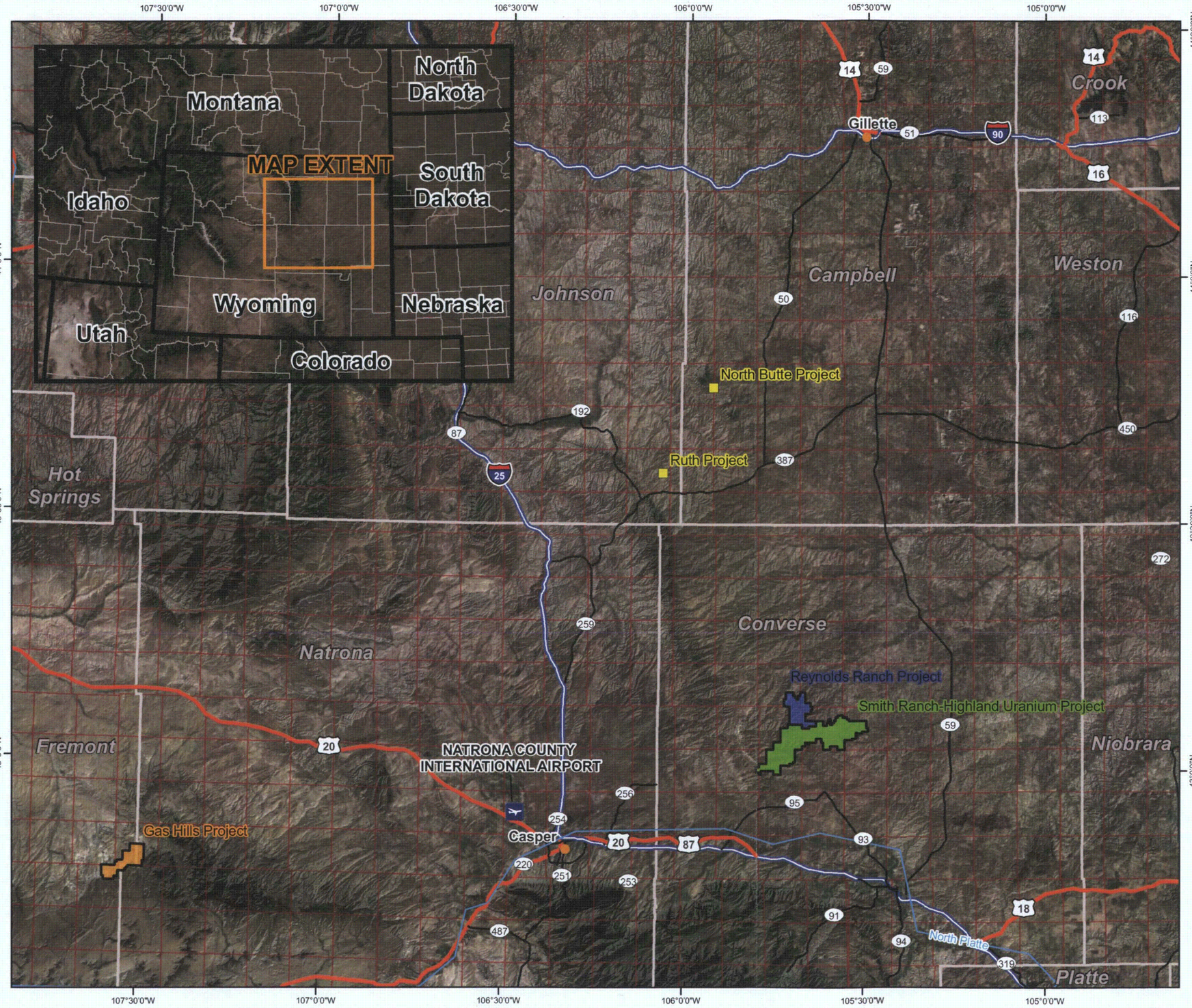
Wind speed averages and directions for a twenty-five year period ending in 2008 were evaluated to assess whether any significant deviations from conditions referenced in past renewal submittals from the 1961 through 1990 period are apparent. The average annual wind speeds for the 1983 to 2008 period was 12.1 mph from the southwest. This is slightly less than the annual average from the 1961 to 1990 period, but from the same direction. The highest mean monthly wind speed for the most recent monitoring period was also in January, at 15.5 mph from a west-southwest direction. This is again slightly less than the highest average monthly wind speed from the 1961 through 1990 period but from the same direction. The lowest average monthly wind speed for the period ending in 2008 was also for July at 9.5 mph from the west-southwest. This is slightly less than from the 1961 through 1990 period, but from the same direction. This data also shows that the prevailing wind direction is from the southwest consistent with the wind rose shown in Figure B-7.4-2.

7.0 CONCLUSIONS

Recent meteorological data (1999 through 2008) were compared to data used in the previous License Renewal submittal (RAMC, 1999) to assess whether changes have occurred that might impact "exposure pathways and doses". The overall climate, precipitation, temperature and wind speed and direction were evaluated. Temperature, wind speed, and wind direction data through 2008 are consistent with the

comparable long-term historical data sets. Annual average precipitation in the years from 1999 to 2008 has been slightly less than the long-term average, due to severe drought conditions in 2001 and 2002. Using these data as indicators, the meteorology for SR-HUP and RR has remained consistent with historic meteorology since the last License Renewal submittal (RAMC, 1999) and should not impact previous analyses of exposure pathways and doses.

FIGURES FOR APPENDIX B-7.4



LEGEND

- Natrona County International Airport
- City
- Project Area
- Limited Access
- Highway
- Major Road
- River
- Smith Ranch-Highland Uranium Project
- Gas Hills Project
- Reynolds Ranch Project
- County Boundary
- Public Land Survey System (PLSS)

REFERENCES

USGS. Various dates. Topo Quad (7.5') drawn from National Geographic TOPO! 4.0 [software] 2005:
Projection: UTM, Zone 13 North, NAD83, Meters.

14 7 0 14 MILES

SCALE 1:900,000 1 INCH = 14 MILES
WHEN PRODUCED AT SIZE 11X17IN

N

PROJECT

CAMECO RESOURCES
SMITH RANCH-HIGHLAND LICENSE RENEWAL
EASTERN WYOMING

TITLE

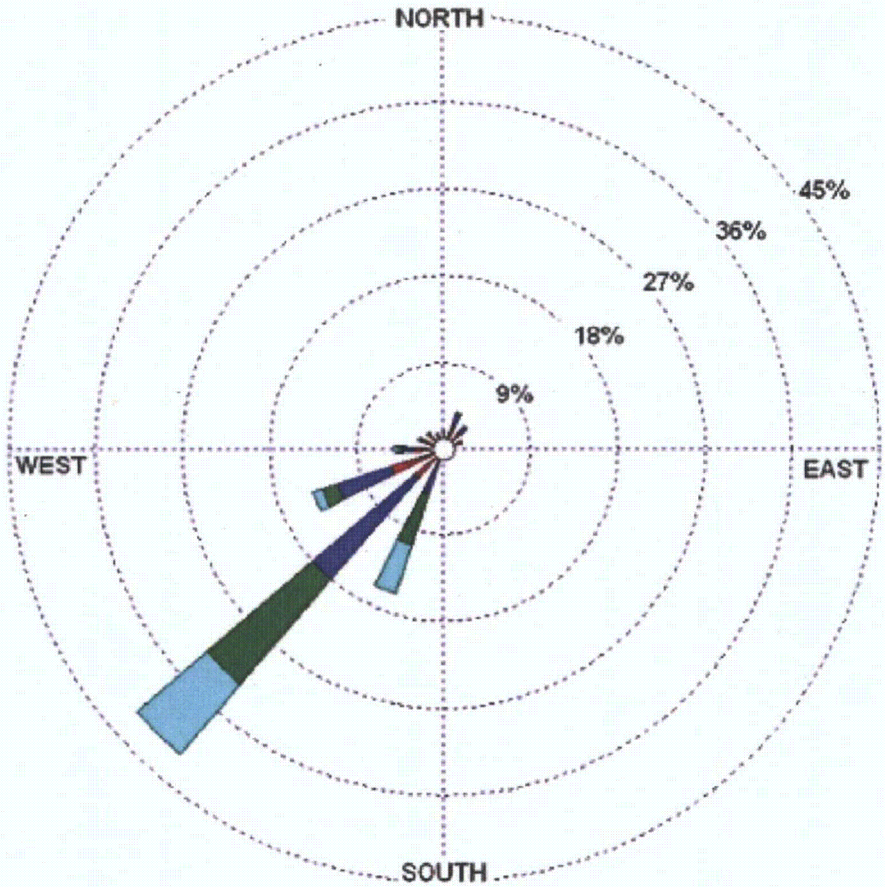
SITE LOCATION RELATIVE TO NEAREST OFFICIAL WEATHER STATION

Golder Associates
Denver, Colorado

PROJECT No.		093-81703	FILE No. 11x17_RA_LocationMapWeatherB.mxd	
DESIGN	AR	11/24/2009	SCALE AS SHOWN	REV 0
GIS	AR	11/24/2009		
CHECK	MEM	05/11/2010	FIGURE B-7.4-1	
REVIEW	KFM	05/11/2010		

Map Document: M:\Cameco\ArcMap\RenewalApp\11x17_RA_LocationMapWeatherB.mxd / Modified 8/2/2010 5:23:07 PM / Plotted 8/2/2010 5:23:07 PM by AReither

WIND ROSE
Station A24099: Casper/Natrona Co Int'l ARPT, WY



	Date 9/3/2002	Company Name USDA ARS
Display Wind Speed	Unit m/s	
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Orientation Direction (Blowing From)	1961-90 Jan 1- Jan 31 Midnight-11pm	

Wind Speed m/s
- > 11.06
- > 8.49 - 11.06
- > 5.40 - 8.49
- > 3.34 - 5.40
- > 1.80 - 3.34
- > 0.51 - 1.80

N

PROJECT

CAMECO RESOURCES
SMITH RANCH-HIGHLAND LICENSE RENEWAL
CONVERSE COUNTY, WYOMING

TITLE

WIND ROSE FOR CASPER/NATRONA COUNTY INTERNATIONAL AIRPORT

Golder Associates
Denver, Colorado

PROJECT No.		093-81703	FILE No.8_5x11_RA_WindSpeedB.mxd
DESIGN	AR	02/23/2010	SCALE AS SHOWN REV 0
GIS	AR	02/23/2010	
CHECK	MEM	05/11/2010	FIGURE B-7.4-2
REVIEW	KFM	05/11/2010	

REFERENCES

National Climate Data Center, 2002.

Map Document: M:\Cameco\ArcMap\RenewalApp\8_5x11_RA_WindSpeedB.mxd / Modified 7/29/2010 10:38:39 AM / Plotted 7/29/2010 10:38:39 AM by aratke

ATTACHMENT 1 TO APPENDIX B-7.4

2008 CASPER METEOROLOGICAL DATA

2008
CASPER
WYOMING (KCPR)

Casper is located in the central portion of Wyoming in the North Platte River Valley at an elevation of about 5,300 feet. The country immediately surrounding Casper is mostly rolling and hilly with considerable flat prairie land in each direction except toward the south where Casper Mountain rises some 3,500 feet above the valley floor. The prairie land is used mainly for grazing.

The National Weather Service Office is located at Natrona County International Airport, some 8 miles west-northwest of the Casper Post Office and about 200 feet higher in elevation.

The climate of Casper is semi-arid. Most of the air masses reaching this area move in from the Pacific and the mountains to the west are effective moisture barriers. About 70 percent of the annual precipitation occurs during the growing season of late spring and summer, mostly in thunderstorms. Monthly snowfall amounts are unusually uniform from November through February, and a bit heavier in March and April. Snow has occurred as early in the season as September and as late as early June.

Casper experiences large diurnal and annual temperature ranges. This is due to the advent of both warm and cold air masses and the relatively high elevation which permits rapid incoming and outgoing radiation. The mean daily temperature averages about 71 degrees in summer and 22 degrees in winter. Temperatures during winter months average a few degrees higher and summer temperatures average several degrees cooler than locations in the Missouri Valley to the east.

Windy days are quite frequent during winter and spring months. Usually the stronger winds are from the southwest and this tends to raise the temperature because the air is moving downslope.

Based on the 1951-1980 period, the average first occurrence of 32 degrees Fahrenheit in the fall is September 22 and the average last occurrence in the spring is May 22.

METEOROLOGICAL DATA FOR 2008
CASPER (KCPR)

LATITUDE: 42 ° 53'N | LONGITUDE: -106° 28'W | ELEVATION (FT): GRND: 5318 BARO: 5351 | TIME ZONE: MOUNTAIN (UTC -7) | WBAN: 24089

	ELEMENT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE °F	MEAN DAILY MAXIMUM	30.7	37.9	43.9	55.7	63.4	76.6	90.6	86.5	73.0	59.8	50.9	33.3	58.5
	HIGHEST DAILY MAXIMUM	48	51	60	77	85	93	99	99	85	80	71	56	99
	DATE OF OCCURRENCE	05	29+	24	29	21	30	27	01	25	02+	02	02	AUG 01
	MEAN DAILY MINIMUM	10.3	17.6	20.6	23.6	36.0	41.9	52.5	50.1	38.5	29.9	26.6	7.2	29.6
	LOWEST DAILY MINIMUM	-11	3	10	10	20	34	37	36	25	17	11	-20	-20
	DATE OF OCCURRENCE	21	15+	28	01	02	08	13	28	24	27+	27+	15	DEC 15
	AVERAGE DRY BULB	20.5	27.8	32.3	39.7	49.7	59.3	71.6	68.3	55.8	44.9	38.8	20.3	44.1
	MEAN WET BULB	17.8	23.9	27.1	31.8	42.5	48.8	55.2	52.9	44.6	37.0	32.2		
	MEAN DEW POINT	9.4	16.6	18.8	19.2	35.7	39.1	41.5	38.9	33.3	27.3	22.3		
	NUMBER OF DAYS WITH:													
	MAXIMUM >= 90°	0	0	0	0	0	3	20	13	0	0	0	0	36
	MAXIMUM <= 32°	16	7	5	0	0	0	0	0	0	1	2	13	44
	MINIMUM <= 32°	31	29	31	27	8	0	0	0	7	23	19	29	204
	MINIMUM <= 0°	6	0	0	0	0	0	0	0	0	0	0	9	15
H/C	HEATING DEGREE DAYS	1374	1075	1007	755	466	177	8	26	280	618	780	1380	7946
	COOLING DEGREE DAYS	0	0	0	0	0	12	219	136	8	0	0	0	375
RH	MEAN (PERCENT)	60	64	62	50	65	53	40	40	51	56	55	62	55
	HOUR 05 LST	63	69	72	66	80	73	64	63	73	69	60	66	68
	HOUR 11 LST	53	53	47	32	47	34	21	29	32	41	42	54	40
	HOUR 17 LST	61	65	57	38	50	36	22	23	39	55	56	63	47
	HOUR 23 LST	64	68	73	66	79	72	56	51	63	65	64	63	65
S	PERCENT POSSIBLE SUNSHINE													
W/O	NUMBER OF DAYS WITH:													
	HEAVY FOG(VISBY <= 1/4 MI)	2	0	2	1	2	0	0	0	1	3	0	3	14
	THUNDERSTORMS	0	0	0	0	6	6	5	1	5	1	0	0	24
CLOUDNESS	SUNRISE-SUNSET: (OKTAS)													
	CEILOMETER (<= 12,000 FT.)													
	SATELLITE (> 12,000 FT.)													
	MIDNIGHT-MIDNIGHT: (OKTAS)													
	CEILOMETER (<= 12,000 FT.)													
	SATELLITE (> 12,000 FT.)													
	NUMBER OF DAYS WITH:													
	CLEAR													
	PARTLY CLOUDY													
	CLOUDY													
PR	MEAN STATION PRESS. (IN.)	24.61	24.61	24.65	24.62	24.63	24.70	24.75	24.73	24.81	24.81	24.74	24.58	24.69
	MEAN SEA-LEVEL PRESS. (IN.)	30.05	29.98	30.00	29.91	29.87	29.88	29.86	29.86	30.04	30.10	30.06	30.03	29.97
WINDS	RESULTANT SPEED (MPH)	15.1	12.0	8.4	7.2	2.0	4.2	1.3	2.1	2.6	4.4	7.8	10.2	6.2
	RES. DIR. (TENS OF DEGS.)	22	23	23	25	31	26	27	24	25	24	24	23	24
	MEAN SPEED (MPH)	17.6	14.9	13.2	11.8	9.9	9.9	8.2	8.4	7.9	9.8	11.9	14.0	11.5
	PREVAIL.DIR.(TENS OF DEGS.)	22	22	22	22	24	24	22	22	23	22	22	22	22
	MAXIMUM 2-MINUTE WIND													
	SPEED (MPH)	64	45	46	49	39	49	43	37	35	30	40	53	64
	DIR. (TENS OF DEGS.)	22	22	25	23	08	35	01	25	25	30	21	22	22
	DATE OF OCCURRENCE	05	01	29	20	22	18	06	21	22	29	04	25	JAN 05
	MAXIMUM 3-SECOND WIND:													
	SPEED (MPH)	78	54	56	64	52	64	60	49	43	44	49	68	78
	DIR. (TENS OF DEGS.)	23	21	24	24	08	22	01	20	25	23	22	22	23
	DATE OF OCCURRENCE	05	01	29	20	22	25	06	25	22	03	04	25	JAN 05
PRECIPITATION	WATER EQUIVALENT:													
	TOTAL (IN.)	0.30	0.37	0.69	1.27	4.26	0.57	0.66	0.72	0.74	1.58	0.36	0.38	11.90
	GREATEST 24-HOUR (IN.)	0.11	0.18	0.25	0.39	1.11	0.21	0.52	0.53	0.27	0.54	0.19	0.17	1.11
	DATE OF OCCURRENCE	20-21	13-14	01-02	30	23-24	10	06	14-15	10-11	09-10	10-11	08	MAY 23-24
	NUMBER OF DAYS WITH:													
	PRECIPITATION 0.01	7	6	10	10	16	9	3	4	7	7	6	8	93
	PRECIPITATION 0.10	1	1	2	5	10	2	1	3	4	4	0	1	34
	PRECIPITATION 1.00	0	0	0	0	0	0	0	0	0	0	0	0	0
SNOWFALL	SNOW,ICE PELLETS,HAIL													
	TOTAL (IN.)	5.5	10.1	9.9	12.6	5.3	0.0	0.0	0.0	0.0	9.4	0.8	11.2	64.8
	GREATEST 24-HOUR (IN.)	1.9	3.4	2.0	3.5	4.8	0.0	0.0	0.0	0.0	5.0	0.6	4.4	5.0
	DATE OF OCCURRENCE	17	13	01	30	02					11	30	08	OCT 11
	MAXIMUM SNOW DEPTH (IN.)	4	3	2	1	1	0	0	0	0	5	T	3	5
	DATE OF OCCURRENCE	21	14	06+	24+	10+					12	14	08	OCT 12
	NUMBER OF DAYS WITH:													
	SNOWFALL >= 1.0	2	5	5	7	1	0	0	0	0	4	0	6	30

NORMALS, MEANS, AND EXTREMES
CASPER (KCPR)

LATITUDE: 42° 53'N LONGITUDE: -106° 28'W ELEVATION (FT): GRND: 5318 BARO: 5351 TIME ZONE: MOUNTAIN (UTC -7) WBAN: 24089

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE °F	NORMAL DAILY MAXIMUM	30	32.3	37.0	46.9	56.1	66.4	78.8	86.8	85.3	73.4	59.5	42.6	33.6	58.2
	MEAN DAILY MAXIMUM	60	33.7	37.8	45.7	56.2	66.8	78.5	87.8	85.8	74.2	60.5	44.6	35.4	58.9
	HIGHEST DAILY MAXIMUM	58	60	68	75	84	95	102	104	102	97	87	72	63	104
	YEAR OF OCCURRENCE		1971	1982	2004	1992	2003	1990	2006	1979	1995	1993	1999	1995	JUL 2006
	MEAN OF EXTREME MAXS.	60	50.6	54.9	65.3	75.7	84.4	93.1	97.8	95.7	89.9	79.0	63.5	52.3	75.2
	NORMAL DAILY MINIMUM	30	12.2	16.4	23.1	29.3	37.9	46.6	53.2	51.8	41.7	31.8	21.3	14.0	31.6
	MEAN DAILY MINIMUM	60	12.9	16.4	21.6	29.4	38.5	46.8	54.2	52.6	42.4	32.6	22.3	15.4	32.1
	LOWEST DAILY MINIMUM	58	-40	-32	-21	-6	16	28	30	33	16	-3	-21	-41	-41
	YEAR OF OCCURRENCE		1972	2006	1965	1997	1953	1969	1972	1977	1983	1971	1985	1990	DEC 1990
	MEAN OF EXTREME MINS.	60	-13.6	-8.6	0.0	13.7	26.3	35.8	43.9	41.4	28.6	16.1	-1.0	-10.3	14.4
	NORMAL DRY BULB	30	22.3	26.7	35.0	42.7	52.1	62.7	70.0	68.6	57.6	45.7	32.0	23.8	44.9
	MEAN DRY BULB	60	23.3	27.1	33.7	42.8	52.6	62.8	71.0	69.2	58.3	46.6	33.5	25.4	45.5
	MEAN WET BULB	25	20.6	22.3	28.7	35.0	43.3	49.7	54.5	52.9	45.2	36.4	27.1	21.3	36.4
	MEAN DEW POINT	24	14.9	16.7	22.5	27.4	36.3	42.1	46.1	43.8	36.8	28.8	21.1	15.0	29.3
	NORMAL NO. DAYS WITH:														
	MAXIMUM >= 90	30	0.0	0.0	0.0	0.0	*	4.7	13.2	11.5	1.8	0.0	0.0	0.0	31.2
	MAXIMUM <= 32	30	13.0	8.3	3.4	1.2	*	0.0	0.0	0.0	0.1	0.9	6.6	12.1	45.6
	MINIMUM <= 32	30	29.3	26.0	26.4	19.1	6.3	0.2	*	0.0	3.6	15.0	25.0	28.3	179.2
	MINIMUM <= 0	30	6.7	3.6	1.0	0.2	0.0	0.0	0.0	0.0	0.0	0.1	1.8	5.0	18.4
H/C	NORMAL HEATING DEG. DAYS	30	1312	1073	921	661	393	118	16	25	233	582	975	1262	7571
	NORMAL COOLING DEG. DAYS	30	0	0	0	0	3	64	182	152	27	0	0	0	428
RH	NORMAL (PERCENT)	30	65	65	62	59	58	52	46	45	50	57	62	64	57
	HOUR 05 LST	30	69	71	74	76	80	76	71	69	68	69	69	69	72
	HOUR 11 LST	30	60	58	53	47	44	37	32	32	37	46	54	58	47
	HOUR 17 LST	30	63	57	47	43	41	33	27	26	31	42	57	62	44
	HOUR 23 LST	30	70	70	71	69	70	64	56	54	59	65	67	67	65
S	PERCENT POSSIBLE SUNSHINE														
W/O	MEAN NO. DAYS WITH:														
	HEAVY FOG(VISBY <= 1/4 MI)	45	1.0	0.9	1.3	1.3	0.9	0.5	0.3	0.2	0.7	1.3	1.1	0.8	10.3
	THUNDERSTORMS	60	0.0	0.0	0.3	1.3	5.8	7.9	8.6	6.5	2.9	0.5	0.1	0.0	33.9
CLOUDNESS	MEAN:														
	SUNRISE-SUNSET (OKTAS)	46	5.3	5.2	5.4	5.4	5.3	4.2	3.4	3.5	3.6	4.1	5.0	4.9	4.6
	MIDNIGHT-MIDNIGHT (OKTAS)	32	4.8	4.8	5.1	5.0	4.8	3.9	3.4	3.2	3.4	4.0	4.7	4.5	4.3
	MEAN NO. DAYS WITH:														
	CLEAR	46	6.9	6.3	5.6	5.5	5.7	9.9	13.5	12.9	12.8	11.1	7.0	8.0	105.2
	PARTLY CLOUDY	46	8.0	8.4	8.9	8.9	10.6	11.2	10.8	10.7	8.5	7.9	8.3	8.1	110.3
	CLOUDY	46	16.1	13.5	16.5	15.6	14.8	8.9	6.1	6.8	8.0	11.4	14.1	14.2	146.0
PR	MEAN STATION PRESSURE(IN)	25	24.68	24.67	24.65	24.65	24.67	24.72	24.79	24.79	24.77	24.74	24.70	24.68	24.71
	MEAN SEA-LEVEL PRES. (IN)	25	30.09	30.06	29.97	29.92	29.88	29.87	29.91	29.93	29.97	30.02	30.05	30.10	29.98
WINDS	MEAN SPEED (MPH)	25	15.5	14.0	12.8	11.8	10.9	10.5	9.5	9.7	10.2	11.3	13.9	15.3	12.1
	PREVAIL.DIR(TENS OF DEGS)	30	23	23	23	25	25	25	25	23	25	23	23	23	23
	MAXIMUM 2-MINUTE:														
	SPEED (MPH)	12	64	51	49	49	45	54	52	46	44	51	51	53	64
	DIR. (TENS OF DEGS)		22	20	24	23	23	26	29	26	25	24	25	22	22
	YEAR OF OCCURRENCE		2008	1999	1999	2008	2005	2002	2005	2006	2003	2004	1998	2008	JAN 2008
	MAXIMUM 3-SECOND														
	SPEED (MPH)	12	78	66	60	64	54	66	70	56	59	63	63	68	78
	DIR. (TENS OF DEGS)		23	20	25	24	24	27	05	27	26	02	22	22	23
	YEAR OF OCCURRENCE		2008	1999	1999	2008	2002	2002	2006	1998	2005	2006	2007	2008	JAN 2008
PRECIPITATION	NORMAL (IN)	30	0.58	0.64	0.90	1.52	2.38	1.43	1.29	0.73	0.98	1.14	0.82	0.62	13.03
	MAXIMUM MONTHLY (IN)	58	1.42	1.42	2.43	3.92	6.46	4.69	3.54	2.66	3.40	4.62	2.72	3.71	6.46
	YEAR OF OCCURRENCE		1987	1987	1954	1974	1978	2003	2007	1979	1982	1998	1983	1982	MAY 1978
	MINIMUM MONTHLY (IN)	58	T	.13	0.12	0.08	0.30	0.03	0.09	0.02	0.07	T	0.05	0.03	T
	YEAR OF OCCURRENCE		1952	2005	2004	1992	1966	1956	1991	1950	1956	1965	2007	1952	OCT 1965
	MAXIMUM IN 24 HOURS (IN)	58	0.82	0.60	1.00	3.00	2.61	2.34	2.07	2.22	2.04	2.49	1.21	1.64	3.00
	YEAR OF OCCURRENCE		1987	1995	1958	1974	1978	1982	1983	2007	1989	1962	1983	1982	APR 1974
	NORMAL NO. DAYS WITH:														
	PRECIPITATION >= 0.01	30	7.6	7.5	9.4	10.4	11.4	8.9	8.1	6.0	6.8	7.3	7.2	7.7	98.3
	PRECIPITATION >= 1.00	30	0.0	0.0	0.0	0.1	0.4	0.2	0.3	*	0.1	0.1	0.0	0.1	1.3
SNOWFALL	NORMAL (IN)	30	11.1	10.7	12.3	13.8	4.9	0.1	0.0	0.0	2.0	7.1	12.0	11.9	85.9
	MAXIMUM MONTHLY (IN)	57	24.0	23.8	36.2	56.3	24.6	3.0	T	T	11.5	21.0	37.1	62.8	62.8
	YEAR OF OCCURRENCE		1987	1952	1975	1973	1978	1969	1996	2006	1982	2003	1983	1982	DEC 1982
	MAXIMUM IN 24 HOURS (IN)	57	14.0	11.0	14.6	16.5	14.1	3.0	T	T	6.9	16.0	14.3	31.1	31.1
	YEAR OF OCCURRENCE'		1987	1987	1954	1973	1950	1969	1994	1993	1995	1998	1983	1982	DEC 1982
	MAXIMUM SNOW DEPTH (IN)	49	15	12	12	20	12	2	0	0	6	12	14	21	21
	YEAR OF OCCURRENCE		1949	1987	1954	1973	1973	1995			1965	1971	1979	1982	DEC 1982
	NORMAL NO. DAYS WITH:														
	SNOWFALL >= 1.0	30	3.7	3.9	3.7	3.2	1.2	0.0	0.0	0.0	0.5	2.0	3.4	3.2	24.8

PRECIPITATION (inches) 2008 CASPER (KCPR)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1979	0.81	0.39	1.31	0.83	2.25	1.31	1.22	2.66	0.18	0.50	0.75	0.36	12.57
1980	0.81	0.63	1.19	0.35	2.82	0.10	0.85	0.65	0.10	0.64	0.74	0.37	9.25
1981	0.46	0.23	0.77	1.56	3.51	0.37	1.27	0.50	0.23	0.76	0.75	0.43	10.84
1982	0.41	0.33	0.60	1.25	2.10	4.15	1.92	0.88	3.40	1.18	0.55	3.71	20.48
1983	0.42	0.35	2.29	2.28	1.40	3.76	2.61	0.75	0.20	0.88	2.72	0.75	18.41
1984	1.19	0.48	1.59	2.23	1.33	1.34	2.26	0.25	0.50	0.71	0.70	0.78	13.36
1985	0.79	0.61	0.52	1.25	1.37	1.32	1.57	0.09	1.09	0.46	1.56	1.05	11.68
1986	0.36	0.89	0.55	1.89	1.33	4.06	0.88	0.27	1.31	2.63	1.48	0.27	15.92
1987	1.42	1.42	1.43	0.35	1.40	0.70	1.93	1.80	0.59	0.55	0.77	0.63	12.99
1988	0.28	0.79	0.71	0.71	1.24	0.28	0.55	0.16	0.74	0.12	0.48	0.50	6.56
1989	0.16	1.37	0.49	0.72	2.77	1.95	0.28	1.00	3.22	1.17	0.34	0.31	13.78
1990	0.27	0.70	1.13	1.35	1.09	0.66	2.15	1.89	0.52	0.90	1.27	0.61	12.54
1991	0.54	0.38	0.45	1.42	4.75	1.70	0.09	0.61	0.40	0.55	1.18	0.34	12.41
1992	0.17	0.35	1.27	0.08	2.05	0.79	1.51	0.86	0.29	0.22	0.90	0.88	9.37
1993	0.72	1.00	0.52	2.37	2.85	2.79	0.86	1.14	0.97	1.14	0.87	0.68	15.91
1994	0.60	0.82	0.57	0.90	0.37	0.22	2.66	0.85	0.68	4.17	1.79	0.37	14.00
1995	0.84	0.95	0.50	1.66	6.31	3.62	0.43	0.04	2.56	1.07	0.62	0.34	18.94
1996	0.94	0.24	0.56	1.72	1.29	0.83	1.26	.32	.47	1.64	1.06	.51	10.84
1997	0.57	0.69	0.92	1.79	1.99	1.21	1.46	0.76	1.21	0.83	0.08	0.53	12.04
1998	0.49	0.56	0.52	1.00	0.73	2.67	1.99	0.59	0.79	4.62	0.42	0.10	14.48
1999	0.22	0.30	0.45	1.53	2.29	1.78	0.24	0.11	1.30	0.25	0.36	0.10	8.93
2000	0.46	0.54	0.58	1.18	3.32	0.86	0.22	0.95	1.65	0.38	0.20	0.36	10.70
2001	0.31	0.38	0.18	1.07	0.63	0.29	1.19	0.31	1.09	0.42	0.76	0.13	6.76
2002	0.04	0.17	0.64	0.77	1.15	0.51	1.07	0.53	1.12	0.59	0.24	0.19	7.02
2003	0.10	0.51	0.97	1.54	0.51	4.69	0.40	1.68	1.38	0.60	0.30	0.39	13.07
2004	0.03	0.64	0.12	1.17	1.07	0.54	2.58	0.44	1.75	0.87	0.58	0.07	9.86
2005	0.15	0.13	0.83	1.04	2.63	0.41	1.32	2.24	0.23	1.18	0.56	0.29	11.01
2006	0.73	0.66	0.76	1.03	0.94	0.68	0.82	1.45	1.40	0.94	0.84	0.57	10.82
2007	0.52	0.26	1.36	0.37	2.86	0.72	3.54	2.57	0.71	1.08	0.05	0.74	14.78
2008	0.30	0.37	0.69	1.27	4.26	0.57	0.66	0.72	0.74	1.58	0.36	0.38	11.90
POR= 60 YRS	0.50	0.56	0.89	1.40	2.10	1.38	1.18	0.72	0.95	1.01	0.70	0.54	11.93

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AVERAGE TEMPERATURE (°F) 2008 CASPER (KCPR)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1979	8.8	23.6	35.4	43.7	49.3	61.8	70.8	67.7	62.1	47.8	26.5	28.7	43.9
1980	16.4	27.5	31.0	44.2	51.6	64.4	72.2	66.4	59.7	46.5	33.8	34.3	45.7
1981	31.4	29.9	38.0	48.3	51.4	64.3	71.8	69.2	62.0	44.4	39.0	27.3	48.1
1982	20.1	25.7	36.6	41.1	51.1	60.3	70.7	73.7	56.9	45.2	32.2	23.3	44.7
1983	31.2	31.5	36.3	38.0	48.4	60.4	71.2	74.8	60.3	49.7	31.2	10.9	45.3
1984	21.9	27.5	34.4	39.1	54.5	61.5	70.4	71.2	52.5	40.1	34.8	22.9	44.2
1985	16.1	19.7	33.3	45.5	55.3	61.3	71.6	66.7	53.4	45.3	20.3	21.3	42.5
1986	31.6	28.5	42.8	44.4	50.9	67.4	69.0	69.3	55.5	45.9	32.0	26.2	47.0
1987	23.1	28.4	32.4	49.7	57.5	64.8	70.7	66.2	58.7	46.7	35.5	23.8	46.5
1988	20.3	27.4	32.0	46.0	54.2	72.6	73.5	69.8	58.0	49.8	34.0	26.3	47.0
1989	26.1	11.9	35.6	44.9	54.0	61.2	73.4	69.0	58.2	46.3	37.3	24.1	45.2
1990	29.1	27.9	35.4	44.3	50.5	64.6	69.8	68.5	63.2	46.3	36.9	15.8	46.0
1991	21.3	35.5	36.5	42.0	51.8	65.0	71.5	72.0	59.5	46.0	30.4	27.9	46.6
1992	28.1	36.3	40.7	49.0	56.2	63.7	67.3	68.4	61.1	50.7	32.3	21.9	48.0
1993	21.5	19.6	38.3	43.9	56.2	60.3	66.7	68.0	58.2	47.4	29.4	28.9	44.9
1994	29.0	25.2	41.5	46.8	61.0	68.4	71.4	73.4	62.8	45.6	32.1	31.8	49.1
1995	27.3	30.9	36.9	40.4	48.4	59.4	69.0	72.6	58.0	44.0	37.2	28.4	46.0
1996	20.9	28.3	30.8	43.3	50.3	64.3	69.9	67.9	55.8	44.1	32.5	26.0	44.5
1997	21.3	24.7	37.0	34.9	51.6	63.2	69.0	68.4	60.0	46.9	32.0	22.8	44.3
1998	25.6	31.2	31.8	42.7	54.4	56.0	72.7	69.9	64.7	44.8	38.4	24.5	46.4
1999	27.6	32.9	37.7	39.1	49.9	60.9	71.8	70.0	54.4	47.2	43.8	29.9	47.1
2000	27.3	33.8	36.8	44.4	54.9	61.2	72.7	72.4	57.2	45.9	21.2	19.9	45.6
2001	24.6	21.8	35.2	45.0	54.9	65.0	73.8	72.1	61.3	45.7	38.7	25.3	47.0
2002	24.0	26.7	25.8	42.8	50.3	65.4	73.6	66.6	58.6	38.3	33.0	28.5	44.5
2003	31.2	22.2	35.4	45.5	53.3	59.5	73.3	72.4	55.3	49.0	29.4	29.0	46.3
2004	28.0	27.0	37.4	44.0	53.3	60.1	68.3	64.5	58.6	47.0	33.0	29.8	45.9
2005	28.2	32.2	36.0	42.4	50.7	61.9	72.7	66.3	61.1	48.3	37.7	24.7	46.9
2006	30.9	23.5	34.2	46.6	54.4	67.7	75.3	69.8	54.6	44.4	36.0	27.5	47.1
2007	19.1	27.8	40.6	43.0	54.2	64.0	74.8	70.6	59.2	47.5	35.6	20.9	46.4
2008	20.5	27.8	32.3	39.7	49.7	59.3	71.6	68.3	55.8	44.9	38.8	20.3	44.1
POR= 60 YRS	23.3	27.1	33.7	42.8	52.6	62.8	71.0	69.2	58.3	46.6	33.5	25.4	45.5

HEATING DEGREE DAYS (base 65°F) 2008 CASPER (KCPR)

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
1979-80	0	41	118	523	1149	1116	1505	1081	1048	617	408	75	7681
1980-81	0	44	176	566	931	943	1036	979	829	494	418	86	6502
1981-82	15	17	129	633	775	1161	1385	1097	873	709	423	173	7390
1982-83	4	0	276	604	977	1287	1040	930	881	802	506	156	7463
1983-84	22	0	190	468	1009	1673	1331	1082	941	769	332	146	7963
1984-85	0	0	386	767	899	1298	1512	1264	973	578	297	151	8125
1985-86	0	51	355	606	1337	1348	1031	1017	678	613	434	37	7507
1986-87	4	7	282	586	986	1196	1293	1018	1001	453	235	67	7128
1987-88	26	59	204	561	880	1271	1377	1084	1016	564	339	21	7402
1988-89	2	15	223	465	924	1191	1201	1484	905	597	336	162	7505
1989-90	0	14	214	574	825	1261	1107	1032	912	614	442	116	7111
1990-91	22	3	111	570	835	1523	1349	819	875	681	403	49	7240
1991-92	5	0	192	587	1031	1140	1140	825	747	478	283	81	6509
1992-93	33	71	136	443	972	1328	1341	1266	821	625	266	168	7470
1993-94	40	25	208	543	1063	1111	1108	1109	720	544	142	31	6644
1994-95	12	11	105	595	980	1023	1158	948	862	729	507	188	7118
1995-96	17	3	259	645	825	1129	1361	1059	1056	649	447	66	7516
1996-97	2	24	279	644	968	1202	1347	1123	863	897	410	76	7835
1997-98	33	25	177	556	981	1301	1212	942	1023	664	319	266	7499
1998-99	0	1	104	618	792	1250	1149	891	840	768	460	146	7019
1999-00	7	6	316	548	631	1082	1162	900	865	615	314	144	6590
2000-01	0	0	258	583	1306	1390	1247	1206	920	596	312	100	7918
2001-02	0	0	154	588	781	1225	1265	1064	1207	661	457	83	7485
2002-03	1	45	217	823	952	1123	1037	1192	911	576	378	175	7430
2003-04	0	26	295	490	1061	1108	1140	1096	850	620	360	158	7204
2004-05	26	74	207	553	951	1084	1134	913	890	670	436	152	7090
2005-06	7	41	152	513	813	1241	1051	1159	947	542	332	17	6815
2006-07	4	15	313	631	863	1153	1414	1037	750	653	333	107	7273
2007-08	0	16	216	534	872	1362	1374	1075	1007	755	466	177	7854
2008-	8	26	280	618	780	1380							

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COOLING DEGREE DAYS (base 65°F) 2008 CASPER (KCPR)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1979	0	0	0	0	0	62	187	129	37	0	0	0	415
1980	0	0	0	0	1	64	232	93	20	0	0	0	410
1981	0	0	0	0	0	73	235	155	45	0	0	0	508
1982	0	0	0	0	0	41	188	275	37	0	0	0	541
1983	0	0	0	0	0	24	220	309	56	0	0	0	609
1984	0	0	0	0	14	48	175	197	15	0	0	0	449
1985	0	0	0	0	4	48	210	109	13	0	0	0	384
1986	0	0	0	0	0	117	135	150	0	0	0	0	402
1987	0	0	0	0	8	68	211	100	20	0	0	0	407
1988	0	0	0	0	12	252	273	170	20	0	0	0	727
1989	0	0	0	0	0	56	268	148	18	0	0	0	490
1990	0	0	0	0	0	113	176	120	65	0	0	0	474
1991	0	0	0	0	1	54	214	225	31	4	0	0	529
1992	0	0	0	4	18	50	108	186	27	2	0	0	395
1993	0	0	0	0	1	33	98	123	10	4	0	0	269
1994	0	0	0	2	25	141	218	278	46	0	0	0	710
1995	0	0	0	0	0	28	150	247	57	1	0	0	483
1996	0	0	0	0	0	49	160	121	9	0	0	0	339
1997	0	0	0	0	0	32	161	138	32	0	0	0	363
1998	0	0	0	0	0	5	247	162	104	0	0	0	518
1999	0	0	0	0	0	30	226	167	4	0	0	0	427
2000	0	0	0	0	7	36	244	235	33	0	0	0	555
2001	0	0	0	0	5	105	279	225	48	0	0	0	662
2002	0	0	0	0	7	106	272	103	32	0	0	0	520
2003	0	0	0	0	22	17	262	263	12	0	0	0	576
2004	0	0	0	0	3	17	136	67	26	0	0	0	249
2005	0	0	0	0	0	65	251	91	42	3	0	0	452
2006	0	0	0	0	10	107	330	168	5	0	0	0	620
2007	0	0	0	0	6	82	308	200	47	0	0	0	643
2008	0	0	0	0	0	12	219	136	8	0	0	0	375

SNOWFALL (inches) 2008 CASPER (KCPR)

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
1979-80	0.0	0.0	0.0	3.6	16.5	8.8	22.1	13.5	17.3	3.7	15.7	0.0	101.2
1980-81	0.0	0.0	0.0	6.1	10.0	7.9	9.9	7.3	5.0	10.3	0.4	0.0	56.9
1981-82	0.0	0.0	0.0	5.8	7.3	6.1	10.0	6.1	9.3	17.8	6.3	T	68.7
1982-83	0.0	0.0	11.5	11.3	2.5	62.8	4.4	6.2	27.7	23.3	1.9	0.0	151.6
1983-84	0.0	0.0	0.3	1.3	37.1	12.0	19.4	7.6	26.1	33.6	5.7	0.0	143.1
1984-85	0.0	0.0	3.1	9.4	6.1	10.2	14.7	10.5	9.7	11.6	0.0	0.0	75.3
1985-86	0.0	0.0	7.0	4.8	28.3	14.4	6.2	13.4	6.1	16.3	9.4	0.0	105.9
1986-87	0.0	0.0	0.0	16.1	17.2	5.5	24.0	22.7	16.4	3.3	T	0.0	105.2
1987-88	0.0	0.0	0.0	5.0	3.4	11.8	5.9	13.7	13.6	8.9	4.9	0.0	67.2
1988-89	0.0	0.0	T	T	7.5	10.1	4.9	21.5	6.3	6.0	T	T	56.3
1989-90	0.0	T	0.0	6.4	3.2	5.6	4.4	12.8	12.4	4.6	2.5	T	51.9
1990-91	T	T	0.0	7.1	13.8	9.5	10.2	5.9	5.9	15.1	0.4	T	67.9
1991-92	0.0	0.0	T	7.6	16.8	4.7	3.6	3.7	10.3	T	T	T	46.7
1992-93	0.0	T	0.0	1.2	16.5	13.2	12.6	12.5	5.4	19.5	0.4	0.0	81.3
1993-94	0.0	T	0.4	5.0	11.2	12.2	11.2	12.1	6.8	4.8	0.0	0.0	63.7
1994-95	T	0.0	4.9	14.7	22.4	6.4	10.8	16.9	4.5	10.2	8.0	2.1	100.9
1995-96	0.0	0.0	7.1	13.4	8.7	6.6	16.2	6.1	8.3	13.6			
1996-97	T			14.1	13.9								
1997-98						23.8	11.0	7.7	9.1	5.5			
1998-99				20.2	6.0	4.0	4.9	5.0	8.0	20.8	1.0	0.0	
1999-00	0.0	0.0	T	6.0	3.6	2.6	13.2	8.1	7.6	18.9	0.0	0.0	60.0
2000-01	0.0	0.0	11.5	3.1	11.1	14.2	5.1	11.3	2.1	4.7	3.8	0.0	66.9
2001-02	0.0	0.0	0.0	2.4	8.7	3.8	1.4	6.4	14.2	10.8	8.3	0.0	56.0
2002-03	0.0	0.0	0.0	7.8	6.9	2.4	0.4	9.2	19.4	7.0	0.4	0.0	53.5
2003-04	0.0	0.0	2.5	21.0	5.2	11.2	0.8	18.9	1.5	6.0	1.0	0.0	68.1
2004-05	0.0	0.0	0.0	3.5	15.3	1.9	9.2	2.4	10.0	13.5	0.0	T	55.8
2005-06	0.0	0.0	0.0	3.5	10.5	4.8	11.0	16.0	15.8	8.3	5.0	0.0	74.9
2006-07	0.0	T	0.0	4.9	4.4	8.9	13.9	4.3	14.1	3.7	11.3	T	65.5
2007-08	0.0	0.0	0.0	3.0	0.8	16.1	5.5	10.1	9.9	12.6	5.3	0.0	63.3
2008-	0.0	0.0	0.0	9.4	0.8	11.2							
POR= 60 YRS	T	T	1.3	6.3	9.8	10.1	9.9	9.9	12.6	11.9	3.9	0.3	76.0

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REFERENCE NOTES :

PAGE 1:
THE TEMPERATURE GRAPH SHOWS NORMAL MAXIMUM AND NORMAL MINIMUM DAILY TEMPERATURES (SOLID CURVES) AND THE ACTUAL DAILY HIGH AND LOW TEMPERATURES (VERTICAL BARS).

PAGE 2 AND 3:
H/C INDICATES HEATING AND COOLING DEGREE DAYS.
RH INDICATES RELATIVE HUMIDITY
W/O INDICATES WEATHER AND OBSTRUCTIONS
S INDICATES SUNSHINE.
PR INDICATES PRESSURE.
CLOUDINESS ON PAGE 3 IS THE SUM OF THE CEILOMETER AND SATELLITE DATA NOT TO EXCEED EIGHT EIGHTHS(OKTAS).

GENERAL:
T INDICATES TRACE PRECIPITATION, AN AMOUNT GREATER THAN ZERO BUT LESS THAN THE LOWEST REPORTABLE VALUE.
+ INDICATES THE VALUE ALSO OCCURS ON EARLIER DATES.
BLANK ENTRIES DENOTE MISSING OR UNREPORTED DATA.
NORMALS ARE 30-YEAR AVERAGES (1971 - 2000).
ASOS INDICATES AUTOMATED SURFACE OBSERVING SYSTEM.
PM INDICATES THE LAST DAY OF THE PREVIOUS MONTH.
POR (PERIOD OF RECORD) BEGINS WITH THE JANUARY DATA MONTH AND IS THE NUMBER OF YEARS USED TO COMPUTE THE MEAN. INDIVIDUAL MONTHS WITHIN THE POR MAY BE MISSING.
WHEN THE POR FOR A NORMAL IS LESS THAN 30 YEARS, THE NORMAL IS PROVISIONAL AND IS BASED ON THE NUMBER OF YEARS INDICATED.
0.* OR * INDICATES THE VALUE OR MEAN-DAYS-WITH IS BETWEEN 0.00 AND 0.05.
CLOUDINESS FOR ASOS STATIONS DIFFERS FROM THE NON-ASOS OBSERVATION TAKEN BY A HUMAN OBSERVER. ASOS STATION CLOUDINESS IS BASED ON TIME-AVERAGED CEILOMETER DATA FOR CLOUDS AT OR BELOW 12,000 FEET AND ON SATELLITE DATA FOR CLOUDS ABOVE 12,000 FEET.
THE NUMBER OF DAYS WITH CLEAR, PARTLY CLOUDY, AND CLOUDY CONDITIONS FOR ASOS STATIONS IS THE SUM OF THE CEILOMETER AND SATELLITE DATA FOR THE SUNRISE TO SUNSET PERIOD.

GENERAL CONTINUED:
CLEAR INDICATES 0 - 2 OKTAS, PARTLY CLOUDY INDICATES 3 - 6 OKTAS, AND CLOUDY INDICATES 7 OR 8 OKTAS. WHEN AT LEAST ONE OF THE ELEMENTS (CEILOMETER OR SATELLITE) IS MISSING, THE DAILY CLOUDINESS IS NOT COMPUTED.
WIND DIRECTION IS RECORDED IN TENS OF DEGREES (2 DIGITS) CLOCKWISE FROM TRUE NORTH. "00" INDICATES CALM. "36" INDICATES TRUE NORTH.
RESULTANT WIND IS THE VECTOR AVERAGE OF THE SPEED AND DIRECTION.
AVERAGE TEMPERATURE IS THE SUM OF THE MEAN DAILY MAXIMUM AND MINIMUM TEMPERATURE DIVIDED BY 2.
SNOWFALL DATA COMPRISE ALL FORMS OF FROZEN PRECIPITATION, INCLUDING HAIL.
A HEATING (COOLING) DEGREE DAY IS THE DIFFERENCE BETWEEN THE AVERAGE DAILY TEMPERATURE AND 65 F.
DRY BULB IS THE TEMPERATURE OF THE AMBIENT AIR.
DEW POINT IS THE TEMPERATURE TO WHICH THE AIR MUST BE COOLED TO ACHIEVE 100 PERCENT RELATIVE HUMIDITY.
WET BULB IS THE TEMPERATURE THE AIR WOULD HAVE IF THE MOISTURE CONTENT WAS INCREASED TO 100 PERCENT RELATIVE HUMIDITY.

ON JULY 1, 1996, THE NATIONAL WEATHER SERVICE BEGAN USING THE "METAR" OBSERVATION CODE THAT WAS ALREADY EMPLOYED BY MOST OTHER NATIONS OF THE WORLD. THE MOST NOTICEABLE DIFFERENCE IN THIS ANNUAL PUBLICATION WILL BE THE CHANGE IN UNITS FROM TENTHS TO EIGHTS(OKTAS) FOR REPORTING THE AMOUNT OF SKY COVER.

NOTE:
The "Period of Record:(POR) for all "averages" is based on the "Summary of the Day First Order Station" and "Cooperative Summary of the Day" archives.

APPENDIX B-7.5

GEOLOGIC OR HYDROLOGIC SETTING FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 INTRODUCTION

NUREG 1569 Appendix A (NRC, 2003c) states that "*updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including ...the geologic or hydrologic setting*" shall be included. This section provides a review of geologic and hydrologic setting for the RR.

2.0 BACKGROUND

The last License Renewal submittal (RAMC, 1999) addressed the following for the SR-HUP site:

- Regional geology
- Site geology
- Seismology
- Surface water hydrology
- Groundwater hydrology

A brief summary of each topic above is provided based upon available literature and data collected from the site. This is followed by a conclusions section that provides an evaluation to assess whether "*updates and changes to any site characterization (geologic or hydrologic setting) information important to the evaluation of exposure pathways or doses*" has occurred since submittal and approval of the last Renewal submittal (RAMC, 1999). Data and interpretation for this topic is on a "regional" level. Given the immediately adjacent location of the RR to SR-HUP, there are no discernible differences between the geologic and hydrologic settings of these properties. The following discussion of SR-HUP geologic and hydrologic setting is applicable to RR.

3.0 REGIONAL GEOLOGY

Regional assessments of geology of the Powder River Basin and uranium deposits were conducted in the late 1960s and early 1970s (Davis, 1969; Langden, 1973; Harshman, 1968). Some of the more recent investigations performed have been focused on coal-bearing strata within the basin, and do not address the uranium bearing zones at the SR-HUP site (USGS, 2006). NUREG 1910 (NRC, 2009e) and other recent data (NRC, 2007a; USGS, 2010) was reviewed for any updates to the regional geologic setting, and this information is included in the summary below.

The license area is located in the southern portion of the Powder River Basin, which is in the unglaciated Missouri Plateau section of the Great Plains physiographic province (Thornbury, 1969). The Powder River Basin is synclinal, with the synclinal axis oriented in a general northwest-southeast direction along the western margin of the basin.

Of particular interest in the license area are the Tertiary-age formations as listed below:

- Formation (Age) Years
  - White River (Oligocene) 25-40 million
  - Wasatch (Eocene) 40-55 million
  - Fort Union (Paleocene) 45-65 million

The uranium-bearing sandstones mined at SR-HUP lie within the Fort Union and Wasatch formations. In the Powder River Basin, recoverable ore that can be mined by ISR methods is located in parts of the Wasatch Formation, extending from depths of 400 to 1000 feet below the surface (Davis, 1969). The Fort Union Formation underlies the Wasatch Formation, and, to a limited extent, is also a host to sandstone-type uranium deposits (NRC, 2009e).

The uranium deposits in the Powder River Basin are stratabound and genetically related to geochemical interfaces, or roll fronts. The roll-front ore deposits are usually multiple C-shaped rolls distorted by variations in gross lithology. The principle ore minerals are uraninite, coffinite, metatyuyamunite, and carnotite (NRC, 2009e).

The source of uranium in sandstone-type deposits in central Wyoming has been supported by different theories (NRC, 2009e). The most popular of these theories are: (1) leaching uranium from overlying ash-fall tuffs; (2) leached uranium from the igneous and metamorphic rocks in the highlands surrounding the basins; (3) leached uranium from the host sandstones themselves; and (4) hydrothermal uranium from a magma source at depth (Harris and King, 1993). Combinations of theories have been proposed as well (Boberg, 1981). Uranium deposits at SR-HUP and the RR are thought to derive largely from (1) leached uranium from the igneous and metamorphic rocks in the highlands surrounding the basins, (2) from leached uranium from the sandstones themselves; and (3) from leaching uranium from overlying ash-fall tuffs.

In the late Paleocene uplift, inland masses surrounded the Powder River Basin and accelerated subsidence in the southern portion of the basin, resulting in thick sequences of arkosic sediments being deposited. Arkosic sediments were derived from the granitic cores of the Laramie and Granite Mountains exposed to weathering and erosion by the Laramide uplift. Uranium contained in these arkosic facies constitutes the oldest ore zones in the SR-HUP-RR area.

Continued acceleration of uplift in the Laramie and Granite Mountains in central Wyoming resulted in further deposits of coarse clastic sediments. Since drainage was generally northward, the finer sediments were carried north toward the center of the basin. Rapidly flowing streams cut channels through the accumulating sediments near the basin margins. These streams eventually filled with coarse clastic sediments, providing zones of high transmissivity for mineralizing solutions that entered the area later.

During that time, and well into the Eocene, the Powder River Basin remained largely flat and portions of it were intermittently cut off from the main channels of surface water flows.

Near the end of the Eocene, northward tilting and deep weathering with minor erosion took place in the basin. Uranium migration and changes in concentrations occurred at that time. Subsidence resumed in the late Oligocene and continued through the Miocene and Pliocene (e.g. eras following Oligocene). A great thickness of tuffaceous sediments was deposited in the basin during at least a part of this period of subsidence. By the late Pliocene, regional uplift was taking place, leading to a general rise in elevation of several thousand feet. The massive erosional pattern that characterizes much of the Powder River Basin began with this Pliocene uplift and continues to the present.

4.0 SITE GEOLOGY

The Wasatch Formation is the youngest bedrock unit throughout most of the license area. It consists of interbedded claystones, silty sandstones, and relatively clean sandstones (Sharp and Gibbons, 1964). As a result of active stream erosion, approximately 500 feet of the Wasatch Formation remains in the central and east-central portions of the license area, and none of the formation in the southwestern portion of the licensed area.

The surface contact between the Wasatch Formation and the underlying Fort Union Formation roughly parallels the axis of the Powder River Basin through the southwestern portion of the license area. The interbedded claystones, siltstones, and relatively clean sandstones in the Wasatch vary in degree of lithification, from uncemented to moderately well cemented sandstones, and from weakly compacted and cemented claystones to fissile shales.

The Fort Union Formation in the Powder River Basin is lithologically similar to the Wasatch Formation. Throughout the license area, the Fort Union Formation includes interbedded silty claystones, sandy siltstones, relatively clean sandstones, and claystones with a few thin coal seams occurring locally. The degree of lithification is quite variable, ranging from virtually uncemented sands to moderately well cemented siltstones and sandstones. The total thickness of the Fort Union Formation in the license area is approximately 3000 feet.

Both the Wasatch and Fort Union strata are highly lenticular, with numerous facies changes within short lateral distances. In some cases, it is essentially impossible to trace even relatively thick stratigraphic units more than a few thousand feet. On the other hand, some units can be traced for miles.

One shale layer, marking the top of the Fort Union Formation, is believed to persist throughout the license area. This shale, designated locally as the "P" shale, averages over 60 feet thick. Approximately 500 feet of alternating sandstones and shales of the Wasatch Formation overlie the "P" shale in the vicinity of the SR CPP. The sandstone beds generally are 40 to 100 feet thick and alternate with shales that range from 20 to

50 feet thick. Some of the lower sandstones in the Wasatch are mineralized. Below the "P" shale are about 400 feet of sediments, largely sandstone, that include the mineralized zones to be mined.

5.0 SEISMOLOGY

The area of east central Wyoming, where the licensed area is situated, lies in a low seismicity region of the United States. Although distant earthquakes may produce shocks strong enough to be detected on the Powder River Basin, the region is ranked to be one of minor seismic risk as there have been only a few smaller earthquakes documented in the area, southwest of the site (USGS, 2010) (see Figure A-7.5-1).

Figure A-7.5-2 (USGS, 2010) shows the nearby faults that have been reported to cause earthquakes in the last 1.6 million years. Faulting has also not been evident from the numerous wells drilled and logged, and corresponding geophysical log interpretations associated with the development of new mine units since the last license Renewal submittal. The maximum ground accelerations for the area are reported as 0.03 g to 0.04g (g being gravity, where 1 g is equivalent to 9.81 m/sec^2) with a 10 percent chance of occurrence in 50 years (USGS, 2010) (see Figure A-7.5-3). Further, in the unlikely event that an earthquake does occur during the life of the facility, it is not considered to be of a magnitude that would disturb the operations or facilities at SR-HUP (Christenson, 1994).

6.0 SURFACE WATER HYDROLOGY

The RR area is located in the Duck Creek, Willow Creek and Brown Springs Creek drainages all attendant to the Dry Fork of the Little Cheyenne River. The Little Cheyenne River is part of the Cheyenne River Drainage system in the southern part of the Powder River Basin. The only natural surface water in the permit area is ephemeral runoff in response to intermittent precipitation and seepage into small basins at low points in the Duck Creek, Willow Creek and Broun Springs Creek drainages. Surface runoff is very limited, surrounding stock ponds collect some runoff for livestock and wildlife consumption, but are dry most of the year. Some stock ponds on the licensed area are fed by a pumped well and will contain water for longer durations. From 2000 through 2008, the mean annual precipitation was 9.3 inches, which is a couple of inches lower than average. A review of the precipitation record indicates that this was due to two unusually dry years, 2001 and 2002, when only 6.8 inches and 7.0 inches of precipitation were recorded, respectively (NCDC, 2008). These two years correspond to a well documented drought in Wyoming (NCDC, 2002). When these two years are excluded, the mean average precipitation since the last license Renewal submittal in November 1999 was 11.7 inches, or within one percent of the long-term average. These data indicate that outside of the extreme drought years of 2001 and 2002, precipitation amounts have not changed appreciably for the site and would not alter surface water hydrology at the site.

7.0 GROUNDWATER HYDROLOGY

Descriptions of the geologic formations of the Powder River Basin and their hydrologic properties have been discussed in numerous publications (Hodson, 1971; Whitcomb et al., 1958). The primary hydrologic units of interest for ISR for the license area are the Wasatch Formation and the Fort Union Formation. There are no known wells within the license area less than 30 feet deep, and only three wells less than 100 feet deep within the uppermost alluvial deposits at the site. Therefore, there is very little information on water in the alluvial deposits.

Small amounts of precipitation infiltrate the alluvium during part of the year, and the intermittent flow in drainage channels across the alluvium may provide some recharge to localized perched water tables in the alluvium. However, since the water table is typically more than 100 feet below the land surface throughout the license area, most of the recharge flows through the alluvium to the Wasatch Formation.

The Wasatch Formation typically consists of lenticular fine- to coarse-grained sandstones with interbedded claystones and siltstones. This formation ranges from 0 to approximately 500 feet thick in the license area and includes some of the more important shallow aquifers in the Powder River Basin (NRC, 2009e). Most properly constructed wells completed in a Wasatch aquifer yield from 5 to 15 gallons per minute (gpm). However, the water supply well (WW-103) for the SR-HUP located at the SR Main Office/CPP can produce 140 gpm from a completion interval of approximately 120 feet containing four separate lenses. This well is 474 feet deep and above the uppermost mining unit (PRI, 2004e).

For the most part, the upper Wasatch aquifers occur under water table (unconfined) conditions. Artesian (confined) aquifers near the base of the formation are separated from overlying formations and from each other by impermeable claystone or mudstone layers. The Wasatch Formation is considered a good water supply for limited development; however, the formation does crop out in the license area and the amount of ground water available is difficult to assess.

The Fort Union Formation underlies the Wasatch Formation beneath most of the license area, but in the southwestern portion of the area, the Fort Union lies directly beneath the surface. Typically, it is comprised of lenticular sandstones with interbedded claystones and siltstones (NRC, 2009e). The Fort Union is as much as 3,000 feet thick beneath the SR Main Office/CPP site.

The Fort Union Formation also includes important aquifers in the Powder River Basin, and most of the wells in the vicinity of the plant site penetrate this formation. While most wells tap these aquifers for small (5 to 20 gpm) water volumes, test wells completed in the Fort Union have produced as much as 560 gpm.

The Wasatch and Fort Union aquifers are separated by a relatively thick impermeable shale (locally designated the "P" shale). Similar separation of aquifers within the Fort Union is common, and wells completed in these layers are often found to be under artesian pressure. There have been approximately

20,000 holes and wells drilled in the licensed area by numerous companies since the early 1960s. There have been no boreholes or wells drilled in the licensed area that has encountered flowing artesian conditions.

Confined sandstone beds of the Fort Union Formation are the uranium-bearing aquifers at the SR-HUP. The Fort Union Formation contains multiple confined sandstone aquifers in the eastern and northeastern parts of the license area, but is unconfined in the southwestern and western parts of the site (NRC, 2009e). Hydrologic characteristics of the Fort Union have been illustrated by previous pump tests at the SR-HUP provided in the previous Renewal submittal, and O-Sand and U/S-Sand pump tests (NRC, 2006c).

8.0 CONCLUSIONS

Evaluation of recent regional and local geologic data, seismicity, surface hydrology and groundwater hydrology were conducted and compared to data contained in the last Renewal submittal (RAMC, 1999) to assess whether any updates or changes have occurred important to the evaluation of exposure pathways or doses for the RR.

The regional geologic descriptions in the literature (NRC, 2006c; NRC, 2009e) are consistent with past descriptions. There have been no changes or updates to regional and site geology, or groundwater hydrology that would be important to evaluation of exposure pathways or doses, specific to the RR.

Surface water hydrology is consistent with past descriptions (NRC, 2009e). Activities on the RR have been limited to installation of monitoring wells, drilling for ore body delineation, installation of a deep disposal well and pumphouse, and improvements to the road leading to the drilling staging area. These activities have not impacted surface water on the RR and would not have any significant effect on the previous evaluation of exposure pathways or doses.

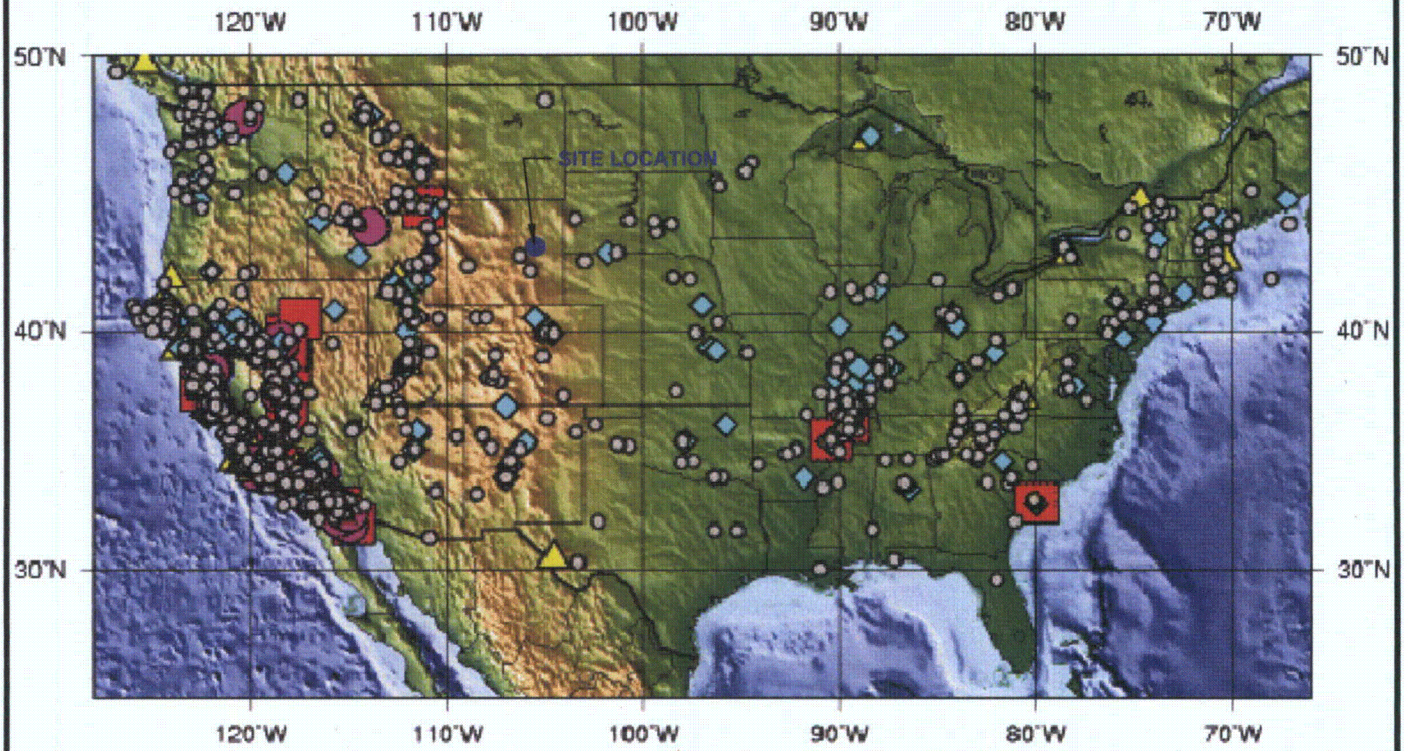
Recent seismology data was also reviewed. This data is important as any faults within mined units could provide preferential pathways for groundwater impacted by mining operations to migrate vertically from the active mine unit area. There are no faults within the SR-HUP/RR area (USGS, 2010) (see Figure A-7.5-2). Further, mine unit assessments have not found any indication of faulting in mine units brought into operation since the last License Renewal submittal. Monitoring of units both above and below active units also provides evidence that no preferential pathways as would be created by faults exists as monitoring data for these units have shown no excursions (see Section A-4). Thus, a review of recent data on faulting shows no changes or updates that would be important to the evaluation of exposure pathways or doses.

FIGURES FOR APPENDIX B-7.5

US Earthquakes Causing Damage

1750 - 1996

Modified Mercalli Intensity VI - XII



Intensity

- VI
- VII
- VIII
- IX
- X-XII

Prepared by:
USGS National Earthquake Information Center

Data Source:
Seismicity of the United States, 1750 - 1989
Preliminary Determination of Epicenters, 1990 - 1996

REFERENCE

1. U.S.G.S., 2010 EARTHQUAKE HAZARDS PROGRAM.

PROJECT
CAMECO RESOURCES
SMITH RANCH-HIGHLAND LICENSE RENEWAL
CONVERSE COUNTY, WYOMING

TITLE
US EARTHQUAKES CAUSING DAMAGE 1750-1996 MODIFIED MERCALLI INTENSITY VI-XII

Golder Associates
DENVER, COLORADO

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REVIEW	KFM	03/05/10		

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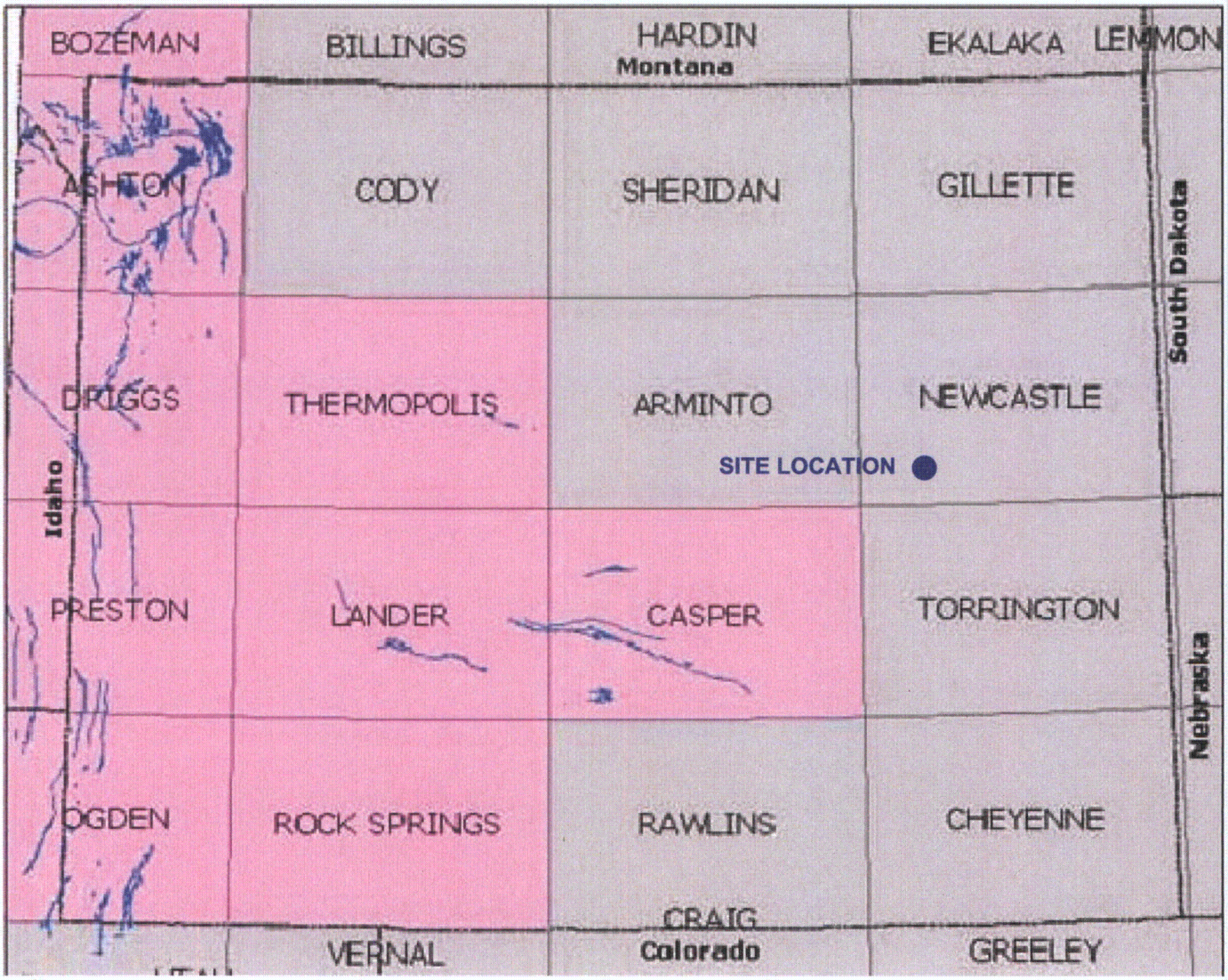

REFERENCE

1. U.S.G.S., 2010 SEISMIC HAZARDS PROGRAM.

PROJECT

CAMECO RESOURCES
SMITH RANCH-HIGHLAND LICENSE RENEWAL
CONVERSE COUNTY, WYOMING

TITLE

FAULTS CAUSING EARTHQUAKES IN LAST 1.6 MILLION YEARS

Golder Associates
DENVER, COLORADO

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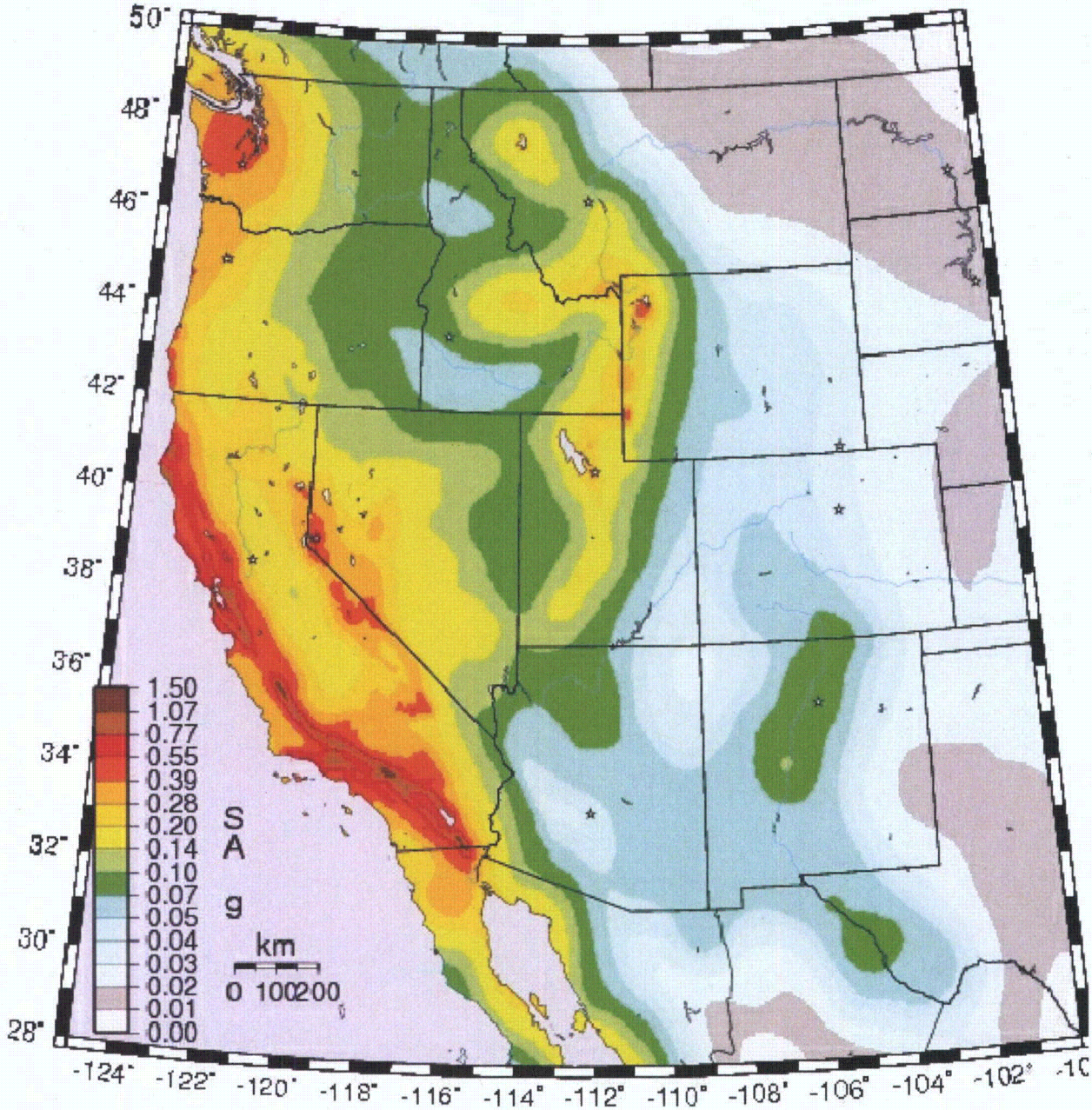

REFERENCE

1. U.S.G.S., 2010 PROBABILISTIC SEISMIC HAZARDS ASSESSMENT CRUSIAL AND SUBDUCTION SOURCES. 2 Hz FREQUENCY WITH 10% PROBABILITY IN 50 YEARS.

PROJECT

CAMECO RESOURCES
SMITH RANCH-HIGHLAND LICENSE RENEWAL
CONVERSE COUNTY, WYOMING

TITLE

GROUND ACCELERATION
2 Hz FREQUENCY WITH 10%
PROBABILITY IN 50 YEARS

Golder Associates
DENVER, COLORADO

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REVIEW	KFM	03/05/10		

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APPENDIX B-7.6

ECOLOGY FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 INTRODUCTION

NUREG 1569 Appendix A (NRC, 2003c) states that "*updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including ...ecology*" shall be included in a license renewal application. This requirement is addressed for Cameco Resources' Source Material License SUA-1548 for the RR in this appendix. The following sections provide background, discussion of changes to ecology, and the importance of the changes to exposure pathways and doses as applicable to the RR property.

2.0 BACKGROUND

NUREG 1569, Section 2.1 (NRC, 2003c), describes the area of NRC review for ecology for original license applications as follows:

> "*The staff should review the descriptions and inventories of the flora and fauna in the vicinity of the site, including habitats and distribution. The review should include terrestrial and aquatic organisms on or near the site, and their relative (qualitative) abundance should be established. ...If important species are determined to be present, the staff should evaluate any likely detrimental effects on the organism by the proposed facility and its operations.*"

This requirement was met most recently in the application for RR Amendment No. 11 in December 2004 (PRI, 2004e), which provides a comprehensive description of the ecology at SR-HUP and the surrounding area. The RR property is immediately adjacent to the SR-HUP. As such, the discussion of Ecology for the SR-HUP presented in Appendix A-7.6 is equally relevant to the RR and is summarized below.

3.0 SUMMARY OF ECOLOGY AND UPDATES

Vegetation in the SR-HUP and RR is a typical northern plains short grass prairie forage characteristic of areas of low annual precipitation. Dominant plant species present are Sage Brush, Western Wheatgrass, Needlegrasses, Blue Gramma and Threadleaf Sedge. Detailed vegetation studies have been presented in previous license applications and environmental assessments (RAMC, 1999; PRI, 2004e; NRC, 2007a). These studies are incorporated here by reference.

Studies and observations of wildlife within the license boundaries of SR-HUP and RR, and in the surrounding vicinity have been presented in previous applications and environmental assessments (RAMC, 1999; PRI, 2004e; NRC, 2007a). These studies are incorporated here by reference. Important game species include the Pronghorn Antelope, Cottontail Rabbit, Sage Grouse, Mourning Dove and Mule Deer. Non-game species are typical of the sage brush grassland habitat in the region and include small mammals (e.g. mice, ground squirrels) and carnivores (e.g. raptors, coyotes). There have been no overall changes to the types and distribution of flora and fauna at the SR-HUP and RR since the previous assessments.

The U.S. Fish and Wildlife Service, Mountain-Prairie Region web site lists endangered and threatened species for Converse County, Wyoming. The species listed for Converse County exist only within habitats (e.g. along the North Platte River) that do not exist within the license area (USFWS, 2009). Therefore, there have been no changes or updates to the ecology of endangered or threatened species in and adjacent to the license area.

The State of Wyoming is in the process of finalizing "core areas" of protection for the Greater Sage Grouse, which in March 2010 the U.S. Fish and Game Department designated as "warranted but precluded" from listing under the Endangered Species Act. To protect the bird and to increase the likelihood of it not being listed as Endangered, the state's Sage Grouse Implementation Team appointed by the Governor has mapped proposed core protection areas based on the number of active leks and other factors. At present, the Reynolds Ranch is outside of sage grouse core area.

The state is developing stipulations that will limit and control development within core area and has established working groups, including a working group for the uranium industry, to develop proposed stipulations that would detail the type and extent of operations permitted while protecting the bird.

4.0 IMPORTANCE OF UPDATES TO ECOLOGY AND CONCLUSIONS

There have been no changes to the flora, fauna and threatened/endangered species for the license area of the SR-HUP and RR. In its Environmental Assessment prepared for the addition of SR-2, the NRC (NRC, 2007a) concluded the following:

> *"Wildlife losses were not expected to result in any long-term decrease in any wildlife populations since the number lost due to construction and operation of ISL activities at Smith Ranch (including SR-2) is expected to be a very small percentage of the total population. Further, wildlife populations are expected to rebound as the disturbed areas are reclaimed."*

Impacts to flora were previously evaluated in license applications (RAMC, 1999; PRI, 2004e). Impacts to vegetation are temporary and limited to areas of disturbance at mine wellfields, satellite facilities and the Central Processing Plant. Final reclamation and re-seeding of the disturbed areas would occur after the cessation of ISR operations. Vegetation would be affected by spills of injection and production fluids during operations. However, Cameco Resources' spill documentation, per NRC's requirements, will be used during decommissioning to identify any impacted soils. Affected areas will be re-seeded with a WDEQ approved seed mixture. Since no updates or changes to flora or fauna have occurred in the license area, and Cameco Resources' reporting and decommissioning procedures prevent any long-term impacts to the ecology, the previous conclusion that the ecology will not experience any significant adverse impact due to operations of the SR-HUP and RR remains valid.

APPENDIX B-7.7

TRANSPORTATION FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 INTRODUCTION

This section provides a review of the impacts of transportation for RR.

NUREG 1569 Appendix A (NRC, 2003c) states that "*updates and changes to any site characterization information important to the evaluation of exposure pathways and doses, including other environmental features,*" shall be included in a license renewal application. Other environmental features include transportation. The impacts to transportation in and around the SR-HUP site were updated most recently in relation to the addition of RR Amendment No. 11 (NRC, 2007c), Satellite SR-2 through Amendment No. 12 (NRC, 2007a) and the Final EA for Toll Mining through Amendment No. 15 (NRC, 2009f. The 2007 and 2009 updates to impacts of transportation for SR-HUP are documented in Appendix A-7.7. These updates are considered representative of the RR due to the following:

- The RR property is immediately adjacent to SR-HUP. Thus the transportation impacts within the boundaries of SR-HUP and RR are virtually identical;
- RR is in a developmental mode without any transportation-related activities, and therefore, under this License Renewal submittal has had no impact on transportation RR; and
- When the RR is actively mined, onsite transportation will include movement of drilling rigs, ion exchange resin tankers, and routine maintenance traffic (Cameco Resources' vehicles), similar to current practices at the SR-HUP. Offsite transportation has been addressed, as noted above, in recent license amendments.

The assessment of transportation impacts for the SR-HUP property is also applicable to the RR and is presented in the following sections.

2.0 BACKGROUND

NUREG 1569, Section 2.10 (NRC, 2003c), describes the area of NRC review for other environmental features for original license applications as follows:

> "*The staff should consider environmental information provided in this section as auxiliary information to support an application for a given facility. The information should be considered in a site-specific context and should be consistent with the information provided in other sections of the application.*"

The transportation impacts information presented in the recent license amendments (NRC, 2007a, NRC, 2009a) was reviewed to assess whether there have been any updates or changes that might impact the evaluation of exposure pathways and doses.

3.0 SUMMARY OF TRANSPORTATION AND UPDATES

The SR-HUP facility is accessed via Ross Road (Converse County 31). Ross Road begins at the junction of State Routes 93 and 95 in south-central Converse County, and it extends generally to the northwest

where it ends at the intersection with State Route 387 in Campbell County, Wyoming. Increased traffic to the site as well as the potential for accidents was evaluated by the NRC (NRC, 2007a; NRC, 2009a).

On-site transportation impacts that are directly related to RR (2007 to present) include:

- Improvements made to the road within the RR property, leading to the drilling staging area;
- Drilling and construction vehicle traffic associated with installation of a deep disposal well and associated pumphouse;
- Vehicular traffic associated with installation of monitoring wells; and
- Vehicular traffic associated with plug drilling for delineation of the ore body.

Under License Condition 9.1 in SUA-1548 Amendment No. 11 "... *operations of the ...Reynolds Ranch facilities shall be limited to shipments of loaded ion exchange (ix) resin or yellowcake slurry which will be transported to the central processing plant at Smith Ranch*" (NRC, 2007c). When RR is active, it will have minimal impact with respect to current onsite and offsite traffic.

4.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, could be presented. Following NRC guidance relating to license renewals in NUREG-1569, Appendix A, Cameco Resources has examined the RR historical facility operations, including updates and changes to transportation impacts for the RR as summarized in the sections above, and has determined that no new or significant information can be added at this time. Previously submitted information relating to transportation impacts for the RR is still relevant and is hereby incorporated by reference.

APPENDIX B-8

ENVIRONMENTAL EFFECTS OF SITE OPERATIONS INCLUDING DATA ON RADIOLOGICAL AND NON-RADIOLOGICAL EFFECTS, ACCIDENTS, AND THE ECONOMIC AND SOCIAL EFFECTS OF OPERATIONS FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 INTRODUCTION

This appendix (Appendix B-8) of the License Renewal submittal for Source Material License SUA-1548 has been prepared in conformance to NUREG-1569, "*Standard Review Plan for In Situ Leach Uranium Extraction License Applications*" (NRC, 2003c). The approach to preparation of license renewal applications as presented in NUREG-1569 Appendix A is streamlined, requiring the licensee to present "*compliance history or record of site operations and changes*" to the NRC for review. Further, NUREG-1569 Appendix A states that:

> *"Aspects of the facility and its operations that have not changed since the last license renewal or amendment should not be reexamined".*

The information and data presented in the license renewal submittal can therefore be optimized, to present:

- By reference, any previously submitted documentation in areas that have not changed;
- The record of site operations demonstrating that health, safety and environment have been protected throughout the previous license period; and
- Any "new or significant" information, describing aspects of facility or operations that have changed during the previous license period.

This approach allows for the NRC review to be keenly focused on "*only those changes proposed by license renewal or amendment application*" (NRC, 2003c).

2.0 APPENDIX B-8 CONTENT

Appendix B-8 has been prepared to conform with NUREG-1569 Appendix A guidance, specifically:

> *"Environmental effects of site operations including data on radiological and non-radiological effects, accidents, and the economical and social effects of operations.*" (NRC, 2003c)

Appendix B-8 is specifically focused on the RR which was included under Cameco Resources' Source Material License SUA-1548 by Amendment No. 11 (NRC, 2007c). Topics covered in Appendix B-8 include the following:

- B-8.1: Release and Accident History for Reynolds Ranch Satellite Facility
- B-8.2: Historical Groundwater and Surface Water Monitoring Program for Reynolds Ranch Satellite Facility
- B-8.3: Assessment of Occupational Radiation Exposure and Dose Data for Reynolds Ranch Satellite Facility
  - B-8.3-1: Historical Radiation Monitoring Program Assessment for Reynolds Ranch Satellite Facility
  - B-8.3-2: Historical Results of Radiation Dose Calculations for Reynolds Ranch Satellite Facility

- B-8.3-3: Historical Bioassay Program Assessment for Reynolds Ranch Satellite Facility
- B-8.3-4: Historical Occupational Exposure Rate Monitoring Assessment for Reynolds Ranch Satellite Facility

- B-8.4: Historical Airborne Effluent and Environmental Monitoring Program Assessment for Reynolds Ranch Satellite Facility
- B-8.5: Historical Quality Assurance Program Assessment for Reynolds Ranch Satellite Facility
- B-8.6: Cumulative Effects of Operations for Reynolds Ranch Satellite Facility

The topics discussed in Appendix B-8 are incorporated by reference to previously submitted documentation, due to the inactive status of the RR since its inclusion under SUA-1548.

APPENDIX B-8.1

RELEASE AND ACCIDENT HISTORY FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 INTRODUCTION

This section provides a review of the impacts of spills and releases for the RR. RR is currently an undeveloped area of the SR-HUP under Source Materials License SUA-1548.

In accordance with SUA-1548 License Condition 12.1:

> *"Until license termination, the licensee shall maintain documentation on spills of source or 11e(2) byproduct materials (including mining solutions) and process chemicals. Documented information shall include, but not be limited to: date, spill volume, total activity of each radionuclide released, radiological survey results, soil sample results (if taken), corrective actions, results of post remediation surveys (if taken), and a map showing the spill location and the impacted area."* (NRC, 2007c)

Further, License Condition 12.1 requires the licensee to maintain and follow procedures for evaluation of consequences of any spill and to determine if reporting to the NRC Operations Center is necessary. The timing of initial notification and written reports to the NRC and WDEQ are also described in License Condition 12.1.

2.0 SUMMARY OF SPILLS AND RELEASES FOR RR

Since its inclusion under the SR-HUP license SUA-1548, the RR has been inactive as a mining operation. There have been no spills requiring documentation, evaluation of consequences against reporting criteria, notification or report submittal to the NRC or WDEQ as to Cameco Resources' activities on the RR Satellite Facility.

3.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of information previously provided to the NRC to assess whether there is "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569, Appendix A (NRC, 2003c), Cameco Resources has examined the RR historical facility operations, including documentation of spills or releases for the RR as summarized in the sections above, and has determined that no new or significant information can be added at this time. Consequently, previously submitted information relating to areas covered in this appendix is still relevant and is hereby incorporated by reference.

This approach is consistent with NUREG-1569 (Page xvii) guidance that the application for renewal need not resubmit a complete application covering all aspects of facility operation and should instead only submit information containing changes from the currently accepted license.

APPENDIX B-8.2

SURFACE AND GROUNDWATER MONITORING HISTORY FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 INTRODUCTION

This section provides a summary and review of data from the Groundwater and Surface Water Monitoring Programs for the RR. Cameco Resources has Groundwater and Surface Water Monitoring Programs in place for the SR-HUP property to monitor well fields that are in production or restoration. When the RR is actively mined, it will fall under the existing monitoring programs. Since its inclusion by Amendment No. 11 to SUA-1548 in 2007 (NRC, 2007c), RR has been inactive and there has been no monitoring of groundwater or surface water performed for this site. The following sections present the regulatory background for Groundwater and Surface Water Monitoring Programs, and a conclusion that no "new or significant" information related to groundwater and surface water monitoring for the RR can be presented at this time with the exception of updated SR-HUP Application Addendum D6-8 for Surface and Ground Water Rights for T35_R74, T36_R72, T36_R73, T36_R74, T37_R73 and T37_R74 that have been prepared and included in this submittal on an accompanying CD under a separate PDF file due to the extensive nature of the information contained in the tables. Previous submittals leading to NRC approval of Amendment No. 11 for inclusion of the RR under SUA-1548 are still relevant and are incorporated by reference.

2.0 GROUNDWATER MONITORING BACKGROUND FOR RR

Potential impacts to groundwater resources can occur from various facility activities and operations, for example excursions of leaching solutions from wellfields during production and/or restoration. The Groundwater Monitoring Program at SR-HUP-RR provides additional assurance that wellfields are safely operated and that groundwater excursions are detected in a timely fashion to prevent degradation of groundwater quality outside of the wellfields. The Program includes pre-operational and operational monitoring at wellfields, and monitoring at domestic and stock wells near operating wellfields (PRI, 2004e).

Since the previous License Renewal submittal (RAMC, 1999), groundwater monitoring has been conducted through sampling and analysis of wells surrounding active MUs at the SR-HUP and at domestic and stock wells located near the active MUs. The network of wells has been revised over time to adjust to changes in MU operational status (pre-operational, active operations or restoration).

Groundwater monitoring is conducted at MUs that are in operation to provide early detection of any migration of extraction fluids from the portion of the aquifer where uranium recovery occurs, which is referred to as the "production zone". Also, groundwater monitoring is performed on MUs undergoing restoration to evaluate the effectiveness of the restoration program. The monitoring program provides a means of detecting production fluids that may migrate outside the production zone into other portions of the MU, or into overlying or underlying aquifers. Therefore, groundwater is monitored in the production zone aquifer, overlying aquifer, and underlying aquifer.

Two types of monitor wells are used in the production zone aquifer as defined by their relative location to the ore body: wells completed in the mineralized production pattern area (designated as "MP" wells); and wells configured in a "ring" approximately 500 feet outside the mineralized production pattern (designated as "M" wells). MP-wells are initially used for obtaining pre-mining baseline data. During the MU's production phase, they are utilized for either injection or production, and in the post-mining phase they are used for restoration monitoring. The monitor ring ("M" wells) encircles the MU to ensure containment of mining solutions within the production zone.

Wells completed in the overlying aquifer are designated as "MS" or "MO" (monitoring "shallow" or "overlying"), and wells completed in the underlying aquifer are designated as "MD" or "MU" ("deep" or "underlying"). Some monitor wells are designated for water-level monitoring only because they pump dry during the evacuation of the required purge volume prior to sampling. In some cases, wells are designated Trend Wells and are located between the outer injection wells and the monitor ring to detect potential migration of fluids prior to impacting the monitor ring. The trend wells are not utilized as excursion indicators for compliance purposes.

2.1 Baseline, Production, and Restoration Monitoring

Baseline samples are collected prior to the mining operation in any given wellfield to characterize the aquifer and establish UCLs for excursion indicators and restoration targets. Baseline samples are sent to an accredited outside laboratory with an accompanying Chain of Custody to be analyzed for WDEQ, LQD Guideline 8 parameters. After four rounds of sampling are completed, the UCLs are established and approved by the WDEQ for the parameters of interest. Wells outside the mineralized production pattern of the production aquifer (M-wells) are monitored for water levels and excursion parameters (i.e., chloride, alkalinity, and conductivity) twice a month with at least 10 days between sampling events during production operations and every 60 days during restoration. Production pattern monitoring wells (MP-wells) are also monitored every 60 days during restoration operations to evaluate the restoration progress. The collected samples are analyzed in the on-site Chemical Laboratory and once a month split samples are sent to an outside accredited lab for quality assurance. Results for the excursion parameters are compared to the UCLs to determine if an excursion of production fluids has occurred. If concentrations of any two of the three excursion parameters exceed the UCLs, then the results indicate that an excursion has possibly occurred. Each month, approximately 1,700 samples are collected from monitoring wells at the SR-HUP.

When an excursion is first indicated by monitoring results, sampling is repeated within 24 hours of receiving the analytical data to confirm the excursion. If the excursion is confirmed, the NRC and WDEQ are notified, and subsequent sampling of the well is conducted at least every seven days for the UCL parameters and uranium. Weekly monitoring is continued until the excursion is no longer detected.

During restoration, the groundwater monitoring program continues, but with changes to the monitoring network and frequency of monitoring. At the start of restoration, the MP-Wells designated as restoration stability monitoring wells are sampled and analyzed for a baseline suite of water quality parameters. Following the initial sampling, the restoration stability monitoring MP-wells are sampled approximately every 60 days during active restoration, with samples analyzed for at least conductivity, chloride, and uranium. During the groundwater sweep stage of restoration, the monitoring frequency for monitoring wells in the production-depth aquifer, overlying aquifer and underlying aquifer is reduced to once every 60 days. Regulatory agencies are contacted if the wells cannot be monitored within 65 days of the last sampling event. Analysis for the excursion parameters continues throughout the restoration phase. Following concurrence from WDEQ that restoration has been achieved in a MU, a six month stability period is assessed, during which monitoring continues at the restoration stability monitoring MP-wells and the monitoring wells. During this period, the wells are sampled once every two months, with restoration stability monitoring MP-wells sampled for excursion parameters, uranium, total dissolved solids (TDS), and other parameters, if necessary, and monitoring wells sampled for excursion parameters.

2.2 Monitoring of Domestic and Livestock Wells

As part of the SR-HUP-RR Groundwater Monitoring Program, livestock and domestic wells within one kilometer of operating MUs have been sampled quarterly for natural uranium and radium-226 (Ra^{226}). Since the previous license renewal submittal, an additional nine MUs started operating, resulting in an increase in the number of livestock and domestic wells that are sampled quarterly. Additional groundwater monitoring sites for the RR will be added to the monitoring program when wellfield operations start in those areas.

Concentrations of natural uranium and RA226 from the livestock and domestic wells are compared to the Effluent Concentrations (EC) presented in 10 CFR Part 20, Appendix B. The limits presented in 10 CFR Part 20 are applicable to the assessment and control of dose to the public, and are equivalent to the radionuclide concentrations which, if ingested continuously over the course of a year, would produce a total effective dose equivalent of 0.05 rem. These EC's are 6×10^{-8} microCuries per milliliter (µCi/ml) for Ra^{226} and 3×10^{-7} µCi/ml for natural uranium (10 CFR 20).

3.0 SURFACE WATER MONITORING BACKGROUND FOR THE RR

The purpose of a surface water monitoring program is to detect any potential migration of contaminants from the site into nearby surface water bodies (NRC, 2003c). In general, the risk of contamination to surface water bodies from ISR operations is low when proper operational procedures are followed (NRC, 2003c). Surface water occurrence in drainages within the SR-HUP-RR license area is ephemeral and often drainages can remain dry for several years. This is due primarily to the overall low precipitation in the license area (Culler, 1961). Most of the high flow rates in the drainages in the license area result from

high-intensity storms (e.g. storms that produce a lot precipitation in a short time-frame) that are most likely to occur during May and June (Lowers, 1960).

3.1 Potential Impacts to Surface Water for the RR

In evaluating potential impacts to surface water at the SR-HUP-RR facilities, the following aspects of construction and operations were reviewed and evaluated:

- Relevant maps identifying surface water bodies, streams and Cameco Resource's assessment of likely consequences of surface water contamination to verify that their previous characterization is still relevant regarding impacts from site activities.
- Historical and renewal period records of precipitation, the presence of water in surface water features and analytical data from surface water sampling.
- Water use during the renewal period and anticipated future water uses.
- On-going construction activity such as road construction, erosion, run-off, construction equipment related spills/leaks impacts to surface waters and related habitats. These are covered under General Permit WYR-10-0000, General Permit to Discharge Storm Water Associated with Large Construction Activity under the Wyoming Pollutant Discharge Elimination System. A Storm Water Pollution Prevention Plan (SWPPP) has been prepared for implementation under this license (Tetra Tech, 2010a). It should be noted that the vast majority of construction activity at these facilities is temporary in nature. Surface water impacts from such activities have been eliminated, reduced and/or mitigated through thorough planning, design and best management construction methods as outlined in the SWPPP.
- Plant and Wellfield Operations. Plant process water and the discharge of stormwater is regulated under specific NPDES Permit Authorization Number-WYR000648 and facility implementation program/plans such as the SWPPP (Tetra Tech, 2010a) and Spill Prevention, Countermeasures Control Plan (SPCC) (Tetra Tech, 2010b). Storm water controls at the Smith Ranch Central Processing Plant and at the Highland Central Processing Facility (this facility is currently on standby and not operational) include multiple catchment basins that are of sufficient size to contain runoff from these areas. The catchment basins are inspected frequently and have never overfilled or discharged stormwater outside the berms.

A review of the NUREG-1910, Generic Environmental Impact Statement (GEIS) for ISR facilities in Eastern Wyoming (NRC, 2009e), also indicates that the NRC has determined that "*compliance with permit conditions during operations, aquifer restoration and decommissioning would reduce impacts to surface water from storm water runoff and discharges of treated water. For these reasons, potential impacts to surface waters from operations would be small.*"

3.2 Description of Surface Water Monitoring Program for RR

A network of ten (10) surface water monitoring points at stock ponds within the SR-HUP-RR is maintained by Cameco Resources. Quarterly sampling of Sage Creek and the stock ponds for analysis of uranium and Ra^{226} is conducted when adequate water exists to allow sampling. Flow generated from dewatering

of the underground mine during the 1970s was discharged into Sage Creek drainage and the stream was flowing at that time because of the dewatering. Samples were collected during that time-frame upstream and downstream to verify no discharge of contaminants, but these discharges are no longer occurring and dry conditions have limited sampling since that time.

The ten stock pond monitoring points were added in the Third Quarter of 2003 as a part of SUA-1548 Amendment 5, combining the SR-HUP operations. Sampling of the effluent from the Highland CPF was discontinued in the Third Quarter of 2003 since the Highland facility was placed on standby status. Sampling and analyses for natural uranium and Ra^{226} are conducted quarterly and reported in Semi-Annual Effluent Environmental Monitoring Reports that are provided to the NRC.

Surface water monitoring is not conducted at the RR since mining operations have not been initiated. Additional surface water monitoring sites for the RR will be added to the monitoring program when wellfield operations start in those areas.

4.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, could be presented. Following NRC guidance relating to license renewals in NUREG-1569, Appendix A, Cameco Resources has examined the RR historical facility operations, including updates and changes to groundwater and surface water monitoring programs as summarized in the sections above, and has determined that no new or significant information can be added at this time aside from the updated Groundwater and Surface Water Rights tables. Consequently, references cited within this and other relevant sections and previously submitted information relating to the historical groundwater and surface water monitoring program are still relevant and are hereby incorporated by reference.

APPENDIX B-8.3

ASSESSMENT OF OCCUPATIONAL RADIATION EXPOSURE AND DOSE DATA FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 INTRODUCTION

The following four sub-sections will provide assessment of workers' exposure to radiation through review of historical records for:

- Appendix B-8.3.1: Historical Radiation Monitoring Program Assessment for Reynolds Ranch Satellite Facility
- Appendix B-8.3.2: Historical Results of Radiation Dose Calculations for Reynolds Ranch Satellite Facility
- Appendix B-8.3.3: Historical Bioassay Program Assessment for Reynolds Ranch Satellite Facility
- Appendix B-8.3.4: Historical Occupational Exposure Rate Monitoring Assessment for Reynolds Ranch Satellite Facility

The following appendices address these topics as applied specifically to the RR. The RR is currently an unmined area of the SR-HUP under Source Materials License SUA-1548. Each of the following appendices provides background information on regulatory requirements and NRC guidance for monitoring of radionuclide exposure and occupational doses received by workers. The historical data from Cameco Resources employee monitoring programs, as applicable to RR, are presented. The historical data is reviewed and conclusions are presented.

Due to the minimal level of activity on the RR since its inclusion into the SR-HUP Source Materials License SUA-1548 in 2007, workers' radiation exposure and dose directly related to RR are the result of background radiation, and well below regulatory requirements.

APPENDIX B-8.3-1

HISTORICAL RADIATION MONITORING PROGRAM ASSESSMENT FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 HISTORICAL RESULTS OF AIRBORNE RADIATION MONITORING (OCCUPATIONAL)

This section provides an assessment of occupational radiation exposure due to airborne radionuclides for the RR.

2.0 REGULATORY REQUIREMENTS

Subpart C of 10 CFR Part 20 limits the TEDE limit for occupational workers to 5 rems/year, shallow dose equivalent to the skin to 50 rems/year, and dose equivalent to the embryo/fetus of a pregnant worker to 0.5 rem during the entire pregnancy. In order to limit the internal dose from radionuclide intakes, the NRC requires that work areas be routinely monitored and posted according to their exposure rate classification. In addition, radiation work permits for conducting non-routine tasks must contain information regarding radiation levels in the work areas. Monitoring programs focused on workplace airborne radionuclide concentrations are the most effective tool to evaluate and limit workplace internal doses due to inhalation of radioactive material. (10 CFR 20)

As per NRC License SUA-1548 Condition No. 9.7, NRC's Regulatory Guide 8.30, "*Health Physics Surveys in Uranium Recovery Facilities*," (NRC, 2002a) requires that airborne soluble uranium measurements be conducted weekly in airborne radioactivity areas (areas with the potential for air concentrations to be greater than 1 Derived Air Concentration [DAC]), and monthly in areas not designated as airborne radioactivity areas to determine toxicological intakes and radiobiological doses. Measurement of radon progeny should be collected monthly in areas where radon progeny routinely exceeds 10 percent of the DAC, and increased to weekly if radon progeny exceeds 25 percent of the DAC.

Buildings (or rooms within buildings) that contain or have the potential for airborne radionuclide concentrations exceeding 1 DAC are posted with the sign, "Caution Airborne Radioactivity Area". This posting provides workers and managers with information helpful in minimizing radiation doses.

3.0 AIRBORNE RADIATION MONITORING RESULTS FOR RR

Cameco Resources' monitoring program for occupational exposure due to airborne radionuclides is applicable to indoor work areas such as satellite IX facilities, header houses, and the SR CPP. No such work environments exist on the RR. Thus there are no monitoring results for RR.

4.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last License Renewal submittal. Following NRC

guidance relating to license renewals in NUREG-1569, Appendix A (NRC, 2003c), Cameco Resources has examined the RR historical facility operations, including occupational exposure to airborne radionuclides, determining that no changes have taken place as the RR is not presently nor has been in operation since incorporation into license SUA-1548. Consequently, references cited within this and other relevant sections and previously submitted information relating to uses of adjacent lands and waters are still relevant and are hereby incorporated by reference.

APPENDIX B-8.3-2

HISTORICAL RESULTS OF RADIATION DOSE CALCULATIONS FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 OVERVIEW

This section provides a review of worker radiation dose exposure data reported for the RR.

2.0 REGULATORY REQUIREMENTS

NRC licensees are required to develop and implement a radiation protection program that limits radiation doses to levels that are ALARA and within the occupational dose limits (10 CFR 20.1101 and 10 CFR 20.1201, respectively). Administrative and engineering controls are used to reduce radiation exposures.

Occupational dose limits are specified in 10 CFR 20.1201. The annual limits are the more limiting of: (i) a TEDE of 5 rem/year; (ii) the sum of the deep-dose equivalent and the committed dose to any organ (with exception of the lens of the eye) of 50 rem/year; (iii) the dose to the lens of the eye of 15 rem/year; and (iv) the dose to the skin or any extremity of 50 rem/year. In addition to the annual dose limits, the soluble uranium intake by a worker may not exceed 10 milligrams (mg) in a week. This limit is based on the chemical toxicity of uranium. For normal *in situ* recovery (ISR) operations, limiting the TEDE to 5 rem/year and the intake of uranium to 10 mg/week is the primary focus of the radiation protection program since exposure conditions are not such that high extremity and organ doses are limiting.

Worker monitoring requirements are specified in 10 CFR § 20.1001 to 20.2401 (Standards for Protection Against Radiation). Pursuant to NRC License SUA-1548 License Condition 9.7 and Section 9.11 of the NRC License application (NRC, 2008) employee exposures at SR-HUP and RR are monitored in accordance with NRC Regulatory Guides 8.30, "*Health Physics Surveys in Uranium Recovery Facilities,*" and NRC Regulatory Guide 8.34, "*Monitoring Criteria and Methods to Calculate Occupational Radiation Doses.*" Routine employee external doses are determined and recorded for those employees likely to receive more than 10 percent of the allowable occupational dose limit (i.e. 0.5 rem). External exposures are determined using personnel dosimeters that are exchanged periodically, or at the end of a task, depending on the expected exposure potential. Routine employee internal doses are determined and recorded for those employees likely to receive an intake of more than 10 percent of the ALI from radon daughters or uranium. Internal doses are determined by calculation using air quality data and time of exposures, or from the results of bioassay sampling.

Non-routine doses are determined and recorded for all employees conducting non-routine work activities that require a RWP. In the event that an employee has routine and non-routine doses for a monitoring period, doses are summed to determine the total dose. In accordance with NRC regulations, internal exposures are summed (e.g. quarterly, yearly) and the TEDE calculated by adding the dose equivalent from internal exposure to the dose equivalent from external sources of radiation.

3.0 WORKER EXPOSURES AND ALARA IMPLEMENTATION

Workers who have the potential for receiving 10 percent of the dose limits for internal or external radiation must be monitored. Cameco Resources conservatively interprets this requirement and monitors workers who would not be expected to reach the 10 percent dose threshold. Maintenance and wellfield personnel have been monitored although these work areas are not expected to reach the dose threshold. Long-term monitoring of the radiation doses received in satellite IX facilities, in on-site laboratories and in the CPP has also been performed. Historical results show the maximum TEDEs reported for workers at the SR-HUP are well below applicable standards (provided in Appendix A-8), are consistent with doses the NRC indicates to be representative of uranium ISR facilities, and are stable over the 10-year period since the last License Renewal submittal. Cameco Resources would expect the TEDE for the RR satellite and wellfields to be consistent with TEDEs observed at SR-HUP (provided in A-8.3.2).

4.0 SUMMARY OF HISTORICAL RESULTS OF RADIATION DOSES TO WORKERS FOR RR

A review of the historical results of radiation dose calculations for the SR-HUP is provided in Appendix A-8.3-2. In comparison to routine operations of active wellfields, satellite IX facilities and the CPP, the potential for radiation dose exposure being directly related to RR is minimal and considered background radiation. Review of radiation dose calculations shows that Cameco Resources' employees receive very low radiation doses, as provided in Appendix A-8.3.2.

5.0 CONCLUSIONS

With respect to this License Renewal Submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569, Appendix A (NRC, 2003c), Cameco Resources has examined the RR historical facility operations, including results of radiation dose calculations, determining that no changes have taken place as the RR is not presently nor has been in operation since incorporation into license SUA-1548. Consequently, references cited within this and other relevant sections and previously submitted information relating to historical radiation dose calculations are still relevant and are hereby incorporated by reference.

APPENDIX B-8.3-3

HISTORICAL BIOASSAY PROGRAM ASSESSMENT FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 OVERVIEW

This section provides a review of workers' exposure to radiation as measured through bioassays, and is specific to the RR. NRC licensees are required to limit workers' intake in areas with airborne radionuclides by sequential application of the following:

- Engineering controls;
- Controlled access;
- Limiting exposure time; and
- Use of respiratory protection.

Cameco Resources has implemented a bioassay program to monitor the effectiveness of the respiratory program, and to provide a quantitative method for estimating intakes of radioactive material. A review of the historical bioassay program for SR-HUP workers is provided in Appendix A-8.3-3.

2.0 REGULATORY REQUIREMENTS AND GUIDANCE

Bioassays are used to determine worker intakes when using respiratory protection as required by 10 CFR §20.1703. They are also used to ascertain the effectiveness of the health physics program, qualify the protectiveness of the respiratory protection program, and to demonstrate compliance with chemical toxicity limits for soluble uranium contained in 10 CFR 20.1201(e). Bioassays are required when workers have the potential for intakes of one-tenth of the ALI or more in a year, as well as for declared pregnant workers, occupationally exposed minors, and members of the public allowed access to airborne radioactivity areas. (10 CFR 20)

NRC Regulatory Guide 8.22, "*Bioassay at Uranium Mills*," (NRC, 1988a) provides guidance to licensees that have the potential for exposure to employees from airborne yellowcake dust. All new employees and contractors submit a baseline bioassay prior to commencement of work. Employees and contractors who will handle uranium or contaminated materials submit a bioassay two days after completion of work . Employees are requested to submit a bioassay at termination. Bioassays may be required for special situations requiring a RWP. The regulatory guide specifies a quality control program as well as a requirement that the analytical lower limit of detection (LLD) be less than 5 micrograms per liter (µg/l). The radiation dose equivalent associated with an intake resulting in a urinalysis result of 5 µg/l would be approximately 0.06 mrem.

Table 1 in Regulatory Guide 8.22 provides action levels for concentrations of uranium in bioassay results. For concentrations less than 15 µg/l, no action is required other than to review results. For concentrations between 15 and 35 µg/l, the results should be interpreted as an indicator that uranium confinement and air sampling may not provide an adequate margin of safety. The radiation dose associated with an intake

resulting in a urinalysis result between 15 and 35 µg/l would be approximately 0.17 and 0.4 mrem, respectively. A series of steps are suggested, including confirming the results through additional sampling, improving controls, and considering work restrictions for urinalysis. (NRC, 1988a)

Concentrations greater than 35 µg/l suggests that uranium confinement and perhaps air sampling programs may not be acceptable. Actions taken include those listed above for the 15 to 35 µg/L concentration range, and also include limiting operations until it is certain that no other workers will receive exposures in excess of 35 µg/l. Increased frequency of bioassay sampling is required and work restrictions for affected workers are also recommended for concentrations exceeding 35 µg/l. Two consecutive bioassays from the same employee with concentrations of uranium of 35 µg/l or greater, or a single bioassay with concentration of uranium of 130 µg/l or greater, is an indicator that the worker may have exceeded the regulatory limits on intake of soluble uranium. A series of additional action steps are specified for this scenario.

3.0 BIOASSAY RESULTS FOR RR

With respect to the RR, there are no work areas in which workers could potentially be exposed to airborne radionuclides. The Bioassay Program is not currently and will not be applicable to RR until there are indoor operations on the property.

4.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569, Appendix A (NRC, 2003c), Cameco Resources has examined the RR historical facility operations, including radiation exposure as measured by the bioassay program, and has determined that no changes have taken place as the RR is not presently nor has been in operation since incorporation into license SUA-1548. Consequently, references cited within this and other relevant sections and previously submitted information relating to historical bioassay program results is still relevant and is hereby incorporated by reference.

APPENDIX B-8.3-4

HISTORICAL OCCUPATIONAL EXPOSURE RATE MONITORING ASSESSMENT FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 INTRODUCTION

This section provides an assessment of the historical occupational exposure rate monitoring for the RR.

An assessment of the historical occupational exposure rate monitoring for the SR-HUP is presented in Appendix A-8.3-4. In active ISR mining and production facilities, Cameco Resources made many modifications to reduce the gamma exposure rates in work areas in the previous license period. The review, as documented in Appendix A-8.3-4, demonstrates that Cameco Resources has been in compliance with all of the applicable regulatory standards and license conditions pertaining to personnel exposures to radionuclides, external contamination limits and release limits to the environment during the period since the last License Renewal submittal in 1999. (RAMC, 1999)

The RR is and has been inactive since its inclusion under the SR-HUP license in 2007. As such there is no RR site-specific historical occupational exposure rate monitoring data to be assessed. When RR is actively mined, work activities will be included in the occupational exposure rate monitoring program already in place for SR-HUP. Background and regulatory requirements of exposure rate monitoring are briefly described in the following sections.

2.0 EXPOSURE RATE AND SURFACE CONTAMINATION MONITORING BACKGROUND

Within an ISR uranium facility, the major source of occupational dose to workers arises from exposure to gamma rays emanating from process piping and tanks, resin tanks, and uranium drying and packaging operations. The build-up of MU within tanks and process piping is the primary source of gamma radiation. MU is also responsible for generating Rn^{222}, which may be released and result in a source of internal exposure. The exposure rates presented in this section do not necessarily correlate with dose equivalents to workers from direct sources of radiation. This is because workers' dosimeters respond to the product of the exposure rate and the time that the workers are exposed. The time that a worker is in a work area depends on many factors, including worker efficiency and non-routine maintenance or repair requirements.

Controlling the buildup of MU is accomplished by cleaning tanks periodically to remove MU from the surfaces. Controlling surface contamination within work areas also limits employee contamination and transfer of material from the controlled area. Reducing the levels of surface contamination is achieved through good housekeeping practices and the proper planning of non-routine maintenance and repairs.

3.0 REGULATORY REQUIREMENTS

Subpart C of 10 CFR Part 20 limits the TEDE for occupational workers to 5 rems/year, shallow dose equivalent to the skin of 50 rems/year, and dose equivalent to the embryo/fetus of a pregnant worker to 0.5 rem during the entire pregnancy. In order to limit the exposure from direct radiation, the NRC requires that work areas be routinely monitored and posted according to their exposure rate classification. In addition, RWPs for conducting non-routine tasks should contain information regarding potential radiation exposures prior to and/or during completion of the work. (10 CFR 20)

NRC Regulatory Guide 8.30, "*Health Physics Surveys in Uranium Recovery Facilities (URF)*," suggests that gamma radiation surveys be conducted semi-annually at locations representative of workers' exposure to determine posting and external dosimetry requirements. Surveys in radiation areas are to be conducted quarterly. Regulatory Guide 8.30 also recommends that surface contamination be limited to approximately 220,000 disintegrations per minute per 100 square centimeters so that the contamination does not contribute to unacceptable airborne radionuclide concentrations. (NRC, 2002a)

4.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569, Appendix A, Cameco Resources has examined the RR historical facility operations, including occupational exposure rate monitoring, and has determined that no changes have taken place as the RR is not presently nor has been in operation since incorporation into license SUA-1548. Consequently, references cited within this and other relevant sections and previously submitted information relating to occupational exposure rate monitoring are still relevant and are hereby incorporated by reference..

APPENDIX B-8.4

HISTORICAL AIRBORNE EFFLUENT AND ENVIRONMENTAL MONITORING PROGRAM FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 EFFLUENT AIR MONITORING AND ENVIRONMENTAL GAMMA EXPOSURE RATES

This appendix presents the regulatory background for historical airborne effluent monitoring and gamma radiation exposure rate data as applicable to the RR.

This appendix also provides an overview of the existing air monitoring program for SR-HUP. When mining activity is initiated at the RR, it will be incorporated into the SR-HUP airborne effluent and environmental monitoring program.

2.0 RR AIRBORNE EFFLUENT MONITORING

There is an existing environmental monitoring station (AS-6) located at the RR Satellite Facility: AS-6 monitors conditions downwind of the RR Satellite Facility and is equipped with a track-etch detector and an environmental dosimeter for measurement of Rn^{222} and gamma radiation exposure rate. Track-etch detectors, and dosimeters are collected periodically and sent to an accredited outside laboratory for analysis. Prior to mining activities, AS-6 will be modified to also have a particulate high volume sampling capability.

Airborne effluent monitoring results for RR will be documented and included in a Semi-Annual Effluent and Environmental Monitoring Report prepared by Cameco Resources and submitted to the NRC.

3.0 REGULATORY REQUIREMENTS

Radiation dose limits for individual members of the public are specified in 10 CFR 20 Subpart D. NRC licensees are required to monitor the radiation levels and radioactive material in effluents released to the controlled and unrestricted areas to demonstrate compliance with the 0.1 rem TEDE limit to the public. The licensee may do this by:

- Demonstrating by measurement or calculation that the total effective dose equivalent to the individual likely to receive the highest dose from the licensed operation does not exceed the annual dose limit; or
- Demonstrating that the annual average concentrations of radioactive material released in gaseous and liquid effluents at the point of exposure do not exceed the effluent concentrations in 10 CFR 20, Appendix B, Table 2 and demonstrating that the external radiation sources would not exceed 0.002 rem in an hour or 0.05 rem in a year.

The dose limits are exclusive of the dose contribution from natural background radiation and from radiation doses received from the medical use of radiation and radioactive materials. Controlled areas of the site include a small exclusion area around the processing plants, the satellite plants, process water storage ponds, and small storage areas containing licensed material. Access to the license area is open to the public and therefore the limits apply to members of the public anywhere but the controlled area.

The ECs used for compliance purposes by Cameco Resources are those listed in 10 CFR 20 Subpart B for the radionuclides of concern. The limits and their likely solubility class are 3×10^{-12} microCuries per milliliter (μCi/ml) for U^{Nat} (Class D), 2×10^{-14} μCi/ml for Th^{230} (Class W), 9×10^{-13} μCi/ml for Ra^{226} (Class W), 6×10^{-13} μCi/ml for Pb^{210} (Class D), and 1×10^{-8} μCi/ml for Rn^{222} without progeny present. (10 CFR 20)

The program complies with guidance in NRC Regulatory Guide 4.14, Revision 1, "*Radiological Effluent and Environmental Monitoring at Uranium Mills*". Analytical LLD for the air particulate sampling program are specified as 1×10^{-16} μCi/ml for U^{Nat}, Ra^{226}, and Th^{230}; LLD for Rn^{222} is 2×10^{-10} μCi/ml; and the LLD for Pb^{210} is 2×10^{-15} μCi/ml. (NRC, 2007b)

4.0 MONITORING RESULTS FOR THE RR

Since its inclusion under the SR-HUP license SUA-1548, the RR has been in a developmental mode with no mining activities occurring. Consequently, there has been no site-specific airborne effluent monitoring required or performed outside of the collection of background environmental data that will be included in the first .Semi-Annual Effluent and Environmental Monitoring Report of 2010.

5.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, could be presented. Specifically the Semi-Annual Effluent and Environmental Monitoring Reports from 2007 to present were reviewed for occurrences of airborne effluent monitoring results on the RR property and none were found. Cameco Resources has examined the RR historical facility operations, including documentation of airborne effluent monitoring for the RR as summarized in the sections above, and has determined that no new or significant information can be added at this time. Consequently, references cited within this and other relevant sections and previously submitted information relating to uses of adjacent lands and waters is still relevant and is hereby incorporated by reference.

APPENDIX B-8.5

HISTORICAL QUALITY ASSURANCE PROGRAM ASSESSMENT FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 INTRODUCTION

This appendix provides a summary of the historical quality assurance (QA) program results for the RR. The RR is currently an undeveloped area of the SR-HUP under Source Materials License SUA-1548.

The effectiveness of the QA program is tracked through review of NRC Inspection Reports. As documented in Appendix B-1, there have been no NRC Inspection findings that are directly related to the RR. The following sections provide an overview of the license renewal requirements for evaluation of QA programs, and a summary of documentation that was reviewed to support the conclusion that there is no "new or significant" information in this area for the RR.

2.0 REGULATORY BACKGROUND

The acceptance criteria for evaluating a licensee's QA program for a renewal application are provided in Section 5.7.9.3(3) of NUREG-1569 (NRC, 2003c) as follows:

- Historical QA program results are included through the most recent reporting period, preceding the submittal of the license renewal submittal;
- A discussion of the effectiveness of the historical QA program with regard to all applicable 10 CFR Part 20 regulatory requirements; and
- A discussion of long-term trends and explanations of any short-term deviations from the long-term trends.

The elements of an acceptable QA program are described in the NRC Regulatory Guide 4.14 "*Quality Assurance for Radiological Monitoring Programs (Inception through Normal Operations to License Termination) Effluent Streams and the Environment*" (NRC, 2007b) and include:

- Organizational Structure and Responsibilities of Managerial and Operational Personnel
- Specification of Qualifications of Personnel
- Operating Procedures and Instructions
- Records
- Quality Control in Environmental Sampling
- Quality Control in the Radioanalytical Laboratory
- Quality Control for Radioactive Effluent Monitoring Systems
- Verification and Validation
- Assessments and Audits
- Preventive and Corrective Actions

Cameco Resources has a QA program in place for the SR-HUP, which is fully compliant with the required list of program elements. QA requirements specific to certain tasks such as occupational or environmental monitoring are addressed through procedures within the site's Environmental, Health and Safety (EHS) Management System Manual. Evaluations of the effectiveness and implementation of the QA program are presented in the annual ALARA audit reports conducted by Cameco Resources personnel with the assistance of independent third-party auditors and in semi-annual NRC license inspection reports. All pre-mining activities that have occurred on the RR property from 2007 to present have been covered by the QA program for the SR-HUP.

3.0 ASSESSMENT OF QA PROGRAM EFFECTIVENESS

As documented in Appendix A-8.5, the SR-HUP QA program was assessed through review of all NRC Inspection Reports filed during the previous license period (1999 to 2009). QA-related deficiencies and items of concern and their resolutions were described. There were nine QA-related items identified in routine audits and NRC inspections for SR-HUP over the ten-year licensing period. All items were addressed by implementing appropriate corrective actions. There are currently no open issues related to QA concerns. None of the QA inspection findings items were related to the RR.

4.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, could be presented. Following NRC guidance relating to license renewals in NUREG-1569, Appendix A, Cameco Resources has examined the RR historical facility operations, including assessment of the QA program for the RR as summarized in the sections above, and has determined that no new or significant information can be added at this time. Consequently, references cited within this and other relevant sections and previously submitted information relating to the quality assurance program are still relevant and are hereby incorporated by reference.

APPENDIX B-8.6

CUMULATIVE EFFECTS OF OPERATIONS FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 INTRODUCTION

This section provides a review of cumulative impacts analysis for RR.

RR has been inactive since its inclusion under SUA-1548. This appendix presents the regulatory background that drives the requirement for cumulative impacts analysis and provides reference to previous documentation in this area. Because there is no "new or significant" information for the RR, previous documentation submitted to the NRC and referenced within this Appendix is incorporated by reference.

2.0 BACKGROUND

"Cumulative impacts" are defined in Title 40 of the Code of Federal Regulations (CFR) 1508.7 and include individually minor, but collectively significant, actions taking place over a period of time. It is possible an impact that may be small by itself could result in a moderate or large impact when considered in combination with the impacts of other actions on the affected resource. (10 CFR 40)

Cumulative impacts from the RR operation were addressed by its the addition to the License through, Amendment No. 11. There have been no changes in operational status of the RR since Amendment No. 11 that would alter the evaluation of cumulative impacts. The conclusions from the Environmental Assessment for RR (NRC, 2006c) are incorporated here by reference. The NRC addressed two areas of potential cumulative impacts from RR. These were:

- Cumulative impacts associated with coal bed natural gas (CBNG) development; and
- Cumulative impacts related to conventional uranium mining and milling in the vicinity of SR-HUP.

3.0 SUMMARY OF CUMULATIVE IMPACTS

Cumulative impacts associated with potential CBNG development within the RR area were evaluated in the Environmental Assessment prepared in support of Amendment No. 11 for the RR satellite area (NRC, 2006c). Regarding potential cumulative impacts associated with CBNG drilling, the NRC concluded that

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

methane gas drilling and be in contact with the appropriate Federal and State agencies involved with permitting such drilling."

Since 2006, CR has continued to monitor the status of CBNG drilling activity in the vicinity of the SR-HUP and RR projects in conjunction with the BLM. While drilling activity continues outside of the license area, the coal seams located within the license area are generally considered too thin or too shallow to contain economically-recoverable methane reserves. In the unlikely event that CBNG development should occur closer to or within the RR area, cumulative effects associated with mineral extraction from both activities would need to be re-evaluated at that time. The NRC Generic EIS for ISL development (NRC, 2009e) provides the following mitigation:

"Competing access to mineral rights could be either delayed for the duration of the in-situ leach (ISL) project or be intermixed with ISL operations (e.g., oil and gas exploration)."

The NRC (NRC, 2009e) provides additional safeguards, as follows:

"If there are oil, gas, coal bed methane, or other production layers near the ISL facility, and if NRC determines that there could be potentials for cross contamination between the ISL production zone and other production layers based on environmental impact assessments, NRC may require the licensee to expand the monitoring well ring for detection of potential contamination between the ISL production zone and other mineral production layers. If excursions are detected, the monitoring well is placed on excursion status and reported to the NRC. Corrective actions are taken, and the well is placed on a more frequent monitoring schedule until the well is found to no longer be in excursion."

Potential cumulative impacts related to conventional uranium mining and milling in the vicinity of SR-HUP and RR are unlikely. In the southern Powder River Basin, uranium was historically mined via conventional methods (e.g. open pits and subsurface mine shafts) during the 1970s and 1980s. The last conventional mining operation near the site, Exxon Highland Facility near the eastern border of the SR-HUP license area, ended operations in 1984. Although conventional mining cannot be ruled out altogether for the future of the area around SR-HUP, it is very unlikely for two reasons. First, ISR operations are approximately two to three times more cost-effective than open pit/conventional mining. Second, virtually all the South Powder River uranium ore deposits are amenable to ISR development.

4.0 CONCLUSIONS

No updates or changes have occurred to site operations since the addition of the RR satellite area via Amendment No. 11 (NRC, 2006c). The NRC concluded that drilling activity associated with CBNG development outside the license area should have no effect on the RR project. CBNG development activity is unlikely to take place within the SR-HUP and RR license areas and, in the event that development does occur, mitigations and safeguards have been included in the NRC's Generic EIS for ISL development (NRC, 2009e). Because of the cost-effectiveness of ISR in the South Powder River

Basin, the NRC concluded that it was unlikely that conventional mining would resume in the area, and thus any corresponding cumulative impacts are also unlikely.

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether any "new or significant" information has developed due to operational changes at the RR since its inclusion under SUA-1548. Following NRC guidance relating to license renewals in NUREG-1569, Appendix A, Cameco Resources has examined the RR historical facility operations, including cumulative effects of operation. Specifically, the cumulative impacts of radiation exposures, deep well disposal of mining wastes, and conventional uranium mining in the vicinity were evaluated. No operational changes have taken place at the RR that would require re-evaluation of cumulative impacts. Consequently, references cited within this and other relevant sections and previously submitted information relating to cumulative effects is relevant and is hereby incorporated by reference.

APPENDIX B-9

UPDATES AND CHANGES TO FACTORS THAT MAY CAUSE RECONSIDERATION OF ALTERNATIVES TO THE PROPOSED ACTION FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 INTRODUCTION

NUREG-1569 Appendix A (NRC, 2003c) states that "*updates and changes to factors that may cause reconsideration of alternatives to the proposed action*" shall be included in license renewal submittals. This requirement is addressed for the RR in the following sections.

2.0 BACKGROUND

NUREG-1569, Section 8.0, describes the area of review for alternatives to proposed action for original license applications as follows:

> "*the staff will review comparative reconnaissance level evaluations of available alternatives to the licensing action proposed in the in situ leach facility application in accordance with the requirements of National Environmental Policy Act of 1969 including realistic alternatives for the various processing stages. As part of this review, the staff should consider the no-action alternative*" (NRC, 2003c).

Realistic alternatives including the no-action alternative for the RR are discussed below. Processing stages considered are: uranium extraction (mining methods); siting of process facilities; consumer energy source options; solution mining recovery methods (alternative injection fluids); waste disposal; and the no-action alternative.

3.0 ALTERNATIVES TO THE PROPOSED ACTION

Cameco Resources currently operates the SR-HUP, a commercial ISR uranium mining operation located in Converse County, Wyoming, and is licensed under NRC License Number SUA-1548. The RR property is immediately adjacent to and north of the SR-HUP. Since NRC approval of the RR amendment, activities on the RR property have been limited to installation of monitoring wells; development drilling for ore body delineation; improvements to the road leading to the drilling staging area; installation of a deep disposal well and pumphouse; and hydrologic testing and baseline water quality sampling. When the RR site becomes active, mining and production practices will be the same as those currently employed on Cameco Resources' SR-HUP properties.

3.1 Alternate Mining Methods

Underground and open pit mining represent the two currently available alternatives to ISR for mining of the uranium deposits in the SR-HUP and RR areas (PRI, 2004e). The following information documented in the application for Amendment No. 11 to the SR-HUP license (PRI, 2004e) remains valid regarding alternate mining methods:

> "*From an environmental perspective, open pit mining or underground mining and the associated mill involve higher risks to employees, the public, and the environment. Radiological exposure to the personnel in these processes is increased not only from the mining process but also from milling and the resultant mill tailings. Moreover, the personnel*

injury rate is traditionally much higher in open pit and underground mines than has been the experience at [ISR] solution mining operations.

Both open pit and underground mining methods would require substantial dewatering to depress the potentiometric surface of the local aquifers to provide access to the ore. The ground water would contain naturally high levels of Ra-226 that would have to be removed prior to discharge resulting in additional radioactive solids that would have to be disposed of. For conventional mining, a mill tailings pond that could contain 5 to 10 million tons of solid tailings waste from the uranium mill would also be required.

In a comparison of the overall impacts of in situ [recovery] of uranium compared with conventional mining, an NRC evaluation [NUREG-0925 (1983) Para. 2.3.5] concluded that environmental and socioeconomic advantages of in situ [recovery] include the following:

- *Significantly less surface area is disturbed than in surface mining, and the degree of disruption is much less.*
- *No mill tailings are produced, and the volume of solid wastes is reduced significantly. The gross quantity of solid wastes produced by in situ [recovery] is generally less than 1% of that produced by conventional milling methods [more than 948 kg (2090 lb) of tailings usually result from processing each metric ton (2200 lb) of ore].*
- *Because no ore and overburden stockpiles, or tailings pile(s), are created and the crushing and grinding ore-processing operations are not needed, the air pollution problems caused by windblown dusts from these sources are eliminated.*
- *The tailings produced by conventional mills contain essentially all of the radium-226 originally present in the ore. By comparison, less than 5% of the radium in an ore body is brought to the surface when in situ [recovery] methods are used. Consequently, operating personnel are not exposed to the radionuclides present in and emanating from the ore and tailings, and the potential for radiation exposure is significantly less than that associated with conventional mining and milling.*
- *By removing the solid wastes from the site to a licensed waste disposal site and otherwise restricting them from contaminating the surface and subsurface environment, the entire mine site can be returned to unrestricted use within a relatively short time.*
- *Solution mining results in significantly less water consumption than conventional mining and milling.*
- *Socioeconomic advantages of in situ [recovery] include:*
  - *Ability to mine a lower grade ore;*
  - *A mining of capital investment;*
  - *Less risk to the miner;*
  - *Shorter lead time before production begins; and*
  - *Lower manpower requirements."*

Based on the evaluation of underground and open pit mining as presented above, neither of these methods is economically viable for producing uranium from the local uranium-bearing deposits at

the SR-HUP and RR sites. ISR is the optimum mining method, both economically and environmentally, for these sites.

3.2 Alternative Sites for the Processing Plants

Most of the facilities and support systems for the SR-HUP site are in-place from past and ongoing uranium operations. When the RR property is actively mined, additional field processing facilities will be similar to those existing for SR-HUP (e.g. header houses and satellite ion exchange facilities). There are no realistic alternatives for the mining and uranium recovery stages. No new surface disturbances will be needed for the yellowcake processing facilities. RR production can be processed in the existing CPP.

3.3 Alternate Leach Solutions

Sodium carbonate/carbon dioxide leach solution was selected for the SR-HUP because of favorable performance in the pilot programs and other commercial ISR operations, with no significant adverse environmental impact (NRC, 2007a). Alternate leach solutions for extracting uranium include ammonium carbonate solutions and acidic leach solutions; however, operators of ISR facilities using these alternate leach solutions have experienced difficulty in restoring and stabilizing the aquifer (NRC, 2007a). As a result of this past experience by others, Cameco Resources has excluded the use of these alternate leach solutions from consideration for the SR-HUP and RR.

With regard to groundwater restoration on-site, the combination of groundwater sweep and RO clean water reinjection has been selected and is in process on the SR-HUP property because of the proven success of the pilot program and other commercial ISR operations (NRC, 2007a). A discussion of the groundwater restoration at the SR-HUP site is provided in Appendix A-11. When the RR property is actively mined, groundwater restoration will be similar to current practices on the SR-HUP property.

3.4 Liquid Waste Disposal Alternatives

Liquid wastes produced at the SR-HUP site are disposed of via the use of deep disposal wells and land application methods. A discussion of these processes (NRC, 2007a), is summarized as follows:

> *"The use of deep waste disposal wells in conjunction with storage/evaporation ponds to dispose of the high TDS liquid wastes that primarily results from the yellowcake processing and drying facilities is considered the best alternative to dispose of these types of wastes. The zones receiving these wastes are approximately 9,000 – 10,000 feet below the ground surface and are authorized by the State of Wyoming and the EPA UIC Program to receive such wastes.*
>
> *The use of the deep disposal wells in combination with the exiting land application (irrigation) facilities to dispose of the treated wellfield purge fluids has proven to be the most cost effective way to dispose of this relatively good quality waste water."*

Wastewater treatment does not present realistic alternatives to deep well disposal due to the following:

- Economic advantage of deep well disposal over any viable treatment option;
- Regulatory requirements and additional permitting for groundwater reinjection or surface water outfall of treated wastewater;
- Generation of secondary wastes (e.g. concentrated waste streams from evaporation or membrane filtration, spent ion exchange resins, spent activated carbon) for disposal as 11e(2) byproduct material waste; and
- Secondary wastes resulting from wastewater treatment will require off-site disposal, presenting additional costs and risks associated with transportation and additional potential for public exposure.

A deep disposal well and associated pumphouse have been installed on the RR property and will be used when the RR property is actively mined.

3.5 No Action Alternative

The no-action alternative would allow Cameco Resources to continue mining operations in the current SUA-1548 licensed area unless the NRC formally denied the renewal of the license submittal. Cameco Resources is required to submit a License Renewal submittal for the source material license to the NRC at least thirty days before the expiration date of the existing license. By doing so, the license will not expire until the NRC determined the final disposition of the License Renewal submittal and advised Cameco Resources of its decision. If the License Renewal submittal is not approved by the NRC, restoration and reclamation activities would then become the primary activities at the site.

If renewal of the current source material license was not granted, all activities at the SR-HUP not associated with groundwater restoration and decommissioning would cease, resulting in the loss of a significant portion of the total employment at the site. At the completion of decommissioning activities, all employment opportunities at the SR-HUP would be terminated.

In addition to the loss of significant employment opportunities in Converse and Natrona Counties, the premature closing of the SR-HUP before commercially viable resources had been recovered would adversely affect the economic base of Converse County. A decision not to renew SUA-1548 for mining of the SR-HUP would leave the RR resource unavailable for energy production supplies, with the SR-HUP being the largest ISR uranium producing facility in the United States. The SR-HUP represents an important source of domestic uranium supplies that are essential in providing a continuing source of fuel to power generation facilities.

4.0 PROPOSED ACTION

The Reynolds ranch BLM EA , under "Purpose and Need for the Proposed " states that:

> *"Exploration and development of locatable federal minerals by private industry is part of the BLM's minerals program under the authority of the Mineral Leasing Act of 1920 (MLA) as amended, the Mining and Minerals Policy Act of 1970, the Federal Land Policy and Management Act of 1976, and the National Materials and Minerals Policy, Research, and Development Act of 1980.*
>
> *Expanding nuclear power is a key component of the Energy Policy Act (EPACT 2005) that was signed into law on August 8, 2005. The Policy calls for federal agencies "to develop a national energy policy designed to help the private sector, and, as necessary and appropriate, State and local governments, promote dependable, affordable, and environmentally sound production and distribution of energy for the future." In addition to providing this direction, the EPACT 2005 provides significant incentives for the continuation and expansion of nuclear power in the United States. On February 16, 2010, President Obama supported the expanded use of nuclear energy in the United States with the following, "To meet our growing energy needs and prevent the worst consequences of climate change, we need to increase our supply of nuclear power and today's announcement helps to move us down that path," referring to the Department of Energy offering of conditional commitments for a total of $8.33 billion in loan guarantees for the construction and operation of two new nuclear reactors at a plant in Burke, Georgia (DOE 2010). The announcement was followed by these statements of support by Energy Secretary Steven Chu, "As the world moves to address climate change, nuclear energy will play an indispensable role," and "This is a significant step by the Obama Administration to restart our domestic nuclear industry, helping to create valuable long-term jobs and reduce our greenhouse gas emissions" (DOE 2010).*
>
> *The purpose and need for this project is to develop the uranium resources held within federal mineral ownership. Development of the Proposed Action would allow PRI to develop, extract, remove, and market recovered uranium from the federal mining claims over lain by federal lands in the Reynolds Ranch area. Cameco/PRI's need is to be assured of the continuation of a supply of uranium, via an orderly, efficient and environmentally responsible mining of the uranium resource. These lands are open to mineral entry, and valid mining claims have been filed on them. The mining claimant has the right to mine and develop the mining claims as long as it can be done without causing unnecessary or undue degradation and is in accordance with pertinent laws and regulations."*

With NRC approval of the License Renewal submittal for Source Material License SUA-1548, Cameco Resources would continue to operate the SR-HUP ISR operation. Amendments to the license may be sought, as needed, in order to recover the uranium resources in the most effective manner. Operations could also expand to the RR, under SUA-1548.

The solution mining method is proposed over other mining methods for recovery of uranium from the uranium-bearing deposits present at the SR-HUP site because *in situ* mining is the most economical and environmentally sound method presently available for mining these reserves. This conclusion is based on the history of uranium mining in the South Powder River Basin area, which includes open pit mining, underground mining, and solution mining projects.

5.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, could be presented. Following NRC guidance relating to license renewals in NUREG-1569, Appendix A, Cameco Resources has examined the RR historical facility operations, including updates and changes to factors that may cause reconsideration of alternatives to the proposed action and has determined that no new or significant information can be added at this time. Consequently, references cited within this and other relevant sections and previously submitted information relating to alternatives to the action plan is still relevant and is hereby incorporated by reference.

APPENDIX B-10

UPDATES AND CHANGES TO THE ECONOMIC COSTS AND BENEFITS FOR THE FACILITY SINCE THE LAST APPLICATION FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 INTRODUCTION

NUREG-1569 Appendix A requires that Source Materials License Renewal submittal include updates and changes to the economic costs and benefits for uranium mining operations (NRC, 2003c). Direct and indirect economic benefits continue to accrue locally in the community and state-wide from the presence of mining. This section provides a summary of the actual and projected economic benefits and costs of continued operations at SR-HUP since the last licensing action, with addition of the RR (NRC, 2007c).

RR is currently an undeveloped area of the SR-HUP under Source Materials License SUA-1548.

The following sections present a summary of updates and changes to: State tax revenues; regional employment; and local economic impacts for continued operation of SR-HUP. The economic impacts associated with operations startup on the RR are included.

2.0 TAX REVENUES

Future tax revenues are dependent on uranium prices, which cannot be forecast with any accuracy. However, these taxes are also somewhat dependent on the number of pounds of uranium produced by SR-HUP.

The present taxes are based on a relatively consistent production rate of uranium. Table B-10-1 summarizes the Wyoming tax revenues from Cameco Resources' Wyoming projects, which includes the SR-HUP and the inactive satellite operations (i.e., non-operational RR, Ruth, North Butte, and Gas Hills).

TABLE B-10-1

CAMECO RESOURCES' WYOMING TAX REVENUE SUMMARY 2005 THROUGH 2008

	2009*	2008	2007	2006	2005
Ad Valorem	$694,000	$ 1,204,000	$ 1,030,000	$ 744,000	$ 530,000
Property Taxes	$316,000	$ 239,000	$ 216,000	$ 207,000	$ 193,000
Sales and Use Taxes	$178,000	$ 312,000	$ 161,000	$ 53,000	$ 37,000
Severance Taxes	$456,000	$ 797,000	$ 680,000	$ 493,000	$ 222,000
Total	**$1,644,000**	**$ 2,552,000**	**$ 2,087,000**	**$ 1,497,000**	**$ 982,000**

Yellowcake production from the CPP cannot exceed 5.5 million pounds annually (NRC, 2007c). Upon startup, uranium recovered from the RR would be processed through the CPP subject to this production limit. At permitted maximum production, 22.5 percent of the CPP throughput could come from the RR.

3.0 CURRENT EMPLOYMENT STATUS

Current staffing information available for the SR-HUP is from 2009, and presented herein. The SR-HUP employed approximately 116 employees and 42 contractors on a full-time basis in 2009. Short-term contractors and part-time employees are also used for specific projects and/or during the summer months and may add up to 7 percent to the total staffing. This level of employment achieved by Cameco Resources is significant to the local economies as outlined below.

The private employment in Converse and Natrona Counties, Wyoming, in 2008 was 38,700 out of a total labor force of 45,500. Based on these statistics, SR-HUP currently provides approximately 0.3 percent of the private employment (0.4 percent, if contractors are included). In 2009, SR-HUP's total payroll was over 10.374 million dollars. Of the total private Natrona and Converse County wage and salary payments of approximately 1.68 billion dollars in 2008, the SR-HUP payroll represented about 0.5 percent. Cameco Resources' total employee payroll for the past five years is summarized in Table B-10-2.

TABLE B-10-2

CAMECO RESOURCES' EMPLOYEE PAYROLL 2005 THROUGH 2009 (EST.)

Year	Total Estimated Annual Payroll
2005	$ 4,593,000
2006	$ 4,952,000
2007	$ 7,443,000
2008	$ 8,387,000
2009	$ 10,370,000

The average annual income for all workers in Converse and Natrona Counties was $41,700 and $43,800, respectively. By comparison, the average wage for an employee of SR-HUP is approximately $53,000 per year. Entry level workers for SR-HUP earn a minimum of $16.15 per hour, or $33,593 per year, not including overtime, bonus or benefits.

SR-HUP actively pursues a policy of hiring and training local residents to fill all available positions. Due to the technical skills required for some positions, a small percentage of the current staff (less than 8 percent) have been hired elsewhere and relocated to the area. Because of the small number of people who have needed to move into the area to support this project, the impact on the community in terms of expanded services has been minimal.

Cameco Resources expects that the type of positions created by any future expansion will be filled primarily with individuals from the local workforce, and would have no significant impact on services and resources such as housing, schools, hospitals, or other public facilities.

The socioeconomic impacts as described in the RR amendment submittal read as follows:

> *"Continued operation of the SR-HUP/Reynolds Ranch amendment area will provide jobs for about 100 company employees and 20 to 40 contract employees. The general population of Converse County declined approximately 20 percent between 1980 and 1984 and the overall economy remains depressed; therefore, the impact of the project, although limited, will be beneficial to the local communities. No adverse impact is anticipated as current housing, schools and other support facilities are more than adequate to accommodate the projected employment."* (PRI, 2004e)

Should Cameco Resources begin active mining on the RR, the level of direct and contracted employees would not change significantly over the current level for SR-HUP.

4.0 IMPACT ON THE LOCAL ECONOMY

In addition to providing a significant number of well-paid jobs in the local communities of Casper, Douglas and Glenrock, Wyoming, Cameco Resources actively supports the local economies through purchasing procedures that emphasize obtaining all possible supplies and services that are available in the local area. In 2009, Cameco Resources' procurement procedures resulted in local purchases estimated at over 26 million dollars. The vast majority of these purchases were made in Converse and Natrona Counties. This level of business is expected to continue through continued operations of the SR-HUP and potential startup of the RR. Total SR-HUP payments made to Wyoming businesses for the past five years are summarized in Table B-10-3.

TABLE B-10-3

SR-HUP PAYMENTS TO WYOMING BUSINESSES 2005 THROUGH 2009 (EST.)

Year	Total Estimated Annual Payments
2005	$ 10,036,600
2006	$ 12,311,000
2007	$ 14,801,000
2008	$ 24,247,000
2009	$ 26,065,000

In addition, mineral royalty payments accrue to local landowners. Production royalties paid to land owners were slightly less than 2.1 million dollars in 2009.

Local procurement of supplies and services and mineral royalty payments will continue with ongoing operations of the SR-HUP and potential operations startup of the RR.

5.0 ECONOMIC IMPACT SUMMARY

As discussed in the previous sections, approval of this License Renewal submittal would have positive impacts on the state and local economies. The current economic impact of the SR-HUP and additional Cameco Resources employment related to other projects in Wyoming is summarized in Table B-10-4.

TABLE B-10-4

CURRENT ECONOMIC IMPACT OF THE SR-HUP

	Current SR-HUP Operation	Other Wyoming Projects
Employment		
Full-Time Employees	116	17
Full-Time Contractor employees	42	
Part-Time Employees and Short-term Contractors	10	20
Payroll – 2009(1)	$ 10,370,000	Included
Taxes		
Ad Valorem	$ 694,000	
Property Taxes	$ 316,000	--
Sales and Use Taxes	$ 178,000	--
Severance Taxes	$ 456,000	--
Total Taxes 2009	$ 1,644,000	Included
Local Purchases		
Local Purchases, 2009	$ 26,065,000	Included
Total Direct Economic Impacts	$ 40,32,000	

(1) Payroll does not include full-time contractor or part-time employee salaries.

6.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, could be presented. Following NRC guidance relating to license renewals in NUREG-1569, Appendix A, Cameco Resources has examined the RR historical facility operations, including updates and changes to the economic costs and benefits for the RR as summarized in the sections above, and has determined that no new or significant information can be added at this time. Consequently, references cited within this and other relevant sections and previously submitted information relating to economic costs and benefits are still relevant and are hereby incorporated by reference.

The economic impact from the SR-HUP/RR, as summarized in Table B-10-4 shows a significant positive impact on both the local and state economies. The impacts extend to both economic and employee opportunities afforded to the local population in higher than average paying jobs. Local businesses have also benefitted by the presence and operation of SR-HUP as Cameco Resources has a first preference for utilizing local, then state, then regional businesses to satisfy development and sustained operations.

APPENDIX B-11

RESULTS AND EFFECTIVENESS OF ANY MITIGATION PROPOSED AND IMPLEMENTED IN ORIGINAL LICENSE FOR REYNOLDS RANCH SATELLITE FACILITY

1.0 INTRODUCTION

NUREG-1569 Appendix A requires that Source Materials License Renewal Submittals include "*results and effectiveness of any mitigation proposed and implemented in original license*" for uranium mining operations (NRC, 2003c). This section meets that requirement for the RR by providing a summary of groundwater restoration for the RR during the update period, spanning from the approval of the Reynolds Ranch amendment application (NRC, 2007c) through the first quarter of 2010.

The purpose of groundwater restoration is to return the portion of the aquifer designated for uranium recovery to its pre-operational water quality, as determined from baseline monitoring data. The RR is currently an undeveloped area and therefore has no MUs in production or restoration.

A background discussion of groundwater restoration goals is presented in Section 2.0. Section 3.0 presents a discussion of the review of documentation related to RR historical operations, concluding that no new or significant information with respect to groundwater restoration at the RR can be presented at this time.

2.0 GROUNDWATER RESTORATION GOALS

Within the uranium ISR production zone, impacts from operations may include elevated levels of various constituents introduced with the production fluid (e.g., oxygen, bicarbonate, and hydrogen peroxide) and chemical species that are mobilized by the production fluid (e.g., uranium and other metals) (Miller, 2009). After uranium recovery ends, groundwater restoration is conducted to return the production zone of the aquifer to its pre-operational water quality. If the baseline conditions are not achieved after diligent application of the best practicable technology, in accordance with the WDEQ Act (§35-11-103(f) (iii)), a secondary goal is to return the groundwater to a quality consistent with the use, or uses, for which the water was suitable prior to production. In other words, the standard is to return the affected groundwater to its pre-mining Class of Use, per NUREG-1569 (Section 6.1.3.4.b) and defined by WDEQ Water Quality Rules and Regulations, Chapter 8, Section 4(d).

To return the groundwater to its pre-operational water quality, restoration is conducted through a variety of methods. NRC allows licensees the flexibility to select the restoration methods to be used for each wellfield (NRC, 2003c). During the update period, groundwater restoration has consisted of two phases:

1. Groundwater Sweep Phase: initial phase, in which groundwater is pumped from the wellfield without re-injection, causing an influx of baseline quality water from the perimeter of the mining unit, which "sweeps" the affected portion of the aquifer.

2. Groundwater Treatment Phase: groundwater recovered from the wellfield is treated with one or more of the following methods, and then re-injected into the affected portion of the aquifer:

   - Processing through the uranium recovery plant to recover additional uranium;

- Degassing, by using a de-carbonator unit to remove residual carbon dioxide;
- RO, with re-injection of the clean, permeate water; and/or
- Addition of chemical and biological reductants to decrease the concentration of oxidized metals.

During restoration, groundwater monitoring is conducted to monitor restoration progress and to monitor for excursions. Excursions during restoration may occur from unintentional movement of restoration fluids or unintentional movement of groundwater impacted from production fluids.

At the start of restoration, wells that were used to determine baseline water quality are sampled for the parameters required by WDEQ LQD Guideline 8 to determine the end-of-injection water quality. During restoration, the monitoring wells are sampled approximately every 60 days for uranium, chloride, and conductivity. Following concurrence from WDEQ that restoration has been achieved in the mining area, a six month stability period is assessed to show that the restoration goal has been adequately maintained. Once restoration has been approved by WDEQ and NRC, wells are plugged in accordance with WDEQ LQD Guideline 8. The RR is currently un-mined and has no MUs in restoration.

3.0 MITIGATIVE ACTIONS REGARDING EFFECTS OF OPERATIONS AND/OR ACCIDENTS

A review of the original permit application with regard to mitigative actions for identified effects of mining operations and accidents indicates that proposed mitigation actions have been and continue to be effectively implemented and do not require revision.

Impacts resulting from mining operations requiring mitigation include ephemeral drainage areas whereby erosion controls have been required to effectively minimize soil impacts; monitor well drilling and road construction activities where short term disturbances (erosion and fugitive dust) may occur that have been kept to a minimum with prescribed protective steps to control top soil erosion-sedimentation taken through the practice of re-seeding disturbed areas as soon as possible, in addition to re-contouring (as necessary) that has also helped prevent soil erosion problems.

Impacts resulting from accidents requiring mitigation include tank failure (inside and outside of buildings), piping failure, fire-explosions and weather-related impacts. RR currently has no operational tankage, piping on site nor has there been any mining activities occurring, consequently mitigative actions within the original application are still considered to be effective actions until proven otherwise.

4.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, could be presented. Following NRC guidance relating to license renewals

in NUREG-1569, Appendix A, Cameco Resources has examined the RR historical facility operations, including groundwater restoration for the RR as summarized in the sections above, and has determined that no new or significant information can be added at this time. The RR is currently un-mined and has no MUs in restoration. Consequently, references cited within this and other relevant sections and previously submitted information relating to mitigation results and effectiveness are still relevant and are hereby incorporated by reference.

APPENDIX C

RUTH AND NORTH BUTTE SATELLITE FACILITIES NUREG-1569 ASSESSMENT

1.0 INTRODUCTION

This appendix (Appendix C) of the License Renewal submittal for U.S. Nuclear regulatory Commission (NRC) Source Material License SUA-1548 has been prepared to respond to requirements identified in NUREG-1569, "*Standard Review Plan for In Situ Leach Uranium Extraction License Applications*" (NRC, 2003c) and, in particular, specific guidance in NUREG-1569 that applies to renewals of existing licenses. Specifically, this appendix follows the NRC guidance in NUREG-1569 Appendix A for examining historical facility operations, providing documentation and review of historical information for the Ruth (RU) and North Butte (NB) Satellite Facilities (NRC, 2004b) that is used to assess the effectiveness of the operations in minimizing any effects to public and occupational health and safety and the environment.

With respect to the RU and NB satellite facility status review, both have remained in the developmental mode with no active mining activities having commenced.

While a part of the NRC SUA-1548 License Renewal submittal, Appendix C is also meant to serve as a stand-alone document providing a review and update of the RU and NB Applications.

2.0 APPENDIX C CONTENT

NUREG-1569 states that "*if, after a review of the historical aspects of site operations, the staff* [NRC] *concludes that the site has been operated so as to protect health and safety and the environment and that no un-reviewed safety-related concerns have been identified, then only those changes proposed by the license renewal or amendment application should be reviewed using appropriate sections of this* [NUREG-1569] *standard review plan*". To provide the historical aspects of site operations and review of the effectiveness of operations in minimizing effects to health and safety and the environment, Appendix C of this report follows NUREG-1569 Appendix A. The contents of this appendix as it relates to the requirements of NUREG-1569 Appendix A (*in italics*) for the RU and NB Satellite Facilities are provided below:

- *For License Renewals, U.S. Nuclear Regulatory Commission (NRC) inspection reports and license performance reports*:
  - Appendix C-1: Summary of NRC Inspection and License Performance Reports for the Ruth and the North Butte Satellite Facilities
- *Amendments and changes to operating practices or procedures*:
  - Appendix C-2: Amendments and Changes to Operating Practices or Procedures for the Ruth and the North Butte Satellite Facilities
- *License violations identified during NRC or Agreement State site inspections*:
  - Appendix C-3: License Violations Identified During NRC or Agreement State Site Inspections for the Ruth and the North Butte Satellite Facilities

- *Excursions, incident investigations or root cause analyses, and resultant cleanup histories or status*:
  - Appendix C-4: Summary of Wellfield Excursions for Ruth and North Butte Satellite Facilities
- *Exceedances of any regulatory standard or license condition pertaining to radiation exposure, contamination, or release limits*:
  - Appendix C-5: Exceedances of Any Regulatory Standard or License Condition Pertaining to Radiation Exposure, Contamination, or Release Limits for the Ruth and the North Butte Satellite Facilities
- *Exceedances of any non-radiation contaminant exposure or release limits:*
  - Appendix C-6: Exceedances of Any Non-radiation Contaminant Exposure or Release Limits for the Ruth and the North Butte Satellite Facilities
- *Updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including site location and layout; uses of adjacent lands and waters; population distributions; meteorology; the geologic or hydrologic setting; ecology; background radiological or non-radiological characteristics; and other environmental features:*
  - Appendix C-7: Updates and Changes Site Characterization Information Important to the Evaluation of Exposure Pathways and Doses for the Ruth and North Butte Satellite Facilities
    - Appendix C-7.1: Site Location and Layout for the Ruth and the North Butte Satellite Facilities
    - Appendix C-7.2: Use of Adjacent Lands and Waters for the Ruth and the North Butte Satellite Facilities
    - Appendix C-7.3: Population Distribution for the Ruth and the North Butte Satellite Facilities
    - Appendix C-7.4: Meteorology for the Ruth and the North Butte Satellite Facilities
    - Appendix C-7.5: Geologic and Hydrologic Setting for Ruth and North Butte Satellite Facilities
    - Appendix C-7.6: Ecology for the Ruth and the North Butte Satellite Facilities
    - Appendix C-7.7: Transportation for the Ruth and North Butte Satellite Facilities
- *Environmental effects of site operations including data on radiological and non-radiological effects, accidents, and the economical and social effects of operations:*
  - Appendix C-8: Environmental Effects of Site Operations Including Data on Radiological and Non-radiological Effects, Accidents, and the Economic and Social Effects of Operations for the Ruth and the North Butte Satellite Facilities
    - Appendix C-8.1: Release and Accident History for Ruth and the North Butte Satellite Facilities
    - Appendix C-8.2: Surface and Groundwater Monitoring History for Ruth and North Butte Satellite Facilities
    - Appendix C-8.3: Assessment of Occupational Radiation Exposure and Dose Data for the Ruth and the North Butte Satellite Facilities
      - Appendix C-8.3-1: Historical Radiation Monitoring Program Assessment for the Ruth and the North Butte Satellite Facilities

Appendix C-8.3-2: Historical Results of Radiation Dose Calculations for the Ruth and the North Butte Satellite Facilities

Appendix C-8.3-3: Historical Bioassay Program Assessment for Ruth and the North Butte Satellite Facilities

Appendix C-8.3-4: Historical Occupational Exposure Rate Monitoring Assessment for the Ruth and the North Butte Satellite Facilities

- Appendix C-8.4: Historical Airborne Effluent and Environmental Monitoring Program for the Ruth and the North Butte Satellite Facilities
- Appendix C-8.5: Historical Quality Assurance Program Assessment for the Ruth and the North Butte Satellite Facilities
- Appendix C-8.6: Cumulative Effects of Operations for the Ruth and the North Butte Satellite Facilities

- *Updates and changes to factors that may cause reconsideration of alternatives to the proposed action:*
  - Appendix C-9: Updates and Changes to Factors that May Cause Reconsideration of Alternatives to the Proposed Action for Ruth and North Butte Satellite Facilities
- *Updates and changes to the economic costs and benefits for the facility since the last application:*
  - Appendix C-10: Updates and Changes to the Economic Costs and Benefits for the Ruth and the North Butte Satellite Facilities
- *For License Renewals, the results and effectiveness of any mitigation proposed and implemented in original license:*
  - Appendix C-11: Results and Effectiveness of Any Mitigation Proposed and Implemented in Original License for the Ruth and the North Butte Satellite Facilities

3.0 APPROACH AND REGULATORY BASIS

NUREG-1569 states that license renewal submittals should include an environmental report that includes any new and significant information. Specifically, 10 CFR 40.31.a states that "information contained in previous applications, statements or reports filed with the Commission may be incorporated by reference ..." and 10 CFR 51.60(a) indicates that for a license renewal, "*for which the applicant has previously submitted an environmental report, the supplement to applicant's environmental report may be limited to incorporating by reference, updating or supplementing the information previously submitted to reflect any significant environmental change, including any significant environmental change resulting from operational experience or a change in operations or proposed decommissioning activities.*" The RU and NB Satellite Facilities have been in a developmental mode since its inclusion into the SR-HUP Source Material License SUA-1548 in 2004 (NRC, 2004b). The assessment of the overall health and safety and environmental effects of RU and NB Satellite Facilities operations provided in Appendix C-8 is limited to regulatory background and review of documentation that shows no "new or significant information" can be

presented at this time. NUREG-1748 (Environmental Review Guidance for Licensing Actions Associated with NMSS Programs, (NRC, 2003a)) has been used as guidance in Appendix C-8 for evaluating specific aspects of the environment that may have been impacted by operations.

NUREG-1569 Appendix A requires an update to new and significant site characterization data. Any new and significant changes to site characterization data is provided in Appendix C-7, if such changes have an impact on the environmental effects as discussed in Appendix C-8. This includes land use, transportation, geology and soils, water resources, ecological resources, air quality, noise, historical and cultural resources, visual/scenic resources, socioeconomic, public and occupational health, waste management and cumulative impacts. NUREG-1910 (Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities (NRC, 2009e)) provides guidance on the importance of each environmental category for the Wyoming region, and was also used when assessing environmental effects as discussed Appendix C-8. New and significant changes to site characterization data were evaluated and documented by comparing the latest site characterization data provided to the NRC to current data and evaluating which changes could have an impact on the environmental impacts discussed in Appendix C-8.

While the RU and NB Satellite Facilities are non-operational, a review of the historical operational items listed in NUREG-1569 Appendix A for the satellite operations is provided, for completeness.

APPENDIX C-1

SUMMARY OF NRC INSPECTION AND LICENSE PERFORMANCE REPORTS FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 BACKGROUND

This section provides a review of NRC inspections that are conducted as a matter of routine, to ensure that facilities are operating in accordance with their license application and conditions in a safe and effective manner. Inspections typically consist of routine review of management and organization controls, site operations, radiation protection and environmental monitoring. An inspection may also be focused on "license performance", which examines activities conducted under the license as they relate to safety and compliance with the Commission's rules and regulations and the conditions of the license. The NRC inspector's findings are discussed with site staff in exit briefings. The official inspection report will identify those items that require a licensee's response to satisfactorily close the findings.

NRC inspection reports for Cameco Resources' Source Material License SUA-1548 covering the years 2000 through 2009 have been reviewed and the results of the review are presented in Appendix A-1. In August 2003, Amendment No. 5 to SUA-1548 was approved by the NRC (2003d), adding RU and NB for future development of *in situ* recovery (ISR) operations. Amendment No. 5 allows for operation of RU and NB as satellite facilities, under the requirements described in License Condition 9.1. (NRC, 2003d).

This appendix provides a brief description of activities for the RU and NB Satellite Facilities that have occurred since incorporation under Source Material License SUA-1548, and the findings in NRC Inspection Reports that are specific to RU and NB. It should be noted here, that the both RU and NB have remained in a developmental mode with no active mining activities having taken place.

2.0 NRC INSPECTION REPORTS FOR THE R/NBP, 2003 TO PRESENT

The scope of NRC inspections routinely covered the following topics: Management Organization and Controls; In-Situ Leach Facilities; Environmental Protection and Radioactive Waste Management; Radiation Protection; and Follow-up on previous findings. Additional details provided in each inspection report include the specific NRC inspection procedures used, the scope of the inspection, observations and findings, and conclusions. Supplemental information provided with every inspection includes a list of persons contacted and Items Opened, Closed and Discussed.

There were ten NRC inspections conducted on Cameco Resources facilities under license SUA-1548 in the time period from August 18, 2003 (the approval date for Amendment No. 5) through present, which could have potentially included records review or site tours on RU and/or NB, however, a review of the inspection "Observations and Findings" sections indicate that there were no observations or findings related to these satellite facilities.

3.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC License

Renewal guidance, Cameco Resources has examined the RU and NB historical facility operations, including NRC Inspection and License Performance Reports, and has determined that no changes have taken place noting that RU or NB is presently, nor has been, in operation since incorporation into license SUA-1548. Consequently, all references cited within sections of this appendix are still relevant and are hereby incorporated by reference.

As noted throughout this License Renewal submittal, this approach is consistent with NUREG-1569 (Page xvii) guidance that the application for a renewal need not resubmit a complete application covering all aspects of facility operation and should instead only submit information containing changes from the current accepted license.

APPENDIX C-2

AMENDMENTS AND CHANGES TO OPERATING PRACTICES OR PROCEDURES FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 BACKGROUND

Cameco Resources Source Materials License SUA-1548 is a "performance-based license". The basis for performance-based licenses is documented in "*A Baseline Risk-Informed Performance-Based Approach for In Situ Leach Uranium Extraction Licensees*", NUREG/CR-6733 (NRC, 2001f). NRC acknowledges in this document that *"existing...regulations are not specifically applicable to uranium mining facilities*".

Recognizing the significant differences between ISR and other Source Materials Licensees, NRC established the framework for performance-based uranium ISR licenses. The primary feature of the performance-based license is the licensee's capability to "self-regulate" through a Safety and Environmental Review Panel (SERP). Per NUREG/CR-6733:

> *"The purpose of this panel is to review proposed changes, tests or experiments to determine whether they require a license amendment. Changes, tests or experiments may be conducted without prior NRC approval if (i) they do not conflict with any requirements specifically stated in the license or impair the licensee's ability to meet all applicable NRC regulations, (ii) there is no degradation in the essential safety or environmental commitments in the license application or those provided in an approved reclamation plan, and (iii) they are consistent with NRC conclusions regarding actions analyzed and selected in the facility environmental assessment"* (NRC, 2001f).

The review criteria for determination of changes requiring the licensee to obtain a license amendment are provided in License Condition 9.4. (NRC, 2010). In short, an amendment is required if the change, test or experiment increases risk of accident or malfunction of safety features, or creates a possibility of a different kind of accident or malfunction than those previously evaluated in the license renewal submittal. If the SERP finds that no increased risk of accident or malfunction of safety features would result from a "change", then a license amendment is not required. Thus, all "changes, tests, or experiments" are documented through either a SERP review or license amendment application and approval. SERPs are routinely reviewed by NRC Inspectors during NRC inspections and submitted to the NRC in the required Semi-Annual Report.

2.0 RUTH AND /NORTH BUTTE SERP RECORDS AND LICENSE AMENDMENTS

SERP records and License Amendments related to RU and NB since their inclusion in the SR-HUP license were reviewed, and no SERPs related to RU or NB were completed. No changes, tests, or experiments were conducted under the SERP review process without License Amendment on either RU or NB since its inclusion under the SR-HUP license as both RU and NB are still in the developmental phase.

The RU and NB satellite facilities were amended into the SR-HUP Source Materials License SUA-1548 as Amendment No. 5 (NRC, 2003d). Additional amendments affecting the sites include Amendment No. 7 and 16, which were surety updates for RU and NB (NRC, 2004c, 2010), and Amendment No. 9, which removed inspection requirements for NB and reduced inspection requirements at RU from monthly to

quarterly (NRC, 2004e). There have been no subsequent amendments related to changes, tests or experiments for RU or NB.

3.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569, Appendix A, Cameco Resources has examined the RU and NB historical facility operations, including amendments and changes to operating practices or procedures, determining that no changes have taken place. Consequently, previously submitted information referenced in this Appendix relating to areas covered in this section is still relevant and is hereby incorporated by reference.

This approach is consistent with NUREG-1569 (Page xvii) guidance that the application for renewal need not resubmit a complete application covering all aspects of facility operation and should instead only submit information containing changes from the currently accepted license.

APPENDIX C-3

LICENSE VIOLATIONS IDENTIFIED DURING NRC OR AGREEMENT STATE SITE INSPECTIONS FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 BACKGROUND

NRC Inspection Reports for Source Material License SUA-1548 covering the years 2003 through 2009 were reviewed for occurrences of Notices of Violation (NOVs) and Non-Cited Violations (NCVs) related to the RU and NB Satellite facilities. RU and NB were included under License SUA-1548 by NRC approval of Amendment No. 5 (NRC, 2003d). A summary of the RU and the NB Satellite Facilities Site Characterization is presented in Appendix C-7.

1.1 Notices Of Violation

NOVs are categorized for severity by the NRC using levels I, II, III and IV, with I being the highest severity level and IV being the lowest. Severity Level IV is defined by NRC as follows: *"Violations at Severity Level IV involve noncompliance with NRC requirements that are not considered significant based on risk"* (NRC, 2005a). Cameco Resources has never been cited with an NOV of Severity Level I, II or III under License SUA-1548.

NOVs require response from the licensee in the form of a written statement or explanation to the NRC within sixty days of the effective NOV date. NOV replies must include *"(1) the reason for the violation, or, if contested, the basis for disputing the violation or severity level, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken to avoid further violations, and (4) the date when full compliance will be achieved"* (NRC, 2005a). Typically, the licensee's NOV reply is acknowledged by the NRC as "responsive," and the NOV will be documented as "closed" in a subsequent NRC Inspection Report.

1.2 Non-Cited Violations

NRC's *"Enforcement Policy"* describes NCVs as *"having very low safety significance"* (NRC, 2005a). The process for dispositioning an NCV is further described as follows:

> *"NCVs... are documented as violations in inspection reports (or inspection records for some materials licensees) to establish public record of the violations, but are not cited in Notices of Violation which normally require written responses from licensees. Dispositioning violations in this manner does not eliminate the NRC's emphasis on compliance with requirements nor the importance of maintaining safety. Licensees are still responsible for maintaining safety and compliance and must take steps to address corrective actions for these violations. While licensees are not required to provide written responses to NCVs, this approach allows licensees to dispute violations described as NCVs."* (NRC, 2005a)

NCVs can be "opened" and "closed" within the duration of the on-site inspection in which they occurred. A single NRC Inspection Report typically provides documentation of the NCV, the corrective actions taken or planned by the licensee, and NRC's acceptance of the effectiveness of corrective actions, closing the NCV.

2.0 NOVs AND NCVs FOR R/NBP

Following the RU-NB Amendment adding the satellite facilities to NRC License SUA-1548 to present, there have been a total of ten (10) inspections. With respect to RU and NB, none of the NRC inspections resulted in a NOV or NCV being issued to either of these facilities.

APPENDIX C-4

SUMMARY OF WELLFIELD EXCURSIONS FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 INTRODUCTION

This section is intended to provide a summary and review of wellfield excursions reported for RU and NB. RU and NB are both currently an undeveloped area of the SR-HUP under Source Materials License SUA-1548. The RU and NB Satellite facilities were added to SUA-1548 under the License Conditions described in Amendment No. 5 (NRC 2003d).

Potential impacts to groundwater resources can occur from excursions of leaching solutions from wellfields during production and/or restoration. Groundwater Monitoring Programs for RU and NB will be implemented to ensure that wellfields are being operated to minimize the potential of excursions and that any groundwater excursions are detected in a timely manner. The early detection of an excursion allows prompt corrective action to mitigate the excursion to prevent any groundwater quality degradation outside of the wellfields. When active mining is initiated for RU or NB, its wellfields will be included in the Groundwater Monitoring Program.

1.1 Definition of an Excursion

A migration of production fluids into the overlying or underlying aquifers and/or detected at the monitor well ring is termed an excursion. Excursions are indicated from monitoring well sampling data, when two or more excursion parameters (i.e., alkalinity, chloride, and specific conductivity) exceed the upper control limits (UCLs) as determined from the approved baseline water quality data. When an excursion is first indicated by monitoring results, a confirming sample is collected within 24 hours of receiving the original analytical data. If the excursion is confirmed by the second sample, the NRC and Wyoming Department of Environmental Quality (WDEQ) are notified in accordance with the license, and subsequent sampling of the well is conducted at least every seven days for the UCL parameters and uranium. If the second sample does not confirm the excursion, a third sample is collected within twenty four hours of the second sample results to confirm or deny the excursion. If the excursion is confirmed, the appropriate agencies are contacted and sampling is conducted at least every seven days. Weekly monitor well sampling is continued until the excursion parameter exceedances are no longer detected in the analytical results. Excursion events do not necessarily result in environmental impacts, but just can be indicators of the unintended movement of production fluids (Miller, 2009).

1.2 Excursions for the Ruth/North Butte Property

There are no active wellfields within the boundaries of either RU or NB. Thus, there have been no wellfield excursions since the RU and NB amendment was approved in August 2003.

2.0 CONCLUSIONS

With respect to this License Renewal Submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant"

information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined RU and NB historical facility operations, including air and groundwater quality monitoring and compliance history with respect to groundwater excursion aspects, determining that no changes have taken place as neither the RU or NB is not presently, nor has been, in operation since incorporation into license SUA-1548. Consequently, all references cited in this section are still relevant and are hereby incorporated by reference.

APPENDIX C-5

EXCEEDANCES OF ANY REGULATORY STANDARD OR LICENSE CONDITION PERTAINING TO RADIATION EXPOSURE, CONTAMINATION, OR RELEASE LIMITS FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 BACKGROUND

The purpose of this section is to provide a summary and review of radiation exposure, radioactive contamination, and radionuclide release data reported for the RU and NB Satellite Facilities.

The ensuing sections include a review of:

- Section 2.0 - Historical Radiation Monitoring Program Assessment
- Section 3.0 - Historical Results of Radiation Dose Calculations
- Section 4.0 - Historical Bioassay Program Assessment
- Section 5.0 - Historical Occupational Exposure Rate Monitoring Assessment

2.0 HISTORICAL RADIATION MONITORING PROGRAM ASSESSMENT

The Radiation Monitoring Program (RMP) for RU and NB will involve periodic measurements of airborne concentration of natural uranium and Ra^{222} progeny in various buildings associated with operations including header houses and the satellite ion exchange (IX) facilities. Since August 2003, when RU and NB were amended into SUA-1548, no ISR operations buildings have been constructed at these facilities. When indoor operations at RU or NB begin, the RMP will be implemented and data collection necessary for future assessment of the RMP will initiate.

3.0 HISTORICAL RESULTS OF RADIATION DOSE CALCULATIONS

The NRC requires strict adherence to radiation worker monitoring requirements. A review of the historical results of radiation dose calculations for the SR-HUP is provided in Appendix A-8.3-2. In comparison to routine operations of active wellfields, satellite IX facilities and the Central Processing Plant (CPP), the potential for radiation dose exposure being directly related to RU or NB is the result of background radiation exposures. The maximum Total Effective Dose Equivalent (TEDEs) reported for workers at SR-HUP are well below applicable standards, as summarized in Section A-8.3-2, and are consistent with doses the NRC indicates to be representative of uranium ISR facilities, and are stable over the 10-year period since the last License Renewal submittal. This demonstrates that Cameco Resources is committed to continually evaluating sources of worker exposures to ionizing radiation and implementing improvements in order to maintain occupational radiation doses at levels which are "as low as is reasonably achievable" (ALARA). With the non-operational status of RU and NB, the only source of exposure is from natural background radiation.

4.0 HISTORICAL BIOASSAY PROGRAM ASSESSMENT

NRC licensees are required to limit workers' intake in areas with airborne radionuclides by sequential application of the following:

- Engineering controls;
- Controlled access;
- Limiting exposure time; and
- Use of respiratory protection.

Cameco Resources has implemented a bioassay program to monitor the effectiveness of the respiratory program, and to provide a quantitative method for estimating intakes of radioactive material. A review of the historical bioassay program for Smith ranch-Highland Uranium Project (SR-HUP) workers is provided in Appendix A-8.3-3. With the non-operational status of RU and NB, there are no work areas in which workers could potentially be exposed to airborne radionuclides. When indoor work areas are established, the SR-HUP Bioassay Program will be implemented for RU and NB and data collection necessary for future assessment of the Bioassay Program will initiate.

4.1 Historical Occupational Exposure Rate Monitoring Assessment

An assessment of the historical occupational exposure rate monitoring for the SR-HUP is provided in Appendix A-8.3-4. Once operational, similar exposure rates would be anticipated for RU and the NB Satellite Facilities as at existing satellite plants.

As both RU and NB have remained in a developmental mode with no active mining activities taking place since amendment into the SR-HUP Source Material License, any assessment of historical occupational exposure to gamma radiation can only be performed when RU and NB operations begin.

5.0 CONCLUSIONS

With respect to this License Renewal Submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the RU and NB historical facility operations, including air and groundwater quality monitoring and compliance history with respect to radiation exposure, radioactive contamination, and radionuclide release aspects, determining that no changes have taken place as RU and NB are not presently, nor has been, in operation since incorporation into license SUA-1548 (NRC, 2003d). Consequently, all references cited within this Appendix are still relevant and are hereby incorporated by reference.

APPENDIX C-6

EXCEEDANCES OF ANY NON-RADIATION CONTAMINANT EXPOSURE OR RELEASE LIMITS FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 INTRODUCTION

The purpose of this section is to provide a summary and review of non-radiation contaminant exposure, or exceedances of release limits reported for the RU and NB.

2.0 REGULATORY BACKGROUND

This appendix has been prepared in conformance to the guidance provided in NUREG-1569 Appendix A (NRC, 2003c), which provides a list of "*specific areas where a compliance history or record of site operations and changes should be provided for review*" including "*exceedances of any non-radiation contaminant exposure or release limit*".

Cameco Resources' license SUA-1548 includes Condition 12.1 as follows:

> *"Until license termination, the licensee shall maintain documentation on spills of source or 11e.(2) byproduct materials (including mining solutions) and process chemicals. Documented information shall include, but not be limited to: date, spill volume, total activity of each radionuclide released, radiological survey results, soil sample results (if taken), corrective actions, results of post remediation surveys (if taken), and a map showing the spill location and the impacted area."* (NRC, 2003d)

License Condition 12.1 requires the licensee to maintain and follow procedures for evaluation of consequences of any spill and to determine if reporting to the NRC Operations Center is necessary. The timing of initial notification and written reports to the NRC and appropriate State agencies are also described in License Condition 12.1.

3.0 REVIEW OF NON-RADIATION CONTAMINANT EXPOSURE AND RELEASES FOR THE R/NBP

Cameco Resources documents compliance with License Condition 12.1 through submittal of "Semi-Annual Effluent and Environmental Monitoring Reports" to the NRC. These reports include review of all environmental releases to groundwater, surface water, land application, and air, inclusive of any non-radiation contaminant exposures. Semi-Annual Effluent Reports from 2003 to present were reviewed for occurrences of exposure or releases related to activities at RU or NB. Minimal, non-mining related activities have taken place at RU or NB since their inclusion under license SUA-1548. There have been no reported exceedances of non-radiation contaminants or release limits associated with either the RU or NB.

Additionally, the extent of all spills of process solutions are mapped, radiologically assessed with a gamma meter, and/or soil sampled for radionuclides. Spills meeting reporting limits are submitted to the NRC and WDEQ, with all pertinent information maintained on site in a decommissioning file. Non-

radiologic spills are managed in accordance with the Smith Ranch (SR)-Highland Operation, Environmental, Health and Safety Management System Operating Procedures Volume I-VIII.

4.0 CONCLUSIONS

With respect to this License Renewal Submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the RU and NB historical facility operations, including compliance history and record of site operations with respect to exceedances of non-radiation contaminant exposure and release limits, determining that no changes have taken place. RU and NB are not presently, nor has it been, in operation since incorporation into license SUA-1548. Consequently, previously submitted information referenced within this section relating to areas covered in this appendix is still relevant and is hereby incorporated by reference.

APPENDIX C-7

UPDATES AND CHANGES SITE CHARACTERIZATION INFORMATION IMPORTANT TO THE EVALUATION OF EXPOSURE PATHWAYS AND DOSES FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 INTRODUCTION

This appendix (Appendix C-7) of the License Renewal submittal for Source Material License SUA-1548 has been prepared in conformance to NUREG-1569, "*Standard Review Plan for In Situ Leach Uranium Extraction License Applications*" (NRC, 2003c). The approach to preparation of license renewal applications as presented in NUREG-1569 Appendix A is streamlined, requiring the licensee to present "*compliance history or record of site operations and changes*" to the NRC for review. Further, NUREG-1569 Appendix A states that:

> *"Aspects of the facility and its operations that have not changed since the last license renewal or amendment should not be reexamined".*

The information and data presented in the license renewal submittal can therefore be optimized, to present:

- By reference, any previously submitted documentation in areas that have not changed;
- The record of site operations demonstrating that health, safety and environment have been protected throughout the previous license period; and
- Any "new or significant" information, describing aspects of facility or operations that have changed during the previous license period.

This approach allows for the NRC review to be keenly focused on "*only those changes proposed by license renewal or amendment application*" (NRC, 2003c).

2.0 APPENDIX C-7 CONTENT

Appendix C-7 has been prepared to conform with NUREG-1569 Appendix A guidance, specifically:

> *"Updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including site location and layout; uses of adjacent lands and waters; population distributions; meteorology; the geologic or hydrologic setting; ecology; background radiological or non-radiological characteristics; and other environmental features."* (NRC, 2003c)

Appendix C-7 is specifically focused on RU and NB which were included under Cameco Resources' Source Material License SUA-1548 by Amendment No. 5 (NRC, 2003d). Topics covered in Appendix C-7 include the following:

- C-7.1: Site Location and Layout for the Ruth and the North Butte Satellite Facilities.
- C-7.2: Use of Adjacent Lands and Waters for the Ruth and the North Butte Satellite Facilities
- C-7.3: Population Distribution for the Ruth and the North Butte Satellite Facilities
- C-7.4: Meteorology for the Ruth and the North Butte Satellite Facilities

- C-7.5: Geologic or Hydrologic Setting for the Ruth and the North Butte Satellite Facilities
- C-7.6: Ecology for the Ruth and the North Butte Satellite Facilities
- C-7.7: Transportation for the Ruth and the North Butte Satellite Facilities

The topics covered in Appendix C-7 are largely covered by reference to previously submitted documentation, identified and referenced in this Appendix due to the nonoperational status of the RU and NB satellite facilities since their inclusion under SUA-1548.

APPENDIX C-7.1

SITE LOCATION AND LAYOUT FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 INTRODUCTION

This section provides a review of the site location and layout for RU and NB Satellite Facilities.

NUREG-1569 Appendix A states that "*updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including...site location and layout*" shall be included in a license renewal submittal. This section provides background, any changes to site locations and layout, and the importance of the changes to exposure pathways and doses. Figure 1 (included in the main body of the License Renewal Submittal) shows the general location of SR-HUP, RU and NB within the state of Wyoming.

2.0 BACKGROUND

NUREG-1569, Section 2.1, describes the area of review for site location and layout for original license applications as follows:

> "*The reviewer should establish the validity and completeness of the basic data, to determine that the site location and proposed layout proposed in the application are complete and accurate, and that the site information is sufficient to evaluate the location of proposed facilities relative to key features and activities.*"

This requirement was met in the RU and NB Amendment No. 5 issued in August 2003 (NRC, 2003d) and by PRI (PRI, 2006d), which provides a description of the site location and layout for the RU and NB Satellite Facilities as of December 2006. The site location and layout for the RU and NB Satellite Facilities is summarized below.

NB is located in southwest Campbell County, Wyoming, approximately 42 air miles south-southwest of Gillette, Wyoming. RU is located approximately 15 air miles southwest of NB in Johnson County, Wyoming. The general layout of the proposed NB site includes 10 mine units with each being about 15 acres. It will also include auxiliary facilities including office accommodations, two evaporation ponds, a disposal well(s), and a surface discharge area. Proposed layouts for mine units and facilities at RU have not been revised since the original license application submittal.

3.0 CHANGES IN SITE LOCATION AND LAYOUT

There have been no changes to either RU nor the NB locations or site layouts since 2006 (PRI, 2006d).

4.0 CONCLUSIONS

With respect to this License Renewal Submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the RU and

NB historical facility operations, including site location and layout, and has determined that no changes to the layout or location above have taken place. As neither RU nor NB are presently, nor have been in operation since incorporation into license SUA-1548, previously submitted information relating to areas covered in this appendix is still relevant and is hereby incorporated by reference.

APPENDIX C-7.2

USE OF ADJACENT LANDS AND WATERS FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 INTRODUCTION

This section provides a review of uses of adjacent lands and waters for RU and the NB Satellite Facilities. NUREG-1569 Appendix A (NRC, 2003c) states that "*updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including ... uses of adjacent lands and waters*" shall be included in a license renewal submittal. Any changes to adjacent land and water use for the North Butte site from the time of the "*North Butte ISL Satellite Project, Supportive Information for Wyoming DEQ Permit to Mine and USNRC Source Material License Amendment*" (PRI, 2006d) were examined. The Ruth site is located approximately 15 air miles southwest of the North Butte site, and is characterized by similar conditions.

The following sections provide discussion of background on uses of adjacent lands and waters, an assessment of any changes to uses of adjacent lands and waters, and the importance of the changes to exposure pathways and doses. Figure 1 (included in the main body of the License Renewal submittal) shows the general location of RU and NB within the state of Wyoming.

2.0 BACKGROUND

NUREG-1569, Section 2.1 (NRC, 2003c), describes the area of NRC review for uses of adjacent lands and waters for original license applications as follows: "*The staff should review descriptions of present and projected land use (e.g. agriculture, sanctuaries, hunting, mining, grazing, industry recreation, roads) and trends or changes in population or industrial patterns.*"

Further, NUREG-1569 states "*the staff should determine that the application contains the location of residences, ground-water supply wells, surface water reservoirs, and the estimated use of water in the lands surrounding the site of the proposed facility.*" These requirements were met most recently in 2006 by Power Resources Inc. (PRI) (PRI, 2006d), which provides a comprehensive description of the uses of adjacent lands and waters. Uses of the adjacent lands and waters as described in this document and the RU-NB Amendment No. 5 are incorporated here by reference. A review was conducted to assess whether "*any updates and changes important to the evaluation of the exposure pathways and doses*" has occurred. This review is documented in the following section.

3.0 UPDATES TO USES OF ADJACENT LANDS AND WATERS

Cattle and sheep ranching is the major land use in the region surrounding the proposed project site. There are nine ranches located within eight miles of the North Butte site. About 94 percent of the land in the Powder River Basin is classified as rangeland. Native rangeland vegetation provides the majority of the livestock forage in the region. The extraction of energy related minerals is the major industrial land use in the Powder River Basin. The production of coal, coal bed methane, uranium, oil and gas has been factors in the economy of the area.

The RU and NB sites and the surrounding areas are composed predominantly of private land, although there are parcels of state and federal (Bureau of Land Management) owned land. Even with federal ownership of land within the area, recreational use for hunting and fishing is very limited because access is often controlled by private land owners. Other than wells associated with RU and NB, there are three known water wells with pumps installed located on the North Butte license area and on adjacent land. All three wells are utilized by the T Chair Land Company for stock water, plus the Pfister Ranch well is also used for domestic purposes other than drinking and cooking.

The North Butte site is located in the Willow Creek drainage which is tributary to the Powder River. Willow Creek is classified as an ephermeral stream in the license area. The stream flows only in response to heavy snow melt and to large convective rainstorms (PRI, 2006d).

4.0 IMPORTANCE OF CHANGES TO EXPOSURE PATHWAYS AND DOSES

There have been no changes to adjacent land uses or groundwater or surface water use in the areas adjacent to the RU and NB licensed areas. As such, there have been no changes to use of adjacent lands or water that could affect evaluations of exposure pathways and doses.

5.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, can be presented. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the RU and NB historical facility operations, including uses of adjacent lands and waters, and has determined that no changes have taken place. Consequently, previously submitted information identified and referenced in this Appendix and/or section relating to uses of adjacent lands and waters is still relevant and is hereby incorporated by reference.

APPENDIX C-7.3

POPULATION DISTRIBUTION FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 INTRODUCTION

This section provides a review of population distribution data for RU and NB Satellite facilities.

NUREG-1569 Appendix A (NRC, 2003c) states that *"updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including...population distribution"* shall be included in a license renewal submittal. Population distribution data from the R/NBP was documented by the NRC (NRC, 2003d) and PRI (PRI, 2006d).

2.0 BACKGROUND

NUREG-1569, Section 2.3, describes the area of review for population distribution for original license applications as follows:

> *"the staff should review population data based on the most recent census, including maps that identify places of significant population grouping, such as cities and towns within 80-km [50-mi] radius... from the approximate center of projected (life of facility) activities"* (NRC, 2003c).

Population distribution information presented by PRI (PRI, 2006d) was reviewed and is incorporated here by reference. Recent U.S. Census Bureau information (U.S. Census Bureau, 2000 and 2010) data was reviewed to assess whether there have been any updates or changes to population distribution data that might impact the evaluation of exposure pathways and doses.

3.0 POPULATION DISTRIBUTION

This section provides a brief summary of population distribution and any changes to the regional and local population distributions. NB is located in southwest Campbell County, Wyoming, approximately 42 air miles south-southwest of Gillette, Wyoming. RU is located approximately 15 air miles southwest of NB in Johnson County, Wyoming. The majority of the population in the area resides on widely scattered ranch property.

Table C-7.3-1 provides a summary of the population fluctuation in the counties of Campbell and Johnson between the years of 1990 through 2009. The U.S. Census Bureau conducts a census every 10 years, with a census currently underway for calendar year 2010. Therefore, the most recent comprehensive census data for the cities and counties of Wyoming is available for 2000. The U.S. Census Bureau provided population estimates for the counties of Campbell and Johnson in 2009, also summarized in Table C-7.3-1.

TABLE C-7.3-1

POPULATION TRENDS IN CAMPBELL AND JOHNSON COUNTIES 1980 THROUGH 2009

Location	1980	1990	2000	2009 (Estimate)
Campbell County	24,367	29,370	33,698	43,967
Johnson County	Not available	6,145	7,075	8,531
Gillette, Wyoming	12,234	Not available	19,646	Not available
Buffalo, Wyoming	Not available	Not available	3,900	Not available

Sources: PRI, 2006d; U.S. Bureau of the Census, 1990; U.S. Census Bureau, 2000; U.S. Census Bureau, 2010.

Campbell County, the location of NB is ranked seventh in size within Wyoming. Campbell County has experienced considerable growth, with an estimated 23.4 percent growth in population from 2000 through 2009, after a documented growth of approximately 12.8 percent during the period of 1990 to 2000 and another 17.0 percent during the period of 1980 to 1990.

Despite the growth in population, Campbell County remains sparsely populated outside the town of Gillette, Wyoming. As shown in Table C-7.3-1, census information for the city of Gillette, Wyoming, indicates a population growth of approximately 37.7 percent during the period of 1980 to 2000. Therefore, most of the growth within Campbell County can be attributed to growth of the city of Gillette.

Johnson County has experienced approximately 17.0 percent growth in population from 2000 through 2009, after a documented growth of approximately 13.1 percent during the period of 1990 to 2000. The majority of the population in Johnson County is located in the city of Buffalo, which is located approximately 45 air miles northwest of RU.

Since nearly all of the population within 50 miles of the RU and NB Satellite facilities, lives more than 25 miles from the site, changes in population comparable to increases for Campbell County and Johnson County will not affect the conclusion that impacts due to the population will be negligible.

4.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, can be presented. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the RU and NB historical facility operations, including population distribution and has determined that no changes have taken place that would affect previous evaluations of pathways and doses. Consequently, references cited within this section and Appendix previously submitted information relating to population distribution is still relevant and is hereby incorporated by reference.

APPENDIX C-7.4

METEOROLOGY FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 INTRODUCTION

As part of the License Renewal submittal for the SR-HUP, NUREG 1569-Appendix A (NRC, 2003c) states that "*updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including...meteorology*" shall be included. This appendix addresses that requirement for the RU and NB Satellite Facilities by reviewing meteorological data collected near the site.

2.0 BACKGROUND

NUREG-1569, Section 2.5, describes the area of review for meteorology for original license applications as follows:

> "*the staff should determine whether the application includes sufficient local and regional-scale meteorological information to support estimates of airborne radionuclide transport from the proposed in situ leach facility to the surrounding area and for determination of airborne pathway inputs to risk assessment models*" (NRC, 2003c).

The meteorological information for NB in the "*North Butte ISL Satellite Project, Supportive Information for Wyoming DEQ Permit to Mine and USNRC Source Material License Amendment*" (PRI, 2006d) was obtained from various sources including the Natrona County International Airport located near Casper. RU is located only 15 air miles to the southwest of NB, and is characterized by the same climate. Further, the climate of RU and NB (combined Ruth and North Butte sites) as documented by PRI (PRI, 2006d) is comparable to that of the SR-HUP in that it is about 40 miles north without any significant barriers between the sites that would alter weather patterns.

3.0 GENERAL METEOROLOGY

The project license area is located in eastern Wyoming, where the climate has been generally classified under the Koppen System as semiarid and cool. The climate in the area is rather dry due to the effective barrier to moisture from the Pacific Ocean offered by the Cascades, Sierra Nevada, and the Rocky Mountains when winds are from the west and northwest. The mountain ranges in the west-central portion of the state, which are oriented in a general north-south direction, are perpendicular to the prevailing winds. These ranges also tend to restrict the passage of storms and thus restrict precipitation in the eastern part of Wyoming (NCDC, 2008).

Meteorological data (wind speed, wind direction, precipitation and temperature) for the project area are taken from the Natrona County International Airport near Casper, Wyoming. About 70 percent of the annual precipitation occurs during the growing season of late spring and summer, mostly as thunderstorms. Monthly snowfall amounts are unusually uniform from November through February, and a bit heavier in March and April. The site experiences large diurnal and annual temperature ranges. This is due to the advent of both warm and cold air masses and the relatively high elevation which permits rapid

incoming and outgoing radiation. Windy days are quite frequent during winter and spring months. Usually the stronger winds are from the southwest and this tends to raise the temperature because the wind is moving downslope.

A review of the meteorological data indicates that the precipitation, temperature and wind speed and direction for the SR-HUP have not changed appreciably such that they would change overall estimates of exposure and doses from the site. Because of RU and NB's relative proximity to the SR-HUP and the fact that much of the data for RU and NB is also from the Natrona County Airport, it is concluded that temperature, precipitation and wind speed and direction have not changed appreciably and would not impact exposure or doses.

4.0 CONCLUSIONS

Comparisons of recent meteorological data (through 2008) were compared to data used in the License Renewal submittal (RAMC, 1999) for the SR-HUP to assess whether changes have occurred that might impact "exposure pathways and doses". The overall climate, precipitation, temperature and wind speed and direction were evaluated. This comparison shows that temperature, wind speed, and wind direction data through 2008 have been consistent with data for these parameters from previous periods used for the last License Renewal Submittal (RAMC, 1999). Using these data as indicators, the meteorology for the SR-HUP, RU, and NB has remained consistent with historic meteorology since the last License Renewal Submittal and should not impact previous analyses of exposure pathways and doses.

APPENDIX C-7.5

GEOLOGIC OR HYDROLOGIC SETTING FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

Appendix C-7.5 Geologic or Hydrologic Setting for the Ruth and North Butte Satellite Facilities

1.0 INTRODUCTION

NUREG-1569 Appendix A (NRC, 2003c) states that "*updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including...the geologic or hydrologic setting*" shall be included. This section provides a review of the geologic and hydrologic setting for RU and the NB Satellite facilities.

2.0 BACKGROUND

The document titled "*North Butte ISL Satellite Project, Supporting Information for Wyoming DEQ Permit to Mine and USNRC Source Material License Amendment*" prepared by PRI (2006d) included a description of the geology, topography, stratigraphy, structure, seismicity, and hydrology for the North Butte site. Due to its close proximity, located only 15 air miles to the southwest, the regional conditions described in PRI (2006d) are considered relevant also to the Ruth site.

A review of each topic above was conducted based upon available literature and data collected from the site. This is followed by a conclusions section that provides an evaluation to assess whether "*updates and changes to any site characterization (geologic or hydrologic setting) information important to the evaluation of exposure pathways or doses*" has occurred since PRI (2006d) was prepared.

3.0 REGIONAL AND LOCAL GEOLOGY

The following discussion on the regional and local geology of the area surrounding the RU and NB Satellite Facilities was obtained from PRI (2006d).

The Powder River Basin is a large structural and topographic depression parallel to the Rocky Mountain trend. The Basin is bounded on the south by the Hartville Uplift and the Laramie Range, on the east by the Black Hills, and on the west by the Big Horn Mountains and the Casper Arch. The Basin is an asymmetrical syncline with its axis closely paralleling the western margin. During sediment deposition, the structural axis shifted westward resulting in the asymmetry present in the Basin. On the eastern flank of the Basin, sedimentary rock strata dip gently to the west at approximately 0.5 to 3 degrees. On the western flank, the strata dip more steeply, 0.5 to 15 degrees to the east towards the axis of the Basin, with the dip increasing as distance from the axis increases.

The North Butte solution mining site is situated in the Eocene Wasatch Formation off the southeast flank of North Pumpkin Butte in Campbell County. The mineralized sand members are in the lower part of the formation, at an approximate average depth of 500 to 650 feet. The host sands are primarily arkosic in composition, very friable, and contain substantial organic debris and carabonaceous stringers. Though periodic small, localized, sandy shale intervals occur within the sand, the main body of the sand is relatively free of interstitial shale; however, the sands may thicken and/or thin to the point of removal in some areas.

There are three primary mineralized sand members in the North Butte mining sand. These sand members are identified as "C", "B", and "A" in descending order. The "C" sand member is the shallowest, and the "A" sand member is the deepest. The primary ore bearing member of the three is the "B" sand. In most of the license area, these sand members are separate and distinct; however, in a substantial portion of the area, the separating aquicludes between the sands thin and allow vertical contact between either the "A" and "B" members, or the "B" and "C" members. In these areas, there are effectively only two mining members in the North Butte mining sand. The North Butte mining sand, with its three members, is bounded above and below by impermeable shale layers. The upper and lower aquicludes are composed of shales, silty shales, and shaley lignite interbeds.

The ore body is a typical Power River Basin roll front deposit. In the NB area, the oxidation front extends from the northwest to the southwest. The sand members also have several vertically superimposed individual roll fronts. Due to the occasional vertical contact between the mineralized sand members, there are often several smaller fronts that overlay each other.

In the NB ore deposit, the uranium mineralization is present as amorphous uranium oxide or sooty pitchblende with some subordinate carnotite. The host sandstones are composed of quartzite, feldspars, and rock fragments with locally occurring carbon fragments. Grain size ranges from very fine-grained sand to small grains. The sandstone is weakly to moderately cemented and friable. Occasional occurrences of pyrite and calcite as cementing materials can be observed. The uranium is deposited upon individual detrital sand grains or upon and within authigenic clays in the interstices. The interstitial clays present are primarily montmorillonite with lesser amounts of kaolinite. Hematite, along with minor limonite, is a common oxidation product of pyrite within the host rock.

4.0 TOPOGRAPHY

In the eastern and southern portions of the license area, the topography is fairly level, although moderately dissected by ephemeral stream channels. In the northern and western portions, the slope of the topography increases and the drainages become more incised due to the proximity of North Butte. The surface elevations range from about 4,900 feet in the extreme south of NB, to about 5,700 feet near the flank of NB.

The overall topographic condition of the North Butte portion of the license area is that 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. The drainages are ephemeral in nature and generally trend from the north to the south, eventually forming tributaries to Willow Creek, which runs from east to west, crossing the southern tip of the NB license area. In the western portion of the NB license area, the terrain is more sloped with the drainages more incised.

5.0 STRATIGRAPHY

The Powder River Basin incorporates a sedimentary rock sequence that approaches 15,000 feet thick along the synclinal axis. These sedimentary rocks range in age from Tertiary to Cambrian. The Tertiary rock units were deposited in fluvial to lacustrine environments in a cyclic fashion.

The Tertiary fluvial system had a general drainage direction from south to north. Source areas of the sediments were primarily located to the south and southwest. The drainage systems, both surface and subsurface, generally follow the Tertiary paleodrainage trends. Rock types generally consist of sandstones, siltstones, shales, and numerous coal seams. The Tertiary rock units outcropping within the Basin are the Fort Union Formation (Paleocene), the Wasatch Formation (Eocene), and the White River Formation (Oligocene). NB is located within the Wasatch Formation. The basement rocks of the Powder River Basin are sediments of Paleozoic and Mesozoic age. These igneous and metamorphic rocks form the outcrop rim around the Basin.

The Wasatch Formation consists of brown to gray claystone, siltstone, and carbonaceous shales interbedded with buff sandstone lenses and coal beds. In the vicinity of the Pumpkin Buttes, the Wasatch Formation is predominantly a pink to red and gray, variegated sequence. The formation has a maximum thickness of about 3,500 feet within the Powder River Basin. The base of the Wasatch Formation in the license area is about 1,350 feet below the surface.

The structural attitude of the beds is nearly horizontal in the Basin, with only a slight dip of 0.5 to 1.5 degrees to the northwest. Evidence of structural instability at the North Butte site such as faulting has not been observed. The closest known faulting or significant folding is present approximately 16 miles to the west of the NB site, along Pine Ridge.

6.0 SEISMICITY

The area of central Wyoming where RU and NB are located lies in a relatively quiet seismic region of the U.S. Although distant earthquakes may produce shocks strong enough to be felt in the Powder River Basin, the region is ranked as one of minor seismic risk. Few earthquakes capable of producing damage have originated in this region. The seismically active region closest to RU and NB is the Intermountain Seismic Belt of the Western U.S., which extends in a northerly direction between Arizona and British Columbia. Part of this seismic belt extends along the Wyoming-Idaho border, more than 200 miles west of the license area, and is the most probable source of earthquakes affecting the site.

7.0 GROUNDWATER HYDROLOGY

NB is located slightly west of the axis of the Powder River Basin syncline. Each of the aquifers of interest exists in the Wasatch Formation. This formation is a fluvial deposit and contains alternating layers of sands and shales. The major sands can be correlated for miles, and are the basis for regional

aquifers in the Powder River Basin. Regionally, combined with the underlying Fort Union Formation, the Wasatch is developed extensively by shallow domestic and stock wells that are stratigraphically above proposed mine units. Locally, the Wasatch Formation is developed mainly as a source of groundwater for livestock use.

Recharge to the sands of the Wasatch is mainly on their outcrops, with some influx of groundwater from a vertical movement through adjacent aquitards. Flow in the aquifers generally moves to the north along the paleodrainage trends, with a small portion of the groundwater discharging to streams. Aquifer properties are locally unpredictable due to large variations in local lithologies.

Extensive chemical data exists for the Wasatch aquifer system. Due to the discontinuous nature of the water-bearing sandstones, water quality concentrations within the system can be quite variable. Typically, total dissolved solids (TDS) content varies from less than 250 milligrams per liter (mg/l) to over 6,500 mg/l, with a general decrease in TDS with increasing depth for parts of the aquifer. Waters containing less than 500 mg/l TDS are generally enriched with bicarbonate, while higher TDS waters generally exhibit higher dissolved sulfates.

8.0 CONCLUSIONS

Evaluations of regional and local geologic data, seismicity, and groundwater hydrology were conducted by PRI (PRI, 2006d). The regional descriptions presented in the literature have not changed as there have been no additional regional evaluations that have been performed since 2006. Consequently, no changes or updates to regional and site geology or hydrology that would impact the existing evaluation of exposure pathways or doses specific to RU or NB.

APPENDIX C-7.6

ECOLOGY FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 INTRODUCTION

NUREG-1569 Appendix A (NRC, 2003c) states that "*updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including...ecology*" shall be included in a license renewal submittal. This requirement is addressed for Cameco Resources' Source Material License SUA-1548 for the RU and NB Satellite Facilities in this appendix.

The following sections provide background, discussion of any changes to ecology, and the importance of the changes to exposure pathways and doses as applicable to RU and NB.

2.0 BACKGROUND

NUREG-1569, Section 2.1, describes the area of NRC review for ecology for original license applications as follows:

> "*The staff should review the descriptions and inventories of the flora and fauna in the vicinity of the site, including habitats and distribution. The review should include terrestrial and aquatic organisms on or near the site, and their relative (qualitative) abundance should be established. ...If important species are determined to be present, the staff should evaluate any likely detrimental effects on the organism by the proposed facility and its operations.*" (NRC, 2003c)

This requirement was met most recently in PRI (2006d), which provides a comprehensive description of the ecology at NB, which is summarized below. RU is located in close proximity to NB, and is therefore assumed to be characterized by similar ecology.

3.0 VEGETATION

The RU and NB Satellite Facilities licensed areas are located in a semi-arid region with severe winters, cool summers, and about 14 inches of precipitation annually. Grasses on the North Butte site are primarily cool-season, sod forming, and bunchgrasses. Artemisia tridentate is the dominant shrub species on the license area. Along Willow Creek, numerous Pooulus deltoides are found. Junipers are common on the slopes of the North Butte and the drainages leading away from the Butte.

The North Butte portion of the RU and NB license area encompasses approximately 1,039 acres and supports four vegetation types. These types, and their respective percentages on the license area, are as follows:

- Sagebrush/Grassland: 62.2%
- Grassland: 34.5%
- Bottomland: 2.5%
- Juniper/Sagebrush: 0.8%

A total of 120 plant species were identified on the North Butte license area. Of these, five noxious weed species and one selenium-indicator species were encountered during field surveys. No plant species currently listed or proposed for listing as threatened or endangered by the U.S. Fish and Wildlife Service were observed on the license area.

One Extended Reference Area was established in an area that will not be disturbed for the life of the mine. This area will be used to evaluate post-mining revegetation success.

The NB license area is currently used as rangeland for domestic livestock and provides wildlife habitat.

4.0 WILDLIFE

Pronghorn and mule deer were the only big game species observed on the study area (i.e., North Butte site) during baseline investigations. Although the Wyoming Game and Fish classifies the study area as winter/yearlong range, pronghorn appear to favor areas outside of the study area during the winter. During other seasons of the year, they make use of habitat within the study area. Mule deer were observed on the study area throughout the year.

No active prairie dog colonies are located on or within one-half mile of the NB license area. During morning and evening hours, coyote, red fox and badgers were observed in the study area vicinity. Also, one striped skunk was observed. While these species are rarely seen, they are believed to be common in the Pumpkin Buttes vicinity. White-tailed jackrabbits were common throughout the study area, while cottontails were most common around man-made structures. Numerous mice and voles inhabit the study area, of which the deer mouse is likely the most common. Also, several bat species have been identified within the area.

No raptor nests were located on the NB license area during baseline investigations. Within one mile of the North Butte license area, several nests were identified; however, none of these nests appeared to be active during studies performed in 1988 (PRI, 2006d). Golden eagles were the most conspicuous year-round residents in the study area and vicinity. They have been observed frequently throughout the year, flying over the study area or roosting on fence posts and power poles. Bald eagles were only observed in the vicinity of the study area during the winter months. Other raptors which have been observed in the area include red-tailed hawk, marsh hawk, ferruginous hawk, Swainson's, hawk, rough-legged hawk, American kestrel and the prairie falcon.

No sage grouses leks have been identified within the NB license area. There are, however, two strutting grounds located in the near vicinity. No sage grouse nests were observed on the license area, but it is likely that some individual nests are located on land adjacent to the license area. During June, female sage grouse and their broods were observed throughout the license area in the sagebrush and grassland habitat types.

The State of Wyoming is in the process of finalizing "core areas" of protection for the Greater Sage Grouse, which in March 2010 the U.S. Fish and Game Department designated as "warranted but precluded" from listing under the Endangered Species Act. To protect the bird and to increase the likelihood of it not being listed as Endangered, the state's Sage Grouse Implementation Team appointed by the Governor has mapped proposed core protection areas based on the number of active leks and other factors. At present, RU and the NB Satellite Facilities are outside of sage grouse core areas.

The state is developing stipulations that will limit and control development within core area and has established working groups, including a working group for the uranium industry, to develop proposed stipulations that would detail the type and extent of operations permitted while protecting the bird.

Mourning doves were the only other upland game bird observed within the study area. They are quite common and were most often observed in the juniper habitat on the flanks of the North Butte. No waterfowl were observed in the study area.

Three Federally-listed endangered species, the bald eagle, peregrine falcon and black-footed ferret, are potential inhabitants in the study area. Bald eagles are commonly observed in the vicinity of the study area during winter months. Peregrine falcons are considered a rare migrant and winter visitant in Wyoming. Black-footed ferrets are not expected to occur on the license area due to the absence of active prairie dog colonies.

Three species considered rare in Wyoming, the burrowing owl, spotted bat and the pale milk snake, could potentially occur in the study area. Habitat for the burrowing owl (i.e., prairie dog colonies) has not be detected in the study area. The rimrock of the Buttes seems to provide suitable habitat for the spotted bat; however, the spotted bat is only known to occur in the Big Horn Basin and is not likely to occur in the study area. The pale milk snake is secretive in nature and occupies a variety of habitats ranging from coniferous forest, broadleaf woodlands, and river bottoms to rocky hillsides, prairies, and sand dunes and has not been detected study area.

5.0 IMPORTANCE OF UPDATES TO ECOLOGY AND CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, can be presented. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the RU and NB historical facility operations, including ecology, and has determined that no changes have taken place. Consequently, previously submitted information relating to ecology is still relevant and is hereby incorporated by reference.

APPENDIX C-7.7

TRANSPORTATION FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 INTRODUCTION

This section provides a review of the impacts of transportation for the RU and NB Satellite Facilities.

NUREG-1569 Appendix A (NRC, 2003c) states that "*updates and changes to any site characterization information important to the evaluation of exposure pathways and doses, including other environmental features,*" shall be included in a license renewal submittal. Other environmental features include transportation.

A brief review of main transportation routes and impacts from the RU and NB Satellite Facilities are presented in the following sections, along with an assessment of any updates and changes to transportation important to the evaluation of exposure pathways and doses.

2.0 BACKGROUND

NUREG-1569, Section 2.10, describes the area of NRC review for other environmental features for original license applications as follows:

> "*The staff should consider environmental information provided in this section as auxiliary information to support an application for a given facility. The information should be considered in a site-specific context and should be consistent with the information provided in other sections of the application.*" (NRC, 2003c)

The transportation impacts information was reviewed to assess whether there have been any updates or changes in major transportation routes that might impact the evaluation of exposure pathways and doses.

3.0 SUMMARY OF TRANSPORTATION AND UPDATES

Access to NB is by State Highway 50, south from Gillette to Savageton, then west and south on a Campbell County road and an existing oil field road to the existing plant site access road located in Section 25 of T44N, R76W. At that point, the road is used exclusively for North Butte mining activities and coal bed methane property development and progresses approximately 0.9 miles to the site (PRI, 2006d). RU is located approximately 15 air miles to the southeast of NB, is accessed from State Highway 387 in Johnson County.

Since both RU and NB are satellite facilities that will have a satellite plant only (i.e., only IX loading of uranium occurs). Resin from these satellite facilities will be transported to the SR CPP for processing. Based upon information from the Gas Hills Satellite facility (GH), it is anticipated that shipments will be limited to no more than one or two trips per day.

Surface transportation routes from RU and NB to the SR-HUP CPP include:

- From North Butte site to SR-HUP: From site access, take State Highway 50 south to State Highway 387 (approximately 12 miles). Go west on State Highway 387 (approximately 30 miles) to Interstate 25 (I-25). Go south on I-25 (approximately 55 miles) to State Highway 95 (19 miles), then 0.1 miles of State Highway 93, 7.6 miles along Ross Road, and 1 mile of gravel road to the SR-HUP.
- From Ruth site to SR-HUP: From site access, take State Highway 387 (approximately 20 miles) west to Interstate 25 (I-25). Go south on I-25 (approximately 55 miles) to State Highway 95 (19 miles), then 0.1 miles of State Highway 93, 7.6 miles along Ross Road, and 1 mile of gravel road to SR-HUP.

RU and the NB Satellite Facilities are not currently operational. Additional traffic volumes anticipated once operations commence are relatively small compared to the existing traffic on the roadways in the vicinity, and therefore is not expected to significantly contribute to the congestion or accident rates on these roadways. There have been no changes to the proposed transportation routes for workers to the site or shipment of uranium-loaded resin to the SR-HUP facility.

4.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, could be presented. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the RU and NB historical facility operations, including updates and changes to transportation impacts for RU and NB as summarized in the sections above, and has determined that no new or significant information can be added at this time. Previously submitted information and referenced cited in this Appendix relating to transportation impacts for RU and NB are still relevant and is hereby incorporated by reference.

APPENDIX C-8

ENVIRONMENTAL EFFECTS OF SITE OPERATIONS INCLUDING DATA ON RADIOLOGICAL AND NON-RADIOLOGICAL EFFECTS, ACCIDENTS, AND THE ECONOMIC AND SOCIAL EFFECTS OF OPERATIONS FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 INTRODUCTION

This appendix (Appendix C-8) of the License Renewal submittal for Source Material License SUA-1548 has been prepared in conformance to NUREG-1569, "*Standard Review Plan for In Situ Leach Uranium Extraction License Applications*" (NRC, 2003c). The approach to preparation of license renewal submittals as presented in NUREG-1569 Appendix A is streamlined, requiring the licensee to present "*compliance history or record of site operations and changes*" to the NRC for review. Further, NUREG-1569 Appendix A states that:

> *"Aspects of the facility and its operations that have not changed since the last license renewal or amendment should not be reexamined".*

The information and data presented in the license renewal submittal can therefore be optimized, to present:

- By reference, any previously submitted documentation in areas that have not changed;
- The record of site operations demonstrating that health, safety and environment have been protected throughout the previous license period; and
- Any "new or significant" information, describing aspects of facility or operations that have changed during the previous license period.

This approach allows for the NRC review to be keenly focused on "*only those changes proposed by license renewal or amendment application*" (NRC, 2003c).

2.0 APPENDIX C-8 CONTENT

Appendix C-8 has been prepared to conform with NUREG-1569 Appendix A guidance, specifically:

> *"Environmental effects of site operations including data on radiological and non-radiological effects, accidents, and the economical and social effects of operations.*" (NRC, 2003c)

Appendix C-8 is specifically focused on RU and NB which was included under Cameco Resources' Source Material License SUA-1548 by Amendment No. 5 in 2003 (NRC, 2003d). Topics covered in Appendix C-8 include the following:

- C-8.1: Release and Accident History for the Ruth and the North Butte Satellite Facilities
- C-8.2: Surface and Groundwater Monitoring History for Ruth and North Butte Satellite Facilities
- C-8.3: Assessment of Occupational Radiation Exposure and Dose Data for the Ruth and the North Butte Satellite Facilities
- C-8.4: Historical Airborne Effluent and Environmental Monitoring Program Assessment for the Ruth and the North Butte Satellite facilities

- C-8.5: Historical Quality Assurance Program Assessment for the Ruth and the North Butte Satellite facilities
- C-8.6: Cumulative Effects of Operations for the Ruth and the North Butte Satellite facilities

The topics discussed in Appendix C-8 are largely covered by reference to previously submitted documentation, due to the non-operational status of these satellite facilities.

APPENDIX C-8.1

RELEASE AND ACCIDENT HISTORY FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 INTRODUCTION

This section provides a review of the impacts of spills and releases for the RU and NB Satellite Facilities.

In accordance with SUA-1548 License Condition 12.1:

> *"Until license termination, the licensee shall maintain documentation on spills of source or 11e(2) byproduct materials (including mining solutions) and process chemicals. Documented information shall include, but not be limited to: date, spill volume, total activity of each radionuclide released, radiological survey results, soil sample results (if taken), corrective actions, results of post remediation surveys (if taken), and a map showing the spill location and the impacted area."* (NRC, 2007c)

Further, License Condition 12.1 requires the licensee to maintain and follow procedures for evaluation of consequences of any spill and to determine if reporting to the NRC Operations Center is necessary. The timing of initial notification and written reports to the NRC and appropriate State agencies are also described in License Condition 12.1.

2.0 SUMMARY OF SPILLS AND RELEASES FOR THE R/NBP

Since its inclusion under the SR-HUP license SUA-1548, both the RU and NB has been non-operational. There have been no spills that required documentation, evaluation of consequences against reporting criteria, notification or report submittal to the NRC or State agencies associated with Cameco Resources' activities at RU or NB.

3.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of information previously provided to the NRC to assess whether there is "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the RU and NB historical facility operations, including documentation of spills or releases as summarized in the sections above, and has determined that no new or significant information can be added at this time. Consequently, previously submitted information relating to areas covered in this appendix is still relevant and is hereby incorporated by reference.

APPENDIX C-8.2

SURFACE AND GROUNDWATER MONITORING HISTORY FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 INTRODUCTION

This section provides a summary and review of data from the Groundwater and Surface Water Monitoring Programs for the RU and NB Satellite Facilities. Both of these satellite facilities continue to be in a developmental phase with no mining activities having taken place.

Cameco Resources has Groundwater and Surface Water Monitoring Programs in place for the RU and NB satellite facilities to monitor well fields that will be in production or restoration. When these satellite facilities are actively mined, both will fall under their respective monitoring programs. Since their inclusion by Amendment No. 5 (NRC, 2003d) into SUA-1548 in 2003, both satellite facilities have been inactive and there has been no monitoring of groundwater or surface water performed for these sites. Cameco Resources has Groundwater and Surface Water Monitoring Programs in place for the RU and NB satellite facilities to monitor well fields that will be in production or restoration. When these satellite facilities are actively mined, both will fall under their respective monitoring programs. Since their inclusion by Amendment No. 5 (NRC, 2003d) into SUA-1548 in 2003, both satellite facilities have been inactive and there has been no monitoring of groundwater or surface water performed for these sites.

As a result of a review of Water Rights for the licensed areas, the following updated NB and RU Application Tables have been prepared and have been included in this License Renewal submittal on an accompanying CD under a separate PDF file due to the extensive nature of the information contained in the tables.

- NB
  - Table 10.17 Ground Water Rights for T43_R75, T43_R76, T44_R75 and T44_R76.
  - Table 10.16 Surface Water Rights for T44_R75 and T44_R76.
- RU
  - Table 10.20 Ground Water Rights for T42_R77 and T42_R78.
  - Table 10.19 Surface Water Rights for T42_R77 and T42_R78.

While the following sections provide the background for Groundwater and Surface Water Monitoring Programs, a conclusion that no "new or significant" information related to groundwater and surface water monitoring can be presented at this time. Previous submittals referenced within this Appendix leading to NRC approval of Amendment No. 5 for inclusion of the RU and NB Satellite Facilities under SUA-1548 are still relevant and are incorporated by reference.

1.1 Baseline, Production, and Restoration Monitoring

Baseline samples are collected prior to the mining operation in any given wellfield to characterize the aquifer and establish upper control limits (UCLs) for excursion indicators and restoration targets. Baseline samples

are sent to an accredited outside laboratory with an accompanying Chain of Custody to be analyzed for WDEQ, LQD Guideline 8 parameters. After four rounds of sampling are completed, the UCLs are established and approved by the WDEQ for the parameters of interest.

Wells outside the mineralized production pattern of the production aquifer (M-wells) are monitored for water levels and excursion parameters (i.e., chloride, alkalinity, and conductivity) twice a month with at least 10 days between sampling events during production operations and every 60 days during restoration. Production pattern monitoring wells (MP-wells) are also monitored every 60 days during restoration operations to evaluate the restoration progress. The collected samples are analyzed in the on-site Chemical Laboratory and once a month split samples are sent to an outside accredited lab for quality assurance. Results for the excursion parameters are compared to the UCLs to determine if an excursion of production fluids has occurred. If concentrations of any two of the three excursion parameters exceed the UCLs, then the results indicate that an excursion has possibly occurred.

When an excursion is first indicated by monitoring results, sampling is repeated within 24 hours of receiving the analytical data to confirm the excursion. If the excursion is confirmed, the NRC and WDEQ are notified, and subsequent sampling of the well is conducted at least every seven days for the UCL parameters and uranium. Weekly monitoring is continued until the excursion is no longer detected.

During restoration, the groundwater monitoring program continues, but with changes to the monitoring network and frequency of monitoring. At the start of restoration, the MP-Wells designated as restoration stability monitoring wells are sampled and analyzed for a baseline suite of water quality parameters. Following the initial sampling, the restoration stability monitoring MP-wells are sampled approximately every 60 days during active restoration, with samples analyzed for at least conductivity, chloride, and uranium. During the groundwater sweep stage of restoration, the monitoring frequency for monitoring wells in the production-depth aquifer, overlying aquifer and underlying aquifer is reduced to once every 60 days. Regulatory agencies are contacted if the wells cannot be monitored within 65 days of the last sampling event. Analysis for the excursion parameters continues throughout the restoration phase. Following concurrence from WDEQ that restoration has been achieved in a mine unit, a six month stability period is assessed, during which monitoring continues at the restoration stability monitoring MP-wells and the monitoring wells. During this period, the wells are sampled once every two months, with restoration stability monitoring MP-wells sampled for excursion parameters, uranium, total dissolved solids (TDS), and other parameters, if necessary, and monitoring wells sampled for excursion parameters.

1.2 Monitoring of Domestic and Livestock Wells

As with the SR-HUP Groundwater Monitoring Program, livestock and domestic wells within one kilometer of operating mine units have been sampled quarterly for natural uranium and Ra^{226}. Concentrations of natural uranium and Ra^{226} from the livestock and domestic wells are compared to the Effluent Concentrations presented in 10 CFR Part 20, Appendix B. The limits presented in 10 CFR Part 20

are applicable to the assessment and control of dose to the public, and are equivalent to the radionuclide concentrations which, if ingested continuously over the course of a year, would produce a total effective dose equivalent of 0.05 rem. These Effluent Concentrations are 6 x 10^{-8} microCuries per milliliter (μCi/ml) for radium-226 and 3 x 10^{-7} μCi/ml for natural uranium (10 CFR 20).

2.0 SURFACE WATER MONITORING BACKGROUND FOR RU AND NB

The purpose of a surface water monitoring program is to detect any potential migration of contaminants from the site into nearby surface water bodies (NRC, 2003d). In general, the risk of contamination to surface water bodies from ISR operations is low when proper operational procedures are followed (NRC, 2003d).

2.1 Description of Surface Water Monitoring Program for RU-NB

Surface water monitoring is not conducted at RU and NB since mining operations have not been initiated.

3.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, could be presented. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the RU and NB historical facility operations, including updates and changes to groundwater and surface water monitoring programs as summarized in the sections above, and has determined that no new or significant information can be added at this time aside from the updated Groundwater and Surface Water Rights tables. Consequently, references cited within this and other relevant sections and previously submitted information relating to the historical groundwater and surface water monitoring program are still relevant and are hereby incorporated by reference.

APPENDIX C-8.3

ASSESSMENT OF OCCUPATIONAL RADIATION EXPOSURE AND DOSE DATA FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 INTRODUCTION

The following four sub-sections will provide assessment of workers' exposure to radiation through review of historical records for:

- Appendix C-8.3.1: Historical Radiation Monitoring Program Assessment for Ruth and North Butte Satellite Facilities
- Appendix C-8.3.2:– Historical Results of Radiation Dose Calculations for Ruth and North Butte Satellite Facilities
- Appendix C-8.3.3:– Historical Bioassay Program Assessment for Ruth and North Butte Satellite Facilities
- Appendix C-8.3.4:–Historical Occupational Exposure Rate Monitoring Assessment for Ruth and North Butte Satellite Facilities

The following appendices address these topics as applied specifically to RU and NB.

Each of the following appendices provides background information on regulatory requirements and NRC guidance for monitoring of radionuclide exposure and occupational doses received by workers. The historical data from Cameco Resources employee monitoring programs, as applicable to both RU and NB, are presented. The historical data is reviewed and conclusions are presented.

Due to the minimal level of activity on the RU and NB Satellite Facilities since its inclusion into the SR-HUP Source Materials License SUA-1548 in 2003, workers' radiation exposure and dose directly related to satellite facilities are the result of exposure to background radiation and are minimal, and well below regulatory requirements.

APPENDIX C-8.3-1

HISTORICAL RADIATION MONITORING PROGRAM ASSESSMENT FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 HISTORICAL RESULTS OF AIRBORNE RADIATION MONITORING (OCCUPATIONAL)

The purpose of this section is to provide an assessment of occupational radiation exposure due to airborne radionuclides, for the RU and NB Satellite Facilities.

2.0 REGULATORY REQUIREMENTS

Subpart C of 10 CFR Part 20 limits the TEDE limit for occupational workers to 5 rems/year, shallow dose equivalent to the skin to 50 rems/year, and dose equivalent to the embryo/fetus of a pregnant worker to 0.5 rem during the entire pregnancy. In order to limit the internal dose from radionuclide intakes, the NRC requires that work areas be routinely monitored and posted according to their exposure rate classification. In addition, radiation work permits (RWP) for conducting non-routine tasks must contain information regarding radiation levels in the work areas. Monitoring programs focused on workplace airborne radionuclide concentrations are the most effective tool to evaluate and limit workplace internal doses due to inhalation of radioactive material.

As per NRC License SUA -1548 Condition No. 9.7, NRC's Regulatory Guide 8.30, "*Health Physics Surveys in Uranium Recovery Facilities*," (NRC, 2002a) requires that airborne soluble uranium measurements be conducted weekly in airborne radioactivity areas (areas with the potential for air concentrations to be greater than 1 Derived Air Concentration [DAC]), and monthly in areas not designated as airborne radioactivity areas to determine toxicological intakes and radiobiological doses. Measurement of radon progeny should be collected monthly in areas where radon progeny routinely exceeds 10 percent of the DAC, and increased to weekly if radon progeny exceeds 25 percent of the DAC.

Buildings (or rooms within buildings) that contain or have the potential for airborne radionuclide concentrations exceeding 1 DAC are posted with the sign, "Caution Airborne Radioactivity Area". This posting provides workers and managers with information helpful in minimizing radiation doses.

3.0 AIRBORNE RADIATION MONITORING RESULTS FOR THE R/NBP

Cameco Resources' monitoring program for occupational exposure due to airborne radionuclides is applicable to indoor work areas such as satellite IX facilities, header houses, and the SR CPP, and when operational, the HUP CPF. No such work environments exist at either RU or NB at present, consequently, there are no monitoring results for either RU or NB.

4.0 CONCLUSIONS

With respect to this License Renewal Submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance

relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the RU and NB historical facility operations, including occupational exposure to airborne radionuclides, determining that no changes have taken place as there have been no current mining activities nor has there been any mining operations since incorporation into license SUA-1548. Consequently, previously submitted information relating to areas referenced in this appendix is still relevant and is hereby incorporated by reference.

APPENDIX C-8.3-2

HISTORICAL RESULTS OF RADIATION DOSE CALCULATIONS FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 OVERVIEW

The purpose of this section is to provide a review of worker radiation dose exposure data reported for the RU and NP Satellite Facilities.

2.0 REGULATORY REQUIREMENTS

NRC licensees are required to develop and implement a radiation protection program that limits radiation doses to levels that ALARA and within the occupational dose limits (10 CFR 20.1101 and 10 CFR 20.1201, respectively). Administrative and engineering controls are used to reduce radiation exposures.

Occupational dose limits are specified in 10 CFR 20.1201. The annual limits are the more limiting of: (i) a TEDE of 5 rem/year; (ii) the sum of the deep-dose equivalent and the committed dose to any organ (with exception of the lens of the eye) of 50 rem/year; (iii) the dose to the lens of the eye of 15 rem/year; and (iv) the dose to the skin or any extremity of 50 rem/year. In addition to the annual dose limits, the soluble uranium intake by a worker may not exceed 10 milligrams (mg) in a week. This limit is based on the chemical toxicity of uranium. For normal ISR operations, limiting the TEDE to 5 rem/year and the intake of uranium to 10 mg/week is the primary focus of the radiation protection program since exposure conditions are not such that high extremity and organ doses are limiting.

Worker monitoring requirements are specified in 10 CFR § 20.1001 to 20.2401 (Standards for Protection Against Radiation). Pursuant to NRC License SUA-1548 License Condition 9.7 and Section 9.11 of the NRC License Renewal Submittal (NRC, 2008) employee exposures at SR-HUP and RR are monitored in accordance with NRC Regulatory Guides 8.30, "*Health Physics Surveys in Uranium Recovery Facilities,*" and NRC Regulatory Guide 8.34, "*Monitoring Criteria and Methods to Calculate Occupational Radiation Doses.*" Routine employee external doses are determined and recorded for those employees likely to receive more than 10 percent of the allowable occupational dose limit (i.e. 0.5 rem). External exposures are determined using personnel dosimeters that are exchanged periodically, or at the end of a task, depending on the expected exposure potential. Routine employee internal doses are determined and recorded for those employees likely to receive an intake of more than 10 percent of the Annual Limit on Intake (ALI) from radon daughters or uranium. Internal doses are determined by calculation using air quality data and time of exposures, or from the results of bioassay sampling.

Non-routine doses are determined and recorded for all employees conducting non-routine work activities that require a RWP. In the event that an employee has routine and non-routine doses for a monitoring period, doses are summed to determine the total dose. In accordance with NRC regulations, internal exposures are summed (e.g. quarterly, yearly) and the TEDE calculated by adding the dose equivalent from internal exposure to the dose equivalent from external sources of radiation.

3.0 WORKER EXPOSURES AND ALARA IMPLEMENTATION

Workers who have the potential for receiving 10 percent of the dose limits for internal or external radiation must be monitored. Cameco Resources conservatively interprets this requirement and monitors workers who would not be expected to reach the 10 percent dose threshold. Maintenance and wellfield personnel have been monitored although these work areas are not expected to reach the dose threshold. Long-term monitoring of the radiation doses received in satellite ion exchange facilities, in on-site laboratories and in the SR CPP has also been performed. Historical results show the maximum TEDEs reported for workers at the SR-HUP are well below applicable standards, are consistent with doses the NRC indicates to be representative of uranium ISR facilities, and are stable over the 10 year period since the last License Renewal Submittal.

4.0 SUMMARY OF HISTORICAL RESULTS OF RADIATION DOSES TO WORKERS FOR THE R/NBP

A review of the historical results of radiation dose calculations for the SR-HUP is provided in Appendix A-8.3-2. In comparison to routine operations of active wellfields, satellite IX facilities and the CPP, the potential for radiation dose exposure being directly related to RU or NB activities is minimal. Dose history could be considered inclusive of contribution from the minimal on-site RU and NB activities that have occurred since 2003. Review of radiation dose calculations shows that Cameco Resources' employees receive very low radiation doses resulting from background radiation exposure that is well below the regulatory limits.

5.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the RU and NB historical facility operations, including results of radiation dose calculations, determining that no changes have taken place as both RU and NB not presently nor has been in operation since incorporation into license SUA-1548. Consequently, previously submitted information relating to areas covered in this appendix is still relevant and is hereby incorporated by reference.

APPENDIX C-8.3-3

HISTORICAL BIOASSAY PROGRAM ASSESSMENT FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 OVERVIEW

The purpose of this section is to provide a review of workers' exposure to radiation as measured through bioassays, and is specific to the RU and NB Satellite Facilities.

NRC licensees are required to limit workers' intake in areas with airborne radionuclides by sequential application of the following:

- Engineering controls;
- Controlled access;
- Limiting exposure time; and
- Use of respiratory protection.

Cameco Resources has implemented a bioassay program to monitor the effectiveness of the respiratory program, and to provide a quantitative method for estimating intakes of radioactive material. A review of the historical bioassay program for SR-HUP workers is provided in Appendix A-8.3-3.

2.0 REGULATORY REQUIREMENTS AND GUIDANCE

Bioassays are used to determine worker intakes when using respiratory protection as required by 10 CFR §20.1703. They are also used to ascertain the effectiveness of the health physics program, qualify the protectiveness of the respiratory protection program, and to demonstrate compliance with chemical toxicity limits for soluble uranium contained in 10 CFR 20.1201(e). Bioassays are required when workers have the potential for intakes of one-tenth of the ALI or more in a year, as well as for declared pregnant workers, occupationally exposed minors, and members of the public allowed access to airborne radioactivity areas.

NRC Regulatory Guide 8.22, "*Bioassay at Uranium Mills*," provides guidance to licensees that have the potential for exposure to employees from airborne yellowcake dust. New employees and contractors who will handle uranium or contaminated materials submit a bioassay prior to completing their assignment. The same employees submit a bioassay at termination. All new employees and contractors submit a baseline bioassay prior to commencement of work. Employees and contractors who handle uranium or contaminated materials submit to a bioassay two days after completion of work on a routine basis. Bioassays may be required for special situations requiring a RWP. The regulatory guide specifies a quality control program as well as a requirement that the analytical lower limit of detection (LLD) be less than 5 micro grams per liter (µg/l). The radiation dose equivalent associated with an intake resulting in a urinalysis result of 5 µg/L would be approximately 0.06 mrem.

Table 1 in Regulatory Guide 8.22 provides action levels for concentrations of uranium in bioassay results. For concentrations less than 15 µg/l, no action is required other than to review results.

For concentrations between 15 and 35 µg/l, the results should be interpreted as an indicator that uranium confinement and air sampling may not provide an adequate margin of safety. The radiation dose associated with an intake resulting in a urinalysis result between 15 and 35 µg/l would be approximately 0.17 and 0.4 mrem, respectively. A series of steps are suggested, including confirming the results through additional sampling, improving controls, and considering work restrictions for urinalysis.

Concentrations greater than 35 µg/L suggests that uranium confinement and perhaps air sampling programs may not be acceptable. Actions taken include those listed above for the 15 to 35 µg/l concentration range, and also include limiting operations until it is certain that no other workers will receive exposures in excess of 35 µg/l. Increased frequency of bioassay sampling is required and work restrictions for affected workers are also recommended for concentrations exceeding 35 µg/l. Two consecutive bioassays from the same employee with concentrations of uranium of 35 µg/l or greater, or a single bioassay with concentration of uranium of 130 µg/l or greater, is an indicator that the worker may have exceeded the regulatory limits on intake of soluble uranium. A series of additional action steps are specified for this scenario.

3.0 BIOASSAY RESULTS FOR THE R/NBP

With respect to the RU and NB Satellite Facilities, there are no work areas in which workers could potentially be exposed to airborne radionuclides. The Bioassay Program is not currently and will not be applicable to these facilities until there are indoor operations commence.

4.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the RU and NB historical facility operations, including radiation exposure as measured by the bioassay program, and has determined that no changes have taken place as these satellite facilities are not presently nor has been in operation since incorporation into license SUA-1548. Consequently, previously submitted information relating to areas covered in this appendix is still relevant and is hereby incorporated by reference.

APPENDIX C-8.3-4

HISTORICAL OCCUPATIONAL EXPOSURE RATE MONITORING ASSESSMENT FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 INTRODUCTION

The purpose of this section is to provide an assessment of the historical occupational exposure rate monitoring for the RU and NB Satellite Facilities.

Both the RU and NB are and have been inactive since its inclusion under the SR-HUP license in 2003. As such, there is no site-specific historical occupational exposure rate monitoring data to be assessed for these satellite facilities. When the RU and NB are actively mined, work activities will be included in the occupational exposure rate monitoring program already in place for the SR-HUP. Background and regulatory requirements of exposure rate monitoring are briefly described in the following sections.

2.0 REGULATORY REQUIREMENTS

Subpart C of 10 CFR Part 20 limits the TEDE for occupational workers to 5 rems/year, shallow dose equivalent to the skin of 50 rems/year, and dose equivalent to the embryo/fetus of a pregnant worker to 0.5 rem during the entire pregnancy. In order to limit the exposure from direct radiation, the NRC requires that work areas be routinely monitored and posted according to their exposure rate classification. In addition, RWPs for conducting non-routine tasks must contain information regarding potential radiation exposures prior to and/or during completion of the work (10 CFR 20).

NRC Regulatory Guide 8.30, "*Health Physics Surveys in Uranium Recovery Facilities (URF),*" suggests that gamma radiation surveys be conducted semi-annually at locations representative of workers' exposure to determine posting and external dosimetry requirements. Surveys in radiation areas are to be conducted quarterly. Regulatory Guide 8.30 also recommends that surface contamination be limited to approximately 220,000 disintegrations per minute, per 100 square centimeters, so that the contamination does not contribute to unacceptable airborne radionuclide concentrations.

3.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the RU and NB historical facility operations, including occupational exposure rate monitoring, and has determined that no changes have taken place as the RU and NB are not presently nor has been in operation since incorporation into license SUA-1548. Consequently, previously submitted information relating to areas covered in this appendix is still relevant and is hereby incorporated by reference.

APPENDIX C-8.3-4

HISTORICAL OCCUPATIONAL EXPOSURE RATE MONITORING ASSESSMENT FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 EFFLUENT AIR MONITORING AND ENVIRONMENTAL GAMMA EXPOSURE RATES

This appendix presents the regulatory background for historical airborne effluent monitoring and gamma radiation exposure rate data as applicable to RU and the NB Satellite Facilities.

When mining activity is initiated at either RU or NB, an airborne effluent and environmental monitoring program, analogous to the one utilized at SR-HUP, will be established. Uranium production processes at RU and NB will be limited to uranium recovery through IX. Loaded IX resin will be transported to the SR CPP. Thus, the airborne effluent monitoring associated with yellowcake production (described below) will not be applicable to either RU or NB.

2.0 RU AND NB AIRBORNE EFFLUENT MONITORING

Cameco Resources maintains two environmental monitoring stations at two locations on and around the NB Satellite Facility while there are no stations currently at RU. Each station is equipped with a track-etch detector and an environmental dosimeter for measurement of radon-222 (Rn^{222}) and gamma radiation exposure rate. Track-etch detectors, and dosimeters are collected periodically and sent to an independent accredited, outside third party laboratory for analysis. The air monitoring stations are located as follows:

- West - Upwind: This station monitors background conditions, upwind of the proposed NB wellfields.
- East - Downwind: This station monitors the downwind property boundary from the satellite facility.

Airborne effluent monitoring results will be provided in the Semi-Annual Effluent and Environmental Monitoring Reports prepared by Cameco Resources and submitted to the NRC.

Upon the initiation of active mining at either RU or NB, the new air sampling stations will be added to ensure that airborne effluents from the RU and the NB Satellite Facilities are appropriately monitored upwind and downwind, similar to the SR-HUP program.

3.0 REGULATORY REQUIREMENTS

Radiation dose limits for individual members of the public are specified in 10 CFR 20 Subpart D. NRC licensees are required to monitor the radiation levels and radioactive material in effluents released to the controlled and unrestricted areas to demonstrate compliance with the 0.1 rem TEDE limit to the public. The licensee may do this by:

- Demonstrating by measurement or calculation that the TEDE to the individual likely to receive the highest dose from the licensed operation does not exceed the annual dose limit; or
- Demonstrating that the annual average concentrations of radioactive material released in gaseous and liquid effluents at the point of exposure do not exceed the effluent

concentrations in 10 CFR 20, Appendix B, Table 2 and demonstrating that the external radiation sources would not exceed 0.002 rem in an hour or 0.05 rem in a year.

The dose limits are exclusive of the dose contribution from natural background radiation and from radiation doses received from the medical use of radiation and radioactive materials. Controlled areas of the site include a small exclusion area around the processing plants, the satellite plants, process water storage ponds, and small storage areas containing licensed material. Access to the license area is open to the public and therefore the limits apply to members of the public anywhere but the controlled area.

4.0 MONITORING RESULTS FOR THE RU AND NB SATELLITE FACILITIES

Since its inclusion under the SR-HUP license SUA-1548, the RU and NB have been nonoperational. As previously noted only baseline data is currently being collected at NB. No site-specific airborne effluent monitoring has been performed at the RU Satellite Facility.

5.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, could be presented. Specifically the Semi-Annual Effluent and Environmental Monitoring Reports from 2003 to present were reviewed for occurrences of airborne effluent monitoring results on the RU and NB property and none were found. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the RU and NB historical facility operations, including documentation of airborne effluent monitoring as summarized in the sections above, and has determined that no new or significant information can be added at this time. Previously submitted information relating to airborne effluent monitoring and referenced in this Appendix for these satellite facilities are still relevant and is hereby incorporated by reference.

APPENDIX C-8.5

HISTORICAL QUALITY ASSURANCE PROGRAM ASSESSMENT FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 INTRODUCTION

This appendix provides a summary of the historical quality assurance (QA) program results for the RU and NB Satellite Facilities.

The effectiveness of the QA program is tracked through review of NRC Inspection Reports. As documented in Appendix C-1, there have been no NRC Inspection findings that are directly related to RU or NB. The following sections provide an overview of the license renewal requirements for evaluation of QA programs, and a summary of documentation that was reviewed to support the conclusion that there is no "new or significant" information in this area for these satellite facilities.

2.0 REGULATORY BACKGROUND

The acceptance criteria for evaluating a licensee's QA program for a license renewal submittal are provided in Section 5.7.9.3(3) of NUREG-1569 (NRC, 2003c) as follows:

- Historical QA program results are included through the most recent reporting period, preceding the submittal of the license renewal submittal;
- A discussion of the effectiveness of the historical QA program with regard to all applicable 10 CFR Part 20 regulatory requirements; and
- A discussion of long-term trends and explanations of any short-term deviations from the long-term trends.

The elements of an acceptable QA program are described in the NRC Regulatory Guide 4.14 "*Quality Assurance for Radiological Monitoring Programs (Inception through Normal Operations to License Termination) Effluent Streams and the Environment*" (NRC, 2007b) and include:

- Organizational Structure and Responsibilities of Managerial and Operational Personnel
- Specification of Qualifications of Personnel
- Operating Procedures and Instructions
- Records
- Quality Control in Environmental Sampling
- Quality Control in the Radioanalytical Laboratory
- Quality Control for Radioactive Effluent Monitoring Systems
- Verification and Validation
- Assessments and Audits
- Preventive and Corrective Actions

Cameco Resources has a QA program in place for the SR-HUP, which is fully compliant with the required list of program elements. QA requirements specific to certain tasks such as occupational or environmental monitoring are addressed through procedures within the site's Environmental, Health and Safety (EHS) Management System Manual. Evaluations of the effectiveness and implementation of the QA program are presented in the annual ALARA audit reports conducted by Cameco Resources personnel with the assistance of independent third-party auditors and in semi-annual NRC license inspection reports. Prior to the commencement of any mining activities at RU and/or NB the existing SR-HUP QA program will be modified to include RU and NB activities.

3.0 ASSESSMENT OF QA PROGRAM EFFECTIVENESS

As documented in Appendix A-8.5, the SR-HUP QA program was assessed through review of all NRC Inspection Reports filed during the previous license period (1999 to 2009). QA-related deficiencies and items of concern and their resolutions were described. There were nine QA-related items identified in routine audits and NRC inspections for SR-HUP over the ten-year licensing period. All items were addressed by implementing appropriate corrective actions. There are currently no open issues related to QA concerns. None of the QA inspection findings items were related to either the RU or NB.

4.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, could be presented. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the RU and NB historical facility operations, including assessment of the QA program for these satellite facilities as summarized in the sections above, and has determined that no new or significant information can be added at this time. Previously submitted information relating to the QA program for the RU and NB is still relevant and is hereby incorporated by reference.

APPENDIX C-8.6

CUMULATIVE EFFECTS OF OPERATIONS FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 INTRODUCTION

This section provides a review of cumulative impacts analysis for the RU and NB Satellite Facilities.

The RU and NB Satellite Facilities have been inactive since its inclusion under SUA-1548. This appendix presents the regulatory background that drives the requirement for cumulative impacts analysis and provides reference to previous documentation in this area. Because there is no "new or significant" information for the RU or NB, previous documentation submitted to the NRC and referenced within this Appendix are incorporated by reference.

2.0 BACKGROUND

"Cumulative impacts" are defined in 40 of CFR 1508.7 and include individually minor, but collectively significant, actions taking place over a period of time. It is possible an impact that may be small by itself could result in a moderate or large impact when considered in combination with the impacts of other actions on the affected resource.

Monitoring of groundwater and surface water (Appendix C-8.2), employee radiation dose exposures (Appendix C-8.3) and air emissions (Appendix C-8.4) are provided to evaluate the cumulative impacts from the inactive RU and NB sites. These monitoring programs show that the cumulative impacts from site operations are such that the environment, the public and workers are being protected as summarized in the aforementioned appendices and Appendix C-5.

3.0 SUMMARY OF CUMULATIVE IMPACTS

Potential cumulative impacts related to conventional uranium mining and milling in the vicinity of SR-HUP and RU and NB Satellite Facilities are unlikely. In the southern Powder River Basin, uranium was historically mined via conventional methods (e.g. open pits and subsurface mine shafts) during the 1970s and 1980s. The last conventional mining operation near the site, Exxon Highland Facility near the eastern border of the SR-HUP license area, ended operations in 1984. Although conventional mining cannot be ruled out altogether for the future of the area around SR-HUP or RU or NB, it is very unlikely for two reasons. First, SR operations are approximately two to three times more cost-effective than open pit/conventional mining. Second, virtually all the South Powder River uranium ore deposits are amenable to ISR development.

4.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether any "new or significant" information has developed due to operational changes at these facilities since its inclusion under SUA-1548. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has

examined the RU and NB historical facility operations, including cumulative effects of operation. Specifically, the cumulative impacts of radiation exposures, deep well disposal of mining wastes, and conventional uranium mining in the vicinity were evaluated. No operational changes have taken place at the RU and NB Satellite Facilities that would require re-evaluation of cumulative impacts. Consequently, previously submitted information relating to areas covered in this appendix is still relevant and is hereby incorporated by reference.

APPENDIX C-9

UPDATES AND CHANGES TO FACTORS THAT MAY CAUSE RECONSIDERATION OF ALTERNATIVES TO THE PROPOSED ACTION FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 INTRODUCTION

NUREG-1569 Appendix A (NRC, 2003c) states that *"updates and changes to factors that may cause reconsideration of alternatives to the proposed action"* shall be included in license renewal submittals. This requirement is addressed for the RU and NB satellite Facilities in the following sections.

2.0 BACKGROUND

NUREG-1569, Section 8.0, describes the area of review for alternatives to proposed action for original license applications as follows:

> *"the staff will review comparative reconnaissance level evaluations of available alternatives to the licensing action proposed in the in situ leach facility application in accordance with the requirements of National Environmental Policy Act of 1969 including realistic alternatives for the various processing stages. As part of this review, the staff should consider the no-action alternative"* (NRC, 2003c).

Realistic alternatives, including the no-action alternative for the RU and NB Satellite Facilities, are discussed below. Processing stages considered are: uranium extraction (mining methods); siting of process facilities; consumer energy source options; solution mining recovery methods (alternative injection fluids); waste disposal; and the no-action alternative.

3.0 ALTERNATIVES TO THE PROPOSED ACTION

Cameco Resources currently operates the SR-HUP, a commercial ISR uranium mining operation located in Converse County, Wyoming, currently licensed under NRC License Number SUA-1548. The Ruth and North Butte properties are located in Johnson and Campbell Counties, respectively, approximately 160 miles (via existing highways and access roads) from the SR-HUP. Since NRC approval of the RU and NB amendment, activities at these facility licensed areas have been limited to monitoring groundwater levels at NB and routine inspections at RU and NB. When the RU or NB project becomes active, mining and production practices will be similar to those currently employed on Cameco Resources' SR-HUP properties.

3.1 Alternate Mining Methods

Conventional mining and milling represents the only currently available alternative to ISR for mining of the uranium deposits in the RU and NB licensed areas. The following information documented in the Gas Hills Satellite Facility EA (NRC, 2004a) remains valid and has equal relevance to these satellite facilities, regarding alternate mining methods:

> *"The economic costs and environmental impacts associated with conventional mining and milling are greater than the corresponding costs and impacts of an ISL uranium recovery facility, especially given... the labor intensive requirements of mining ore, the capital investment required for a conventional mining and milling facility, and the unavoidable surface and subsurface impacts and required related to mining and tailings disposal. For these considerations, conventional mining and milling is the less preferred alternative."*

Based on the evaluation of conventional mining and milling as presented above, this method is not economically viable for producing uranium from the local uranium-bearing deposits at RU and NB. ISR is the optimum mining method, both economically and environmentally, for RU and NB.

3.2 Alternative Sites for the Processing Plants

Most of the facilities and support systems for the SR-HUP site are in-place from past and ongoing uranium operations. When either RU or the NB is actively mined, additional field processing facilities will be similar to those existing for SR-HUP (e.g. header houses and satellite ion exchange plants). There are no realistic alternatives for the mining and uranium recovery stages. No new surface disturbances will be needed for the yellowcake processing facilities. RU and NB production can be processed in the existing SR CPP and/or the HUP CPF.

3.3 Alternate Leach Solutions

Sodium carbonate/carbon dioxide leach solution was selected for the SR-HUP because of favorable performance in the pilot programs and other commercial ISR operations, with no significant adverse environmental impact (NRC, 2007c). Alternate leach solutions for extracting uranium include ammonium carbonate solutions and acidic leach solutions; however, operators of ISR facilities using these alternate leach solutions have experienced difficulty in restoring and stabilizing the aquifer (NRC, 2007c). As a result of this past experience by others, Cameco Resources has excluded the use of these alternate leach solutions from consideration for the SR-HUP, RU and NB.

With regard to groundwater restoration on-site, the combination of groundwater sweep, bio-remediation and reverse osmosis (RO) clean water reinjection has been selected and is in process on the SR-HUP property because of the proven success of the pilot program and other commercial ISR operations (NRC, 2007c). A discussion of the groundwater restoration at the SR-HUP site is provided in Appendix A-11. When RU and NB is actively mined, groundwater restoration will be similar to current practices on the SR-HUP property.

3.4 Liquid Waste Disposal Alternatives

Liquid wastes produced at the SR-HUP site are disposed of via the use of deep disposal wells and land application methods. At either the RU or NB, four primary process waste water streams are anticipated during operations: well-field bleed; RO brine fluids; well work-over water; and satellite wash down water (NRC, 2004a). A discussion of the processes to dispose of waste water is provided in the Gas Hills Satellite Facility (GH) EA (NRC, 2004a) and is summarized below. Waste streams and disposal methods at the RU and NB Satellite Facilities are analogous to those discussed for the GHP.

> *"All waste water will undergo filtration to remove suspended solids; volume reduced using RO, ultra-filtration, nano-filtration and/or brine concentration; solar evaporation of the concentrated brine; and re-injection into the aquifer. Surface discharge of the treated water is*

an available option but is not expected to be used…. The reverse osmosis brine fluids from all phases of the project will be sent to the evaporation ponds."

At the SR-HUP, waste water is disposed via deep waste disposal wells, which is an alternative that Cameco Resources is also considering for the RU and NB. The Reynolds Ranch amendment (PRI, 2004e) provides the following discussion of the deep waste disposal wells at the SR-HUP:

> *"The use of deep waste disposal wells in conjunction with storage/evaporation ponds to dispose of the high TDS liquid wastes that primarily results from the yellowcake processing and drying facilities is considered the best alternative to dispose of these types of wastes. The zones receiving these wastes are approximately 9,000 – 10,000 feet below the ground surface and are authorized by the State of Wyoming and the EPA UIC Program to receive such wastes.*
>
> *The use of the deep disposal wells in combination with the existing land application (irrigation) facilities to dispose of the treated wellfield purge fluids has proven to be the most cost effective way to dispose of this relatively good quality waste water."*

Wastewater treatment does not present realistic alternatives to deep well disposal due to the following:

- Economic advantage of deep well disposal over any viable treatment option;
- Regulatory requirements and additional permitting for groundwater reinjection or surface water outfall of treated wastewater;
- Generation of secondary wastes (e.g. concentrated waste streams from evaporation or membrane filtration, spent ion exchange resins, spent activated carbon) for disposal as 11e(2) byproduct material waste; and
- Secondary wastes resulting from wastewater treatment will require off-site disposal, presenting additional costs and risks associated with transportation and additional potential for public exposure.

Currently, neither the RU nor the NB have active evaporation ponds or deep disposal wells. RU has two small non-operation storage cells remaining from the original research and development project. On-site deep well disposal will be evaluated as the safest and most economic method of waste disposal when the RU and/or NB are actively mined.

3.5 No Action Alternative

The no-action alternative would allow Cameco Resources to continue mining operations in the current SR-HUP license area unless the NRC formally denied the renewal of the license submittal. Cameco Resources is required to submit a License Renewal submittal for the source material license to the NRC at least thirty days before the expiration date of the existing license. By doing so, the license will not expire until the NRC determined the final disposition of the Renewal submittal and advised Cameco Resources of its decision. If the License Renewal submittal is not approved by the NRC, restoration and reclamation activities would then become the primary activities at the site.

If renewal of the current source material license was not granted, all activities at the SR-HUP not associated with groundwater restoration and decommissioning would cease, resulting in the loss of a significant portion of the total employment at the site. At the completion of decommissioning activities, all employment opportunities at the SR-HUP would be terminated.

In addition to the loss of significant employment opportunities in Converse and Natrona Counties, the premature closing of the SR-HUP before commercially viable resources had been recovered would adversely affect the economic base of Converse County. A decision not to renew SUA-1548 for mining of the SR-HUP would leave the RU and NB resource unavailable for energy production supplies, with the SR-HUP being the largest ISR uranium producing facility in the United States. This would also result in the loss of significant employment opportunities for Campbell and Johnson Counties associated with the RU and NB. The SR-HUP represents an important source of domestic uranium supplies that are essential in providing a continuing source of fuel to power generation facilities.

4.0 PROPOSED ACTION

With NRC approval of the License Renewal submittal for Source Material License SUA-1548, Cameco Resources would continue to operate the SR-HUP ISR operation. Amendments to the license may be sought, as needed, in order to recover the uranium resources in the most effective manner. Operations could also expand to RU and NB under SUA-1548.

The solution mining method is proposed over other mining methods for recovery of uranium from the uranium-bearing deposits present at the SR-HUP site because *in situ* mining is the most economical and environmentally sound method presently available for mining these reserves. This conclusion is based on the history of uranium mining in the South Powder River Basin and Gas Hills Uranium District areas, which includes open pit mining, underground mining, and solution mining projects.

5.0 CONCLUSIONS

With respect to this License Renewal Submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information occurring since the last license renewal could be presented. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the RU and NB historical facility operations, including updates and changes to factors that may cause reconsideration of alternatives to the proposed action and has determined that no new or significant information can be added at this time. Consequently, references cited within this and other relevant sections and previously submitted information relating to alternatives to the action plan is still relevant and is hereby incorporated by reference.

APPENDIX C-10

UPDATES AND CHANGES TO THE ECONOMIC COSTS AND BENEFITS FOR THE FACILITY SINCE THE LAST APPLICATION FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 INTRODUCTION

NUREG-1569 Appendix A requires that Source Materials License Renewal submittal include updates and changes to the economic costs and benefits for uranium mining operations. Direct and indirect economic benefits continue to accrue locally in the community and state-wide from the presence of mining. This section provides a summary of the actual and projected economic benefits and costs of continued operations at SR-HUP since the last licensing action, with addition of the RU and NB Satellite Facilities.

The following sections present a summary of updates and changes to: State tax revenues; regional employment; and local economic impacts for continued operation of SR-HUP. The economic impacts associated with operations startup were most recently updated as part of the Gas Hills Satellite Facility (GH) EA in 2004 (NRC, 2004a). The discussion of economics in the EA includes the SR-HUP plus its non-operational satellite properties (Reynolds Ranch, GH, RU and NB).

2.0 TAX REVENUES

Future tax revenues are dependent on uranium prices, which cannot be forecast with any accuracy. However, these taxes are also somewhat dependent on the number of pounds of uranium produced by SR-HUP.

The present taxes are based on a relatively consistent production rate of uranium. Table C-10-1 summarizes the Wyoming tax revenues from Cameco Resources' Wyoming projects, which includes the SR-HUP and the inactive satellite operations (i.e., non-operational RR, GH and RU and NB).

TABLE C-10-1

CAMECO RESOURCES' WYOMING TAX REVENUE SUMMARY 2005 THROUGH 2008

	2009	2008	2007	2006	2005
Ad Valorem	$694,000	$ 1,204,000	$ 1,030,000	$ 744,000	$ 530,000
Property Taxes	$316,000	$ 239,000	$ 216,000	$ 207,000	$ 193,000
Sales and Use Taxes	$178,000	$ 312,000	$ 161,000	$ 53,000	$ 37,000
Severance Taxes	$456,000	$ 797,000	$ 680,000	$ 493,000	$ 222,000
Total	**$1,644,000**	**$ 2,552,000**	**$ 2,087,000**	**$ 1,497,000**	**$ 982,000**

Yellowcake production from the CPP cannot exceed 5.5 million pounds annually (NRC, 2007c). Upon startup, uranium recovered from the RU or NB would be processed through the SR CPP subject to this production limit.

3.0 CURRENT EMPLOYMENT STATUS

Current staffing information available for the SR-HUP is from 2009, and presented herein. The SR-HUP employed approximately 133 employees and 42 contractors on a full-time basis in 2009. Short-term contractors and part-time employees are also used for specific projects and/or during the summer months and may add up to 7 percent to the total staffing. This level of employment achieved by Cameco Resources is significant to the local economies, as outlined below.

The private employment in Converse and Natrona Counties, Wyoming, in 2008 was 38,700 out of a total labor force of 45,500. Based on these statistics, SR-HUP currently provides approximately 0.3 percent of the private employment (0.4 percent, if contractors are included). In 2009, SR-HUP's total payroll was over 10.37 million dollars. Of the total private Natrona and Converse County wage and salary payments of approximately 1.68 billion dollars in 2008, the SR-HUP payroll represented about 0.5 percent. Employment levels within four miles of RU and NB, located in Campbell and Johnson Counties, are currently negligible, pending development of the site (NRC, 2004a). Cameco Resources' total employee payroll for the past five years is summarized in Table C-10-2.

TABLE C-10-2

CAMECO RESOURCES' EMPLOYEE PAYROLL 2005 THROUGH 2009 (EST.)

Year	Total Estimated Annual Payroll
2005	$ 4,593,000
2006	$ 4,952,000
2007	$ 7,443,000
2008	$ 8,387,000
2009	$ 10,370,000

The average annual income for all workers in Converse and Natrona Counties was $41,700 and $43,800, respectively. As reported in the EA for the GHP (NRC, 2004a), the personal income per capita (includes children and other persons not working) for Fremont and Natrona Counties was $11,800 and $15,690, respectively, in 2000. By comparison, the average wage for an employee of SR-HUP is approximately $53,000 per year. Entry level workers for SR-HUP earn a minimum of $16.15 per hour, or $33,593 per year, not including overtime, bonus or benefits.

SR-HUP actively pursues a policy of hiring and training local residents to fill all available positions. Due to the technical skills required for some positions, a small percentage of the current staff (less than 8 percent) have been hired elsewhere and relocated to the area. Because of the small number of people

who have needed to move into the area to support this project, the impact on the community in terms of expanded services has been minimal.

Cameco Resources expects that the type of positions created by any future expansion will be filled primarily with individuals from the local workforce, and would have no significant impact on services and resources such as housing, schools, hospitals, or other public facilities.

The socioeconomic impacts as described in the RR amendment application read as follows:

> *"Continued operation of the SR-HUP/Reynolds Ranch amendment area will provide jobs for about 100 company employees and 20 to 40 contract employees. The general population of Converse County declined approximately 20 percent between 1980 and 1984 and the overall economy remains depressed; therefore, the impact of the project, although limited, will be beneficial to the local communities. No adverse impact is anticipated as current housing, schools and other support facilities are more than adequate to accommodate the projected employment."* (PRI, 2004e)

Should Cameco Resources begin active mining at either the RU or NB, the level of direct and contracted employees would not change significantly over the current level for SR-HUP.

4.0 IMPACT ON THE LOCAL ECONOMY

In addition to providing a significant number of well-paid jobs in the local communities of Casper, Douglas and Glenrock, Wyoming, Cameco Resources actively supports the local economies through purchasing procedures that emphasize obtaining all possible supplies and services that are available in the local area. In 2009, Cameco Resources' procurement procedures resulted in local purchases estimated at over 26 million dollars. The vast majority of these purchases were made in Converse and Natrona Counties. This level of business is expected to continue through continued operations of the SR-HUP and potential startup of the RU and/or NB. Total SR-HUP payments made to Wyoming businesses for the past five years are summarized in Table C-10-3.

TABLE C-10-3

SR-HUP PAYMENTS TO WYOMING BUSINESSES 2005 THROUGH 2009 (EST.)

Year	Total Estimated Annual Payments
2005	$ 10,036,600
2006	$ 12,311,000
2007	$ 14,801,000
2008	$ 24,247,000
2009	$ 26,065,000

In addition, mineral royalty payments accrue to local landowners. Production royalties paid to land owners were slightly less than 2.1 million dollars in 2009.

Local procurement of supplies and services and mineral royalty payments will continue with ongoing operations of the SR-HUP and potential operations startup of the RU and/or NB.

5.0 ECONOMIC IMPACT SUMMARY

As discussed in the previous sections, approval of this License Renewal submittal would have positive impacts on the state and local economies. The current economic impact of the SR-HUP and additional Cameco Resources employment related to other projects in Wyoming is summarized in Table C-10-4.

TABLE C-10-4

CURRENT ECONOMIC IMPACT OF THE SR-HUP

	Current SR-HUP Operation	Other Wyoming Projects
Employment		
Full-Time Employees	116	17
Full-Time Contractor employees	42	
Part-Time Employees and Short-term Contractors	10	20
Payroll – 2009(1)	$ 10,370,000	Included
Taxes		
Ad Valorem	$ 694,000	
Property Taxes	$ 316,000	--
Sales and Use Taxes	$ 178,000	--
Severance Taxes	$ 456,000	--
Total Taxes 2009	$ 1,664,000	Included
Local Purchases		
Local Purchases, 2009	$ 26,065,000	Included
Total Direct Economic Impacts	$ 40,327,000	

(1) Payroll does not include full-time contractor or part-time employee salaries.

6.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information occurring since the last license renewal could be presented. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the RU and NB historical facility operations, including updates and changes to the economic costs and benefits for the RU-NB as summarized in the sections above, and has determined that no new or significant information can be added at this time. Consequently, references cited within this and other relevant sections and previously

submitted information relating to economic costs and benefits are still relevant and are hereby incorporated by reference.

The economic impact from the SR-HUP and the RU and NB Satellite facilities as summarized in Table C-10-4 shows a significant positive impact on both the local and state economies. The impacts extend to both economic and employee opportunities afforded to the local population in higher than average paying jobs. Local businesses have also benefitted by the presence and operation of SR-HUP as Cameco Resources has a first preference for utilizing local, then state, then regional businesses to satisfy development and sustained operations.

APPENDIX C-11

RESULTS AND EFFECTIVENESS OF ANY MITIGATION PROPOSED AND IMPLEMENTED IN ORIGINAL LICENSE FOR RUTH AND NORTH BUTTE SATELLITE FACILITIES

1.0 INTRODUCTION

NUREG-1569 Appendix A requires that Source Materials License Renewal submittals include "*results and effectiveness of any mitigation proposed and implemented in original license*" for uranium mining operations. This section meets that requirement for the RU and NB by providing a summary of groundwater restoration during the update period, spanning from the approval of these satellite facilities amendment application through the first quarter of 2010.

The purpose of groundwater restoration is to return the portion of the aquifer designated for uranium recovery to its pre-operational water quality, as determined from baseline monitoring data.

A background discussion of groundwater restoration goals is presented in Section 2.0. Section 3.0 presents a discussion of the review of documentation related to R/NBP historical operations, concluding that no new or significant information with respect to groundwater restoration at the R/NBP can be presented at this time.

2.0 GROUNDWATER RESTORATION GOALS

Within the uranium production zone, impacts from operations may include elevated levels of various constituents introduced with the production fluid (e.g., oxygen, bicarbonate, and hydrogen peroxide) and chemical species that are mobilized by the production fluid (e.g., uranium and other metals) (Miller, 2009). After uranium recovery ends, groundwater restoration is conducted to return the production zone of the aquifer to its pre-operational water quality. If the baseline conditions are not achieved after diligent application of the best practicable technology, in accordance with the WDEQ Act (§35-11-103(f)(iii)), a secondary goal is to return the groundwater to a quality consistent with the use, or uses, for which the water was suitable prior to production. In other words, the standard is to return the affected groundwater to its pre-mining Class of Use per NUREG-1569 (Section 6.1.3.4.b) an, and as defined by WDEQ Water Quality Rules and Regulations, Chapter 8, Section 4(d).

To return the groundwater to its pre-operational water quality, restoration is conducted through a variety of methods. NRC allows licensees the flexibility to select the restoration methods to be used for each wellfield (NRC, 2003b). During the update period, groundwater restoration has consisted of two phases:

1. Groundwater Sweep Phase: initial phase, in which groundwater is pumped from the wellfield without re-injection, causing an influx of baseline quality water from the perimeter of the mining unit, which "sweeps" the affected portion of the aquifer.

2. Groundwater Treatment Phase: groundwater recovered from the wellfield is treated with one or more of the following methods, and then re-injected into the affected portion of the aquifer:

   - Processing through the uranium recovery plant to recover additional uranium;
   - Degassing, by using a de-carbonator unit to remove residual carbon dioxide;

- RO, with re-injection of the clean, permeate water; and/or
- Addition of chemical and biological reductants to decrease the concentration of oxidized metals.

During restoration, groundwater monitoring is conducted to monitor restoration progress and to monitor for excursions. Excursions during restoration may occur from unintentional movement of restoration fluids or unintentional movement of groundwater impacted from production fluids.

At the start of restoration, wells that were used to determine baseline water quality are sampled for the parameters required by WDEQ Land Quality Division (LQD) Guideline 8 to determine the end-of-injection water quality. During restoration, the monitoring wells are sampled approximately every 60 days for uranium, chloride, and conductivity. Following concurrence from WDEQ that restoration has been achieved in the mining area, a six month stability period is assessed to show that the restoration goal has been adequately maintained. Once restoration has been approved by WDEQ and NRC, wells are plugged in accordance with WDEQ LQD Guideline 8.

3.0 MITIGATIVE ACTIONS REGARDING EFFECTS OF OPERATIONS AND/OR ACCIDENTS

A review of the original permit application with regard to mitigative actions for identified effects of mining operations and accidents indicates that proposed mitigation actions have been and continue to be effectively implemented and do not require revision.

Impacts resulting from mining operations requiring mitigation include ephemeral drainage areas whereby erosion controls have been required to effectively minimize soil impacts; monitor well drilling and road construction activities where short term disturbances (erosion and fugitive dust) may occur that have been kept to a minimum with prescribed protective steps to control top soil erosion-sedimentation taken through the practice of re-seeding disturbed areas as soon as possible, in addition to re-contouring (as necessary) that has also helped prevent soil erosion problems.

Impacts resulting from accidents requiring mitigation include tank failure (inside and outside of buildings), piping failure, fire-explosions and weather-related impacts. Neither RU nor NB currently has operational tankage, piping on site nor has any mining activities occurring, consequently mitigative actions within the original application are still considered to be effective actions until proven otherwise.

4.0 CONCLUSIONS

With respect to this License Renewal Submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information occurring since the last license renewal could be presented. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the RU and NB historical facility

operations, including groundwater restoration as summarized in the sections above, and has determined that no new or significant information can be added at this time. The RU and NB are currently undeveloped and have no mine units in restoration. Consequently, references cited within this and other relevant sections and previously submitted information relating to mitigation results and effectiveness are still relevant and are hereby incorporated by reference.

APPENDIX D

GAS HILLS SATELLITE FACILITY NUREG-1569 ASSESSMENT

1.0 INTRODUCTION

This appendix (Appendix D) of the License Renewal submittal for Source Material License SUA-1548 has been prepared to respond to requirements identified in NUREG-1569, "*Standard Review Plan for In Situ Leach Uranium Extraction License Applications*" (NRC, 2003c) and, in particular, specific guidance in NUREG-1569 that applies to renewals of existing licenses. Specifically, this appendix follows the U.S. Nuclear Regulatory Commission (NRC) guidance in NUREG-1569 Appendix A for examining historical facility operations, providing documentation and review of historical information for the Gas Hills Satellite Facility (GH) (NRC, 2004b) that is used to assess the effectiveness of the operations in minimizing any effects to public and occupational health and safety and the environment.

With respect to the GH status review, the GH has remained in a developmental mode with no active mining activities having taken place.

While a part of the NRC SUA-1548 License Renewal Submittal, Appendix D is also meant to serve as a stand-alone document providing a review and update of the GH Application.

2.0 APPENDIX D CONTENT

NUREG-1569 states that "*if, after a review of the historical aspects of site operations, the staff* [NRC] *concludes that the site has been operated so as to protect health and safety and the environment and that no un-reviewed safety-related concerns have been identified, then only those changes proposed by the license renewal or amendment application should be reviewed using appropriate sections of this* [NUREG-1569] *standard review plan*". To provide the historical aspects of site operations and review of the effectiveness of operations in minimizing effects to health and safety and the environment, Appendix D of this report follows NUREG-1569 Appendix A. The contents of this appendix as it relates to the requirements of NUREG-1569 Appendix A (*in italics*) for the GH are provided below:

- *For License Renewals, U.S. Nuclear Regulatory Commission (NRC) inspection reports and license performance reports*:
  - Appendix D-1: Summary of NRC Inspection and License Performance Reports for Gas Hills Satellite Facility
- *Amendments and changes to operating practices or procedures*:
  - Appendix D-2: Amendments and Changes to Operating Practices or Procedures for Gas Hills Satellite Facility
- *License violations identified during NRC or Agreement State site inspections*:
  - Appendix D-3: License Violations Identified During NRC or Agreement State Site Inspections for Gas Hills Satellite Facility

- *Excursions, incident investigations or root cause analyses, and resultant cleanup histories or status*:
  - Appendix D-4: Summary of Wellfield Excursions for Gas Hills Satellite Facility
- *Exceedances of any regulatory standard or license condition pertaining to radiation exposure, contamination, or release limits*:
  - Appendix D-5: Exceedances of Any Regulatory Standard or License Condition Pertaining to Radiation Exposure, Contamination, or Release Limits for the Gas Hills Satellite Facility
- *Exceedances of any non-radiation contaminant exposure or release limits:*
  - Appendix D-6: Exceedances of Any Non-radiation Contaminant Exposure or Release Limits for Gas Hills Satellite Facility
- *Updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including site location and layout; uses of adjacent lands and waters; population distributions; meteorology; the geologic or hydrologic setting; ecology; background radiological or non-radiological characteristics; and other environmental features:*
  - Appendix D-7: Updates and Changes Site Characterization Information Important to the Evaluation of Exposure Pathways and Doses for Gas Hills Satellite Facility
    - Appendix D-7.1: Site Location and Layout for Gas Hills Satellite Facility
    - Appendix D-7.2: Use of Adjacent Lands and Waters for Gas Hills Satellite Facility
    - Appendix D-7.3: Population Distribution for Gas Hills Satellite Facility
    - Appendix D-7.4: Meteorology for Gas Hills Satellite Facility
    - Appendix D-7.5: Geologic or Hydrologic Setting for Gas Hills Satellite Facility
    - Appendix D-7.6: Ecology for Gas Hills Satellite Facility
    - Appendix D-7.7: Transportation for Gas Hills Satellite Facility
- *Environmental effects of site operations including data on radiological and non-radiological effects, accidents, and the economical and social effects of operations:*
  - Appendix D-8: Environmental Effects of Site Operations Including Data on Radiological and Non-radiological Effects, Accidents, and the Economic and Social Effects of Operations for Gas Hills Satellite Facility
    - Appendix D-8.1: Release and Accident History for Gas Hills Satellite Facility
    - Appendix D-8.2: Surface and Groundwater Monitoring History for Gas Hills Satellite Facility
    - Appendix D-8.3: Assessment of Occupational Radiation Exposure and Dose Data for Gas Hills Satellite Facility
      - Appendix D-8.3-1: Historical Radiation Monitoring Program Assessment for Gas Hills Satellite Facility
      - Appendix D-8.3-2: Historical Results of Radiation Dose Calculations for Gas Hills Satellite Facility
      - Appendix D-8.3-3: Historical Bioassay Program Assessment for Gas Hills Satellite Facility

Appendix D-8.3-4: Historical Occupational Exposure Rate Monitoring Assessment for Gas Hills Satellite Facility

- Appendix D-8.4: Historical Airborne Effluent and Environmental Monitoring Program for Gas Hills Satellite Facility
- Appendix D-8.5: Historical Quality Assurance Program Assessment for Gas Hills Satellite Facility
- Appendix D-8.6: Cumulative Effects of Operations for Gas Hills Satellite Facility

■ *Updates and changes to factors that may cause reconsideration of alternatives to the proposed action:*

- Appendix D-9: Updates and Changes to Factors that May Cause Reconsideration of Alternatives to the Proposed Action for Gas Hills Satellite Facility

■ *Updates and changes to the economic costs and benefits for the facility since the last application:*

- Appendix D-10: Updates and Changes to the Economic Costs and Benefits for the Gas Hills Satellite Facility

■ *For License Renewals, the results and effectiveness of any mitigation proposed and implemented in original license:*

- Appendix D-11: Results and Effectiveness of Any Mitigation Proposed and Implemented in Original License for Gas Hills Satellite Facility

3.0 APPROACH AND REGULATORY BASIS

NUREG-1569 states that license Renewals should include an environmental report that includes any new and significant information. Specifically, 10 Code of Federal Regulations (CFR) 40.31.a states that "information contained in previous applications, statements or reports filed with the Commission may be incorporated by reference ..." and 10 CFR 51.60(a) indicates that for a license renewal, "*for which the applicant has previously submitted an environmental report, the supplement to applicant's environmental report may be limited to incorporating by reference, updating or supplementing the information previously submitted to reflect any significant environmental change, including any significant environmental change resulting from operational experience or a change in operations or proposed decommissioning activities.*" The GH has been inactive since its inclusion under the SR-HUP Source Material License SUA-1548 Amendment No. 6 (NRC, 2004b). The assessment of the overall health and safety and environmental effects of GH operations provided in Appendix D-8 is limited to regulatory background and review of documentation that shows no "new or significant information" can be presented at this time. NUREG-1748 (Environmental Review Guidance for Licensing Actions Associated with NMSS Programs, (NRC, 2003a)) has been used as guidance in Appendix D-8 for evaluating specific aspects of the environment that may have been impacted by operations.

NUREG-1569 Appendix A requires an update to new and significant site characterization data. Any new and significant changes to site characterization data is provided in Appendix D-7, if such changes have an impact on the environmental effects as discussed in Appendix D-8. This includes land use,

transportation, geology and soils, water resources, ecological resources, air quality, noise, historical and cultural resources, visual/scenic resources, socioeconomic, public and occupational health, waste management and cumulative impacts. NUREG-1910 (Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities (NRC, 2009e)) provides guidance on the importance of each environmental category for the Wyoming region, and was also used when assessing environmental effects as discussed Appendix D-8. New and significant changes to site characterization data were evaluated and documented by comparing the latest site characterization data provided to the NRC to current data and evaluating which changes could have an impact on the environmental impacts discussed in Appendix D-8.

While the GH Satellite Facility is non-operational, a review of the historical operational items listed in NUREG-1569 Appendix A for the satellite operations is provided, for completeness.

APPENDIX D-1

SUMMARY OF NRC INSPECTION AND LICENSE PERFORMANCE REPORTS FOR GAS HILLS SATELLITE FACILITY

Appendix D-1 Summary of NRC Inspection and License Performance Reports for Gas Hills Satellite Facility

1.0 BACKGROUND

This section provides a review of NRC inspections conducted as a matter of routine, to ensure that facilities are operating in accordance with their license application and conditions in a safe and effective manner. Inspections typically consist of routine review of management and organization controls, site operations, radiation protection and environmental monitoring. An inspection may also be focused on "license performance", which examines activities conducted under the license as they relate to safety and compliance with the Commission's rules and regulations and the conditions of the license. The NRC inspector's findings are discussed with site staff in exit briefings. The official inspection report will identify those items that require a licensee's response to satisfactorily close the findings.

NRC inspection reports for Cameco Resources' Source Material License SUA-1548 covering the years 2000 through 2009 have been reviewed and the results of the review are presented in Appendix A-1. In January 2004, Amendment No. 6 to SUA-1548 was approved by the NRC, adding the GH for future development of ISR uranium operations. Amendment No. 6 allows for operation of the GH as a satellite facility, under the requirements described in License Condition 9.4 (NRC, 2004b). Of note, while the GH is a satellite facility, no Central Processing Plant (CPP) will be located there. The GH will have satellite plant(s) only, wherein only ion exchange (IX) loading of uranium occurs.

This appendix provides a brief description of activities on the GH licensed area that have occurred since incorporation under Source Material License SUA-1548, and the findings in NRC Inspection Reports that are specific to the GH. It should be noted here, that the GH has remained in a developmental mode with no active mining activities having taken place.

2.0 NRC INSPECTION REPORTS FOR THE GH, 2004 TO PRESENT

The scope of NRC inspections routinely covered the following topics: Management Organization and Controls; In-Situ Leach Facilities; Environmental Protection and Radioactive Waste Management; Radiation Protection; and Follow-up on previous findings. Additional details provided in each inspection report include the specific NRC inspection procedures used, the scope of the inspection, observations and findings, and conclusions. Supplemental information provided with every inspection includes a list of persons contacted and Items Opened, Close and Discussed.

There were nine NRC inspections conducted on Cameco Resources facilities under license SUA-1548 in the time period from January 2004 (the approval date for Amendment No. 6) through present, which could have potentially included records review or site tours on the GH. Review of the inspection "Observations and Findings" sections indicate that there were no observations or findings related to the GH.

3.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC License Renewal guidance, Cameco Resources has examined the GH historical facility operations, including NRC Inspection and License Performance Reports, and has determined that no changes have taken place noting that GH is not presently, nor has been, in operation since incorporation into license SUA-1548. Consequently, all references cited within sections of this appendix are still relevant and are hereby incorporated by reference.

As noted throughout this Renewal submittal, this approach is consistent with NUREG-1569 (Page xvii) guidance that the license renewal submittal need not resubmit a complete application covering all aspects of facility operation and should instead only submit information containing changes from the currently accepted license.

APPENDIX D-2

AMENDMENTS AND CHANGES TO OPERATING PRACTICES OR PROCEDURES FOR GAS HILLS SATELLITE FACILITY

1.0 BACKGROUND

Cameco Resources Source Materials License SUA-1548 is a "performance-based license". The basis for performance-based licenses is documented in "*A Baseline Risk-Informed Performance-Based Approach for In Situ Leach Uranium Extraction Licensees*", NUREG/CR-6733 (NRC, 2001f). NRC acknowledges in this document that "*existing...regulations are not specifically applicable to uranium mining facilities*".

Recognizing the significant differences between in situ uranium (ISR) and other Source Materials Licensees, NRC established the framework for performance-based uranium ISR licenses. The primary feature of the performance-based license is the licensee's capability to "self-regulate" through a Safety and Environmental Review Panel (SERP). Per NUREG/CR-6733:

> *"The purpose of this panel is to review proposed changes, tests or experiments to determine whether they require a license amendment. Changes, tests or experiments may be conducted without prior NRC approval if (i) they do not conflict with any requirements specifically stated in the license or impair the licensee's ability to meet all applicable NRC regulations, (ii) there is no degradation in the essential safety or environmental commitments in the license application or those provided in an approved reclamation plan, and (iii) they are consistent with NRC conclusions regarding actions analyzed and selected in the facility environmental assessment"* (NRC, 2001f).

The review criteria for determination of changes requiring the licensee to obtain a license amendment are provided in License Condition 9.4 (NRC, 2010). In short, an amendment is required if the change, test or experiment increases risk of accident or malfunction of safety features, or creates a possibility of a different kind of accident or malfunction than those previously evaluated in the license application. If the SERP finds that no increased risk of accident or malfunction of safety features would result from a "change", then a license amendment is not required. Thus, all "changes, tests, or experiments" are documented through either a SERP review or license amendment application and approval. SERPs are routinely reviewed by NRC Inspectors during NRC inspections and submitted to the NRC in the required Semi-Annual Report.

2.0 GAS HILLS SERP RECORDS AND LICENSE AMENDMENTS

SERP records and License Amendments related to the GH since its inclusion in the SR-HUP license were reviewed, and no SERPs related to the GH were initiated during the license renewal period. No changes, tests, or experiments were conducted under the SERP review process without License Amendment on the GH since its inclusion under the SR-HUP license as GH is still in a developmental phase.

The GH was amended into the SR-HUP Source Materials License SUA-1548 as Amendment No. 6 (NRC, 2004b). Amendment No. 14 and 16 (NRC, 2009c, 2010) implemented a surety update for GH. There have been no subsequent amendments related to changes, tests or experiments on the GH.

3.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569, Appendix A, Cameco Resources has examined the GH historical facility operations, including amendments and changes to operating practices or procedures, determining that no changes have taken place. Consequently, previously submitted information referenced in this Appendix relating to areas covered in this appendix is still relevant and is hereby incorporated by reference.

This approach is consistent with NUREG-1569 (Page xvii) guidance that the license renewal submittal need not resubmit a complete application covering all aspects of facility operation and should instead only submit information containing changes from the currently accepted license.

APPENDIX D-3

LICENSE VIOLATIONS IDENTIFIED DURING NRC OR AGREEMENT STATE SITE INSPECTIONS FOR GAS HILLS SATELLITE FACILITY

1.0 BACKGROUND

NRC Inspection Reports for Source Material License SUA-1548 covering the years 2004 through 2009 were reviewed for occurrences of Notices of Violation (NOVs) and Non-Cited Violations (NCVs) related to GH. The GH was included under License SUA-1548 via Amendment No. 6 (NRC, 2004b).

1.1 Notices Of Violation

NOVs are categorized for severity by the NRC using levels I, II, III and IV, with I being the highest severity level and IV being the lowest. Severity Level IV is defined by NRC as follows: *"Violations at Severity Level IV involve noncompliance with NRC requirements that are not considered significant based on risk"* (NRC, 2005a). Cameco Resources has never been cited with an NOV of Severity Level I, II or III under License SUA-1548.

NOVs require response from the licensee in the form of a written statement or explanation to the NRC within sixty days of the effective NOV date. NOV replies must include *"(1) the reason for the violation, or, if contested, the basis for disputing the violation or severity level, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken to avoid further violations, and (4) the date when full compliance will be achieved"* (NRC, 2007d). Typically, the licensee's NOV reply is acknowledged by the NRC as "responsive," and the NOV will be reviewed and if appropriate, will be "closed" by the NRC in a subsequent Inspection Report.

1.2 Non-Cited Violations

NRC's *"Enforcement Policy"* describes NCVs *"as having very low safety significance"* (NRC, 2005a). The process for dispositioning an NCV is further described as follows:

> *"NCVs… are documented as violations in inspection reports (or inspection records for some materials licensees) to establish public record of the violations, but are not cited in Notices of Violation which normally require written responses from licensees. Dispositioning violations in this manner does not eliminate the NRC's emphasis on compliance with requirements nor the importance of maintaining safety. Licensees are still responsible for maintaining safety and compliance and must take steps to address corrective actions for these violations. While licensees are not required to provide written responses to NCVs, this approach allows licensees to dispute violations described as NCVs."* (NRC, 2005a)

NCVs can be "opened" and "closed" within the duration of the on-site inspection in which they occurred. A single NRC Inspection Report typically provides documentation of the NCV, the corrective actions taken or planned by the licensee, and NRC's acceptance of the effectiveness of corrective actions, closing the NCV.

2.0 NOVs AND NCVs FOR GAS HILLS PROJECT

Following the GH Amendment adding the satellite facility to NRC License SUA-1548 to present, there have been a total of nine inspections conducted. A total of seven NOVs were opened and are described in Appendix A-3. With respect to the GH, none of the NRC inspections resulted in a NOV or NCV being issued for GH.

APPENDIX D-4

SUMMARY OF WELLFIELD EXCURSIONS FOR GAS HILLS SATELLITE FACILITY

1.0 INTRODUCTION

This section is intended to provide a summary and review of wellfield excursions reported for the GH. GH is currently an undeveloped area of the Smith Ranch-Highland Uranium Project (SR-HUP) under Source Materials License SUA-1548. Potential impacts to groundwater resources can occur from excursions of leaching solutions from wellfields during production and/or restoration. The Groundwater Monitoring Program for GH will be implemented to ensure that wellfields are being operated in a way to minimize the potential of excursions and that any groundwater excursions are detected in a timely manner. The early detection of an excursion allows prompt corrective action to mitigate the excursion to prevent any groundwater quality degradation outside of the wellfields. When active mining is initiated for the GH, its wellfields will be included in the Groundwater Monitoring Program.

1.1 Definition of an Excursion

A migration of production fluids into the overlying or underlying aquifers and/or detected at the monitor well ring is termed an excursion. Excursions are indicated from monitoring well sampling data, when two or more excursion parameters (i.e., alkalinity, chloride, and specific conductivity) exceed the upper control limits (UCLs) as determined from the approved baseline water quality data. When an excursion is first indicated by monitoring results, a confirming sample is collected within 24 hours of receiving the original analytical data. If the excursion is confirmed by the second sample, the NRC and Wyoming Department of Environmental Quality (WDEQ) are notified in accordance with the license, and subsequent sampling of the well is conducted at least every seven days for the UCL parameters and uranium. If the second sample does not confirm the excursion, a third sample is collected within twenty four hours of the second sample results to confirm or deny the excursion. If the excursion is confirmed, the appropriate agencies are contacted and sampling is conducted at least every seven days. Weekly monitor well sampling is continued until the excursion parameter exceedances are no longer detected in the analytical results. Excursion events do not necessarily result in environmental impacts, but just can be indicators of the unintended movement of production fluids (Miller, 2009).

1.2 Excursions for the Gas Hills Property

There are no active wellfields within the boundaries of the GH. Thus, there have been no wellfield excursions since the GH amendment was approved in January 2004 (NRC, 2004b).

2.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A (NRC, 2003c), Cameco Resources has examined the GH historical facility operations, including air and groundwater quality monitoring and

compliance history with respect to groundwater excursion aspects, determining that no changes have taken place noting that GH is not presently, nor has been, in operation since incorporation into license SUA-1548. Consequently, all references cited in this section are still relevant and are hereby incorporated by reference.

APPENDIX D-5

EXCEEDANCES OF ANY REGULATORY STANDARD OR LICENSE CONDITION PERTAINING TO RADIATION EXPOSURE, CONTAMINATION, OR RELEASE LIMITS FOR GAS HILLS SATELLITE FACILITY

1.0 BACKGROUND

The purpose of this section is to provide a summary and review of radiation exposure, radioactive contamination, and radionuclide release data reported for the GH Satellite Facility.

The ensuing sections include a review of:

- Section 2.0 - Historical Radiation Monitoring Program Assessment
- Section 3.0 - Historical Results of Radiation Dose Calculations
- Section 4.0 - Historical Bioassay Program Assessment
- Section 5.0 - Historical Occupational Exposure Rate Monitoring Assessment

2.0 HISTORICAL RADIATION MONITORING PROGRAM ASSESSMENT

The Radiation Monitoring Program for GH will involve periodic measurements of airborne concentration of natural uranium and radon-222 (Rn^{222}) progeny in various buildings associated with operations including header houses and the satellite IX facilities. Since August 2004, when GH was amended into SUA-1548, no ISR operations buildings have been constructed. When indoor operations at GH begin, the Radiation Monitoring Program (RMP) will be implemented and data collection necessary for future assessment of the RMP will initiate.

3.0 HISTORICAL RESULTS OF RADIATION DOSE CALCULATIONS

The NRC requires strict adherence to radiation worker monitoring requirements. A review of the historical results of radiation dose calculations for the SR-HUP is provided in Appendix A-8.3-2. In comparison to routine operations of active wellfields, satellite IX facilities and the CPP, the potential for radiation dose exposure being directly related to GH is the result of background radiation exposures. The maximum Total Effective Dose Equivalent (TEDEs) reported for workers at SR-HUP are well below applicable standards, as summarized in Section A-8.3-2, and are consistent with doses the NRC indicates to be representative of uranium ISR facilities, and are stable over the 10-year period since the last License Renewal submittal. This demonstrates that Cameco Resources is committed to continually evaluating sources of worker exposures to ionizing radiation and implementing improvements in order to maintain occupational radiation doses at levels which are "as low as is reasonably achievable" (ALARA). With the non-operational status of GH the only source of exposure is from natural background radiation.

4.0 HISTORICAL BIOASSAY PROGRAM ASSESSMENT

NRC licensees are required to limit workers' intake in areas with airborne radionuclides by sequential application of the following:

- Engineering controls;
- Controlled access;
- Limiting exposure time; and
- Use of respiratory protection.

Cameco Resources has implemented a bioassay program to monitor the effectiveness of the respiratory program, and to provide a quantitative method for estimating intakes of radioactive material. A review of the historical bioassay program for SR-HUP workers is provided in Appendix A-8.3-3. With the non-operational status of GH, there are no work areas in which workers could potentially be exposed to airborne radionuclides. When indoor work areas are established, the SR-HUP Bioassay Program will be implemented for GH and data collection necessary for future assessment of the Bioassay Program will initiate.

4.1 Historical Occupational Exposure Rate Monitoring Assessment

An assessment of the historical occupational exposure rate monitoring for the SR-HUP is provided in Appendix A-8.3-4. Once operational, similar exposure rates would be anticipated for GH as at the existing satellite plants.

As GH has remained in a developmental mode with no active mining activities taking place since amendment into the SR-HUP Source Material License, any assessment of historical occupational exposure to gamma radiation can only be performed when GH operations begin.

5.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the GH historical facility operations, including air and groundwater quality monitoring and compliance history with respect to radiation exposure, radioactive contamination, and radionuclide release aspects, determining that no changes have taken place as GH is not presently, nor has been, in operation since incorporation into license SUA-1548 (NRC, 2003d). Consequently, all references cited within this Appendix are still relevant and are hereby incorporated by reference.

APPENDIX D-6

EXCEEDANCES OF ANY NON-RADIATION CONTAMINANT EXPOSURE OR RELEASE LIMITS FOR GAS HILLS SATELLITE FACILITY

1.0 INTRODUCTION

The purpose of this section is to provide a summary and review of non-radiation contaminant exposure, or exceedances of release limits reported for the GH.

2.0 REGULATORY BACKGROUND

This appendix has been prepared in conformance to the guidance provided in NUREG-1569 Appendix A (NRC, 2003c), which provides a list of "*specific areas where a compliance history or record of site operations and changes should be provided for review*" including "*exceedances of any non-radiation contaminant exposure or release limit*".

Cameco Resources' license SUA-1548 includes Condition 12.1 as follows:

> *"Until license termination, the licensee shall maintain documentation on spills of source or 11e.(2) byproduct materials (including mining solutions) and process chemicals. Documented information shall include, but not be limited to: date, spill volume, total activity of each radionuclide released, radiological survey results, soil sample results (if taken), corrective actions, results of post remediation surveys (if taken), and a map showing the spill location and the impacted area."* (NRC, 2004b)

License Condition 12.1 requires the licensee to maintain and follow procedures for evaluation of consequences of any spill and to determine if reporting to the NRC Operations Center is necessary. The timing of initial notification and written reports to the NRC and appropriate State agencies are also described in License Condition 12.1.

3.0 REVIEW OF NON-RADIATION CONTAMINANT EXPOSURE AND RELEASES FOR THE GH

Cameco Resources documents compliance with License Condition 12.1 through submittal of "Semi-annual Effluent and Environmental Monitoring Reports" to the NRC. These reports include review of all environmental releases to groundwater, surface water, land application, and air, inclusive of any non-radiation contaminant exposures. Semi-Annual Effluent Reports from 2004 to present were reviewed for occurrences of exposure or releases related to activities at the GH. Minimal non-mining related activities have taken place at GH since its inclusion under license SUA-1548 in 2004.

Additionally, in the event of a release the extent of all spills of process solutions are mapped, radiologically assessed with a gamma meter, and/or soil sampled for radionuclides. Spills meeting reporting limits are submitted to the NRC and WDEQ, with all pertinent information maintained on site in a decommissioning file. There have been no reported exceedances of non-radioactive contaminants or release limits associated with the GH Satellite Facility.

4.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A (NRC, 2003c) Cameco Resources has examined the GH historical facility operations, including compliance history and record of site operations with respect to exceedances of non-radiation contaminant exposure and release limits, determining that no changes have taken place. The GH is not presently, nor has it been, in operation since incorporation into license SUA-1548. Consequently, previously submitted information referenced within this section relating to areas covered in this appendix is still relevant and is hereby incorporated by reference.

APPENDIX D-7

UPDATES AND CHANGES SITE CHARACTERIZATION INFORMATION IMPORTANT TO THE EVALUATION OF EXPOSURE PATHWAYS AND DOSES FOR GAS HILLS SATELLITE FACILITY

1.0 INTRODUCTION

This appendix (Appendix D-7) of the Renewal Submittal for Source Material License SUA-1548 has been prepared in conformance to NUREG-1569, "*Standard Review Plan for In Situ Leach Uranium Extraction License Applications*" (NRC, 2003c). The approach to preparation of license renewal submittals as presented in NUREG-1569 Appendix A is streamlined, requiring the licensee to present "*compliance history or record of site operations and changes*" to the NRC for review. Further, NUREG-1569 Appendix A states that:

> *"Aspects of the facility and its operations that have not changed since the last license renewal or amendment should not be reexamined".*

The information and data presented in the license renewal submittal can therefore be optimized, to present:

- By reference, any previously submitted documentation in areas that have not changed;
- The record of site operations demonstrating that health, safety and environment have been protected throughout the previous license period; and
- Any "new or significant" information, describing aspects of facility or operations that have changed during the previous license period.

This approach allows for the NRC review to be keenly focused on "*only those changes proposed by license renewal or amendment application*" (NRC, 2003c).

2.0 APPENDIX D-7 CONTENT

Appendix D-7 has been prepared to conform with NUREG-1569 Appendix A guidance, specifically:

> *"Updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including site location and layout; uses of adjacent lands and waters; population distributions; meteorology; the geologic or hydrologic setting; ecology; background radiological or non-radiological characteristics; and other environmental features."* (NRC, 2003c)

Appendix D-7 is specifically focused on the GH which was included under Cameco Resources' Source Material License SUA-1548 by Amendment No. 6 (NRC, 2004b). Topics covered in Appendix D-7 include the following:

- D-7.1: Site Location and Layout for Gas Hills Satellite Facility
- D-7.2: Use of Adjacent Lands and Waters for Gas Hills Satellite Facility
- D-7.3: Population Distribution for Gas Hills Satellite Facility

- D-7.4: Meteorology for Gas Hills Satellite Facility
- D-7.5: Geologic or Hydrologic Setting for Gas Hills Satellite Facility
- D-7.6: Ecology for Gas Hills Satellite Facility
- D-7.7: Transportation for Gas Hills Satellite Facility

The topics covered in Appendix D-7 are largely covered by reference to previously submitted documentation, as GH is still in the developmental mode and no mining activities have been occurring there since its inclusion under SUA-1548.

APPENDIX D-7.1

SITE LOCATION AND LAYOUT FOR GAS HILLS SATELLITE FACILITY

1.0 INTRODUCTION

This section provides a review of the site location and layout for GH. GH is currently an undeveloped satellite facility of the SR-HUP under Source Materials License SUA-1548.

NUREG 1569 Appendix A (NRC, 2003c) states that "*updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including ...site location and layout*" shall be included in a license renewal application. This section provides background, any changes to site locations and layout, and the importance of the changes to exposure pathways and doses. Figure 1 (included in the main body of the License Renewal Submittal) shows the general location of SR-HUP and the GH within the state of Wyoming.

2.0 BACKGROUND

NUREG 1569, Section 2.1, describes the area of review for site location and layout for original license applications as follows:

> "*The reviewer should establish the validity and completeness of the basic data, to determine that the site location and proposed layout proposed in the application are complete and accurate, and that the site information is sufficient to evaluate the location of proposed facilities relative to key features and activities.*"

This requirement was met in the GH Amendment No. 6 issued in January 2004 (NRC, 2004b), which provides a description of the site location and layout for GH as of December 2004. The site location and layout as described in the GH is summarized below.

The GH is located in Fremont and Natrona Counties, Wyoming, approximately 65 miles west of Casper. The general layout of the proposed 8500 acre project site, including the 5 mine units and the satellite facility, are shown in the Environmental Assessment (EA) (NRC, 2004a).

3.0 CHANGES IN SITE LOCATION AND LAYOUT

There have been no changes to the GH site layout since 2004. Cameco Resources is currently drilling exploratory holes on-site, but this has not altered the proposed layout as shown by the EA (NRC, 2004a).

4.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the GH historical facility operations, including site location and layout, and has determined that no changes to the

layout or location have taken place. The GH is not presently nor has it been in operation since incorporation into license SUA-1548 by Amendment No, 6 (NRC, 2004b). Consequently, previously submitted information relating to areas covered in this appendix is still relevant and is hereby incorporated by reference.

APPENDIX D-7.2

USE OF ADJACENT LANDS AND WATERS FOR GAS HILLS SATELLITE FACILITY

1.0 INTRODUCTION

This section provides a review of uses of adjacent lands and waters for GH. GH is currently an undeveloped area of the SR-HUP under Source Materials License SUA-1548.

NUREG-1569 Appendix A (NRC, 2003c) states that "*updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including ... uses of adjacent lands and waters*" shall be included in a license renewal application. Any changes to adjacent land and water use from the time of the EA prepared for the GH in 2004 were examined (NRC, 2004a).

The following sections provide discussion of background on uses of adjacent lands and waters, an assessment of any changes to uses of adjacent lands and waters, and the importance of the changes to exposure pathways and doses. Figure 1 (included in the main body of the License Renewal submittal) shows the general location of GH within the state of Wyoming.

2.0 BACKGROUND

NUREG-1569, Section 2.1 (NRC, 2003c), describes the area of NRC review for uses of adjacent lands and waters for original license applications as follows: "*The staff should review descriptions of present and projected land use (e.g. agriculture, sanctuaries, hunting, mining, grazing, industry recreation, roads) and trends or changes in population or industrial patterns.*"

Further, NUREG-1569 states "*the staff should determine that the application contains the location of residences, ground-water supply wells, surface water reservoirs, and the estimated use of water in the lands surrounding the site of the proposed facility.*" These requirements were met most recently in the EA for the GH, Amendment No. 6, in January 2004 (NRC, 2004a), which provides a comprehensive description of the uses of adjacent lands and waters. Uses of the adjacent lands and waters as described in the GH Amendment No. 6 are incorporated here by reference. Current information on location of residences, groundwater supply wells, surface water reservoirs and the estimated use of water in lands surrounding the site was reviewed to assess whether "*any updates and changes important to the evaluation of exposure pathways and doses*" has occurred. This review is documented in the following section.

3.0 UPDATES TO USES OF ADJACENT LANDS AND WATERS

The U.S. Bureau of land Management (BLM) administers public land on which the majority of the proposed facility would be located, and public land in the immediate vicinity of the site. The BLM currently authorizes grazing on the public land it administers to a single lease-holder. Other small parcels of privately and state-owned land are also located within the area to be used for the proposed facility.

In addition to agriculture, the area surrounding the proposed site has been used for a number of purposes. The Gas Hills Uranium District has been exploited for its uranium reserves by a number of

companies, and has produced more than 50,000 tons of ore over the last forty years with open pit or underground conventional mine/mll operations. Most of the mines and processing facilities involved in these activities have been, or are being, decommissioned and reclaimed. It is estimated that more than 20 percent of the land that would be used by the proposed facility has been disturbed by previous uranium mining activities. The area has also seen production of oil and gas, although there is currently no production of oil and gas within two miles of the proposed facility boundary.

The area is also used for recreational activities, including hunting, and is an important wildlife habitat for mule deer and pronghorn antelope. Access roads to the surrounding area from the proposed site consist of a graded road to paved State Highway 136 to Riverton in the west, a graded road to US 20/26 to Waltman in the northeast, and a mine haul road to Jeffrey City to the southwest.

There are six non-operating uranium mining/mill sites within fifty miles of the proposed facility. Three of these are located within the Gas Hills Uranium District and are currently being decommissioned, one near Jeffrey City (also being decommissioned), another near Rawlins (not currently operating) and another near Riverton (site reclaimed). Lands within the GH properties and land adjacent to these properties have historically been and continue to be used for sheep grazing.

Water use in the vicinity of the GH area is limited to livestock, wildlife watering and some minor industrial use by the Pathfinder and Umetco mining operations. There is no current domestic or irrigation use of either surface water or groundwater in the vicinity of the project site. The majority of all groundwater rights located within one-half mile of the site boundary are for miscellaneous use as monitor wells and represent no consumptive use of groundwater.

With the exception of some springs, groundwater rights within a two mile radius of the project site that are permitted for consumptive use are associated with mining related activities. Several groundwater rights associated with springs are held by the Matador Cattle Company. These springs discharge from the Wagon Bed Formation which is stratigraphically above the Wind River Formation and crops out within the project site. However, no ISR uranium mining activities will occur in these areas, or within the Wagon Bed Formation, and, thus, the springs should not be impacted.

Several other springs permitted for stock usage discharge from the upper stratigraphic units of the Wind River Formation within and adjacent to the project site. The springs discharge from perched groundwater zones within the Wind River Formation and are located a minimum of one-half mile from any proposed disturbances. Surface disturbance of the spring areas will not occur. Uranium extraction will take place in stratigraphically lower and hydraulically isolated units. Cameron Spring is located hydraulically and topographically upgradient from the proposed Mine Unit No. 1 and should not be affected by ISR activities. Due to the remoteness of the location and the marginal quality of the water in the Wind River Aquifer, future domestic or irrigation use of the groundwater in the vicinity of the project site is unlikely.

4.0 IMPORTANCE OF CHANGES TO EXPOSURE PATHWAYS AND DOSES

There have been no changes to the location of residences, groundwater supply wells, surface water reservoirs, or the estimated use of water in the lands surrounding the license area. As such, previous evaluations of exposure pathways (NRC, 2004b) and doses are unaffected by the current uses of lands and waters adjacent to the GH.

5.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information occurring since the last license renewal, can be presented. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the GH historical facility operations, including uses of adjacent lands and waters, and has determined that no changes have taken place. Consequently, previously submitted information relating to uses of adjacent lands and waters is still relevant and is hereby incorporated by reference.

APPENDIX D-7.3

POPULATION DISTRIBUTION FOR GAS HILLS SATELLITE FACILITY

1.0 INTRODUCTION

This section provides a review of population distribution data for GH. The GH is currently an undeveloped area of the SR-HUP under Source Materials License SUA-1548.

NUREG-1569 Appendix A (NRC, 2003c) states that *"updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including...population distribution"* shall be included in a license renewal application. Population distribution data from the GH was documented by the NRC in the EA for the GH (NRC, 2004a).

2.0 BACKGROUND

NUREG-1569, Section 2.3, describes the area of review for population distribution for original license applications as follows:

> *"the staff should review population data based on the most recent census, including maps that identify places of significant population grouping, such as cities and towns within 80-km [50-mi] radius... from the approximate center of projected (life of facility) activities"* (NRC, 2003c).

The original population distribution information presented in the application for the GH (PRI, 1998), and the EA for the GH (NRC, 2004a) were reviewed and are incorporated here by reference. Recent U.S. Census Bureau information (U.S. Census Bureau, 2000 and 2010) data was reviewed to assess whether there have been any updates or changes to population distribution data that might impact the evaluation of exposure pathways and doses.

3.0 POPULATION DISTRIBUTION

This section provides a brief summary of population distribution and any changes to the regional and local population distributions. The GH is located in a remote rural area on the boundary between Fremont and Natrona Counties in central Wyoming, roughly 45 miles east of Riverton and approximately 65 miles west of Casper. The majority of the population in the area resides on widely scattered ranch property. Both counties have experienced fluctuating populations since the 1970s with changes in the fortunes of oil, gas and uranium extraction industries in the region, and both counties suffered declining populations during the 1980s.

In contrast, during the 1990s, both counties experienced small increases in population. In Fremont County, the population increased by 7.1 percent to 36,044 between 1990 and 1998, and in Natrona County, the population increased by 3.5 percent to 63,341 over the same period (U.S. Bureau of the Census, 1999). Jeffrey City, located 25 miles to the south of the GH, is the nearest population center and has an estimated stable population of less than 100.

Over the period from 2000 to 2008, the population in Fremont and Natrona Counties continued to increase with Natrona increasing about 10 percent and Fremont about 7.4 percent. Despite these changes, the population within 25 miles of the site has seen little change. The closest resident is approximately 11 miles from the site, and the nearest town of Jeffrey City is 25 miles from GH.

The exposure pathways and doses from GH were conservatively estimated and modeled using *MILDOS-AREA* (NRC, 2004a). The EA concluded:

> *"The highest estimated dose from radon exposure was to a hypothetical individual at the eastern boundary of the GH at 7 mrem/yr. This value is well within the 100 mrem/yr dose limit in 10 CFR Part 20 for individual members of the public. The highest estimated dose to the population living within 50 miles of the GH is 0.29 person-Rem/yr. This small value reflects the fact that approximately 99.7 percent of this population lives 25 miles or more from the site. These results indicate that radiological impacts to individuals and the population around the GH will be negligible."*

Since the highest dose was estimated for a hypothetical individual living at the eastern boundary of the GH, any small changes in population to the ranches around the site would not affect this hypothetical exposure pathway and dose and the conclusion that radiological impacts to individuals will be negligible. Since nearly all (99.7%) of the population with 50 miles lives more than 25 miles from the site, changes in population comparable to increases for Fremont County (7.4%) and Natrona County (10%) will not affect the conclusion that impacts to the population will be negligible.

4.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, can be presented. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the GH historical facility operations, including population distribution and has determined that no changes have taken place that would affect previous evaluations of pathways and doses. Consequently, references cited within this and other relevant sections and previously submitted information relating to population distribution is still relevant and is hereby incorporated by reference.

APPENDIX D-7.4

METEOROLOGY FOR GAS HILLS SATELLITE FACILITY

1.0 INTRODUCTION

This section provides a review of meteorological data for the Gas Hills Project (GH). GH is currently an undeveloped area of the SR-HUP under Source Materials License SUA-1548.

NUREG-1569 Appendix A (NRC, 2003c) states that "*updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including ...meteorology*" shall be included in a license renewal submittal. The Gas Hills 4E Weather Service Station (NWS), located at the GH, has been collecting temperature and precipitation records. The Casper NWS station located at the Natrona County International Airport has been used to evaluate wind data (NRC, 2004a). A brief summary of meteorological conditions at the site and assessment of any updates and changes to meteorology that are important to the evaluation of exposure pathways and doses is provided below.

2.0 BACKGROUND AND SITE METEOROLOGY

NUREG-1569, Section 2.5, describes the area of review for meteorology for original license applications as follows:

> "*the staff should determine whether the application includes sufficient local and regional-scale meteorological information to support estimates of airborne radionuclide transport from the proposed in situ leach facility to the surrounding area and for determination of airborne pathway inputs to risk assessment models*" (NRC, 2003c).

The climate of the area surrounding the GH is semiarid and cool. Wyoming is in the latitudes of prevailing westerly winds. At the Gas Hills 4E weather station, July is the warmest month and January the coldest. Based on 34 years of record (September 1962 through July 1996), the average maximum and minimum temperatures are 82.8°F and 53.7°F, respectively, in July, and 29.1°F and 10.9°F, respectively, in January.

The average annual precipitation at the Gas Hills 4E station is approximately 8.9 inches. About half of the annual precipitation occurs between April and June, while less than a third occurs from October through March. Snow commonly falls as early as October, and often as late as May.

From 1964 to 1994, annual snowfall at the NWS station in Casper, Wyoming averaged 78.8 inches and no measurable amount of snowfall was observed in July and August. Monthly snowfall amounts are unusually uniform from November through February, but increase slightly during March and April.

Based on the wind data collected by the U.S. Environmental Protection Agency (EPA) in Casper, Wyoming for the period of 1984 through 1992, the average wind speed is about 12.9 miles per hour (mph) (NRC, 2004a). The dominant wind direction is from the southwest at an average wind speed of about 17.5 mph. Predominance of wind from the southwest at the Casper station is due primarily to nearby topographic features.

NUREG 1910 (The Generic Environmental Impact Statement for In-situ Leach Uranium Milling Facilities) (NRC, 2009e) indicates that "*radon gas is emitted from ISL well fields and processing facilities during operations and is the only radiological airborne effluent for those facilities that use vacuum dryer technology*", such as SR-HUP. The EA documents that the *MILDOS* computer code was used to evaluate the average concentrations and doses for individuals and populations around the site (NRC, 2004). The EA documents that highest estimated dose from radon exposure is 7 mrem per year to a hypothetical individual at the eastern boundary of the GH (NRC, 2004a). This value is well below the 10 CFR Part 20 (10 CFR 20) annual radiation dose limit for the public of 100 mrem per year. Hence, it would take considerable changes to the average wind patterns to alter the conclusions. With this perspective, the following sections assess overall climate of the area, and the precipitation, temperature and winds to evaluate whether changes have occurred and whether they would be likely to alter the previous evaluation of exposure pathways and doses.

3.0 UPDATES TO SITE METEOROLOGY

From 2008 to 2010, average annual precipitation for the area was within 10 percent of historical averages. These data indicate that precipitation amounts have not changed appreciably for the site and would not influence dispersion from potential sources at the site.

Evaluating temperature records through 2006, the average maximum and minimum temperatures for July were 82.2° F and 53.6° F, respectively, or within 0.6°F and 0.1°F of the averages through 1996. Likewise, the average maximum and minimum temperature for January was 28.4° F and 11.0° F, respectively, or within 0° F and 0.1°F of averages through 1996.

Wind speed data from Natrona County International Airport has been used to estimate wind speed and direction for the GH. The average annual wind speed for the years 1961 through 1990 was 13 mph, with winds originating primarily from the southwest. The highest average monthly wind speed from 1961 to 1990 occurred in January, and was 16.4 mph from a west-southwesterly direction. The lowest average monthly wind speed occurred in July and was reported as 10.1 mph from a west-southwesterly direction.

Wind speed averages and directions for a twenty-five year period ending in 2008 were evaluated to assess whether any significant deviations from conditions referenced in past renewal submittals from the 1961 through 1990 period are apparent. The average annual wind speed for the 1983 to 2008 period was 12.1 mph from the southwest. This is slightly less than the annual average from the 1961 to 1990 period, but from the same direction. The highest average monthly wind speed for the most recent monitoring period was also in January, at 15.5 mph from a west-southwest direction. This is again slightly less than the highest average monthly wind speed from the 1961 through 1990 period, but from the same direction. The lowest average monthly wind speed for the period ending in 2008 was also for July at

9.5 mph from the west-southwest. This is slightly less than from the 1961 through 1990 period, but from the same direction. This data also shows that the prevailing wind direction is from the southwest.

4.0 CONCLUSIONS

Recent meteorological data were compared to data cited in the EA (NRC, 2004a) to assess whether changes have occurred that might impact "exposure pathways and doses". The overall climate, precipitation, temperature and wind speed and direction were evaluated. Temperature, precipitation, wind speed, and wind direction data collected since 2004 are consistent with the comparable long-term historical data sets. Using these data as indicators, the meteorology for the GH has remained consistent with historic meteorology since the EA, and will not impact previous analyses of exposure pathways and doses.

APPENDIX D-7.5

GEOLOGIC OR HYDROLOGIC SETTING FOR GAS HILLS SATELLITE FACILITY

1.0 INTRODUCTION

NUREG-1569 Appendix A (NRC, 2003c) states that "*updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including...the geologic or hydrologic setting*" shall be included. This section provides a review of the geologic and hydrologic setting for the GH Satellite Facility.

2.0 BACKGROUND

The last EA for the GH (NRC, 2004a) described the following for the GH site:

- Geology and Seismology
- Hydrology

A review of each topic above was conducted based upon available literature and data collected from the site. This is followed by a conclusions section that provides an evaluation to assess whether "*updates and changes to any site characterization (geologic or hydrologic setting) information important to the evaluation of exposure pathways or doses*" has occurred since the EA for the GH was prepared (NRC, 2004a).

3.0 REGIONAL AND LOCAL GEOLOGY

The GH is located in the Gas Hills Uranium Mining District in central Wyoming. This district comprises approximately 40 square miles located in the south central portion of the Wind River Basin along a structural hinge line between the Wind River Basin and the Split Rock Syncline. The approximate location of this boundary is the Beaver Rim, which is an east/west trending, north facing, 500 to 700 feet (ft) high escarpment formed by erosion. Along its axis, the basin contains up to 30,000 ft of sediment. The Wind River Basin was formed during the Late Cretaceous and early Tertiary by a major tectonic event, commonly known as the Laramide Orogeny.

During the Early Eocene, high energy streams emanating from the Granite Mountains deposited their sediment loads onto the erosional surface in the Gas Hills area creating a series of alluvial fans. The alluvial fan sediments then coalesced to form the Wind River Formation, which contains the uranium in the Gas Hills area. As much as 1,000 ft of Wind River sediments may have been deposited in the area. The known economic deposits within the GH site occur in the Tertiary (Eocene) Wind River Formation.

The GH has been divided into five local mining areas: Mine Unit (MU) "1", MU "2", MU "3", MU "4", and MU "5". These units correspond to the following deposits: Muskrat Deposit, Bountiful Deposit, Peach Deposit, Buss Deposit, and the Pix Deposit, respectively. Regional and local geology of the GH was described in detail by the NRC (NRC, 2004a). There have been no significant changes to the

characterization of the local or regional geology or seismology since 2004 that would impact exposure pathways and doses, hence the descriptions provided in the EA are incorporated by reference.

4.0 SURFACE WATER HYDROLOGY

The GH lies primarily within the Wind River drainage basin. Only a small portion of the project lies within the Sweetwater River drainage basin. Surface drainage within the project is Primarily to West Canyon Creek, which flows to Canyon Creek. Canyon Creek flows to Deer Creek and is a tributary to Poison Creek. The southwest portion of the project drains to Fraser Draw which is a tributary to Muskrat Creek. Both Muskrat Creek and Poison Creek are tributaries to the Wind River.

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. Streambeds and ponds may develop from intense thunderstorms or melting snow; however, water dissipates through percolation, runoff, and evaporation. The quality of the surface water can vary significantly in terms of their chemical, physical, and radionuclide characteristics. However, in general, the surface waters on the project site are suitable for wildlife and livestock consumption.

The surface water hydrology of the GH was described in detail by the NRC (NRC, 2004a). There have been no significant changes to the characterization of the surface water hydrology since 2004 that would impact exposure pathways and doses, hence the descriptions provided in the EA are incorporated by reference.

5.0 GROUNDWATER HYDROLOGY

The Wind River Formation contains the aquifers of primary importance within the project area. This formation consists of alternating layers of sandstone, siltstone, claystone, and conglomerate. The water-bearing sand and conglomerate units are collectively referred to as the Wind River Aquifer. The water from the Wind River Aquifer in the Gas Hills is Class III, suitable for livestock use in accordance with WDEQ/Water Quality Division Chapter 8 regulations (WDEQ). In the vicinity of uranium ore zones and roll front deposits, elevated concentrations of radionuclides may occur, rendering the water quality unsuitable for livestock use.

Uranium extraction will occur within six different sands of the Wind River aquifer. These include the 30, 40, 50, 60, 70 and 80 Sands. In some areas of the site, these sands are hydraulically separated by siltstone, clay, and shale beds, while in other areas of the site some of the individual sand layers are hydraulically and stratigraphically interconnected.

Within the site boundary, uranium extraction will take place within five different mine units, as described above. From the southwest corner to the northeast corner, these are MU "3", "1", "2", "4", and "5".

Within MU "3", uranium extraction will take place within the 30, 40, and 50 Sands. In MU "1", uranium extraction will take place in the 70 Sand. In MU "2", uranium extraction will take place within the 40, 50, 60, 70, and 80 Sands. In MU "4", uranium extraction will take place within the 50, 60, 70, and 80 Sands. In MU 5"", uranium extraction will take place within the 50 Sand.

Uranium concentrations in the groundwater are relatively low in both the uranium ore and non-ore zones. The maximum recorded uranium concentration is 0.320 milligrams per liter (mg/l), and the average is 0.04 mg/l. Ra^{226} concentrations are higher in uranium ore zones and near mined out ore zones than in non-ore zones. Radium values in non-ore zones are in the 5 to 50 pico-Curies per liter (pCi/l) range, while radium values in the ore zones can average from 65 to 705 pCi/l. To put the non-ore zone radium concentration values in perspective, the EPA drinking water standard for combined $Ra^{226/228}$ is 5 pCi/L.

The groundwater hydrology of the GH was described in detail by the NRC (NRC, 2004a). There have been no significant changes to the characterization of the regional or local groundwater hydrology since 2004 that would impact exposure pathways and doses, hence the descriptions provided in the EA are incorporated by reference.

6.0 CONCLUSIONS

Evaluations of regional and local geologic data, seismicity, surface hydrology and groundwater hydrology were conducted by the NRC (NRC, 2004a). The regional descriptions have not changed in the literature as no additional regional evaluations have been performed since 2004. Similarly, because of the limited amount of site work, there have been no local descriptions that have been updated. Thus, there have been no changes or updates to regional and site geology or hydrology that would be important to evaluation of exposure pathways or doses specific to the GH.

APPENDIX D-7.6

ECOLOGY FOR GAS HILLS SATELLITE FACILITY

1.0 INTRODUCTION

NUREG-1569 Appendix A (NRC, 2003c) states that "*updates and changes to any site characterization information important to the evaluation of exposure pathways and doses including...ecology*" shall be included in a license renewal application. This requirement is addressed for Cameco Resources' Source Material License SUA-1548 for GH in this appendix.

The following sections provide background, discussion of any changes to ecology, and the importance of the changes to exposure pathways and doses as applicable to GH.

2.0 BACKGROUND

NUREG-1569, Section 2.1 (NRC, 2003c), describes the area of NRC review for ecology for original license applications as follows:

> "*The staff should review the descriptions and inventories of the flora and fauna in the vicinity of the site, including habitats and distribution. The review should include terrestrial and aquatic organisms on or near the site, and their relative (qualitative) abundance should be established. ...If important species are determined to be present, the staff should evaluate any likely detrimental effects on the organism by the proposed facility and its operations.*"

This requirement was met most recently in the EA for Gas Hills Amendment No. 6 in January 2004 (NRC, 2004a), which provides a comprehensive description of the ecology at GH and is summarized below.

3.0 SUMMARY OF ECOLOGY

Vegetation in the GH is a typical northern plains short grass prairie forage. 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 percent (7,320 acres) of the approximately 8,500 acres of the GH area. The remaining 14 percent of the site is occupied by reclaimed land, disturbed land, and reservoirs.

Surveys of the project area have been conducted for big game species, upland game birds, raptors, and migratory birds of high Federal interest. Pronghorn (*Antilocapra americana*) and mule deer (*Odocoileus hemionus*) are the only big game species that occur in the project area. Pronghorn are common on the site (survey counts ranged from 54 to 142 animals) especially in habitats dominated by big sagebrush. Mule deer generally are less common (survey counts ranged from 4 to 140) and frequent rough breaks and sagebrush habitats. While SR-HUP, Reynolds Ranch, Ruth and North Butte licensed areas are outside of sage grouse core areas, portions of the southern edge of the GH licensed area overlap proposed core areas. For mule deer, most of the project area is classified as yearlong range, but portions

are considered winter/year-long and spring/summer/fall range. Range designated as "crucial" for both species by the State of Wyoming occurs several miles to the north of the project area.

Sage grouse (*Centrocercus urophasianus*) and mourning doves (*Zenaida macroura*) are the only upland game birds known to occur on the project area. Mourning doves are common residents on the site from spring through fall. Sage grouse inhabit the area year-round, but do not appear to be abundant. A single sage grouse strutting ground, located within a half mile of the northern license boundary, is the only known strutting ground within or adjacent to the project area. Since 1990, the number of male grouse observed on this strutting ground during annual surveys has ranged from 3 to 18.

A number of species of raptors are known to nest within the project area and use a variety of nesting substrates including the ground, trees, rock outcrops, cliffs, highwalls, and a man-made nest structure. Species known to nest on the site include red-tailed hawk (*Buteo jamaicensis*; 8 nests), ferruginous hawk (*Buteo regalis*; 49 nests), golden eagle (*Aquila chrysaetos*; 3 nests), prairie falcon (*Falco mexicanus*; 3 nests), and great-horned owl (*Bubo virginianus*; 1 nest). Other species that occur on the site, but have not been observed nesting, include Swainson's hawk (*Buteo swainsoni*), rough-legged hawk (*Buteo lagopus*), bald eagle (*Haliaeetus leucocephalus*), turkey vulture (*Cathartes aura*), northern harrier (*Circus cyaneus*), and American kestrel (*Falco sparverius*). The open sagebrush and grassland habitats on the site provide suitable foraging habitat for these species.

Migratory birds of high Federal interest that are known to occur in the project area are the bald eagle, golden eagle, ferruginous hawk, prairie falcon, and loggerhead shrike (*Lanius ludovicianus*). As discussed previously, the golden eagle, ferruginous hawk, and prairie falcon nest on the site. Loggerhead shrikes probably also nest in the area, but nesting activity was not observed. Although not observed on the site, the burrowing owl (*Athene cunicularia*) and mountain plover (*Charadrius montanus*) have been seen in adjacent areas. Limited aquatic habitat exists on the project area, and the ecology of these habitats has not been examined. Fish are not known to exist in any of the aquatic habitats present on site. Aquatic habitats on the project area include West Canyon Creek, Cameron Spring Reservoir, a small stock pond (Section 32 Pond), and four reclaimed mine pits. West Canyon Creek, a small, low gradient, soft-bottomed stream, is perennial for much of its length (about 2 miles) through the project area. Wetland vegetation grows in and along the perennial portions of the stream channel. Other streams in the project area flow intermittently, and only during spring run-off and following heavy rainfalls. Cameron Spring Reservoir is spring-fed and holds water year-round although water level varies based on changes in precipitation and evaporation rate. Most of the reservoir edge supports emergent wetland vegetation.

A jurisdictional wetlands delineation for the project area has not been conducted. However, 28 acres of potential wetland were mapped based on the presence of wetland vegetation. Most of this wetland vegetation exists along and within the stream channel of West Canyon Creek, but wetland vegetation also

occurs along the margins of Cameron Spring Reservoir and several small seeps which issue from the base of the Beaver Divide in the southern portion of the site. Wetland species on the site include creeping spikerush (*Eleocharis palustris*), bulrush (*Scirpus pungens*), sedges (*Carex* spp.), and rushes (*Juncus* spp.). A small stand of willows (*Salix* spp.) occurs in the upper portion of West Canyon Creek.

No Federally listed plant species were observed during surveys of the project area. Plant species of concern that, based on records of the Wyoming Natural Diversity Database, are known to occur in the region include Devil's Gate twinpod (*Physaria eburniflora*), Cedar Rim thistle (*Cirsium aridum*), and Nelson's milkvetch (*Astragalus nelsonianus*). These species are all considered rare in the state.

The U.S. Fish and Wildlife Service (USFWS) determined that three species listed as threatened or endangered could occur on the project area. These include the black-footed ferret, bald eagle, and peregrine falcon (Long, 1999). The mountain plover is proposed for listing as a threatened species and the swift fox is a candidate for listing. None of these species are known to occur on the project area. No roosting habitat is available in the area for the bald eagle, and no prairie dog colonies exist within a mile of the project area boundary, precluding occurrence of the black-footed ferret.

The State of Wyoming is in the process of finalizing "core areas" of protection for the Greater Sage Grouse, which in March 2010 the U.S. Fish and Game Department designated as "warranted but precluded" from listing under the Endangered Species Act. To protect the bird and to increase the likelihood of it not being listed as Endangered, the state's Sage Grouse Implementation Team appointed by the Governor has mapped proposed core protection areas based on the number of active leks and other factors. At present, the Reynolds Ranch is outside of sage grouse core area.

The state is developing stipulations that will limit and control development within core area and has established working groups, including a working group for the uranium industry, to develop proposed stipulations that would detail the type and extent of operations permitted while protecting the bird. In the case of Gas Hills, these stipulations when finalized could have some impact on development; however, because virtually all of the Gas Hills permit area is on U.S. Bureau of Land Management land, guidelines developed separately by the BLM for federal land would be of greater significance.

Suitable habitat appears to exist on the site for the mountain plover as plovers may inhabit open grasslands and nest and raise young in sagebrush communities where the sagebrush is short in status and has low canopy cover. No mountain plovers were observed during surveys conducted of the project area in April and May 1997. Suitable habitat also appears to exist for the swift fox; however, no evidence of swift fox use of the project area was found based on 1993 surveys. Peregrine falcons could use the area for hunting during migration. The State of Wyoming does not maintain a list of threatened or endangered plant or animal species, but has established a non-game bird and mammal plan that includes a list of species of special concern (Wyoming Game and Fish Department, 1996). All of the Federally listed animal species are considered by the State as species of special concern. In addition, the

ferruginous hawk and merlin, both known to occur on the site, are species of special concern. The ferruginous hawk nests and forages over the project area; the merlin has been observed once there during migration and could use the site for foraging.

4.0 IMPORTANCE OF UPDATES TO ECOLOGY AND CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, can be presented. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the GH historical facility operations, including ecology, and has determined that no changes have taken place. Consequently, previously submitted information relating to ecology is still relevant and is hereby incorporated by reference.

APPENDIX D-7.7

TRANSPORTATION FOR GAS HILLS SATELLITE FACILITY

1.0 INTRODUCTION

This section provides a review of the impacts of transportation for GH. GH is currently an undeveloped area of the SR-HUP under Source Materials License SUA-1548.

NUREG-1569 Appendix A (NRC, 2003c) states that "*updates and changes to any site characterization information important to the evaluation of exposure pathways and doses, including other environmental features,*" shall be included in a license renewal application. Other environmental features include transportation. The main transportation routes in and around the GH and potential impacts were updated most recently in the EA (NRC, 2004a).

A brief review of main transportation routes and impacts from the GH are presented in the following sections, along with an assessment of any updates and changes to transportation important to the evaluation of exposure pathways and doses.

2.0 BACKGROUND

NUREG-1569, Section 2.10 (NRC, 2003c), describes the area of NRC review for other environmental features for original license applications as follows:

> "*The staff should consider environmental information provided in this section as auxiliary information to support an application for a given facility. The information should be considered in a site-specific context and should be consistent with the information provided in other sections of the application.*"

The transportation impacts information presented in the EA (NRC, 2004a) was reviewed to assess whether there have been any updates or changes in major transportation routes that might impact the evaluation of exposure pathways and doses.

3.0 SUMMARY OF TRANSPORTATION AND UPDATES

Surface transportation routes from the Gas Hills site (Carol Shop) to nearby population centers and SR-HUP include the following roadways:

- To Jeffrey City: 33 miles of graded road.
- To Casper: 3 miles of graded road to Fremont County line, 25 miles of graded County road to Waltman, and 49 miles of paved U.S. Highway 20/26.
- To Riverton: 7 miles of graded road and 44 miles of State Highway 136.
- To SR-HUP: 7 miles of graded road, 44 miles of State Highway 136, 1 mile of State Highway 789, 22 miles of U.S. Highway 26, 100 miles of U.S. Highway 20/26, 21 miles of Interstate Highway 25, 19 miles of State Highway 95, 0.1 miles of State Highway 93, 7.62miles along Ross Road, and 1 mile of gravel road to the SR CPP.

The EA (NRC, 2004a) evaluated average daily traffic (trucks and all vehicles) counts for the roadway segments listed above. With regard to the amount of additional traffic on roads in and around the GH as a result of the project, the EA concludes:

> *"These additional traffic volumes are relatively small compared to the existing traffic on these roadways and, therefore, are not expected to significantly contribute to the congestion or accident rates on these roadways."*

The GH is currently not operational. There have been no changes to the proposed transportation routes for workers to the site or shipment of uranium-loaded resin to the SR-HUP facility. There have also been no changes to estimates of traffic volumes associated with these uses.

4.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, could be presented. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the GH historical facility operations, including updates and changes to transportation impacts for the GH as summarized in the sections above, and has determined that no new or significant information can be added at this time. Previously submitted information relating to transportation impacts for the GH is still relevant and is hereby incorporated by reference.

APPENDIX D-8

ENVIRONMENTAL EFFECTS OF SITE OPERATIONS INCLUDING DATA ON RADIOLOGICAL AND NON-RADIOLOGICAL EFFECTS, ACCIDENTS, AND THE ECONOMIC AND SOCIAL EFFECTS OF OPERATIONS FOR GAS HILLS SATELLITE FACILITY

1.0 INTRODUCTION

This appendix (Appendix D-8) of the License Renewal submittal for Source Material License SUA-1548 has been prepared in conformance to NUREG-1569, "*Standard Review Plan for In Situ Leach Uranium Extraction License Applications*" (NRC, 2003c). The approach to preparation of license renewal applications as presented in NUREG-1569 Appendix A is streamlined, requiring the licensee to present "*compliance history or record of site operations and changes*" to the NRC for review. Further, NUREG-1569 Appendix A states that:

> *"Aspects of the facility and its operations that have not changed since the last license renewal or amendment should not be reexamined".*

The information and data presented in the license renewal submittal can therefore be optimized, to present:

- By reference, any previously submitted documentation in areas that have not changed;
- Records of site operations demonstrating that health, safety and environment have been protected throughout the previous license period; and
- Any "new or significant" information, describing aspects of facility or operations that have changed during the previous license period.

This approach allows for the NRC review to be keenly focused on "*only those changes proposed by license renewal or amendment application*" (NRC, 2003c).

2.0 APPENDIX D-8 CONTENT

Appendix D-8 has been prepared to conform with NUREG-1569 Appendix A guidance, specifically:

> *"Environmental effects of site operations including data on radiological and non-radiological effects, accidents, and the economical and social effects of operations.*" (NRC, 2003c)

Appendix D-8 is specifically focused on the GH which was included under Cameco Resources' Source Material License SUA-1548 by Amendment No. 6 in 2004 (NRC, 2004b). Topics covered in Appendix D-8 include the following:

- D-8.1: Release and Accident History for Gas Hills Satellite Facility
- D-8.2: Surface and Groundwater Monitoring History for Gas Hills Satellite Facility
- D-8.3: Assessment of Occupational Radiation Exposure and Dose Data for Gas Hills Satellite Facility
  - D-8.3-1: Historical Radiation Monitoring Program Assessment for Gas Hills Satellite Facility
  - D-8.3-2: Historical Results of Radiation Dose Calculations for Gas Hills Satellite Facility

- D-8.3-3: Historical Bioassay Program Assessment for Gas Hills Satellite Facility
- D-8.3-4: Historical Occupational Exposure Rate Monitoring Assessment for Gas Hills Satellite Facility

- D-8.4: Historical Airborne Effluent and Environmental Monitoring Program Assessment for Gas Hills Satellite Facility
- D-8.5: Historical Quality Assurance Program Assessment for Gas Hills Satellite Facility
- D-8.6: Cumulative Effects of Operations for Gas Hills Satellite Facility

The topics discussed in Appendix D-8 are largely covered by reference to previously submitted documentation, due to the developmental status of the GH since its inclusion under SUA-1548.

APPENDIX D-8.1

RELEASE AND ACCIDENT HISTORY FOR GAS HILLS SATELLITE FACILITY

1.0 INTRODUCTION

This section provides a review of the impacts of spills and releases for GH. The GH is currently an undeveloped area of the SR-HUP under Source Materials License SUA-1548. In accordance with SUA-1548 License Condition 12.1:

> *"Until license termination, the licensee shall maintain documentation on spills of source or 11e(2) byproduct materials (including mining solutions) and process chemicals. Documented information shall include, but not be limited to: date, spill volume, total activity of each radionuclide released, radiological survey results, soil sample results (if taken), corrective actions, results of post remediation surveys (if taken), and a map showing the spill location and the impacted area."* (NRC, 2004b)

Further, License Condition 12.1 requires the licensee to maintain and follow procedures for evaluation of consequences of any spill and to determine if reporting to the NRC Operations Center is necessary. The timing of initial notification and written reports to the NRC and appropriate State agencies are also described in License Condition 12.1.

2.0 SUMMARY OF SPILLS AND RELEASES FOR GH

Since its inclusion under the SR-HUP license SUA-1548, the GH has been inactive as a mining operation. There have been no spills that required documentation, evaluation of consequences against reporting criteria, notification or report submittal to the NRC or State agencies associated with Cameco Resources' activities on the GH.

3.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information occurring since the last license renewal could be presented. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A (NRC, 2003c), Cameco Resources has examined the GH historical facility operations, including documentation of spills or releases for the GH as summarized in the sections above, and has determined that no new or significant information can be added at this time. Previously submitted information relating to spills for the GH is still relevant and is hereby incorporated by reference.

APPENDIX D-8.2

SURFACE AND GROUNDWATER MONITORING HISTORY FOR GAS HILLS SATELLITE FACILITY

1.0 INTRODUCTION

This section provides a summary and review of data from the Groundwater and Surface Water Monitoring Programs for GH. The GH is currently an undeveloped area of the SR-HUP under Source Materials License SUA-1548. Cameco Resources has Groundwater and Surface Water Monitoring Programs in place for the SR-HUP property to monitor well fields that are in production or restoration. When the GH is actively mined, it will fall under the existing monitoring programs. Since its inclusion by amendment to SUA-1548 in 2004 (NRC, 2004b), the GH has been inactive and there has been no monitoring of groundwater or surface water performed for this site. As part of the renewal process, a review of water rights for the licensed areas resulted in preparation of the following updated NB and RU Application Tables that have been included in this License Renewal submittal on an accompanying CD under a separate PDF file. The CD format is due to the extensive nature of the information contained in the tables. Previous submittals leading to NRC approval of Amendment No. 6 for inclusion of the GH under SUA-1548 are still relevant and are incorporated by reference.

2.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, could be presented. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A (NRC, 2003c), Cameco Resources has examined the GH historical facility operations, including updates and changes to groundwater and surface water monitoring programs as summarized in the sections above, and has determined that no new or significant information can be added at this time aside from the updated Groundwater and Surface Water Rights tables. Previously submitted information relating to groundwater and surface water monitoring for the GH is still relevant and is hereby incorporated by reference.

APPENDIX D-8.3

ASSESSMENT OF OCCUPATIONAL RADIATION EXPOSURE AND DOSE DATA FOR GAS HILLS SATELLITE FACILITY

1.0 INTRODUCTION

The following four sub-sections will provide assessment of workers' exposure to radiation through review of historical records for:

- Appendix D-8.3.1: Historical Radiation Monitoring Program Assessment for Gas Hills Satellite Facility
- Appendix D-8.3.2: Historical Results of Radiation Dose Calculations for Gas Hills Satellite Facility
- Appendix D-8.3.3: Historical Bioassay Program Assessment for Gas Hills Satellite Facility
- Appendix D-8.3.4: Historical Occupational Exposure Rate Monitoring Assessment for Gas Hills Satellite Facility

The following appendices address these topics as applied specifically to GH. The GH is currently an undeveloped area of the SR-HUP under Source Materials License SUA-1548 (NRC, 2004b). Each of the following appendices provides background information on regulatory requirements and NRC guidance for monitoring of radionuclide exposure and occupational doses received by workers. The historical data from Cameco Resources employee monitoring programs, as applicable to the GH, are presented. The historical data is reviewed and conclusions are presented.

Due to the minimal level of activity on the GH since its inclusion into the SR-HUP Source Materials License SUA-1548 in 2004, workers' radiation exposure and dose directly related to GH are the result of exposure to background radiation and minimal, and well below regulatory requirements.

APPENDIX D-8.3-1

HISTORICAL RADIATION MONITORING PROGRAM ASSESSMENT FOR GAS HILLS SATELLITE FACILITY

1.0 HISTORICAL RESULTS OF AIRBORNE RADIATION MONITORING (OCCUPATIONAL)

The purpose of this section is to provide an assessment of occupational radiation exposure due to airborne radionuclides for GH. The GH is currently an undeveloped area of the SR-HUP under Source Materials License SUA-1548 (NRC, 2004b).

2.0 REGULATORY REQUIREMENTS

Subpart C of 10 CFR Part 20 limits the TEDE for occupational workers to 5 rems/year, shallow dose equivalent to the skin to 50 rems/year, and dose equivalent to the embryo/fetus of a pregnant worker to 0.5 rem during the entire pregnancy. In order to limit the internal dose from radionuclide intakes, the NRC requires that work areas be routinely monitored and posted according to their exposure rate classification. In addition, radiation work permits for conducting non-routine tasks must contain information regarding radiation levels in the work areas. Monitoring programs focused on workplace airborne radionuclide concentrations are the most effective tool to evaluate and limit workplace internal doses due to inhalation of radioactive material.

As per NRC License SUA -1548 Condition No. 9.7, NRC's Regulatory Guide 8.30, "*Health Physics Surveys in Uranium Recovery Facilities*," (NRC, 2002a) requires that airborne soluble uranium measurements be conducted weekly in airborne radioactivity areas (areas with the potential for air concentrations to be greater than 1 Derived Air Concentration [DAC]), and monthly in areas not designated as airborne radioactivity areas to determine toxicological intakes and radiobiological doses. Measurement of radon progeny should be collected monthly in areas where radon progeny routinely exceeds 10 percent of the DAC, and increased to weekly if radon progeny exceeds 25 percent of the DAC.

Buildings (or rooms within buildings) that contain or have the potential for airborne radionuclide concentrations exceeding 1 DAC are posted with the sign, "Caution Airborne Radioactivity Area". This posting provides workers and managers with information helpful in minimizing radiation doses.

3.0 AIRBORNE RADIATION MONITORING RESULTS FOR GH

Cameco Resources' monitoring program for occupational exposure due to airborne radionuclides is applicable to indoor work areas such as satellite IX facilities, header houses, and the Smith Ranch CPP. No such work environments exist on the GH. Thus there are no monitoring results for the GH.

4.0 CONCLUSIONS

With respect to this License Renewal Submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance

relating to license renewals in NUREG-1569 Appendix A (NRC, 2003c), Cameco Resources has examined the GH historical facility operations, including occupational exposure to airborne radionuclides, determining that no changes have taken place as the GH is not presently nor has been in operation since incorporation into license SUA-1548. Consequently, references cited within this and other relevant sections and previously submitted information relating to historical radiation monitoring are still relevant and are hereby incorporated by reference..

APPENDIX D-8.3-2

HISTORICAL RESULTS OF RADIATION DOSE CALCULATIONS FOR GAS HILLS SATELLITE FACILITY

1.0 OVERVIEW

The purpose of this section is to provide a review of worker radiation dose exposure data reported for GH. The GH is currently an undeveloped area of the SR-HUP under Source Materials License SUA-1548 (NRC, 2004b).

2.0 REGULATORY REQUIREMENTS

NRC licensees are required to develop and implement a radiation protection program that limits radiation doses to levels that are ALARA and within the occupational dose limits (10 CFR 20.1101 and 10 CFR 20.1201, respectively). Administrative and engineering controls are used to reduce radiation exposures.

Occupational dose limits are specified in 10 CFR 20.1201. The annual limits are the more limiting of: (i) a TEDE of 5 rem/year; (ii) the sum of the deep-dose equivalent and the committed dose to any organ (with exception of the lens of the eye) of 50 rem/year; (iii) the dose to the lens of the eye of 15 rem/year; and (iv) the dose to the skin or any extremity of 50 rem/year. In addition to the annual dose limits, the soluble uranium intake by a worker may not exceed 10 milligrams (mg) in a week. This limit is based on the chemical toxicity of uranium. For normal ISR operations, limiting the TEDE to 5 rem/year and the intake of uranium to 10 mg/week is the primary focus of the radiation protection program since exposure conditions are not such that high extremity and organ doses are limiting.

Worker monitoring requirements are specified in 10 CFR § 20.1001 to 20.2401 (Standards for Protection Against Radiation). Further guidance is contained in NRC Regulatory Guides 8.30, "*Health Physics Surveys in Uranium Recovery Facilities,*" (NRC, 2002a) and NRC Regulatory Guide 8.34, "*Monitoring Criteria and Methods to Calculate Occupational Radiation Doses.*" (NRC, 1992b) Routine employee external doses are determined and recorded for those employees likely to receive more than 10 percent of the allowable occupational dose limit (i.e. 0.5 rem). External exposures are determined using personnel dosimeters that are exchanged periodically, or at the end of a task, depending on the expected exposure potential. Routine employee internal doses are determined and recorded for those employees likely to receive an intake of more than 10 percent of the Annual Limit on Intake (ALI) from radon daughters or uranium. Internal doses are determined by calculation using air quality data and time of exposures, or from the results of bioassay sampling.

Non-routine doses are determined and recorded for all employees conducting non-routine work activities that require a radiation work permit (RWP). In the event that an employee has routine and non-routine doses for a monitoring period, doses are summed to determine the total dose. In accordance with NRC regulations, internal exposures are summed (e.g. quarterly, yearly) and the TEDE calculated by adding the dose equivalent from internal exposure to the dose equivalent from external sources of radiation.

3.0 WORKER EXPOSURES AND ALARA IMPLEMENTATION

Workers who have the potential for receiving 10 percent of the dose limits for internal or external radiation must be monitored. Due to the non-operation status of GH during the renewal period (continuing to the present) radiation monitoring has not been required. Any radiation exposure to workers at the GH is strictly the result of background radiation.

4.0 GH CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A (NRC, 2003c), Cameco Resources has examined the GH historical facility operations, including results of radiation dose calculations, determining that no changes have taken place as the GH is not presently nor has been in operation since incorporation into license SUA-1548. Consequently, references cited within this and other relevant sections and previously submitted information relating to historical radiation dose calculations are still relevant and are hereby incorporated by reference.

APPENDIX D-8.3-3

HISTORICAL BIOASSAY PROGRAM ASSESSMENT FOR GAS HILLS SATELLITE FACILITY

1.0 OVERVIEW

The purpose of this section is to provide a review of workers' exposure to radiation as measured through bioassays, and is specific to the GH Satellite Facility. The GH is currently an undeveloped area of the SR-HUP under Source Materials License SUA-1548 (NRC,2004b).

NRC licensees are required to limit workers' intake in areas with airborne radionuclides by sequential application of the following:

- Engineering controls;
- Controlled access;
- Limiting exposure time; and
- Use of respiratory protection.

Cameco Resources has implemented a bioassay program to monitor the effectiveness of the respiratory program, and to provide a quantitative method for estimating intakes of radioactive material. A review of the historical bioassay program for SR-HUP workers is provided in Appendix A-8.3-3.

2.0 REGULATORY REQUIREMENTS AND GUIDANCE

Bioassays are used to determine worker intakes when using respiratory protection as required by 10 CFR §20.1703. They are also used to ascertain the effectiveness of the health physics program, qualify the protectiveness of the respiratory protection program, and to demonstrate compliance with chemical toxicity limits for soluble uranium contained in 10 CFR 20.1201(e). Bioassays are required when workers have the potential for intakes of one-tenth of the ALI or more in a year, as well as for declared pregnant workers, occupationally exposed minors, and members of the public allowed access to airborne radioactivity areas.

NRC Regulatory Guide 8.22, "*Bioassay at Uranium Mills*," (NRC, 1988a) provides guidance to licensees that have the potential for exposure to employees from airborne yellowcake dust. New employees and contractors who will handle uranium or contaminated materials submit a bioassay prior to completing their assignment. The same employees submit a bioassay at termination. All new employees and contractors submit a baseline bioassay prior to commencement of work. Employees and contractors who handle uranium or contaminated materials submit to a bioassay two days after completion of work on a routine basis. Bioassays may be required for special situations requiring a Radiation Work Permit (RWP). The regulatory guide specifies a quality control program as well as a requirement that the analytical lower limit of detection (LLD) be less than 5 micro grams per liter (µg/l). The radiation dose equivalent associated with an intake resulting in a urinalysis result of 5 µg/l would be approximately 0.06 mrem.

Table 1 in Regulatory Guide 8.22 provides action levels for concentrations of uranium in bioassay results. For concentrations less than 15 µg/l, no action is required other than to review results. For concentrations between 15 and 35 µg/l, the results should be interpreted as an indicator that uranium confinement and air sampling may not provide an adequate margin of safety. The radiation dose associated with an intake resulting in a urinalysis result between 15 and 35 µg/l would be approximately 0.17 and 0.4 mrem, respectively. A series of steps are suggested, including confirming the results through additional sampling, improving controls, and considering work restrictions for urinalysis.

Concentrations greater than 35 µg/l suggests that uranium confinement and perhaps air sampling programs may not be acceptable. Actions taken include those listed above for the 15 to 35 µg/l concentration range, and also include limiting operations until it is certain that no other workers will receive exposures in excess of 35 µg/l. Increased frequency of bioassay sampling is required and work restrictions for affected workers are also recommended for concentrations exceeding 35 µg/l. Two consecutive bioassays from the same employee with concentrations of uranium of 35 µg/l or greater, or a single bioassay with concentration of uranium of 130 µg/l or greater, is an indicator that the worker may have exceeded the regulatory limits on intake of soluble uranium. A series of additional action steps are specified for this scenario.

3.0 BIOASSAY RESULTS FOR GH

With respect to the GH, there are no work areas in which workers could potentially be exposed to airborne radionuclides. The Bioassay Program is not currently and will not be applicable to GH until indoor operations commence.

4.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A (NRC, 2003c), Cameco Resources has examined the GH historical facility operations, including radiation exposure as measured by the bioassay program, and has determined that no changes have taken place as the GH is not presently nor has been in operation since incorporation into license SUA-1548. Consequently, references cited within this and other relevant sections and previously submitted information relating to historical bioassay program results is still relevant and is hereby incorporated by reference.

APPENDIX D-8.3-4

HISTORICAL OCCUPATIONAL EXPOSURE RATE MONITORING ASSESSMENT FOR GAS HILLS SATELLITE FACILITY

1.0 INTRODUCTION

The purpose of this section is to provide an assessment of the historical occupational exposure rate monitoring for GH. The GH is currently an undeveloped area of the SR-HUP under Source Materials License SUA-1548 (NRC, 2004b).

The GH is and has been inactive since its inclusion under the SR-HUP license in 2004. As such there is no GH site-specific historical occupational exposure rate monitoring data to be assessed. When the GH is actively mined, work activities will be included in the occupational exposure rate monitoring program already in place for SR-HUP. Background and regulatory requirements of exposure rate monitoring are briefly described in the following sections.

2.0 REGULATORY REQUIREMENTS

Subpart C of 10 CFR Part 20 limits the TEDE for occupational workers to 5 rems/year, shallow dose equivalent to the skin of 50 rems/year, and dose equivalent to the embryo/fetus of a pregnant worker to 0.5 rem during the entire pregnancy. In order to limit the exposure from direct radiation, the NRC requires that work areas be routinely monitored and posted according to their exposure rate classification. In addition, RWPs for conducting non-routine tasks should contain information regarding potential radiation exposures prior to and/or during completion of the work (10 CFR 20).

NRC Regulatory Guide 8.30, "*Health Physics Surveys in Uranium Recovery Facilities (URF)*," (NRC, 2002a) suggests that gamma radiation surveys be conducted semi-annually at locations representative of workers' exposure to determine posting and external dosimetry requirements. Surveys in radiation areas are to be conducted quarterly. Regulatory Guide 8.30 also recommends that surface contamination be limited to approximately 220,000 disintegrations per minute (dpm) per 100 square centimeters (cm^2) so that the contamination does not contribute to unacceptable airborne radionuclide concentrations.

3.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether there is any "new or significant" information having occurred during the time since the last license renewal. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A (NRC, 2003c), Cameco Resources has examined the GH historical facility operations, including occupational exposure rate monitoring, and has determined that no changes have taken place as the GH is not presently nor has been in operation since incorporation into license SUA-1548. Consequently, references cited within this and other relevant sections and previously submitted information relating to occupational exposure rate monitoring are still relevant and are hereby incorporated by reference.

APPENDIX D-8.4

HISTORICAL AIRBORNE EFFLUENT AND ENVIRONMENTAL MONITORING PROGRAM FOR GAS HILLS SATELLITE FACILITY

1.0 EFFLUENT AIR MONITORING AND ENVIRONMENTAL GAMMA EXPOSURE RATES

This appendix presents the regulatory background for historical airborne effluent monitoring and gamma radiation exposure rate data as applicable to GH. The GH is currently an undeveloped area of the SR-HUP under Source Materials License SUA-1548 (NRC, 2004b).

This appendix also provides an overview of the existing air monitoring program for SR-HUP. When mining activity is initiated at the GH, it will be incorporated into the SR-HUP airborne effluent and environmental monitoring program.

2.0 GHP AIRBORNE EFFLUENT MONITORING

Cameco Resources maintains three environmental monitoring stations at three locations on and around the GH. The three stations are currently collecting baseline data. Each station is also equipped with a track-etch detector and an environmental dosimeter for measurement of Rn^{222} and gamma radiation exposure rate. Track-etch detectors, and dosimeters are collected periodically and sent to an accredited outside laboratory for analysis (prior to mining activities, the monitors will be modified to also have a particulate high volume sampling capability). The air monitoring stations are located as follows:

- West - Upwind: This station monitors background conditions, upwind of the proposed GH wellfields.
- Carol Shop - Controlled Area–Fence Line: This station monitors conditions at the Controlled Area Boundary.
- East - Downwind: This station monitors the property boundary downwind from the satellite facility

Airborne effluent monitoring results will be provided in the Semi-Annual Effluent and Environmental Monitoring Reports prepared by Cameco Resources and submitted to the NRC.

3.0 REGULATORY REQUIREMENTS

Radiation dose limits for individual members of the public are specified in 10 CFR 20 Subpart D. NRC licensees are required to monitor the radiation levels and radioactive material in effluents released to the controlled and unrestricted areas to demonstrate compliance with the 0.1 rem TEDE limit to the public. The licensee may do this by:

- Demonstrating by measurement or calculation that the total effective dose equivalent to the individual likely to receive the highest dose from the licensed operation does not exceed the annual dose limit; or
- Demonstrating that the annual average concentrations of radioactive material released in gaseous and liquid effluents at the point of exposure do not exceed the effluent concentrations in 10 CFR 20, Appendix B, Table 2 and demonstrating that the external radiation sources would not exceed 0.002 rem in an hour or 0.05 rem in a year.

The dose limits are exclusive of the dose contribution from natural background radiation and from radiation doses received from the medical use of radiation and radioactive materials. Controlled areas of the site include a small exclusion area around the processing plants, the satellite plants, process water storage ponds, and small storage areas containing licensed material. Access to the license area is open to the public and therefore the limits apply to members of the public anywhere but the controlled area.

4.0 MONITORING RESULTS FOR THE GH

Since its inclusion under the SR-HUP license SUA-1548, the GH has been nonoperational. As previously noted, only baseline data is currently being collected at GH.

5.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, could be presented. Specifically the Semi-Annual Effluent and Environmental Monitoring Reports from 2004 to present were reviewed for occurrences of airborne effluent monitoring results on the GH property and none were found. Cameco Resources has examined the GH historical facility operations, including documentation of airborne effluent monitoring for the GH as summarized in the sections above, and has determined that no new or significant information can be added at this time. Consequently, references cited within this and other relevant sections and previously submitted information relating to uses of adjacent lands and waters is still relevant and is hereby incorporated by reference.

APPENDIX D-8.5

HISTORICAL QUALITY ASSURANCE PROGRAM ASSESSMENT FOR GAS HILLS SATELLITE FACILITY

1.0 INTRODUCTION

This appendix provides a summary of the historical quality assurance (QA) program results for GH. The GH is currently an undeveloped area of the SR-HUP under Source Materials License SUA-1548 (NRC, 2004b). The effectiveness of the QA program is tracked through review of NRC Inspection Reports. As documented in Appendix D-1, there have been no NRC Inspection findings that are directly related to the GH. The following sections provide an overview of the license renewal requirements for evaluation of QA programs, and a summary of documentation that was reviewed to support the conclusion that there is no "new or significant" information in this area for the GH.

2.0 REGULATORY BACKGROUND

The acceptance criteria for evaluating a licensee's QA program for a renewal application are provided in Section 5.7.9.3(3) of NUREG-1569 (NRC, 2003c) as follows:

- Historical QA program results are included through the most recent reporting period, preceding the submittal of the license renewal submittal;
- A discussion of the effectiveness of the historical QA program with regard to all applicable 10 CFR Part 20 regulatory requirements; and
- A discussion of long-term trends and explanations of any short-term deviations from the long-term trends.

The elements of an acceptable QA program are described in the NRC Regulatory Guide 4.14 "*Quality Assurance for Radiological Monitoring Programs (Inception through Normal Operations to License Termination) Effluent Streams and the Environment*" (NRC, 2007b) and include:

- Organizational Structure and Responsibilities of Managerial and Operational Personnel
- Specification of Qualifications of Personnel
- Operating Procedures and Instructions
- Records
- Quality Control in Environmental Sampling
- Quality Control in the Radioanalytical Laboratory
- Quality Control for Radioactive Effluent Monitoring Systems
- Verification and Validation
- Assessments and Audits
- Preventive and Corrective Actions

Cameco Resources has a QA program in place for the SR-HUP, which is fully compliant with the required list of program elements. QA requirements specific to certain tasks such as occupational or environmental monitoring are addressed through procedures within the site's Environmental, Health and

Safety (EHS) Management System Manual. Evaluations of the effectiveness and implementation of the QA program are presented in the annual ALARA audit reports conducted by Cameco Resources personnel with the assistance of independent third-party auditors and in semi-annual NRC license inspection reports. All pre-mining activities that have occurred on the GH property from 2004 to present have been covered by the QA program for the SR-HUP.

3.0 ASSESSMENT OF QA PROGRAM EFFECTIVENESS

As documented in Appendix A-8.5, the SR-HUP QA program was assessed through review of all NRC Inspection Reports filed during the previous license period (1999 to 2009). QA-related deficiencies and items of concern and their resolutions were described. There were nine QA-related items identified in routine audits and NRC inspections for SR-HUP over the ten-year licensing period. All items were addressed by implementing appropriate corrective actions. There are currently no open issues related to QA concerns. None of the QA inspection findings items were related to the GH.

4.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, could be presented. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the GH historical facility operations, including assessment of the QA program for the GH as summarized in the sections above, and has determined that no new or significant information can be added at this time. Consequently, references cited within this and other relevant sections and previously submitted information relating to the QA program are still relevant and are hereby incorporated by reference.

APPENDIX D-8.6

CUMULATIVE EFFECTS OF OPERATIONS FOR GAS HILLS SATELLITE FACILITY

1.0 INTRODUCTION

This section provides a review of cumulative impacts analysis for GH. The GH is currently an undeveloped area of the SR-HUP under Source Materials License SUA-1548 (NRC, 2004b). The GH has been inactive since its inclusion under SUA-1548. This appendix presents the regulatory background that drives the requirement for cumulative impacts analysis and provides reference to previous documentation in this area. Because there is no "new or significant" information for the GH, previous documentation submitted to the NRC and referenced within this Appendix is incorporated by reference.

2.0 BACKGROUND

"Cumulative impacts" are defined in 40 CFR 1508.7 and include individually minor, but collectively significant, actions taking place over a period of time. It is possible an impact that may be small by itself could result in a moderate or large impact when considered in combination with the impacts of other actions on the affected resource.

Cumulative impacts for the GH were assessed by the NRC independently of the SR-HUP in the Environmental Assessment (NRC, 2004a) in the context of other past, present, and foreseeable future actions in the nearby environs of the GH to determine if there might be any significant cumulative impacts to the environment from the combination of actions at, and around, the project. Past and present activities in the vicinity of the GH include prior conventional uranium mining and milling, and the subsequent reclamation of affected sites. Reclamation of former mill sites in the vicinity of the GH will have a beneficial impact on the environment. Future actions are the GH site would likely involve ISR activities. The impacts to the environment for ISR activities at the GH, including impacts to groundwater, will be temporary and localized, and these disturbances will be corrected when the sites are reclaimed (NRC, 2004a). Accordingly, the NRC (2004) staff concluded "*that there will be no significant cumulative impacts to the environment from the Gas Hills Project and other past, present, and foreseeable future actions in the nearby areas of the project.*"

3.0 SUMMARY OF CUMULATIVE IMPACTS

Potential cumulative impacts related to conventional uranium mining and milling in the vicinity of SR-HUP and its satellite operations, including the GH, are unlikely. In the Gas Hills Uranium Mining District, uranium was historically mined via conventional methods (e.g. open pits and subsurface mine shafts). There are six non-operating uranium mining/mill sites within fifty miles of the GH. Although conventional mining cannot be ruled out altogether for the future of the area around GH, it is very unlikely for two reasons. First, ISR operations are approximately two to three times more cost-effective than open pit/conventional mining. Second, virtually all the Gas Hills Uranium Mining District uranium ore deposits are amenable to ISR development.

4.0 CONCLUSIONS

No updates or changes have occurred to site operations at the GH since the Environmental Assessment (NRC, 2004). Cumulative radiological impacts from GH were evaluated in the Environmental Assessment by the NRC and found to meet the requirements of 10 CFR 20.1301. Also, potential cumulative impacts from deep injection wells were found to have no impacts on nearby shallow groundwater users. Because of the cost-effectiveness of ISR in the Gas Hills Uranium Mining District, the NRC concluded that future actions around the GH would likely involve ISR, and thus any corresponding cumulative impacts are also unlikely.

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC, assessing whether any "new or significant" information has developed due to operational changes at the GH since its inclusion under SUA-1548. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A (NRC, 2003c), Cameco Resources has examined the GH historical facility operations, including cumulative effects of operation. Specifically, the cumulative impacts of radiation exposures, deep well disposal of mining wastes, and conventional uranium mining in the vicinity were evaluated. No operational changes have taken place at the GH that would require re-evaluation of cumulative impacts. Consequently, references cited within this and other relevant sections and previously submitted information relating to cumulative effects is relevant and is hereby incorporated by reference.

APPENDIX D-9

UPDATES AND CHANGES TO FACTORS THAT MAY CAUSE RECONSIDERATION OF ALTERNATIVES TO THE PROPOSED ACTION FOR GAS HILLS SATELLITE FACILITY

1.0 INTRODUCTION

NUREG-1569 Appendix A (NRC, 2003c) states that *"updates and changes to factors that may cause reconsideration of alternatives to the proposed action"* shall be included in license renewal applications. This requirement is addressed for GH in the following sections.

GH is currently an undeveloped satellite facility of the SR-HUP under Source Materials License SUA-1548 (NRC, 2004b).

2.0 BACKGROUND

NUREG-1569, Section 8.0, describes the area of review for alternatives to proposed action for original license applications as follows:

> *"the staff will review comparative reconnaissance level evaluations of available alternatives to the licensing action proposed in the in situ leach facility application in accordance with the requirements of National Environmental Policy Act of 1969 including realistic alternatives for the various processing stages. As part of this review, the staff should consider the no-action alternative"* (NRC, 2003c).

Realistic alternatives including the no-action alternative for the GH are discussed below. Processing stages considered are: uranium extraction (mining methods); siting of process facilities; consumer energy source options; solution mining recovery methods (alternative injection fluids); waste disposal; and the no-action alternative.

3.0 ALTERNATIVES TO THE PROPOSED ACTION

Cameco Resources currently operates the SR-HUP, a commercial ISR uranium mining operation located in Converse County, Wyoming, currently licensed under NRC License Number SUA-1548. The GH property is located in Fremont and Natrona Counties, approximately 140 miles (via existing highways and access roads) from the SR-HUP. Since NRC approval of the GH amendment, activities on the GH property have been limited to reclamation of historical mining pits under the claim of the previous owner; drilling of exploratory wells; and wildlife studies. When the GH site becomes active, mining and satellite operations will be the same as those currently employed on Cameco Resources' SR-HUP properties.

3.1 Alternate Mining Methods

Conventional mining and milling represents the only currently available alternative to ISR for mining of the uranium deposits in the GH areas (NRC, 2004a). The following information documented in the GH EA (NRC, 2004a) remains valid regarding alternate mining methods:

> *"The economic costs and environmental impacts associated with conventional mining and milling are greater than the corresponding costs and impacts of an ISL uranium recovery facility, especially given the lower grade and moderate depth of the ore at Gas Hills, the labor*

intensive requirements of mining ore, the capital investment required for a conventional mining and milling facility, and the unavoidable surface and subsurface impacts and required related to mining and tailings disposal. For these considerations, conventional mining and milling is the less preferred alternative for the Gas Hills site. As the owner and operator of two existing ISL uranium recovery facilities (Highland and Smith Ranch) with full processing capability, PRI's proposal to develop and operate the Gas Hills Project as a satellite uranium recovery facility makes economic sense with favorable environmental implications."

Based on the evaluation of conventional mining and milling as presented above, this method is not economically viable for producing uranium from the local uranium-bearing deposits at the GH site. ISR is the optimum mining method, both economically and environmentally, for this site.

3.2 Alternative Sites for the Processing Plants

The facilities and support systems for the SR-HUP site are in-place from past and ongoing uranium operations. When the GH property is actively mined, additional field processing facilities will be similar to those existing for SR-HUP (e.g. header houses and satellite ion exchange facility). There are no realistic alternatives for the mining and uranium recovery stages. No new surface disturbances will be needed for the yellowcake processing facilities. GH production can be transported to and processed in the existing SR CPP.

3.3 Alternate Leach Solutions

Sodium carbonate/carbon dioxide leach solution was selected for the SR-HUP because of favorable performance in the pilot programs and other commercial ISR operations, with no significant adverse environmental impact (NRC, 2007c). Alternate leach solutions for extracting uranium include ammonium carbonate solutions and acidic leach solutions; however, operators of ISR facilities using these alternate leach solutions have experienced difficulty in restoring and stabilizing the aquifer (NRC, 2007c). As a result of this past experience by others, Cameco Resources has excluded the use of these alternate leach solutions from consideration for the SR-HUP and GH.

With regard to groundwater restoration on-site, the combination of groundwater sweep, bio-remediation and RO clean water reinjection has been selected and is in process on the SR-HUP property because of the proven success of the pilot program and other commercial ISR operations (NRC, 2007c). A discussion of the groundwater restoration at the SR-HUP site is provided in Appendix A-11-1. When the GH property is actively mined, groundwater restoration will be similar to current practices on the SR-HUP property.

3.4 Liquid Waste Disposal Alternatives

Liquid wastes produced at the SR-HUP site are disposed of via the use of deep disposal wells and land application methods. At the GH, four primary process waste water streams are anticipated during operations: well-field bleed; RO brine fluids; well work-over water, and satellite wash down water

(NRC, 2004a). A discussion of the processes to dispose of waste water at the GH is provided in the EA (NRC, 2004a), summarized as follows:

> *"All waste water will undergo filtration to remove suspended solids; volume reduced using RO, ultra-filtration, nano-filtration and/or brine concentration; solar evaporation of the concentrated brine; and re-injection into the aquifer. Surface discharge of the treated water is an available option but is not expected to be used…. The reverse osmosis brine fluids from all phases of the project will be sent to the evaporation ponds."*

At the SR-HUP, waste water is disposed via deep waste disposal wells, which is an alternative that Cameco Resources is also considering for the GH. The Reynolds Ranch amendment (PRI, 2007c) provides the following discussion of the deep waste disposal wells at the SR-HUP:

> *The use of deep waste disposal wells in conjunction with storage/evaporation ponds to dispose of the high TDS liquid wastes that primarily results from the yellowcake processing and drying facilities is considered the best alternative to dispose of these types of wastes. The zones receiving these wastes are approximately 9,000 – 10,000 feet below the ground surface and are authorized by the State of Wyoming and the EPA UIC Program to receive such wastes.*
>
> *The use of the deep disposal wells in combination with the existing land application (irrigation) facilities to dispose of the treated wellfield purge fluids has proven to be the most cost effective way to dispose of this relatively good quality waste water."*

Wastewater treatment does not present realistic alternatives to deep well disposal due to the following:

- Economic advantage of deep well disposal over any viable treatment option;
- Regulatory requirements and additional permitting for groundwater reinjection or surface water outfall of treated wastewater;
- Generation of secondary wastes (e.g. concentrated waste streams from evaporation or membrane filtration, spent ion exchange resins, spent activated carbon) for disposal as 11e(2) byproduct material waste; and
- Secondary wastes resulting from wastewater treatment will require off-site disposal, presenting additional costs and risks associated with transportation and additional potential for public exposure.

Currently, the GH has neither evaporation ponds nor deep disposal wells.

3.5 No Action Alternative

The no-action alternative would allow Cameco Resources to continue mining operations in the current GH license area unless the NRC formally denied the renewal of the license submittal. Cameco Resources is required to submit a License Renewal submittal for the source material license to the NRC at least thirty days before the expiration date of the existing license. By doing so, the license will not expire until the NRC determined the final disposition of the License Renewal submittal and advised Cameco Resources of its decision. If the License Renewal submittal is not approved by the NRC, restoration and reclamation activities would then become the primary activities at the site.

If renewal of the current source material license was not granted, all activities at the SR-HUP and GH not associated with groundwater restoration and decommissioning would cease, resulting in the loss of a significant portion of the total employment at the site. At the completion of decommissioning activities, all employment opportunities at the SR-HUP and GH would be terminated.

In addition to the loss of significant employment opportunities in Converse, Fremont and Natrona Counties, the premature closing of the SR-HUP and GH before commercially viable resources had been recovered would adversely affect the economic base of these counties. A decision not to renew SUA-1548 for mining of the SR-HUP would leave the GH resource unavailable for energy production supplies, with the SR-HUP being the largest ISR uranium producing facility in the United States. This would also result in the loss of significant employment opportunities for Fremont and Natrona Counties associated with GH. The SR-HUP represents an important source of domestic uranium supplies that are essential in providing a continuing source of fuel to power generation facilities.

4.0 PROPOSED ACTION

With NRC approval of the License Renewal submittal for Source Material License SUA-1548, Cameco Resources would continue to operate the SR-HUP ISR operation. Amendments to the license may be sought, as needed, in order to recover the uranium resources in the most effective manner. Operations could also expand to the GH, under SUA-1548.

The solution mining method is proposed over other mining methods for recovery of uranium from the uranium-bearing deposits present at the GH site because *in situ* mining is the most economical and environmentally sound method presently available for mining these reserves. This conclusion is based on the history of uranium mining in the South Powder River Basin and Gas Hills Uranium District areas, which includes open pit mining, underground mining, and solution mining projects.

5.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information occurring since the last license renewal could be presented. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the GH historical facility operations, including updates and changes to factors that may cause reconsideration of alternatives to the proposed action and has determined that no new or significant information can be added at this time. Consequently, references cited within this and other relevant sections and previously submitted information relating to alternatives to the action plan is still relevant and is hereby incorporated by reference.

APPENDIX D-10

UPDATES AND CHANGES TO THE ECONOMIC COSTS AND BENEFITS FOR THE FACILITY SINCE THE LAST APPLICATION FOR GAS HILLS SATELLITE FACILITY

1.0 INTRODUCTION

NUREG-1569 Appendix A (NRC, 2003c) requires that Source Materials License Renewal submittals include updates and changes to the economic costs and benefits for uranium mining operations. Direct and indirect economic benefits continue to accrue locally in the community and state-wide from the presence of mining. This section provides a summary of the actual and projected economic benefits and costs of continued operations at the SR-HUP since the last licensing action, with approved addition of GH (NRC, 2004). The GH is currently an undeveloped area of the SR-HUP under Source Materials License SUA-1548 (NRC, 2004b). The following sections present a summary of updates and changes to: State tax revenues; regional employment; and local economic impacts for continued operation of SR-HUP. The economic impacts associated with operations startup on the GH are included, based on data presented in the GH EA (NRC, 2004a).

2.0 TAX REVENUES

Future tax revenues are dependent on uranium prices, which cannot be forecast with any accuracy. However, these taxes are also somewhat dependent on the number of pounds of uranium produced by SR-HUP.

The present taxes are based on a relatively consistent production rate of uranium. Table D-10-1 summarizes the Wyoming tax revenues from Cameco Resources' Wyoming projects, which includes the SR-HUP and the inactive satellite operations (i.e., non-operational Reynolds Ranch, Ruth, North Butte and GH Satellite Facilities).

TABLE D-10-1

CAMECO RESOURCES' WYOMING TAX REVENUE SUMMARY 2005 THROUGH 2008

	2009	2008	2007	2006	2005
Ad Valorem	$694,000	$ 1,204,000	$ 1,030,000	$ 744,000	$ 530,000
Property Taxes	$316,000	$ 239,000	$ 216,000	$ 207,000	$ 193,000
Sales and Use Taxes	$178,000	$ 312,000	$ 161,000	$ 53,000	$ 37,000
Severance Taxes	$456,000	$ 797,000	$ 680,000	$ 493,000	$ 222,000
Total	**$1,644,000**	**$ 2,552,000**	**$ 2,087,000**	**$ 1,497,000**	**$ 982,000**

Yellowcake production from the SR-HUP CPP cannot exceed 5.5 million pounds annually (NRC, 2007c). Upon startup, uranium recovered from the GH would be processed through the CPP subject to this production limit.

3.0 CURRENT EMPLOYMENT STATUS

Current staffing information available for the SR-HUP is from 2009, and presented herein. The SR-HUP employed approximately 133 employees and 42 contractors on a full-time basis in 2009. Short-term contractors and part-time employees are also used for specific projects and/or during the summer months and may add up to 7 percent to the total staffing. This level of employment achieved by Cameco Resources is significant to the local economies as outlined below.

The private employment in Converse and Natrona Counties, Wyoming, in 2008 was 38,700 out of a total labor force of 45,500. Based on these statistics, SR-HUP currently provides approximately 0.3 percent of the private employment (0.4 percent, if contractors are included). In 2009, SR-HUP's total payroll was over 10.37 million dollars. Of the total private Natrona and Converse County wage and salary payments of approximately 1.68 billion dollars in 2008; the SR-HUP payroll represented about 0.5 percent. Employment levels within four miles of the GH, located in Fremont and Natrona Counties, is currently negligible, pending development of the site (NRC, 2004a). Cameco Resources' total employee payroll for the past five years is summarized in Table D-10-2.

TABLE D-10-2

CAMECO RESOURCES' EMPLOYEE PAYROLL 2005 THROUGH 2009 (EST.)

Year	Total Estimated Annual Payroll
2005	$ 4,593,000
2006	$ 4,952,000
2007	$ 7,443,000
2008	$ 8,387,000
2009	$ 10,370,000

The average annual income for all workers in Converse and Natrona Counties was $41,700 and $43,800, respectively. As reported in the EA for the GH (NRC, 2004a), the personal income per capita (includes children and other persons not working) for Fremont and Natrona Counties was $11,800 and $15,690, respectively, in 2000. By comparison, the average wage for an employee of SR-HUP is approximately $53,000 per year. Entry level workers for SR-HUP earn a minimum of $16.15 per hour, or $33,593 per year, not including overtime, bonus or benefits.

SR-HUP actively pursues a policy of hiring and training local residents to fill all available positions. Due to the technical skills required for some positions, a small percentage of the current staff (less than 8 percent) have been hired elsewhere and relocated to the area. Because of the small number of people who have needed to move into the area to support this project, the impact on the community in terms of expanded services has been minimal.

Cameco Resources expects that the type of positions created by any future expansion will be filled primarily with individuals from the local workforce, and would have no significant impact on services and resources such as housing, schools, hospitals, or other public facilities.

The socioeconomic impacts as described in the Reynolds Ranch amendment application read as follows:

> *"Continued operation of the SR-HUP/Reynolds Ranch amendment area will provide jobs for about 100 company employees and 20 to 40 contract employees. The general population of Converse County declined approximately 20 percent between 1980 and 1984 and the overall economy remains depressed; therefore, the impact of the project, although limited, will be beneficial to the local communities. No adverse impact is anticipated as current housing, schools and other support facilities are more than adequate to accommodate the projected employment."* (PRI, 2004)

Should Cameco Resources begin active mining on the GH, the level of direct and contracted employees would not change significantly over the current level for SR-HUP.

4.0 IMPACT ON THE LOCAL ECONOMY

In addition to providing a significant number of well-paid jobs in the local communities of Casper, Douglas and Glenrock, Wyoming, Cameco Resources actively supports the local economies through purchasing procedures that emphasize obtaining all possible supplies and services that are available in the local area. In 2009, Cameco Resources' procurement procedures resulted in local purchases estimated at over 26 million dollars. The vast majority of these purchases were made in Converse and Natrona Counties. This level of business is expected to continue through continued operations of the SR-HUP and potential startup of the GH. Total SR-HUP payments made to Wyoming businesses for the past five years are summarized in Table D-10-3.

TABLE D-10-3

SR-HUP PAYMENTS TO WYOMING BUSINESSES 2005 THROUGH 2009 (EST.)

Year	Total Estimated Annual Payments
2005	$ 10,036,600
2006	$ 12,311,000
2007	$ 14,801,000
2008	$ 24,247,000
2009	$ 26,065,000

In addition, mineral royalty payments accrue to local landowners. Production royalties paid to land owners were slightly less than 2.1 million dollars in 2009.

Local procurement of supplies and services and mineral royalty payments will continue with ongoing operations of the SR-HUP and potential operations startup of the GH.

5.0 ECONOMIC IMPACT SUMMARY

As discussed in the previous sections, approval of this License Renewal submittal would have positive impacts on the state and local economies. The current economic impact of the SR-HUP and additional Cameco Resources employment related to other projects in Wyoming is summarized in Table D-10-4.

TABLE D-10-4

CURRENT ECONOMIC IMPACT OF THE SR-HUP

	Current SR-HUP Operation	Other Wyoming Projects
Employment		
Full-Time Employees	116	17
Full-Time Contractor employees	42	
Part-Time Employees and Short-term Contractors	10	20
Payroll – 2009(1)	$ 10,370,000	Included
Taxes		
Ad Valorem	$ 694,000	
Property Taxes	$ 316,000	--
Sales and Use Taxes	$ 178,000	--
Severance Taxes	$ 456,000	--
Total Taxes 2009	$ 1,644,000	Included
Local Purchases		
Local Purchases, 2009	$ 26,065,000	Included
Total Direct Economic Impacts	$ 40,327,000	

(1) Payroll does not include full-time contractor or part-time employee salaries.

6.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information occurring since the last license renewal could be presented. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the GH historical facility operations, including updates and changes to the economic costs and benefits for the GH as summarized in the sections above, and has determined that no new or significant information can be added at this time. Consequently, references cited within this and other relevant sections and previously submitted information relating to economic costs and benefits are still relevant and are hereby incorporated by reference.

The economic impact from the SR-HUP/GH, as summarized in Table D-10-4 shows a significant positive impact on both the local and state economies. The impacts extend to both economic and employee opportunities afforded to the local population in higher than average paying jobs. Local businesses have also benefitted by the presence and operation of SR-HUP as Cameco Resources has a first preference for utilizing local, then state, then regional businesses to satisfy development and sustained operations.

APPENDIX D-11

RESULTS AND EFFECTIVENESS OF ANY MITIGATION PROPOSED AND IMPLEMENTED IN ORIGINAL LICENSE FOR GAS HILLS SATELLITE FACILITY

1.0 INTRODUCTION

NUREG-1569 Appendix A (NRC, 2003c) requires that Source Materials License Renewal Submittals include "*results and effectiveness of any mitigation proposed and implemented in original license*" for uranium mining operations. This section meets that requirement for the GH by providing a summary of groundwater restoration for the GH during the update period, spanning from the approval of the Gas Hills amendment application (NRC, 2004b) through the first quarter of 2010.

The purpose of groundwater restoration is to return the portion of the aquifer designated for uranium recovery to its pre-operational water quality, as determined from baseline monitoring data. The GH is currently an undeveloped area, and therefore has no mine units in production or restoration.

A background discussion of groundwater restoration goals is presented in Section 2.0. Section 3.0 presents a discussion of the review of documentation related to GH historical operations, concluding that no new or significant information with respect to groundwater restoration at the GH can be presented at this time.

2.0 GROUNDWATER RESTORATION GOALS

Within the ISR production zone, impacts from operations may include elevated levels of various constituents introduced with the production fluid (e.g., oxygen, bicarbonate, and hydrogen peroxide) and chemical species that are mobilized by the production fluid (e.g., uranium and other metals) (Miller, 2009). After uranium recovery ends, groundwater restoration is conducted to return the production zone of the aquifer to its pre-operational water quality. If the baseline conditions are not achieved after diligent application of the best practicable technology, in accordance with the Wyoming Department of Environmental Quality Act (§35-11-103(f)(iii)), a secondary goal is to return the groundwater to a quality consistent with the use, or uses, for which the water was suitable prior to production. In other words, the standard is to return the affected groundwater to its pre-mining Class of Use, per NUREG-1569 (Section 6.1.3.4.b) and as defined by WDEQ Water Quality Rules and Regulations, Chapter 8, Section 4(d).

To return the groundwater to its pre-operational water quality, restoration is conducted through a variety of methods. NRC allows licensees the flexibility to select the restoration methods to be used for each wellfield (NRC, 2003c). During the update period, groundwater restoration has consisted of two phases:

1. Groundwater Sweep Phase: initial phase, in which groundwater is pumped from the wellfield without re-injection, causing an influx of baseline quality water from the perimeter of the mining unit, which "sweeps" the affected portion of the aquifer.

2. Groundwater Treatment Phase: groundwater recovered from the wellfield is treated with one or more of the following methods, and then re-injected into the affected portion of the aquifer:

- Processing through the uranium recovery plant to recover additional uranium;
- Degassing, by using a de-carbonator unit to remove residual carbon dioxide;

- RO, with re-injection of the clean, permeate water; and/or
- Addition of chemical and biological reductants to decrease the concentration of oxidized metals.

During restoration, groundwater monitoring is conducted to monitor restoration progress and to monitor for excursions. Excursions during restoration may occur from unintentional movement of restoration fluids or unintentional movement of groundwater impacted from production fluids.

At the start of restoration, wells that were used to determine baseline water quality are sampled for the parameters required by WDEQ LQD Guideline 8 to determine the end-of-injection water quality. During restoration, the monitoring wells are sampled approximately every 60 days for uranium, chloride, and conductivity. Following concurrence from WDEQ that restoration has been achieved in the mining area, a six month stability period is assessed to show that the restoration goal has been adequately maintained. Once restoration has been approved by WDEQ and NRC, wells are plugged in accordance with WDEQ LQD Guideline 8. The GH is currently undeveloped and has no mine units in restoration.

3.0 MITIGATIVE ACTIONS REGARDING EFFECTS OF OPERATIONS AND/OR ACCIDENTS

A review of the original permit application with regard to mitigative actions for identified effects of mining operations and accidents indicates that proposed mitigation actions have been and continue to be effectively implemented and do not require revision.

Impacts resulting from mining operations requiring mitigation include ephemeral drainage areas whereby erosion controls have been required to effectively minimize soil impacts; monitor well drilling and road construction activities where short term disturbances (erosion and fugitive dust) may occur that have been kept to a minimum with prescribed protective steps to control top soil erosion-sedimentation taken through the practice of re-seeding disturbed areas as soon as possible, in addition to re-contouring (as necessary) that has also helped prevent soil erosion problems.

Impacts resulting from accidents requiring mitigation include tank failure (inside and outside of buildings), piping failure, fire-explosions and weather-related impacts. GH currently has no operational tankage, piping on site nor has there been any mining activities occurring, consequently mitigative actions within the original application are still considered to be effective actions until proven otherwise.

4.0 CONCLUSIONS

With respect to this License Renewal submittal section, Cameco Resources completed a review of the information previously provided to the NRC to assess whether "new or significant" information, occurring since the last license renewal, could be presented. Following NRC guidance relating to license renewals in NUREG-1569 Appendix A, Cameco Resources has examined the GH historical facility operations,

including groundwater restoration for the GH as summarized in the sections above, and has determined that no new or significant information can be added at this time. The GH is currently undeveloped and has no mine units in restoration. Consequently, references cited within this and other relevant sections and previously submitted information relating to mitigation results and effectiveness are still relevant and are hereby incorporated by reference.