



September 17, 2015

ATTN: Document Control Desk, Director  
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RE: NRC License SUA-1548 (TAC J00704)  
MU B ACL Data Package

Document Control:

Power Resources, Inc. d/b/a Cameco Resources (Cameco) is providing a data package in advance of the meeting with the U.S. Nuclear Regulatory Commission's (NRC) to discuss the application for an ACL for the Mine Unit B (MU B) groundwater restoration at the Smith Ranch Highland Mine. This meeting is scheduled for September 28, 2015.

Included in this data package are a draft Agenda and a draft Table of Responses to the RAIs that were received from NRC in the Public Meeting Summary (ML14010A162) dated January 14, 2014. Also included on a CD are the results of the laboratory analysis of stability samples collect from the MP Wells in MU B and input files of these data for ProUCL . These data span six quarterly sampling events. Finally, Cameco has included some ProUCL output files and box plots of the data to facilitate the discussion.

If you have questions or need additional information, please contact me directly at (307) 333-7665.

Sincerely,

A handwritten signature in black ink that reads "Larry McGonagle".

Larry McGonagle  
SHEQ Manager - Division

# Draft

Discuss Cameco Mine Unit B ACL Application  
September 28, 2015

1. Welcome and Introductions
2. Current Status of the MU-B Wellfield
3. Discussion of Restoration Criteria
4. Update on Ongoing Research Projects
5. Discussion of MU B Sampling and ProUCL
6. Discussion of RAIs – Groundwater Modeling
7. Discussion of RAIs - Geochemical Modeling
8. Discussion of RAIs- Risk Assessment
9. Discussion of RAIs – Miscellaneous
10. Public Comment/Observations
11. Conclude

# Draft

Discuss Cameco Mine Unit B ACL Application  
September 28, 2015

1. Welcome and Introductions
2. Current Status of the MU-B Wellfield
  - a. Brief description of past efforts
  - b. Current status
  - c. Cameco feels that restoration efforts have been substantial and that further restoration activity will not improve ground water quality significantly – Does NRC concur?
3. Discussion of Restoration Criteria
  - a. How is the success of restoration to be judged by the NRC?
  - b. Location of POC and POE wells
  - c. Discussion of conventional mill tailings ACLs and those proposed for ISR
4. Update on Ongoing Research Projects
  - a. Jim Clay to describe currently published work and ongoing research
5. Discussion of MU B Sampling and ProUCL
  - a. The discussion of stability sampling to date and what the results mean
  - b. Discussion of the stability criteria on an individual well basis vs mine unit median basis
6. Discussion of RAIs - Groundwater Flow Modeling
  - a. Discussion of RAI responses
7. Discussion of RAIs - Geochemical Modeling
  - a. Discussion of RAI responses
8. Discussion of RAIs- Risk Assessment
  - a. Discussion of RAI responses

9. Discussion of RAIs – Miscellaneous

a. Discussion of RAI responses

10. Public Comment/Observations

11. Conclude

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Date: 9/9/2015	
(Section 3.2 ) Recent and Projected Conditions. (Section 2.1 of the report)	
NRC Comment	Propose RAI Response
<p><i>Additional point of exposure (POE) well sampling is needed. The licensee has not provided a recent sample demonstrating the current water quality of all POE wells. Only a subset of POE wells were sampled in 2011 for Arsenic, Selenium, Uranium, and Radium-226. The remaining POE wells were last sampled in 1987. All POE wells should be sampled for a full suite of constituents (e.g. Wyoming Department of Environmental Quality [WDEQ] Guideline 8) which includes the proposed ACL parameters of arsenic, selenium, uranium, and radium-226.</i></p>	<p>Cameco Resources has been collecting quarterly samples of Mine Unit B MP POC wells since 2014. Cameco currently continues to sample these wells quarterly.</p> <p>Cameco has sampled the POE wells (current ring monitor wells) once during Sept. 2014. Cameco is preparing to complete a second round of sampling during Sept. 2015.</p>
<p><i>Additional point of compliance (POC) sampling is needed to assess stability trends. NRC staff's trend analysis of available stability data (2004, 2006, 2011) using ProUCL 5.0 shows statistically significant increasing trends in several POC wells for Uranium, Radium-226, Selenium, and Arsenic. All POC wells should be sampled for ACL parameters to assess the current stability trends.</i></p>	<p>Cameco has sampled the MP wells and has analyzed the data using ProUCL 5.0. Cameco is concerned that the methodology proposed by NRC will not be able to demonstrate stability in restored mine units to the 95 % confidence level required.</p>
<p><i>The number, current condition, and use of all water wells within 2 kilometers (km) of MUB have not been satisfactorily established. In Section 1.2.5.4 of the application, surrounding land and water use, no description was provided of the current condition or use of water wells within 2 km of MUB. In an independent search of Wyoming State Engineer's Office (WSEO) records, NRC staff found numerous water wells within 2 km of</i></p>	<p>Cameco has completed a first review and field inspection in the area of review that was requested by NRC. Cameco has discovered some wells in the area that will require additional information to confirm, status, condition, completion interval, and ownership. The results and final status will be reported to NRC.</p>

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<p>MUB located in sections 29, 28, 21, 20, 16 and 17. Many were not identified in the application.</p>	<p>Cameco has completed a well inventory of all of the wells within 2km of Mine Unit B. The inventory has uncovered some wells that require some additional investigation to determine the well status. A detailed update of the wells will be included with the resubmittal of the license amendment.</p>
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(Section 3.3 Flow and Transport Modeling (Section 2.2.1, 2.2.2, and 2.2.3 of the report)	NRC Comment	Proposed RAI Response
<p><i>Ground water model:</i></p> <ul style="list-style-type: none"> <li>• <i>Modeling documentation was not provided in hard copy or electronic form. The 2011 ground water modeling report was referenced, but not provided.</i></li> <li>• <i>The ground water model did not consider the impact of the current or future use of wells that exist near the site on the ground water flow model.</i></li> <li>• <i>The ground water model did not capture the ground water divide that was demonstrated in the northern portion of MUB in the most recent potentiometric surface of the 30 sand.</i></li> <li>• <i>The model did not appear to consider the presence of the mine workings on the northwest side of MUB, which are known to exist.</i></li> </ul>	<p>Cameco will provide electronic model inputs to NRC.</p> <p>Cameco will address the impacts to current or future well users in the area.</p> <p>Cameco will provide more detail on the groundwater divide.</p> <p>The refined model will address the old underground mine workings.</p>	
<p><i>Geochemical model</i></p> <ul style="list-style-type: none"> <li>• <i>All simulations used water from a POC well sample obtained in 2011 as the initial condition for the ACLs. Some POC wells have not shown stability in the ACL parameters. It is unknown if this initial condition is representative.</i></li> <li>• <i>All of the models showed sensitivity to grid size. In the model simulation</i></li> </ul>	<p>Cameco has scheduled a meeting with the geochemical modeler to discuss NRC's questions.</p> <p>Cameco will have the consultant who developed the model address NRC's</p>	

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<p><i>from monitor well (MW) 45 to MW 37 in the southern portion of MUB, the one dimensional model is comprised of nine cells of 50 m each. NRC staff simulations of this case with smaller cell sizes showed model results are very sensitive to number of cells.</i></p> <ul style="list-style-type: none"><li><i>The assignment of solution water quality within cells does not appear to be representative. In the model simulation from MW 45 to MW 37 in the southern portion of MUB, the model uses four cells upgradient of the highest concentration in MUB. The solution water quality in all four upgradient cells were set at background levels from the POE even though some cells were located within MUB. The middle two cells in MUB were set at the highest concentration at the POC, and the last three cells before the down gradient POE were set at background levels even though they were all within MUB. Typically, it is best practice to assign water quality to a model using interpolated concentrations from measured values at existing wells.</i></li><li><i>The definition of geochemical solid phase in the some model cells was not completely justified. In the MW 45 to MW 37 pathway simulation, down gradient cells (seven to nine) were assigned a solid phase which included barium sulfate. NRC staff found no justification for the presence of natural barium sulfate which greatly increases Radium-226 precipitation in the model. NRC staff observes that pyrite was also added as a solid phase in down gradient cells (seven to nine) with no clear justification (e.g., core data). Pyrite greatly enhances precipitation of uranium.</i></li><li><i>Modeling files were only provided in hard copy format. Availability of the electronic version of pH-REdox-EQuilibrium (PHREEQC) input files would significantly aid NRC staff's ability to validate simulations.</i></li><li><i>NRC staff attempted to verify the licensee's PHREEQC simulation, but was unable to do so for the first case the licensee presented. NRC staff attempts resulted in numerous execution issues including non-convergence of the solver.</i></li><li><i>Results of geochemical modeling were not clear to the NRC staff. For example, in the first case, the results at the down gradient were posted</i></li></ul>	<p>concerns.</p> <p>SRH has gathered down gradient and source term core from Mine Unit 9. The core was analyzed by the Geology Department at the University of Wyoming. Cameco will also provide a peer review paper that shows pyrite in post leach field samples in Mine Unit 4.</p> <p>The revised input files will be included in the application</p> <p>A new model will be developed based on the mineralogy determined from core samples collected in MU B</p> <p>This will be addressed in the revised application</p>
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<i>every 61 years on the same graph over 1000 yrs., so resolution of values was not possible.</i>	
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<b>Section 4.1 Human Health Hazard Assessment</b>	
<b>NRC Comment</b>	<b>Proposed RAI Response</b>
<i>The cumulative risks from ACLs were not considered. For individual ACL constituents, the licensee stated these values will meet 1E-4 human health risk, but did not account for cumulative risks from combined constituents. (Section 2.3.3, 2.3.4, and 2.3.5)</i>	Cameco is going to commission a risk assessment study that will be referenced by the main report to address radiation risks and cumulative risk factors.
<i>Some of POE wells currently exceed proposed ACL concentrations. Two POE wells measured in 2011, M-63 (0.0967 mg/l) and M-62 (0.171 mg/l) exceed the proposed POE uranium concentration of 0.09 mg/l. NRC staff observes that the 2011 values are also above their original baseline.</i>	Cameco will provide as a separate appendix to the report a history of the UCL change for the wells near M-62 and M-63 because of the influx of water from the underground workings during the mining and restoration process.
<i>Hazard assessment incorrectly states that aquifer exemption prohibits ground water use by humans now or in the future. NRC staff observes that the aquifer exemption only precludes use as public water supply under the Safe Drinking Water Act. NRC staff's understanding is that state classification of ground water as Class IV is not enforced to prevent future human ingestion.</i>	Cameco will remove from the ACL document any reference that the aquifer exemption provides protections for people accessing the aquifer for use.

<b>Section 4.2 Exposure Assessment</b>	
<b>NRC Comment</b>	<b>Proposed RAI Response</b>
<i>An exposure assessment based on the use of the water within the MUB 30 sand for livestock or irrigation was not presented. In Section 2.3.5 (page 55) of the application, the licensee states the aquifer exemption does not prevent</i>	Cameco will address the deficiency in the exposure assessment identified by NRC by adding this scenario into the new exposure / cumulative risk assessment report.

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<p><i>livestock or irrigation use of water; however, the licensee does not present a hazard/exposure assessment from stock watering/irrigation. NRC staff observes a non-resident rancher scenario of exposure from this water use has been provided in several non-in-situ recovery (ISR) ACL applications.</i></p>	
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Chapter 5 Ground Water Monitoring Program	
NRC Comment	Proposed RAI Response
<p><i>No long term ground water monitoring design or plan was provided. The licensee has not presented a long term ground water monitoring plan to assess trends at POC wells or to verify geochemical modeling results at POE wells. (Section</i></p>	<p>Cameco will present a monitoring plan in the ACL application.</p>

Chapter 6 Corrective Action and Mitigation Measures	
NRC Comment	Proposed RAI Response
<p><i>The corrective action costs were not justified. The licensee's corrective action analysis only considered refurbishment of the entire MUB wellfield infrastructure to support additional restoration across the entire wellfield. This scenario also included the installation of two new disposal wells at a cost at \$7.2 million. The licensee did not consider a scenario where targeted restoration would be performed in areas with higher ground water concentrations. The licensee also did not present cost estimates for targeted restoration of areas with higher ground water concentrations. NRC staff observes this may be a more likely scenario.</i></p>	<p>Cameco is going to provide a better corrective action summary by providing NRC costs and scenarios for different levels of corrective actions in the mine unit.</p>
<p><i>No method to identify or protect the site from ground water use was offered to prevent private well use or installation in the ore zone aquifer or other aquifers in or around MUB. The NRC staff understands that neither WDEQ or WSEO monitors or notifies a potential well applicant of the aquifer exemption, current water quality or class of use of water at</i></p>	<p>Cameco will present clarification on the WDEQ deed notification for the NRC. The deed notification needs further discussion with the WDEQ.</p>

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<p><i>any time. Additionally, the NRC staff understands that WDEQ and WSEO also do not have any regulatory authority to stop a potential well applicant or user from accessing water in the aquifer exemption zone for any purpose. The NRC staff is aware of WDEQ's requirement of a deed notice for individual wellfields once all wells are plugged and abandoned, but the intent of this notification is unknown. NRC staff is unclear if the "deed notice" required by the State confers any protection such as identification of the exempted aquifer.</i></p>	
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<b>Chapter 7 ALARA Analysis</b>	
<b>NRC Comment</b>	<b>Proposed RAI Response</b>
<p><i>The applicant did not demonstrate asymptotic trends for any ACL parameters. Asymptotic trends should be demonstrated for the proposed ACLs to show applicant has exhausted options to meet the ground water protection standards and as low as reasonably achievable (ALARA).</i></p>	<p>Cameco will provide data and analysis to NRC demonstrating that the available options have been exhausted and that the concentrations are ALARA.</p>
<p><i>The ALARA cost analysis is not justified. The corrective action cost analysis includes \$7.2 million for two additional deep disposal wells and \$2 million for infrastructure refurbishment of the wellfield. If these costs were reevaluated for a more realistic cost scenario such as targeted treatment of areas with high ground water concentrations, the value may be below a cost of \$2000/person rem.</i></p>	<p>Cameco will provide to NRC a more detailed description of corrective action options and costs to support the ACL application.</p>

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**NRC Identified Actions:**

Cameco will review the discussion topics from the MUB ACL discussion, evaluate the NRC staff's concerns, and propose a path forward for NRC staff's consideration. Cameco is scheduled to have a meeting with NRC to discuss the RAI's and a path forward on Sept. 28, 2015

**Other Topics not included in NRC Notes:**

**NRC Unsure about where the aquifer exemption boundary is located:** Aquifer exemption boundary correspondence was included in the submittal.

**New aquifer exemption boundaries:** The aquifer exemption boundaries were extended 150 ft. beyond the monitor well ring in 2014 last year.