U.S. Nuclear Regulatory Commission
Requests for Additional Information
Power Resources Inc. dba Cameco Resources (Cameco) Smith Ranch Project
Technical Review of the License Renewal Application
For Source Material License SUA-1548

The purpose of the following Requests for Additional Information (RAIs) is to provide the additional information and data that are necessary for the U.S. Nuclear Regulatory Commission (NRC) to fulfill the requirements of Title 10 *Code of Federal Regulations* Part 40 (10 CFR 40). These RAIs were developed during the NRC staff's review of Power Resources, Inc. dba Cameco Resources (Cameco) (the "Licensee") *Technical Report* (TR), which were submitted to the NRC as part of its license renewal application. When necessary, the staff's review also included portions of the *Environmental Report* (ER).

Note: For the purpose of these RAIs, the Smith Ranch site and its two contiguous satellite sites, Highland and Reynolds Ranch, are collectively referred to as the "Smith Ranch site." Additionally, the three remote satellite sites presented in the Cameco's ER and TR are referred to as specific, individual sites when the discussion is specifically referring to one or more these remote satellite sites. These are denoted as the "Gas Hills site," the "North Butte site"; and/or the "Ruth site," as appropriate. When taken together, all six of these sites are denoted as the "Smith Ranch Project" or "the Project."

On page 1-1 of the TR, Cameco states that it is seeking approval for several aspects of the facility that are either new or have changed since the last renewal. Cameco identified the operations plan for the Gas Hills remote satellite as one of the items representing new or changed information. On page 1-6 of the TR, Cameco defined Sections 3.0 through 6.0 as its updated Operations Plan for the Gas Hills Satellite. In accordance with the guidance in Appendix A of the SRP, staff reviewed the Gas Hills operation plan as new information to be evaluated and approved.

Section 1 – Proposed Activities

RAI 1

Description of Deficiency

The information in TR Section 1 does not meet the applicable requirements of 10 CFR 40.31, using the acceptance criteria in Section 1.3 of NUREG 1569, Standard Review Plan for In Situ Leach Uranium Extraction License Applications (SRP).

Basis for Request

Section 1 of the TR identifies the proposed activities for the Smith Ranch Project. In some cases, numbers such as flow rates or production limits are used throughout the document, but are not necessarily consistent throughout the document. These parameters, along with statements made in the TR form the basis for the staff's licensing decision. This RAI is intended to provide clarity for the staff's licensing basis. Formulation of RAI

Based on its review of the TR, staff understands that Cameo is requesting the following in its license renewal document:

A. That the license be renewed for a 10 year period.
B. That the license be performance based.
C. That the ability to receive and process ion exchange (IX) resins and yellowcake slurry be approved for the Highland Central Processing Facility.
D. That the flow rate at the Reynolds Ranch satellite be increased to 6,000 gallons per minute (gpm).
E. That the flow rate at the Gas Hills remote satellite be increased to 18,000 gpm.
F. That the Gas Hills remote satellite be approved for production to yellowcake slurry.
G. That waste disposal options at the Gas Hills remote satellite include deep disposal wells and associated storage ponds.
H. That the staff approves the operations plans included in the license renewal document for the Gas Hills and North Butte remote satellites.
I. That the flow rate for the North Butte remote satellite be increased to 6,000 gpm.
J. That waste disposal options for the North Butte remote satellite include deep disposal wells and associated storage ponds.
K. That the operations at North Butte will consist of 5 mine units.
L. That Cameco does not propose any changes to the Ruth remote satellite facility.
M. That the licensed yellowcake production capacity will remain at 5.5 million pounds a year.
N. That the license flow rate for the Smith Ranch Highland portion of the facility will remain at 20,000 gpm.
O. That the license area boundaries remain as currently shown on: TR Figure 1.2 for Smith Ranch; on TR Figure 1.10 for North Butte; on TR Figures 1.11 and 1.12 for Gas Hills; and on TR Figure 1.13 for Ruth.

Please verify that the staff's understanding is correct.

Section 2 – Site Characterization

RAI 2

Description of Deficiency

The TR does not appear to be consistent with acceptance criteria (2) and (3) of Section 2.5.3 of the SRP.

Basis for Request

Acceptance criteria (2) and (3) in Section 2.5.3 of the SRP direct staff to evaluate relationships between regional and local weather data and on-site monitoring and assess if the data used is representative of long term conditions at and near the site. The TR does not appear to contain an assessment of whether the weather conditions observed during the renewal period are consistent with long term conditions.

Formulation of RAI

Please provide an assessment or data indicating whether or not the long-term trends of meteorological parameters, such as temperature, precipitation, and wind speed/direction, have significantly changed from previous applications. If meteorological conditions have changed

since the last renewal, please provide quantitative measures of those changes. Up-to-date meteorological data are important for evaluating exposure pathways and doses.

RAI 3

Description of Deficiency

The information provided in TR Section 2.7.3 does not meet the applicable requirements of 10 CFR 40.41(c), using the review procedures in Section 2.7.2 and acceptance criteria in Section 2.7.3 of the SRP.

Basis for Request

Cameco updated the surface water rights for the Smith Ranch permit in Table D6-3 and Table 3.4-3 of the ER. Five new surface water rights had been granted in 2005, but only one, P17548.0S, was located within 2 km of a proposed or existing mine units (Mine Units 9 and 10). Cameco also did not state the source of water for the impoundment (well and/or surface source).

Formulation of RAI

Please describe the source of water for the new surface water right P17548.0S.

RAI 4

Description of Deficiency

The information provided in TR Section 2.7.3 does not meet the applicable requirements of 10 CFR 40.41(c), using the review procedures in Section 2.7.2 and acceptance criteria in Section 2.7.3 of the SRP.

Basis for Request

Cameco established 27 new surface water quality sampling sites at North Butte in addition to maintaining the three original points established by Uranerz (SWS1, SWS2, and SWS3). Eighteen of these sites were located at an impoundment where a berm or dam structure was present to trap water. The remaining nine sites were located upstream or downstream of drainages sufficiently close to the operation. Cameco provided a map displaying the location of all of the sites in TR Appendix D6 Figure D6-1.6 which was difficult to interpret. Cameco did not identify the location of the sampled impoundments or their water source, which is typically a well. Staff cannot evaluate the surface water quality without clear identification of all of the sites and information on their water source.ormulation of RAI

Please clearly identify the names, location, and water source of the 30 surface water sampling sites at North Butte in a table.

RAI 5

Description of Deficiency

The information provided in TR Section 2.7.3 does not meet the applicable requirements of 10 CFR 40.41(c), using the review procedures in Section 2.7.2 and acceptance criteria in Section 2.7.3 of the SRP.

Basis for Request

Cameco provided a table of surface water rights within 3 miles of the North Butte license area in Table D6-1.6. All 16 adjudicated surface water rights are for either reservoirs or stock reservoirs. Many of these surface water rights were granted in 2004 or later. Cameco did not describe the surface water rights in sufficient detail for staff to evaluate if they could impact or be impacted by the in situ recovery (ISR) operation.

Formulation of RAI

Please provide a map at a scale which clearly shows the location, permit number and size of all adjudicated surface water impoundments within 2 km of all proposed mine units at North Butte. Please describe if they receive water from surface sources and/or are supplied by a well. If a well is the source of water, please provide a description of the well.

RAI 6

Description of Deficiency

The information provided in TR Section 2.7.3 does not meet the applicable requirements of 10 CFR 40.41(c), using the review procedures in Section 2.7.2 and acceptance criteria in Section 2.7.3 of the SRP.

Basis for Request

There are numerous CBM wells within and near the North Butte license area. Cameco did not describe how CBM produced water is or will be managed at the site now or in the future. There are 11 new surface water rights since 2004 within 3 miles of the license area, which are typically identified as for stock watering, but may be sourced by CBM wells. Cameco did not disclose if any of the surface water rights are used for disposal or storage of produced CBM water within the license area. Without this information, staff cannot evaluate the potential impact of CBM water on surface and ground water and how it may interfere with the detection of ISR impacts on these resources.

Formulation of RAI

Please describe how CBM produced water is or will be managed at the North Butte license area now or in the future. If produced water is to be discharged in the license area to the surface, drainages or impoundments under Wyoming Pollutant Discharge Elimination System (WYPDES) permits, the location of the WYPDES discharge points and impoundments should be clearly identified. The discharge permit water quality limits should also be provided for each WYPDES discharge point. In addition, Cameco should describe how impacts from CBM produced water on surface water or ground water will be distinguished from spills or leaks from ISR operations within the license area.

RAI 7

Description of Deficiency

The information provided in TR Section 2.7.3 does not meet the applicable requirements of 10 CFR 40.41(c), using the review procedures in Section 2.7.2 and acceptance criteria in Section 2.7.3 of the SRP.

Basis for Request

Cameco provided an updated listing of the ground water rights within 5 km of the Smith Ranch license area in Table 3.4-4 of the ER. Cameco also provided an updated map which displays all stock/domestic permits and ground water rights in Figure 3.4.1 of the ER. Cameco did not identify private industrial, irrigation, or miscellaneous wells on this map which may impact the operations.

Formulation of RAI

Please add the permit numbers of Smith Ranch private irrigation, miscellaneous, or industrial use water wells to ER Figure 3.4-1.

RAI 8

Description of Deficiency

The information provided in TR Section 2.7.3 does not meet the applicable requirements of 10 CFR 40.41(c), using the review procedures in Section 2.7.2 and acceptance criteria in Section 2.7.3 of the SRP.

Basis for Request

Cameco stated two irrigation wells were completed in Section 12 of T35N, R74 W on page D6-12 of the Wyoming Department of Environmental Quality (WDEQ) Smith Ranch permit. Staff was not able to find the Wyoming State Engineer's Office (WSEO) permit numbers for these wells to determine their completion interval or ground water rates to assess if they may affect the safety of operations.

Formulation of RAI

Please provide the WSEO permit names for the two irrigation wells installed in Section 12 of T35NR74 W. Please identify the aquifers in which these wells are completed. Please provide the current status of these wells. Please assess if the ground water use at these wells could affect hydraulic control of nearby mine units within the Smith Ranch license area.

RAI 9

Description of Deficiency

The information provided in TR Section 2.7.3 does not meet the applicable requirements of 10 CFR 40.41(c), using the review procedures in Section 2.7.2 and acceptance criteria in Section 2.7.3 of the SRP.

Basis for Request

Cameco identified three new wells, P193308.0W, P189481.0W, and P193341.0W, which were installed in either 2009 or 2010 near Smith Ranch. These wells have permitted water use rates of 150, 25, and 150 gpm. The permits state the wells are associated with oil and gas drilling operations. Staff could not determine if the wells have been installed or could affect operations.

Formulation of RAI

Cameco approved in either 2009 or 2010. Please provide the current status of these wells. Please identify the aquifers in which these wells are completed. Please evaluate if the use of these wells could affect the hydraulic control of nearby mine units in the Smith Ranch license area.

RAI 10

Description of Deficiency

The information provided in TR Section 2.7.3 does not meet the applicable requirements of 10 CFR 40.41(c), using the review procedures in Section 2.7.2 and acceptance criteria in Section 2.7.3 of the SRP.

Basis for Request

Cameco stated that several mine units at Gas Hills have experienced water level declines in the aquifers due to nearby open pit mining operations. Cameco stated that some sands would not have sufficient potentiometric head for ISR operations. Staff could not determine which sands would be excluded from development due to reduced head. Additionally, staff could not determine if any of the aquifers in targeted ore zones may be unconfined or may become unconfined during ISR operations.

Formulation of RAI

Please describe if any of the aquifers in any of the Gas Hills mine units will be excluded from ISR extraction due to low potentiometric head, or will be or may become, unconfined aquifers during operation.

RAI 11

Description of Deficiency

The information provided in TR Section 2.7.3 does not meet the applicable requirements of 10 CFR 40.41(c), using the review procedures in Section 2.7.2 and acceptance criteria in Section 2.7.3 of the SRP.

Basis for Request

Cameco presented the Reynolds Ranch historical surface water quality sampling results for sites identified as Stock Pond Sec. 31, Silver Spoon Reservoir Sec.12, Martin Springs Sec. 31, and Brown Springs Creek Sec. 31 in Attachment D6-2 of Addendum D-6 C of the TR. Staff review of this data indicated no new sampling results since 1990. Cameco also provided Reynolds Ranch August 2011 surface water quality data for sites identified as Spring #1, Windmill Impoundment, White Rock Springs, and Impoundment #6 in Table 3.4-1 of the ER which was updated in February 2012. The sample locations were shown on Figure 5.7 of the TR. Staff was unable to determine if any of the August 2011 sites were the same as the previously reported historical sites or all new locations.

Formulation of RAI

Please state if any of the August 2011 Reynolds Ranch surface water sampling sites were the same as the previously reported historical sites, or if they represent entirely new locations.

Section 3 – Description of Proposed Facility

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using review procedures in Section 3.1.2 and acceptance criteria outlined in Section 3.1.3 of the SRP.

Basis for Request

Section 3.3.1.3 of the TR states that Table 3-1 lists "all current and proposed mine units for Smith Ranch and their status as of January 2012." However, Figure 4-1 of the Cumulative Hydrologic Impact Analysis in Appendix E to the ER identifies several proposed mine units that are not contained in Figure 3-1 (Mine Unit 8, Mine Unit 12, Mine Unit 13, Mine Unit 16, Mine Unit 17, Mine Unit H Extension, Mine Unit I Extension, and Mine Unit M. It is not clear to the staff if Cameco proposes to recover uranium from these mine units. Staff has not been able to verify that these mine units have been previously approved by the NRC.

Formulation of RAI

Please clarify the discrepancy between TR Table 3-1 and Figure 4-1 of ER Appendix E. Additionally, please verify that any proposed mine units have been previously approved by staff and identify the document(s) containing the previous NRC approval. If the proposed mine units have not been previously approved by staff, please provide a physical description of each of the proposed mine units, including acreage, ore zone, overlying/underlying aquifers, anticipated monitoring well locations and density.

RAI 13

Description of Deficiency

The information provided in TR does not meet the applicable requirements of 10 CFR Part 40, using review procedures in Section 3.1.2 and acceptance criteria outlined in Section 3.1.3 of the SRP.

Basis for Request

Gas Hills Mine Unit 1. The TR states the uranium deposits in Mine Unit 1 are in 70 sand.

Formulation of RAI

Please identify the overlying and underlying aquifers at Mine Unit 1 if the 70 sand is the targeted ore zone.

RAI 14

Description of Deficiency

The information provided in TR does not meet the applicable requirements of 10 CFR Part 40, using review procedures in Section 3.1.2 and acceptance criteria outlined in Section 3.1.3 of the SRP.

Basis for Request

Gas Hills Mine Unit 2: The TR states uranium deposits in Mine Unit 2 are located in the 40, 50, 60, 70, and 80 sands. Mine Unit 2 has two traceable faults. The Bountiful fault has a displacement of 40- 50 feet. The UPZ fault has a displacement of 50 feet. The flow characteristics in the vicinity of the faults is unknown. Previous mining has occurred in the vicinity of Mine Unit 2. The UPZ shaft is located on the southern edge of Mine Unit 2. It is 880 feet deep and was reclaimed in 1991 and backfilled.

Formulation of RAI

Please identify which ore zone(s) will be targeted for extraction and the overlying and underlying aquifers in Mine Unit 2. If aquifers in different sands are to be combined into a single production aquifer at a mine unit, please clearly state which sands will be combined and in which locations of the mine unit. Please indicate if a mine unit crosses a fault and the implications of offset ore zones and aquifers. Please state if the mine unit will use well twinning or recompletes. Please also describe if the aquifers will act as confined or unconfined aquifers during operations.

RAI 15

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using review procedures in Section 3.1.2 and acceptance criteria outlined in Section 3.1.3 of the SRP.

Basis for Request

Gas Hills Mine Unit 3: The TR states uranium deposits in Mine Unit 3 are in the 30, 40, and 50 sands. The ore body is the southern extension of the Pathfinder Lucky Mc open pit. Dewatering of the Pathfinder Lucky Mc pit has lowered the potentiometric surface within the northern portion of the mine. Because of insufficient water pressure, Cameco reports the upper geologic section may be excluded from development. This mine unit has three faults, the PCH fault, the Jasper fault, and the Lucky Mc fault as well as the abandoned underground Atlas mine. The mine unit would intersect the PCH fault and Jasper fault. The Jasper fault may be highly transmissive. The Lucky Mc fault north of the unit may be a hydrological barrier.

Formulation of RAI

Please identify which ore zone(s) will be targeted for extraction and the overlying and underlying aquifers in Mine Unit 3. If aquifers in different sands are to be combined into a single production aquifer at a mine unit, please clearly state which sands will be combined and in which locations of the mine unit. Please indicate if a mine unit crosses a fault and the implications of offset ore zones and aquifers. Please state if the mine unit will use well twinning or recompletes. Please also describe if the aquifers will act as confined or unconfined aquifers during operations.

RAI 16

Description of Deficiency

The information provided in TR does not meet the applicable requirements of 10 CFR Part 40, using review procedures in Section 3.1.2 and acceptance criteria outlined in Section 3.1.3 of the SRP.

Basis for Request

Gas Hills Mine Unit 4: The TR states that the uranium deposits in Mine Unit 4 are in the 50, 60, 70, 80, and 90 sands. The Buss pit is located in the northeastern portion of the planned development area. It was reclaimed in 1995. The prior dewatering of the Buss pit has lowered the ground water level within a portion of Mine Unit 4. Because of insufficient water pressure the upper geologic section may be excluded from development. The mining unit has at least one traceable fault, the Buss fault. It has a vertical displacement of 50 feet. Mining of the Buss pit has affected overall water quality in the vicinity of Mine Unit 4. Other open pits in the 80 and 90 sand included the Two States and Blackstone pits. Other open pits near Mine Unit 4 include the Cap, Bengal and Mars pits, which are backfilled above the water table.

Formulation of RAI

Please identify ore zone(s) will be targeted for extraction and the overlying and underlying aquifers in Mine Unit 4. If aquifers in different sands are to be combined into a single production aquifer at a mine unit, please clearly state which sands will be combined and in which locations of the mine unit. Please indicate if a mine unit crosses a fault and the implications of offset ore zones and aquifers. Please state if the mine unit will use well twinning or recompletes. Please also describe if the aquifers will act as confined or unconfined aquifers during operations.

RAI 17

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using review procedures in Section 3.1.2 and acceptance criteria outlined in Section 3.1.3 of the SRP.

Basis for Request

Mine Unit 5: The TR states the uranium deposits in Mine Unit 5 are located in the 40 and 50 sands. Mine Unit 5 is located in the northeastern portion of the planned development area. Numerous open pit mines are nearby, including the Veca mine, the Rox and Thunderbird mines. AML reclamation land is also present. The mine unit crosses one traceable fault, marking the southern side of the Thunderbird Graben which is characterized by two striking faults and downthrown by about 150 feet. Historic open pit mining has affected the water quality. No isopachs have been developed for Mine Unit 5. A current description aquifer in the 50 sand and the water levels was not provided to determine if it is an unconfined or confined aquifer.

Formulation of RAI

Please identify which ore zone(s) will be targeted for extraction and the overlying and underlying aquifers in Mine Unit 5. If aquifers in different sands are to be combined into a single production aquifer at a mine unit, please clearly state which sands will be combined and in which locations of the mine unit. Please indicate if a mine unit crosses a fault and the implications of offset ore zones and aquifers. Please state if the mine unit will use well twinning or recompletes. Please also describe if the aquifers will act as confined or unconfined aquifers during operations.

RAI 18

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using review procedures in Section 3.1.2 and acceptance criteria outlined in Section 3.1.3 of the SRP.

Basis for Request

Cameco stated it will produce stacked ore zones in the same mine unit using multiple completions or well twinning in Smith Ranch, North Butte and Gas Hills mine units where there are multiple stacked ore zones. Cameco stated it will not begin extraction in an overlying zone in a multiple completion or twinned well until extraction is completed in the prior targeted zone. Cameco did not identify which particular mine units would use multiple or twinned completions. For multiple completions, Cameco did not describe how it will isolate the original extraction zone from the new extraction zone. Cameco did not describe how the mine unit hydrologic package would address the issue of stacked ore zones. Cameco also did not describe how the overlying and underlying aquifers will be defined or monitored in mine units with stacked ore zones. Cameco did not describe how the vertical or horizontal monitoring wells would be established for recompletions in another ore zone. Cameco also did not describe how baseline water

quality will be established for the recompleted zone or approved. Cameco did not describe how restoration will be done and restoration stability established for all extraction zones in a well which has multiple completions. Cameco also did not provide a schedule for extraction and restoration for each zone.

Formulation of RAI

Please identify which mine units will have multiple or twinned completions and the ore zones they will target. Please explain how: (1) baseline water quality will established for each targeted zone; (2) excursion monitoring will be done for the perimeter well ring and overlying and underlying aquifers for each targeted zones; (3) restoration and restoration stability will be done for each targeted zone; and (4) pore volumes will determine for each zone. Please also provide the extraction and restoration schedule for each of the targeted zones in mine units with stacked ore zones.

RAI 19

Description of Deficiency

The information provided in TR Section 3.1.3 does not meet the applicable requirements of 10 CFR Part 40, using review procedures in Section 3.1.2 and acceptance criteria outlined in Section 3.1.3 of the SRP.

Basis for Request

TR Section 3.1.3.4 states that, after installation, all wells will undergo a mechanical integrity test (MIT) before being placed into operation. Staff recommends that all wells should undergo an MIT before any use that is regulated or undertaken to meet a regulatory standard, including ground water sampling.

Formulation of RAI

Cameco should revise the TR to state that the integrity of all wells will be verified by MIT before any use that is regulated or undertaken to meet a regulatory standard, including baseline water quality sampling, or justify why the current approach is protective.

RAI 20

Description of Deficiency

The information provided in TR Section 3.1.3 does not meet the applicable requirements of 10 CFR Part 40, using review procedures in Section 3.1.2 and acceptance criteria outlined in Section 3.1.3 of the SRP.

Basis for Request

TR Section 3.1.3.4 states that MITs will be performed on wells every 5 years after they are placed in service and after any workovers or suspected surface or subsurface damage. If a well fails the MIT it will be repaired or plugged and abandoned. Cameco does not commit to

evaluate the failure or potential contamination of any non-exempt aquifer as a consequence of the MIT failure of injection or extraction wells which have been in operation.

Formulation of RAI

Cameco should provide a commitment to that if a well fails an MIT after being in service as a production or extraction well, Cameco will assess the cause of the failure and evaluate if the well failure may have released fluids to a nonexempt aquifer.

RAI 21

Description of Deficiency

The information provided in TR does not meet the applicable requirements of 10 CFR Part 40, using review procedures in Section 3.1.2 and acceptance criteria outlined in Section 3.1.3 of the SRP.

Basis for Request

Cameco has experienced hundreds of historical MIT failures in mine units C, E and F which were not summarized in the TR.

Formulation of RAI

Please provide a table which summarizes all of the MIT failures for each mine unit at Smith Ranch.

RAI 22

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using review procedures in Section 3.1.2 and acceptance criteria outlined in Section 3.1.3 of the SRP.

Basis for Request

Cameco has been conducting a casing leak investigation of the shallow aquifers in Mine Units C, E, and F to determine if any ground water has been contaminated by casing leaks from historical MIT failures. Cameco has not presented the details of this investigation in the TR. It has not provided any actions it will take if casing leaks are found to have contaminated ground water.

Formulation of RAI

Please provide a discussion of any actions taken to date to determine if shallow ground water has been contaminated by casing leaks from these MIT failures. Please provide the actions to be taken in any mine unit if any ground water contamination has been detected from casing leaks from MIT failures.

RAI 23

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using review procedures in Section 3.1.2 and acceptance criteria outlined in Section 3.1.3 of the SRP.

Basis for Request

Recently, the NRC Inspection Report 040-08964/11-002 (ML11298A293) concluded that Purge Storage Reservoir 2 (PSR2) at Smith Ranch was seeping into the surrounding sediments. This conclusion was reached based on a Cameco contractor report and staff assessment of PSR2 shallow monitoring well data. At the time of the inspection, Cameco committed to assess if ground water has been impacted by PSR 2 seepage by investigating the ground water quality of the first underlying aquifer to PSR 2. The plan of this investigation is provided in the "PSR2 Shallow Ground water Investigation Characterization Plan" in Appendix H of the TR. In addition, Cameco has also been conducting a separate casing leak investigation which is examining the water quality of the shallow aquifers in the northern portion mine unit C just south of PSR 2. This water quality investigation has shown that there may be evidence of PSR 2 leakage to the shallow aquifers in this area. Cameco has not addressed this evidence or PSR 2 leakage to ground water in the TR. PSR2 provides a significant proportion of the waste water disposal capacity at the Smith Ranch facility. Staff is not able to evaluate the future use of PSR2 when Cameco has not provided an evaluation of leakage to underlying shallow ground water from PSR2. Staff cannot evaluate the safe operation of the Smith Ranch facility for the license renewal period if Cameco is required to take corrective action such as removing PSR2 from service to prevent leakage to ground water.

Formulation of RAI

Please discuss the potential for seepage from PSR2 to have impacted shallow ground water. Specifically, please address if PSR2 is the source of the shallow ground water contamination which has been identified in the ground water quality data from the current casing leak investigation in the northern portion of mine unit C. If leakage from PSR2 to ground water is confirmed based on the casing leak water quality data or other water quality data from the proposed PSR 2 shallow ground water characterization, please provide the corrective action which will be taken to prevent this leakage as required by 10 CFR Part 40, Appendix A, Criterion 5F. If corrective action at PSR 2 is to be undertaken (e.g. removing PSR 2 from operation for repair), please address how this corrective action may impact production and restoration operations at the Smith Ranch facility.

RAI 24

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using review procedures in Section 3.1.2 and acceptance criteria outlined in Section 3.1.3 of the SRP.

Basis for Request

Cameco has indicated that some of the aquifers in the ore zones at Gas Hills may have low potentiometric head. Therefore, some of the aquifers may become or act as unconfined aquifers during extraction and restoration operations. Cameco has not identified which ore zone aquifers may act as unconfined aquifers. Cameco has also not addressed the safety issues associated with extraction and restoration of unconfined aquifers. Cameco has identified that unconfined aquifers will be targeted for operations. Staff also does not have sufficient information to be able to make a reasonable assurance finding that Cameco will address the specific safety issues associated with ISR operations in unconfined aquifers.

Formulation of RAI

Please identify any aquifers which are or may become unconfined during extraction and restoration at Gas Hills or any other satellites. Please address the following topics with respect to operations in any production zone aquifer in the license area or satellites which may be unconfined or is likely to become unconfined during operations:

A. The limiting extraction rate for the unconfined aquifer for all operations (including excursion capture) to prevent excessive dewatering.
B. A revised production schedule if this limiting extraction rate for the unconfined aquifer is determined to be less than the proposed bleed required for production and restoration operations.
C. Assurance that dissolved oxygen will be maintained at levels in the lixiviant to prevent “gas lock” when injected into the unconfined aquifer production zone.
D. A strategy to detect and correct for “gas lock” in the unconfined aquifer production zone.
E. A strategy to detect and correct for free gas in produced waters to prevent damage to piping, pumps, and other mine unit infrastructure from the two phase flow of gas and water.
F. An evaluation of the maximum drawdown and mounding expected during operations anywhere the unconfined aquifer.
G. An evaluation which shows that an inward gradient in the mine unit will be maintained at all times with either five-spot, alternating line drive, or line drive patterns that may be used within the unconfined aquifer. If necessary, please provide the updated bleed rate to maintain this inward gradient.
H. A strategy for excursion capture in the unconfined aquifer given the limiting extraction rate.
I. A strategy for assuring complete sweep of the unconfined aquifer during restoration of given the mounding and dewatering patterns which will develop.
J. An updated flare value which takes into account the vertical flow from mounding and dewatering patterns in the unconfined aquifer.

RAI 25

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using review procedures in Section 3.1.2 and acceptance criteria outlined in Section 3.1.3 of the SRP.

Basis for Request

The TR does not state the RO capacity which will be needed or installed for the Smith Ranch facility, North Butte, or Gas Hills satellites to meet the production and restoration water balances. Staff cannot ensure the water balances are representative without a commitment to have the required RO capacity available at each facility or satellite.

Formulation of RAI

Please provide the required RO capacity in gpm and a commitment to install this RO capacity at each facility/satellite to meet the production and restoration schedules in the TR water balances for Smith Ranch, North Butte, and the Gas Hills.

RAI 26

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using review procedures in Section 3.1.2 and acceptance criteria outlined in Section 3.1.3 of the SRP.

Basis for Request

Cameco has provided a schedule of production and restoration in the water balance tables. The water balance at Smith Ranch shows there is little to no excess disposal capacity for deep well injection for several years. Cameco has two deep disposal wells permitted, DDW 7 and 8, which have not been installed and are not included in the water balance. Given the observed drop in deep disposal well injection capacity over time at Smith Ranch, staff does not have sufficient information to be able to make a reasonable assurance finding that Cameco has sufficient waste disposal capacity to meet production and restoration schedules. While the disposal wells at North Butte and Gas Hills do not have observed operational performance data yet, staff anticipates that a similar drop in deep disposal well capacity over time may be observed at these facilities as well.

Formulation of RAI

Please provide a discussion of how Cameco will maintain sufficient waste disposal capacity to meet projected production and restoration schedules at Smith Ranch, North Butte, and Gas Hills. Any analysis of deep disposal capacity should be based on actual field performance, not permitted capacities and should reflect potential operating scenarios. It may be necessary to consider additional disposal options or operating scenarios that minimize the amount of needed

disposal capacity. Examples could include options such as: adding additional disposal capacity by installing the permitted deep disposal wells; reducing the amount of liquids disposed of via deep well injection; adding evaporation ponds; developing a new liquid disposal option; or reducing the addition of new production mine units until restoration of older mine units is completed.

RAI 27

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using review procedures in Section 3.1.2 and acceptance criteria outlined in Section 3.1.3 of the SRP.

Basis for Request

Several of the water balances indicate that restoration flow will not be treated by RO to reduce the volume needed for waste disposal. Waste disposal capacity could be greatly increased if RO was used on these waste streams.

Formulation of RAI

Please provide a discussion for why restoration flow in the water balance is often not being reduced by RO.

RAI 28

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using review procedures in Section 3.1.2 and acceptance criteria outlined in Section 3.1.3 of the SRP.

Basis for Request

Cameco stated all of the oil and gas targeted in the license area would be from the Niobrara shale which is significantly deeper than the ore zones targeted for extraction. All of Cameco's deep disposal wells are located in the Teckla, Teapot, and Parkman formations which lie above the Niobrara Shale. In particular, one oil and gas well, Henry 3-36-74A 1H, API No 009-28809, near RR has been permitted to operate in the Parkman Formation. The WYOGCC has determined that this well is within the Area of Review (AOR) for the RR DDW 1, which means it could potentially interfere with the operation of the deep disposal well.

Formulation of RAI

Please evaluate if any of the deep disposal wells operating, permitted or planned at Smith Ranch, North Butte, and Gas Hills have any permitted oil and gas wells (including horizontal) close to or within their AOR. If yes, please assess if there is or will be a pathway for exposure to byproduct material as required by 10 CFR Part 20, Subpart K.

RAI 29

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using review procedures in Section 3.1.2 and acceptance criteria outlined in Section 3.1.3 of the SRP.

Basis for Request

The TR provided the expected oxygen content in lixiviant. The TR, however, did not assess if Cameco will be able to maintain oxygen in solution during extraction operations in mine units which have low potentiometric head or an unconfined aquifer. The release of oxygen from solution can lead to "gas lock" in the ore zone which can impact hydraulic control by reducing well injectivity and aquifer hydraulic conductivity unpredictably. Free gas can also lead to damage in pipes, pumps, and other infrastructure which has not been designed to handle two phase flow of water and gas. Staff does not have sufficient information to be able to make a reasonable assurance finding related to the safe operation of the mine units and infrastructure without information on the oxygen concentration and a determination if it will stay in solution during operations.

Formulation of RAI

Cameco should discuss if expected concentrations of oxygen will remain in solution at all satellite mine units and infrastructure during operations. In addition, the TR should address if hydrogen peroxide is to be used in the lixiviant as it can also lead to the evolution of free oxygen gas in the ore zone aquifer.

RAI 30

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using review procedures in Section 3.1.2 and acceptance criteria outlined in Section 3.1.3 of the SRP.

Basis for Request

The North Butte ground water modeling study in Appendix B of the TR showed 1 percent bleed sufficient for mine units pattern to maintain an inward gradient. Cameco plans to perform ground water simulations and provide these in the hydrologic data package after mine units are delineated. The cumulative impact analysis of North Butte operations on private wells in Section 4.4 of the ER, shows substantial drawdown in private wells.

Formulation of RAI

Please provide assurance that Cameco will be able to maintain the extraction rates necessary to maintain an inward hydraulic gradient and achieve proposed production and restoration schedules at North Butte given the predicted drawdown realized during the life of operations. Please specifically provide assurance that the WSEO will continue to allow Cameco to operate the ISR wells at permitted rates even if the drawdown caused their operation has impacted surrounding private wells.

RAI 31

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using review procedures in Section 3.1.2 and acceptance criteria outlined in Section 3.1.3 of the SRP.

Basis for Request

The UMETCO mill tailings impoundment is located just to the north of the Gas Hills Mine Unit 5. In 2004, NRC approved an ACL for the UMETCO impoundment based on ground water modeling. None of the maps provided by Cameco show the location of the UMETCO mill tailing impoundment and its proximity to mine unit 5.

Formulation of RAI

Please present a map showing all significant surface features within 2 km of Gas Hills mine unit 5. Please specifically include all of the features of the UMETCO mill tailings impoundment just to the north of Mine Unit 5. Also include the Long Term Surveillance Boundary (LTSB) for the UMETCO mill tailings impoundment ACL. Please also include the location of any monitoring wells which are associated with the UMETCO mill tailings impoundment ACL.

RAI 32

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using review procedures in Section 3.1.2 and acceptance criteria outlined in Section 3.1.3 of the SRP.

Basis for Request

The UMETCO mill tailings impoundment is located just north of Gas Hills Mine Unit 5. In 2002, UMETCO received NRC approval for an ACL for the ground water plume which is moving south from the mill tailings impoundment towards Gas Hills Mine Unit 5. The ground water plume associated with UMETCO is in the same aquifer as the Mine Unit 5 ore zone. The ACL was approved partially based on ground water modeling done by UMETCO which included a hypothetical operating scenario for Cameco Mine Unit 5. This modeling showed no impact to the ACL under very specific operating conditions which represented the best available

knowledge at that time. Cameco stated in the TR that it has not developed the ISR operating conditions for Mine Unit 5 because of the complexity of the geological setting which includes several faults and reclaimed mining pits. Cameco has not provided the final geological characterization of Mine Unit 5. Cameco has also not provided any ground water modeling for proposed ISR operations at Mine Unit 5. Cameco did not acknowledge nor address how the operation of Mine Unit 5 would impact the UMETCO ACL. Therefore, staff does not have sufficient information to assess if the proposed operation of Cameco Mine Unit 5 will impact the approved UMETCO ACL. Cameco has not provided enough information for staff to be able to make a reasonable assurance finding that Cameco can detect or prevent the movement of UMETCO mill tailings contaminated water into Mine Unit 5 during ISR extraction and restoration operations.

Formulation of RAI

Please evaluate if the proposed operation of Gas Hills Mine Unit 5 will impact the approved ACL at the UMETCO mill tailings impoundment. Please provide the strategy Cameco will use to prevent and detect the movement of any contamination from the UMETCO mill tailings impacted ground water into Gas Hills Mine Unit 5 during production and restoration operations. This should include a discussion of determination of baseline, detection of excursions, and restoration of ground water.

Section 4 – Effluent Control Systems

RAI 33

Description of Deficiency

The TR does not appear to be consistent with acceptance criteria (2) of Section 4.2.3 of the SRP, which recommends daily checks of the leak detection system for surface impoundments.

Basis for Request

Regulatory Guide 3.11 and acceptance criteria (2) of Section 4.2.3 of the SRP recommend daily inspections of the leak detection systems for surface impoundment or evaporation ponds. The TR does not appear to discuss this aspect consistently throughout the document. For example, TR section 4.2.4 discusses daily inspections of the leak detection systems at North Butte and Gas Hills, but TR Section 3.6.3.3 discusses bi-weekly inspections of the leak detection system for the North Butte ponds.

Formulation of RAI

Please address this inconsistency in the TR. Additionally, where the proposed leak detection inspection frequency differs from the guidance in the SRP and Regulatory Guide 3.11, please explain how the proposed frequency provides an acceptable level of protection.

RAI 34

Description of Deficiency

The TR does not appear to be consistent with acceptance criteria (6) of Section 4.2.3 of the SRP, which addresses disposal of solid wastes generated during operation of the facility.

Basis for Request

TR Section 3.6.4.3 discusses use of a forced evaporation system at the Gas Hills satellite to provide additional liquid disposal capacity. Staff understands that this process may be used at the Gas Hills remote satellite to reduce the amount of evaporation pond and deep disposal well capacity. TR Section 3.6.4.3 also identifies disposal of solids generated during the forced evaporation process as 11e.(2) byproduct material at an NRC licensed facility. It is not clear to the staff if estimated the solid residue from liquid evaporation generation rate of 1 percent includes the solids generated from the forced evaporation process.

Formulation of RAI

Please confirm that solids generated during the forced evaporation process will be considered 11e.(2) byproduct material and disposed of appropriately. Also, please identify the solid residue generation rate from the forced evaporation process.

Section 5 - Operations

RAI 35

Description of Deficiency

The TR does not appear to be consistent with acceptance criterion (2) of Section 5.2.3 of the SRP.

Basis for Request

As currently stated, Section 5.2.4 of the TR allows for staff other than the Radiation Safety Officer (RSO) to review and approve all procedures related to radiation safety. Regulatory Guide 8.31 specifies that to ensure that proper radiation protection principles and techniques are being applied; written procedures for all activities should be reviewed and approved in writing by RSO before being implemented and whenever a change in a procedure is proposed. The guide further recommends that the RSO should designate a member of the radiation safety office staff or a supervisory member of the production staff who has received specialized radiation protection training to review and sign RWPs when the RSO is not available, e.g., during off shifts. However, Cameco does not appear to have described the training and education requirements of the designee nor the training program for the designee the TR.

Formulation of RAI

Please describe either how the current approach is consistent with Section 2.2 of Regulatory Guide 8.31, provide the training, education, or training program requirements of the designee, or

revise the section of the TR so that annual review and approval is limited to the qualified radiation safety staff.

RAI 36

Description of Deficiency

The TR does not appear to be consistent with acceptance criteria (1) in Section 5.4.3 of the SRP or consistent with acceptance criteria (1) in section 5.5.3 of the SRP. Cameco does not appear to adequately describe the training or qualifications of either the "properly trained employee" or the "qualified designee" assigned to perform daily inspections and contamination or other surveys.

Basis for Request

In TR Section 5.3, Cameco proposes to allow the RSO or HPT or a trained designee to conduct daily walk-through inspections in all areas and weekly inspections of all facilities. In TR Section 5.8, Cameco proposes to allow the RSO, HPT, or properly trained employees to conduct surveys of equipment removed from restricted areas except for small, hand carried items. However, consistent with Regulatory Guide 8.31, designees are not allowed to conduct weekly surveys or to release items for unrestricted use. Additionally, Cameco does not adequately describe the training or qualifications of either the "properly trained employee" or the "qualified designee" assigned to perform contamination or other surveys.

Formulation of RAI

Please provide a description of the training and education requirements for the RSO-designee. Please provide the following information in the TR:

A. The training program for designees that is in addition to the standard radiation worker training required for all employees. Considering that Regulatory Guide 8.31 provides academic and experience requirements for radiation safety staff, the designee training should be a subset of the academic training, facility specific training, and experience required by full radiation staff.
B. The objective manner in which Cameco assesses a potential designee's ability to perform the required tasks. This should be developed in a manner that will allow the staff to determine compliance with Cameco's commitments.
C. The manner in which Cameco will document a designee's qualifications, to allow the staff to determine whether a designee has successfully completed the required qualifications program and is maintaining such qualifications. Be clear in describing training for proficiency in identifying radiation safety or other potentially hazardous problems that are part of the designee's duties.
D. The academic studies, training and experience required to address unusual or emergency conditions because the designee is acting as an agent of the radiation safety staff, when the RSO and RST are not present at the facility. As such, certain unusual or emergency conditions may occur in the absence of the RSO and HPT including leaks, spills, and skin contamination.

RAI 37

Description of Deficiency

The information provided in TR Section 5.7.7 is not consistent with SRP Section 5.7.6.3 acceptance criterion (4).

Basis for Request

Acceptance criterion (4) in SRP Section 5.7.6.3, states the applicant should describe monitoring equipment used for contamination control by type, specification of the range, sensitivity, calibration methods and frequency. However, the NRC staff notes that Cameco has not addressed surveys for beta/gamma contamination for personnel or equipment leaving a restricted area that may result from in-growth of uranium and radon daughter products from operations.

Formulation of RAI
Please provide a description of beta survey equipment and procedures to be used for contamination control and release of personnel and equipment.

RAI 38

Description of Deficiency

Cameco does not appear to be in compliance with10 CFR 20.1204(g).

Basis for Request

In Appendix I of the TR, Cameco states that sampling for isotopes such as Ra 226 is ongoing and should any subsequent analysis indicate the detectable presence of additional radionuclides, the mixed ALI and DAC will be adjusted accordingly. If Cameco identifies that a "mixture" exists which does not meet the exclusion rule of 10 CFR 20.1204(g), a sum of fractions method will be used to determine the appropriate DAC.

Formulation of RAI

Please provide updated isotopic analysis data and a commitment to conduct airborne sampling for natural U, Ra-226, Po-210, and Pb-210 at each in-plant air particulate sampling location at a frequency of once every six months for the first two years and annually thereafter to ensure compliance with 10 CFR 20.1204(g).

RAI 39

Description of Deficiency

Section 5.8.3 of the TR, exposure calculations, does not appear to be consistent with acceptance criteria (1) of Section 5.7.4.3 of the SRP.

Basis for Request

In accordance with 10 CFR 20.1501, the licensee shall make or cause to be made, surveys that are reasonable under the circumstances to evaluate (i) the magnitude and extent of radiation levels; and (ii) concentrations or quantitates of radioactive materials; and (iii) the potential radiological hazards. In addition, according to 10 CFR 20.1204(f), if the identity of each radionuclide in a mixture is known, but the concentration of one or more of the radionuclides in the mixture is not known, the DAC for the mixture must be the most restrictive DAC of any radionuclide in the mixture. Cameco does not appear to address the possibility of various radionuclides that may be present in air.

Formulation of RAI

In accordance with 10 CFR 20.1501 requirements, please demonstrate that how exposure calculations will take into account the possibility of a mixture of radionuclides in air so that the appropriate Derived Air Concentration (DAC) value will be used to control personnel exposures.

RAI 40

Description of Deficiency

The information provided in the TR is not consistent with SRP Section 5.7.7.3 acceptance criteria (1) and (2).

Basis for Request

SRP Section 5.7.7.3 acceptance criterion (1) says the proposed airborne effluent and environmental monitoring program is consistent with Regulatory Guide 4.14, Sections 1.1 and 2.1 (NRC, 1980) and ALARA requirements as described in Regulatory Guide 8.37, Section 3. SRP Section 5.7.7.3 acceptance criterion (2) says the proposed locations of the effluent monitoring stations are consistent with guidance in Regulatory Guide 4.14, Sections 1.1.1 and 2.1.2. Section 5.10 of the TR presents a discussion of the environmental monitoring program results obtained during the renewal period, but this section of the TR does not appear to evaluate sampling locations.

Formulation of RAI

Staff observes that the operational footprint of Smith Ranch has expanded towards the southwest. Staff observes that a change in operational footprint or changes in weather patterns may result in current sampling locations to be improperly sited. Please provide a description of how the current sampling locations properly address the environmental monitoring recommendations in Regulatory Guide 4.14. If applicable, Cameco should use the meteorological data collected by the new on-site monitoring stations and/or other updated information to evaluate sampling locations. Although no processing has occurred at the remote satellite facilities to date, this RAI is intended to apply to the entire Smith Ranch Project.

RAI 41

Description of Deficiency

The TR does not appear to be consistent with acceptance criteria (7) of Section 5.7.3.3 of the SRP.

Basis for Request

Section 5.8.3.5 of the TR refers the staff to Table 4-5 for total effective dose equivalent (TEDE) data for site workers. This table is not present in the TR. The TR does present TEDE information in Table 5-5; however, this table only presents average, minimum, and maximum TEDE values. Table 5-5 does not provide sufficient data on the components of the TEDE (i.e., external, uranium, and radon).

Formulation of RAI

Please revise Table 5-5 to provide additional data on the breakdown of the components of the TEDE.

RAI 42

Description of Deficiency

Section 5.8.3.4 of the TR does not appear to be consistent with acceptance criteria (4) of Section 5.7.4.3 of the SRP. The TR is not clear as to how frequently dosimeter for a declared pregnant woman is exchanged.

Basis for Request

Regulatory Guide 8.36 recommends that the cumulative intake should be quantified and the dose determined at least every 30 days for a declared pregnant woman. The Regulatory Guide further recommends that if significant variation in exposure in the exposure levels may have occurred, the time interval for quantifying the intake should be reduced. More frequent evaluations should be considered as the potential dose to embryo/fetus approaches the limit.

Formulation of RAI

Please provide the proposed frequency at which dosimeters will be exchanged for a declared pregnant woman.

RAI 43

Description of Deficiency

The information provided in the TR does not appear to be consistent with 10 CFR 20.1501 (survey for potential hazards) or Regulatory Guide 3.46 (Standard Format and Content for ISRs).

Basis for Request

Cameco has not provided the detection sensitivity of its instrumentation used for contamination surveys as recommended in Regulatory Guide 3.46. The NRC staff has noticed that the survey

instrumentation may not detect contamination for all required contamination surveys, and has determined that contamination control program may not be sufficient for detecting and quantifying contamination to prevent it from leaving restricted and controlled areas, and subsequently entering unrestricted areas or from leaving the site.

Formulation of RAI

Please provide the surface contamination detection capability (minimum detectable concentration (MDC)) for radiation survey instruments, including scan MDC for portable instruments, used for contamination surveys to release equipment and materials for unrestricted use and for personnel contamination surveys. Methods for determining the scan MDC are described in NUREG-1575 (NRC, 2000a). The detection capability in the scanning mode for the alpha and beta radiation expected shall be provided in terms of dpm per 100 cm^2.

RAI 44

Description of Deficiency

Section 5.10.1.1 of the TR does not appear to be consistent with acceptance criteria (1) in Section 5.7.7.3 of the SRP. This acceptance criterion recommends that the effluent and environmental monitoring program be consistent with the guidance in Regulatory Guide 4.14.

Basis for Request

For operational air particulate sample collection, the RG 4.14 recommends weekly filter change, or more frequently as required by dust loading. For sample analysis, RG 4.14 recommends quarterly composite of weekly samples. For radon gas, RG 4.14 recommends a continuous sample collection frequency, or at least one week per month and monthly sample analysis. Cameco stated that “all particulate samples, track-etch detectors, and dosimeters are collected periodically and sent to an accredited outside laboratory for analysis.” Cameco does not appear to have specified the actual frequency of monitoring.

Formulation of RAI

Please identify the actual frequency air particulate sampling filters are changed and explain the manner in which Cameco’s air sampling procedures are consistent with Regulatory Guide 4.14 and SRP acceptance criteria (1) of 5.7.7.3 (1) of the SRP.

RAI 45

Description of Deficiency

The LRA does not appear to meet the requirements of 10 CFR 20.1301 and 20.1302 because it does not address the calculation of public dose in a manner that takes into account the dose from radon progeny and is consistent with.

Basis for Request

The NRC staff determined that the short-lived radon progeny will be the principal contributor to radiation dose in most practical radon exposure situations. From the Statements of Consideration for the Part 20 update final rule in 1991 (Federal Register, May 21, 1991, 56FR23360), the NRC expects that radon progeny will be present with Rn-222 and that uranium recovery licensees would be using the 10 CFR Part 20, Appendix B, Table 2, value for Rn-222 with daughters present. Therefore, the NRC staff concludes that the appropriate value from 10 CFR Part 20, Appendix B, Table 2, for uranium recovery facility use, is the value for Rn-222 "with daughters present." The NRC staff also concludes that if a licensee performs a dose assessment to show compliance with 20.1301, the dose assessment must address the dose from radon progeny.

In either case (using Appendix B value with daughters present or performing a dose assessment), Cameco may justify use of a radon progeny equilibrium factor (progeny relative to n-222) less than 1. If Cameco opts to use a value different from the Appendix B value, Cameco needs NRC staff approval of the equilibrium factor (per 10 CFR 20.1302(c)).

Formulation of RAI

Cameco should describe how it proposes to calculate the public dose from radon in a manner that takes into account dose from radon progeny and meets the requirements of 10 CFR 20.1301 and 20.1302. Please provide justification if Cameco chooses an alternate methodology.

RAI 46

Description of Deficiency

The airborne effluent and environmental monitoring program does not appear to be consistent with acceptance criterion (3) in Section 5.7.7.3 of the SRP.

Basis for Request

In Section 5.10.1.2 of the TR, Cameco states that annual soil and vegetation sampling was terminated effective from 2000 based on the determination that soil and vegetation sampling at the air particulate monitoring stations was not explicitly required by the license (NRC IR 40-8857/99-02). Therefore, no soil and vegetation sampling data associated with the air particulate monitoring stations is available for the renewal period. Without reviewing annual soil samples and vegetation samples taken throughout the operating phase of Cameco's facility, staff does not have the ability to confirm compliance with Criterion 7 of Appendix A to 10 CFR Part 40, which specifies survey and monitoring requirements and 10 CFR Part 20, Subpart L, which establishes record keeping requirements. Additionally,staff cannot evaluate radiological impacts on the surroundings without soil and vegetation sampling data.

Formulation of RAI

Consistent with acceptance criterion (3) of 5.7.7.3 of the SRP, please discuss how the current approach to soil and vegetation sampling in the vicinity of the air particulate monitoring stations is consistent with the approach recommended in Regulatory Guide 4.14. It may be possible to use data collected prior to 2000 to justify the current approach. Alternatively, Cameco may

provide justification for an alternate methodology, The current staff position is that soil and vegetation samples should be collected as recommended in Regulatory Guide 4.14.

RAI 47

Description of Deficiency

The information provided in the TR does not appear to be consistent with SRP Section 5.7.7.3 acceptance criteria (1). The TR does not appear to contain updated MILDOS analyses for the North Butte and Gas Hills remote satellite facilities.

Basis for Request

In Appendix K, Cameco stated that a weather station has been installed in 2010 at the North Butte expansion area and site specific data would become available in 2012. Cameo states that it would run the MILDOS model and provide the staff a summary of the updated results. This information has not been provided to the staff. Staff was not able to identify an updated MILDOS analysis for Gas Hills.

Formulation of RAI

Please provide the staff a summary of the updated MILDOS model results for North Butte and Gas Hills.

RAI 48

Description of Deficiency

The information provided in the TR does not appear to be consistent with SRP Section 5.7.7.3 acceptance criteria (2). Results from the air particulate monitoring stations are not provided.

Basis for Request

Cameco states in TR Section 5.10.1.1 that air particulate monitoring stations will be installed at the remote satellites North Butte and Gas Hills early in 2012. This data has not been provided for staff's review.

Formulation of RAI

Please provide results and location map of the air particulate monitoring stations along with the wind rose summary. Additionally, provide criteria as per the Regulatory Guide 4.14 used for determining air particulate sampling locations.

RAI 49

Description of Deficiency

The information provided in the TR does not appear to be consistent with SRP Section 5.7.3.3 acceptance criteria (1).

Basis for Request

The TR does not appear to include drawings or figures showing the layout of the North Butte and Gas Hills remote satellite facilities that identifies the locations to be used for in-plant monitoring.

Formulation of RAI

Please provide a drawing or figure that shows the locations of in-plant monitoring for North Butte and Gas Hills remote satellite facilities.

RAI 50

Description of Deficiency

The information provided in TR Section 5.7.8 does not meet the applicable requirements of 10 CFR Part 40, using the review procedures in Section 5.7.8.2 and acceptance criteria in Section 5.7.8.3 of the SRP.

Basis for Request

Cameco did not commit to continue excursion monitoring at all mine units until restoration is approved.

Formulation of RAI

Please provide a commitment to conduct excursion monitoring at some specified schedule until restoration of a mine unit is approved.

RAI 51

Description of Deficiency

The information provided in in the TR does not meet the applicable requirements of 10 CFR Part 40, using the review procedures in Section 5.7.8.2 and acceptance criteria in Section 5.7.8.3 of the SRP.

Basis for Request

Cameco monitors the ground water quality quarterly at numerous wells, labeled GW1-GW20, within the Smith Ranch License area. Staff was not able to identify the WSEO permits associated with these wells, so staff is not able to verify well characteristics or use. Figure D6-2

of the WDEQ Smith Ranch permit showed a ground water well identified as GW-30. Staff has no information on this well or any sampling results for this particular well.

Formulation of RAI

Please identify the WSEO permit number associated with all ground water wells, GW1-GW-20, which are sampled quarterly as part of the environmental monitoring program for the Smith Ranch license area. Please provide the WSEO well permit number for GW-30 and state if the well is used for the environmental monitoring program.

RAI 52

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using the review procedures in Section 5.7.8.2 and acceptance criteria in Section 5.7.8.3 of the SRP.

Basis for Request
In Section 6.1.4 of the ER, Cameco commits to quarterly environmental ground water monitoring of all domestic and livestock wells within 2 km of the SUA 1548 license areas. TR Tables 5-16 and 5-18 provided some of the wells to be monitored at Smith Ranch and North Butte, respectively, but they did not provide all the information staff needs to evaluate private well monitoring. Staff was not able to find a separate table describing all the wells which will be monitored within 2 km of each mine unit for Smith Ranch and its satellites each satellite under this commitment.

Formulation of RAI

Please provide a separate table of all private ground water wells which will be monitored quarterly within 2 km of the mine units at Smith Ranch, North Butte and Gas Hills. Please provide the permit number, owner, location, well completion information including aquifer(s) use and rate for each well if available.

RAI 53

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using the review procedures in Section 5.7.8.2 and acceptance criteria in Section 5.7.8.3 of the SRP.

Basis for Request

Staff was not able to find separate table describing the surface water sites to be sampled for Smith Ranch, North Butte, and Gas Hills. In Section 6.1.4 of the ER, Cameco commits to quarterly monitoring of all natural springs within 2 km of the SUA-1548 license areas. Staff was not able to find a listing of the all springs in the TR which will be monitored under this commitment. In its review of the Gas Hills site, several natural springs did not appear to be included in the surface water sampling of the license area.

Formulation of RAI

Please provide a separate table describing all surface water sites and natural springs which will be monitored quarterly within 2 km of the license area for Smith Ranch, North Butte and Gas Hills. Please provide the surface water site name, location, surface water right (if applicable), and source of water if available.

Section 6 – Ground Water Quality Restoration, Surface Reclamation, and Facility Decommissioning

RAI 54

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using the review procedures in Section 6.1.2 and acceptance criteria in Section 6.1.3 of the SRP.

Basis of Request

In Section 3.4.4 Cameco stated it will determine mine unit baseline water quality for each mine unit by collecting samples from production zone MP wells. Two samples will be collected from each well at least 2 weeks apart and analyzed for all the parameters in Table 3-5. An additional two samples will be collected from each well two weeks apart and sampled for a reduced set of parameters provided in Table 3-4. Staff has determined that four samples from each well is the minimum required to perform outlier analysis and determine if averaging is statistically acceptable for baseline water quality.

Formulation of RAI

Please provide a commitment to collect at least four samples from all MP wells at least 2 weeks apart to determine baseline water quality for a mine unit. Each sample should be analyzed for all the parameters in Table 3-5 unless they are not detected in the first two samples.

RAI 55

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using the review procedures in Section 6.1.2 and acceptance criteria in Section 6.1.3 of the SRP.

Basis of Request

In Section 3.4.4 Cameco stated it will determine perimeter ring, overlying and underlying aquifer baseline water quality for each mine unit by collecting samples from these monitoring wells. Two samples will be collected at least 2 weeks apart and analyzed for all the parameters in TR Table 3-5. An additional two samples will be collected two weeks apart and sampled for a reduced set of parameters provided in TR Table 3-4. Staff has determined that four samples from each well is the minimum required to perform outlier analysis and determine if averaging is statistically acceptable for baseline water quality for the monitoring wells.

Formulation of RAI

Please provide a commitment collect at least four samples from all perimeter, overlying and underlying aquifer wells at least 2 weeks apart. Each sample should be analyzed for all the parameters in Table 3-5 unless they are not detected in the first two samples.

RAI 56

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using the review procedures in Section 6.1.2 and acceptance criteria in Section 6.1.3 of the SRP.

Basis of Request

Cameco indicates that water treatment such as RO will be used for restoration. Many of the water balances presented in the TR do not include the use of RO to reduce waste disposal volumes.

Formulation of RAI

Please confirm and provide an explanation for the absence of RO treatment in some years on the water balances shown on the Reynolds Ranch, North Butte, and Gas Hills satellite water balances.

RAI 57

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using the review procedures in Section 6.1.2 and acceptance criteria in Section 6.1.3 of the SRP.

Basis of Request

Cameco describes restoration stability monitoring in Section 6.1.5.2. The list of constituents to be monitored is provided in Table 6.2. Per 10 CFR Part 40, Appendix A, Criterion 13, gross alpha is a hazardous constituent which must be monitored and meet the Criterion 5B(5) standards.

Formulation of RAI

Please add gross alpha to the list of constituents to be monitored in Table 6.2.

RAI 58

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using the review procedures in Section 6.1.2 and acceptance criteria in Section 6.1.3 of the SRP.

Basis of Request

Cameco states it will conduct stability monitoring quarterly for 1 year. Cameco does not state that the stability monitoring will also demonstrate no significantly increasing statistical trend for any constituent in any well for the most recent four consecutive quarters.

Formulation of RAI

Please provide a commitment to perform stability monitoring quarterly until all constituents in each well show no statistically significant increasing trend for at least four consecutive quarters.

RAI 59

Description of Deficiency

The information provided in the TR does not meet the applicable requirements of 10 CFR Part 40, using the review procedures in Section 6.1.2 and acceptance criteria in Section 6.1.3 of the SRP.

Basis of Request

Cameco did not address all the actions it has taken to improve restoration performance. Specifically, Cameco did not address the installation of hundreds of replacement wells and updates to infrastructure to improve restoration efforts at the Highland C, E and F mine units. It also did not describe the restoration modeling undertaken to optimize restoration to meet schedules.

Formulation of RAI

Please provide a description of the efforts made to improve restoration performance at the Highland mine units including well replacement, infrastructure improvements, ground water modeling and any other actions.

RAI 60

Description of Deficiency

Section 6.4 of the TR is not consistent with acceptance criterion (3) of Section 6.4.3 of the SRP.

Basis for Request

Section 6.4 of the TR discusses the radium benchmark dose approach for conducting post reclamation and decommissioning radiological surveys. Cameco committed to conducting this analysis when the final decommissioning plan for the facility is developed. However, staff observes that Cameco is cleaning up surface spills soon after they occur. It is not clear to the staff how spills of production fluids on soils can be considered 'clean' without having identified cleanup levels.

Formulation of RAI

Please ensure that procedures for conducting post-reclamation and decommissioning radiological surveys meets the acceptance criteria provided in in Section 6.4.3 of the SRP. Cameco needs to develop acceptable methodologies for verification of cleanup (final status survey plan) that demonstrate that residual radium concentration will not exceed the specified concentration limits. Also, Cameco needs to develop concentration criteria for other residual radionuclides in soil following the radium bench mark approach provided in Appendix E of the SRP, including demonstration of As Low As Is Reasonably Achievable (ALARA) and application of the unity test of 10 CFR 40, Appendix A, Criteria 6(6), or needs to provide an acceptable alternate methodology equivalent to that required by this criterion.

Administrative Items

Administrative Issue: Pages 7-11 were blank within WDEQ Permit Addendum D6-C1 which was identified as Addendum D5 C. Please state if this is intentional.

Adminstrative RAI: Figure 3.7 showing the Gas Hills remote satellite license area includes a potentiometric surface. Please state which aquifer is represented by this potentiometric surface.

Administrative Issue: The TR states that Cameco will submit an ACL application in first quarter of 2012. Please update or remove this statement.

Administrative Issue: In Section 5.8 of the TR, Cameco states that it has undertaken a sampling program to evaluate a variety of radiation protection issues raised by NRC with respect to other ISR facilities. The sampling plan would identify the sample type, location, equipment frequency/duration and lower limit of detection (LLD). As committed in the application, please provide data and any revised program proposals for NRC consideration.