

Section 1 – Proposed Activities		—
RAI 1	Response deemed sufficient by NRC	—
Section 2 – Site Characterization		—
<p>RAI 2 <u>Description of Deficiency</u> The TR does not appear to be consistent with acceptance criteria (2) and (3) of Section 2.5.3 of the SRP.</p> <p><u>Basis for Request</u> 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.</p> <p><u>Formulation of RAI</u> 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.</p>	<p>CAMECO RESPONSE: A meteorological analysis and comparison to regional long-term data for the Smith Ranch, North Butte, and Gas Hills sites has been completed and is provided with this submittal as Appendices B, C, and D to the ER. The analysis and data comparison for each site clearly indicate that the short term on-site data is representative of the long-term off-site regional meteorological data. Also, please see the response to ER RAI AQ-1.</p>	<p>CAMECO RESPONSE: A new meteorological report, capturing two years of Smith Ranch site specific Met Data has been included in Appendix B, Section 1 of the Environmental Report. The new report will be in addition to the previous report which contains data that was the basis for previous licensing decisions.</p>
RAI 3	Response deemed sufficient by NRC	—
RAI 4	Response deemed sufficient by NRC	—
RAI 5	Response deemed sufficient by NRC	—
RAI 6	Response deemed sufficient by NRC	—
RAI 7	Response deemed sufficient by NRC	—
RAI 8	Response deemed sufficient by NRC	—
RAI 9	Response deemed sufficient by NRC	—
RAI 10	Response deemed sufficient by NRC	—
RAI 11	Response deemed sufficient by NRC	—
Section 3 – Description of Proposed Facility		—
<p>RAI 12 <u>Description of Deficiency</u> 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.</p> <p><u>Basis for Request</u> 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.</p> <p><u>Formulation of RAI</u> 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</p>	<p>CAMECO RESPONSE: Table 3-1 has been revised to include these proposed production areas. The mine units discussed in this comment are all proposed at this time and have yet to be deemed viable. Because limited development work has been done on them, there is limited geological/production information available.</p>	<p>Physical descriptions of proposed Mine Units 8, 12, 13, 16, 17, H Extension, I Extension and M are summarized in new Table 3-1.1. The proposed mine units are located adjacent to or in close proximity to existing mine units, possess the same production zones and have closely related geologic characteristics. Production aquifer data and representative cross sections of the adjacent mine units have been incorporated into the table by reference to existing reports.</p> <p>The process of developing an individual mine unit will first entail the collection of detailed geologic and hydrologic information and assembly so that pattern areas can be defined, geologic and hydrologic parameters quantified, hydrologic monitoring programs developed, and groundwater quality adequately defined in advance of production. The multi-step program used to accomplish will include submittals to the WDEQ-LQD for review, and approval through the ORC/SERP process described in TR Section 3.4.</p>

<p>provide a physical description of each of the proposed mine units, including acreage, ore zone, overlying/underlying aquifers, anticipated monitoring well locations and density.</p>		<p>TR Section 3.3.1.3 has been updated with the inclusion of new Table 3-1.1 and discussion.</p>
<p>RAI 13 <u>Description of Deficiency</u> 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. <u>Basis for Request</u> Gas Hills Mine Unit 1. The TR states the uranium deposits in Mine Unit 1 are in 70 sand. <u>Formulation of RAI</u> Please identify the overlying and underlying aquifers at Mine Unit 1 if the 70 sand is the targeted ore zone.</p>	<p>CAMECO RESPONSE: Overlying the 70-Sand production target in Mine Unit 1 are the 80, 90 and 100-Sands. Because the 80-Sand is discontinuous within Mine Unit 1 and is a production target in the immediately adjacent Mine Unit 2, it is not considered a viable option as an overlying aquifer. The 90-Sand, continuous throughout the Mine Unit 1 area has been designated as the overlying aquifer for Mine Unit 1.</p> <p>Underlying the 70-Sand within Mine Unit 1 are the 60, 50, 40 and 30-Sands. Although absent from most of Mine Unit 1, where present, the 60-Sand coalesces with the 70-Sand, making the 60-Sand unsuitable as an underlying aquifer. Because the 50-, 40- and 30-Sands are production targets in adjacent mine units, they are not considered to be viable candidates as underlying aquifers. Underlying the 30-Sand in Mine Unit 1 is the Chugwater Formation comprised of approximately 305 meters (1,000 feet) of shale and siltstone forming a very effective aquitard across the Mine Unit 1 area. Because of this unique situation in Mine Unit 1, WDEQ/LQD has agreed that monitoring of an underlying aquifer within Mine Unit 1 will not be required. Text has been added to TR Section 3.3.3.3 to further describe the Mine Unit 1 overlying aquifer, production targets, and underlying aquitard.</p>	<p>The 50 Sand is designated the underlying aquifer to the production sand in Gas Hills Mine Unit 1. The text in the TR Section 3.3.3.3 has been updated to include this designation.</p>
<p>RAI 14</p>	<p>Response deemed sufficient by NRC</p>	<p>—</p>
<p>RAI 15</p>	<p>Response deemed sufficient by NRC</p>	<p>—</p>
<p>RAI 16</p>	<p>Response deemed sufficient by NRC</p>	<p>—</p>
<p>RAI 17 <u>Description of Deficiency</u> 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. <u>Basis for Request</u> 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. <u>Formulation of RAI</u> 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.</p>	<p>CAMECO RESPONSE: As discussed in the response to RAI-32, Cameco has identified mineral resources in the area defined as Mine Unit 5, but has not performed any mine unit geological development work in the area. The development of Mine Unit 5 will not take place for an estimated 10 to 15 years or more after the beginning of production, depending on various factors including the price of uranium. At the time of mine unit development, Cameco will assess the detailed site conditions for Mine Unit 5 including fault conditions, impacts from other previous mining in the area, and determine a production plan for the mine unit.</p> <p>Text has been added in TR Section 3.3.3.3 to identify which ore zone(s) will be targeted for extraction and the overlying and underlying aquifers in Mine Unit 5.</p> <p>Mine Unit 5 will cross two traceable faults, the North Thunderbird and South Thunderbird faults. Considerable attention will be given to mapping, hydrologic testing, and pattern planning in the vicinity of these faults. Patterns will not be installed across the North Thunderbird or South Thunderbird faults, but possibly on both sides of and at some distance from the fault plane, in the hanging and foot walls. Monitor Trend (MT) wells will be installed between patterns and the fault, on both the hanging and foot walls. These wells will be installed to ensure mining fluids are contained between patterns and MT wells and mining fluids do not reach faults and potentially migrate vertically along the fault plane. An explanation of MT wells can be found in Section 3.5.1.2 of</p>	<p>The process of developing Gas Hills Mine Unit 5 will entail the collection of detailed hydrogeological information (see RAI 12 response) including the assessment of hydrologic boundaries (i.e. faults) within the production sand and evaluation of any potential impacts of past surface and underground mining activities and reclamation as well as anticipated water quality changes in the aquifers of interest that may occur during operations. The Operations and Reclamation Plans in the Power Resources, Inc. dba Cameco Resources Gas Hills Permit to Mine No. 687 address baseline characterization, mine unit design, production and restoration activities in locations near previously mined areas that exhibit groundwater quality poorer than the proposed mine unit. The procedures were developed to prevent groundwater excursions or incursions during the production and groundwater restoration phases of operation and include a hydrologic evaluation of the proposed mine unit area. The procedures can be found in Operations Plan Section 5.5.3-Wellfield Setback from Mine Workings and Section 5.5.5-High TDS Groundwater Movement Assessment, and Reclamation Plan Section 2.2.2-Groundwater Restoration Strategy.</p> <p>Cameco recognizes the Umetco ACL site located north of proposed Gas Hills Mine Unit 5. Preventing an incursion from the Umetco site will factor into the wellfield design including minimum setbacks from the mine workings. The hydrologic testing plan for Mine Unit 5 will include pumping tests that monitor the sands affected by the Umetco ACL (the Western and Southwestern Flow</p>

	<p>the TR. An explanation of special considerations and fault mapping/testing can be found in TR Section 3.5.3.8. Text also has been added and clarified in TR Section 3.3.3.3.</p> <p>Due to the complexity of the Mine Unit 5 deposit as a result of overlapping multiple ore trends contained within one or more stratigraphic horizons, well twinning or recompletions will be used. As design of the mine unit continues, Cameco will evaluate the technical and economic merits for both well installation techniques and the most technically and economically viable plans will be developed and implemented in the future.</p> <p>Cameco Resources currently does not plan to produce from any unconfined aquifer. If in the future Cameco Resources does plan to produce from an unconfined aquifer, appropriate production procedures will be developed.</p>	<p>Regimes). The sands affected by the ACL will be identified in relation to the production, overlying and underlying aquifers of Mine Unit 5 so that wellfield production and groundwater restoration activities can be designed to avoid drawing water towards or into the wellfield pattern area.</p> <p>The text in the TR Section 3.3.3.3 has been updated to reflect this information.</p>
<p>RAI 18 <u>Description of Deficiency</u> 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.</p> <p><u>Basis for Request</u> 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.</p> <p><u>Formulation of RAI</u> 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.</p>	<p>CAMECO RESPONSE: All detailed information related to the potential use of multiple/twinned completions will be provided in the hydrologic testing proposal and the subsequent wellfield data package that is provided to LQD for review and comment and is made available for NRC review. Production and restoration schedules together with surety estimates will be provided with annual revised water balance/production and restoration schedules as these particular mine units are developed and prepared for production. Sections 3.4.2, 3.4.8, 3.5.2.4, and 6.1.4.5 of the TR have been revised to clarify and amplify the description of the purpose, well installation, baseline evaluation, production and restoration of multiple ore zone completions within a mine unit.</p>	<p>Existing developed as well as potential future mine units target ore horizons that are vertically stacked and within the same exempted aquifer. Stacked target ore horizons are always vertically separated from only a minor thickness of sediment. Regardless of the thickness and hydrologic connectivity of the intervening sediments between stacked ore horizons, a baseline aquifer characterization plan is developed for approval from the Wyoming Department of Environmental Quality – Land Quality Division (WDEQ – LQD), as required in Permit Number 633. The baseline aquifer characterization plan includes detailed methodologies to evaluate, and segregate if necessary, the baseline groundwater quality between the stacked ore horizons. In addition, a groundwater monitoring and aquifer testing strategy is presented within the plan to test the assurance that adjacent non-exempted aquifers are protected from mining and restoration activities. A description of restoration of stacked ore horizons is found in TR Section 6.1.4.8.</p> <p>Once the aquifer characterization plan is approved by the WDEQ – LQD and executed by Cameco, a comprehensive Wellfield Data Package is prepared and submitted to the State for approval and insertion into the Permit 633. Mining activities do not commence until the Wellfield Data Package is approved by the WDEQ – LQD and the document undergoes the Safety and Environmental Review Panel (SERP) process required in the NRC License SUA-1548. For an example of an approved Wellfield Data Package that addresses NRC concerns related to baseline characterization, groundwater monitoring, and safely mining and restoring stacked ore horizons, the NRC is directed to Volume III-V of Permit 633 which is the Wellfield Data Package for the Mine Unit 7 at Smith Ranch-Highland.</p> <p>TR Sections 3.4.8 and 3.5.2.4 have been updated with this additional information.</p>
<p>RAI 19</p>	<p>Response deemed sufficient by NRC</p>	<p>—</p>
<p>RAI 20</p>	<p>Response deemed sufficient by NRC</p>	<p>—</p>
<p>RAI 21</p>	<p>Response deemed sufficient by NRC</p>	<p>—</p>

<p>RAI 22 <u>Description of Deficiency</u> 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.</p> <p><u>Basis for Request</u> 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.</p> <p><u>Formulation of RAI</u> 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.</p>	<p>CAMECO RESPONSE: Cameco has been performing a casing leak investigation (CLI) within the C, E and F mine units for the past several years to determine if any shallow aquifers have been impacted due to the leakage of lixiviant from failed injection wells. Within mine units C, E and F, Cameco performs accepted mechanical integrity testing (MIT) procedures at 5 year intervals on all existing Class III UIC injection wells that receive lixiviant.</p> <p>Text which explains general MIT procedures and actions to be taken in any mine unit if any ground water contamination has been detected from casing leaks from MIT failures has been updated in TR Section 3.5.2.5.</p>	<p>Cameco has worked closely with the Wyoming Department of Environmental Quality – Land Quality Division (WDEQ – LQD) in establishing potential impacts resulting from casing leakage and in developing a characterization and corrective action strategy for current and future impacts, should they exist. Cameco has closely communicated progress and milestones with the NRC as this issue has evolved over the years, and are captured within the NRC ADAMS database. Below is a summary of major actions related to Casing Leak Investigations (CLI).</p> <ul style="list-style-type: none"> December, 1999: Cameco initiated and submitted an Environmental Audit Report to the WDEQ – LQD and TFN 3 2/290 was issued. August, 2000: WDEQ – LQD issuance of an Administrative Order of Consent related to Casing Leak Investigative necessary actions. October, 2000: Submittal of a CLI Compliance Schedule and Permit Revision to the WDEQ – LQD. 2001 through 2011: Mitigative and remedial actions related to casing leakage and the submittal of quarterly monitoring and progress reports to both WDEQ – LQD and the NRC. March, 2012: Development and submittal to the WDEQ – LQD and NRC of a CLI Sampling and Analysis Plan to further characterize potentially impacted areas and to evaluate past remedial and mitigative efforts. September, 2015: Termination of the August, 2000 Administrative Order of Consent. September, 2015 to Present: Work closely with the WQED – LQD to establish a path forward on past and future CLI’s, so that Permit 633 and NRC License SUA-1548 capture investigative, remedial, and mitigative methodologies. <p>Based upon past efforts described above, Cameco has developed a framework to remain compliant and address future and past Casing Leak Investigations. Cameco is currently closely working with both the WDEQ – LQD and the NRC to capture the CLI Compliance Framework within all associated Permits and Licenses.</p> <p>New Section 3.5.2.5.1, Summary of Major Actions Related to Casing Leak Investigations has been added to the TR to address casing leak performance issues.</p>
<p>RAI 23 <u>Description of Deficiency</u> 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.</p> <p><u>Basis for Request</u> 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</p>	<p>CAMECO RESPONSE: A total of 14 leak detection monitoring wells have been installed adjacent to PSR-2. Additionally, approximately 30 shallow wells in the adjacent C-North Mine Unit also serve to detect potential seepage from PSR-2. In order to detect seepage and characterize fluids in underlying sand horizons, a Characterization Plan has been developed in coordination with NRC personnel. Contained within the last inspection report issued by the NRC and dated December 23, 2013, NRC personnel concurred that Cameco should complete both its characterization of shallow groundwater and sand horizons that may receive fluid adjacent to PSR-2 and the potential for seepage from PSR-2. Ground water characterization methods have been developed by</p>	<p>A Corrective Action Plan to monitor, mitigate, and remediate potential seepage from the Purge Storage Reservoir 2 (PSR-2) has been developed and was submitted to the NRC on November 9, 2015 (ADAMS Accession Number ML15317A079). The NRC has provided concurrence with respect to corrective actions presented within the plan and Cameco has fully implemented those. NRC staff periodically reviews the status of corrective actions during their annual inspections.</p> <p>This Corrective Action Plan narrative has been added to TR Section 3.10.3.2.</p>

<p>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.</p> <p><u>Formulation of RAI</u> 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.</p>	<p>Cameco to determine whether shallow ground water has been impacted by seepage from PSR-2. These characterization methods consist of collecting static water levels and water samples from the above described shallow monitoring wells; chemical analysis of the samples for analytes indicative of waters entering PSR-2; and preparing maps using the analytical data to determine the potential that PSR-2 fluid may have impacted the shallow ground water. These data have been collected over a period of four consecutive quarters and has been used to develop a Draft Characterization Report. The Draft Characterization Report has been provided to NRC personnel for their review and comment. The data suggest that leakage has been detected from PSR-2. A Final Characterization Report will be submitted to the NRC near the end of the second Quarter, 2014, closely followed by a Corrective Action Plan.</p>	
<p>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.</p> <p><u>Basis for Request</u> 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.</p> <p><u>Formulation of RAI</u> 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:</p> <ol style="list-style-type: none"> The limiting extraction rate for the unconfined aquifer for all operations (including excursion capture) to prevent excessive dewatering. 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. Assurance that dissolved oxygen will be maintained at levels in the lixiviant to prevent “gas lock” when injected into the unconfined aquifer production zone. A strategy to detect and correct for “gas lock” in the unconfined aquifer production zone. 	<p>CAMECO RESPONSE: Cameco does not currently plan to mine an unconfined aquifer. Sections 2.2.6 (Smith Ranch), 2.3.6 (North Butte), 2.4.6 (Gas Hills), 2.5.6 (Ruth), and Section 3.3 detail geology and orebodies. The following are specific responses to RAI 24 subcategories:</p> <ol style="list-style-type: none"> Cameco Resources currently plans to mine only formations that are confined. Hydrostatic head is required to keep the mining chemicals (oxygen and carbon dioxide) currently used in the natural groundwater. Cameco will evaluate the technical merits and the techniques required to mine an unconfined orebody if and when a significant unconfined orebody is being evaluated for mining. Cameco does not currently plan to mine an unconfined aquifer. The technical details of how to mine an unconfined aquifer will be addressed during aquifer testing and technical evaluation if and when mining of an unconfined aquifer becomes feasible. Cameco currently does not plan on mining in an unconfined aquifer. The quantity of dissolved oxygen that can be injected into the stream is a simple calculation based on hydraulic head and water temperature. When a formation appears to lack adequate hydraulic head to maintain the concentration of oxygen that is normally used for mining, the maximum amount of oxygen gas that can be added is calculated. Mining in an unconfined aquifer could possibly require alternative oxidants such as hydrogen peroxide. Cameco does not currently plan to mine an unconfined aquifer. The injectivity into the formation drops when gas comes out of solution in the lixiviant. When this occurs, the operator shuts down the well, degasses 	<p>Cameco currently does not plan on producing in an unconfined aquifer. WDEQ requires that Cameco characterize the aquifer properties where the mine units are located by performing a comprehensive hydrologic tests. The characteristics of the aquifer are determined during mine unit hydrologic testing. Once the data from the aquifer test has been analyzed the mine unit characteristics are reported in the mine unit data package.</p> <p>Cameco has not produced from unconfined aquifers. Should resource scarcity and commodity price make production in unconfined and low head aquifers a possibility, Cameco will develop site specific plans for production in unconfined and low head aquifers. Language committing to not producing from unconfined aquifers without approval from LQD who administers the EPA UIC program for class III wells in Wyoming has been included in Section 3.4.2 of the TR.</p>

<p>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.</p> <p>F. An evaluation of the maximum drawdown and mounding expected during operations anywhere the unconfined aquifer.</p> <p>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.</p> <p>H. A strategy for excursion capture in the unconfined aquifer given the limiting extraction rate.</p> <p>I. A strategy for assuring complete sweep of the unconfined aquifer during restoration of given the mounding and dewatering patterns which will develop.</p> <p>An updated flare value which takes into account the vertical flow from mounding and dewatering patterns in the unconfined aquifer.</p>	<p>the well, and restarts the well without injecting gas until the flow returns to the well. Once the flow to the well is established, gas injection can resume at a lower rate. Gas locking limits the ability to contact the ore during mining, limiting the overall recovery during mineral extraction.</p> <p>E. Two phase flow is destructive to pumps, valves, and other equipment and is poor operating practice. During operations the pumping, extraction, and reinjection is operated in a closed loop that is kept under sufficient pressure to keep the dissolved gasses in solution. Keeping the system under pressure prevents the dissolved gas from coming out of solution in pumps and other critical equipment. Most of the oxygen that is injected into the formation is consumed by the uranium and other oxygen consumers in the orebody during mining. Having large oxygen returns to the production pumping system during mining is a waste of reagents. Once the uranium concentrations have reached their peak concentration, the amount of oxygen is slowly reduced until the pattern eventually depletes.</p> <p>F. The evaluation of the aquifers occurs during the hydrologic testing done before each mine unit goes into production. Cameco Resources currently does not plan to produce from an unconfined aquifer. Appropriate production plans will be developed in the future before producing from an unconfined aquifer.</p> <p>G. Cameco Resources currently does not plan to produce from an unconfined aquifer. Appropriate production procedures will be developed before producing from an unconfined aquifer.</p> <p>H. Cameco Resources currently does not currently plan to produce from an unconfined aquifer. Appropriate production procedures will be developed before producing from an unconfined aquifer.</p> <p>I. Cameco Resources currently does not currently plan to produce from an unconfined aquifer. Appropriate production procedures will be developed before producing from an unconfined aquifer.</p> <p>J. Cameco Resources currently does not currently plan to produce from an unconfined aquifer. Appropriate production procedures will be developed before producing from an unconfined aquifer.</p>	
<p>RAI 25</p>	<p>Response deemed sufficient by NRC</p>	<p>—</p>
<p>RAI 26</p>	<p>Response deemed sufficient by NRC</p>	<p>—</p>
<p>RAI 27</p>	<p>Response deemed sufficient by NRC</p>	<p>—</p>
<p>RAI 28</p>	<p>Response deemed sufficient by NRC</p>	<p>—</p>
<p>RAI 29 <u>Description of Deficiency</u> 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.</p> <p><u>Basis for Request</u> 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</p>	<p>CAMECO RESPONSE: The mineability of each mine unit will be determined during the mine unit specific development period, which will include aquifer testing. Should testing and development activities indicate that a mine unit or a portion of a mine unit exhibits unconfined conditions or an extremely low head condition that would make injection and recovery difficult or impossible,</p>	<p>Keeping oxygen in solution without static hydraulic head would make it very difficult to use gaseous oxygen as an oxidant and an alternative such as hydrogen peroxide would have to be considered.</p> <p>As was stated in the accepted RAI 10:</p>

<p>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.</p> <p><u>Formulation of RAI</u> 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.</p>	<p>Cameco will eliminate that mine unit or portion of the mine unit from the production schedule.</p> <p>The oxygen concentration discussed in the TR Section 3.5.3 is a general target concentration for the startup of mine units, and is reduced over time as mine unit production matures. Oxygen reacts with the formation and is totally consumed during the mining process. Gas locking is something Cameco does not want to happen as it would limit the ability to inject lixiviant into the formation and reduce the efficiency of the mining process. Oxygen concentrations sufficient to damage the down-hole pumps from cavitation have not occurred to date at the Smith Ranch Project. If gas locking were to occur, the injection wells would become gas locked and stop taking injection flow long before significant quantities of gas could reach the production wells. Additionally, the satellite/wellfield operators are diligent about checking for signs of gas locking and degas the header houses and reduce the oxygen concentration in the injection stream if and when gas locking appears to becoming a problem.</p> <p>As discussed in TR Section 3.5.3, hydrogen peroxide is not currently used as an oxidant at the Smith Ranch Project because oxygen is a less expensive reagent. If hydrogen peroxide were to be used, the reagent injection rate would be kept low enough so that outgassing would not be a problem. Text in TR Section 3.5.3 has been updated to clarify.</p>	<p>Cameco Resources currently does not plan to produce from any unconfined aquifer. If in the future Cameco Resources does plan to produce from an unconfined aquifer, appropriate production procedures will be developed. However, should individual mine unit development drilling and aquifer testing indicate that there are localized areas of low head or unconfined conditions, those areas will not be made a part of the mine unit production plan. The hydrological testing program to be performed at each mine unit is described in Sections 3.4.2 and 3.4.3 of the TR. This additional testing and modeling to be performed during the individual mine unit development process will serve to resolve any potential issues related to unconfined conditions. It should be noted that NRC evaluated this same information in their 2004 EA for the Gas Hills and concluded that Cameco’s commitment to perform additional mine unit testing and evaluation prior to mine unit operation (See Section 2.6.1 of the 2004 EA) was an acceptable approach for evaluating any potential confinement issues. The first paragraph of Section 3.3.3.3 of the TR has been revised to provide a commitment to performing pre-operational aquifer testing and evaluation.</p> <p>The evaluation of which oxidants would be used during a unconfined or low head aquifer mining would be part of the pre-operational evaluation of the mine unit.</p>
<p>RAI 30</p>	<p>Response deemed sufficient by NRC</p>	<p>—</p>
<p>RAI 31 <u>Description of Deficiency</u> 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.</p> <p><u>Basis for Request</u> 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.</p> <p><u>Formulation of RAI</u> 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.</p>	<p>CAMECO RESPONSE: ER Figure 3.1.9.1 has been included which specifies significant surface features within 2 km of Gas Hills mine unit 5, all features of the UMETCO mill tailings impoundment, the LTSB for the UMETCO mill tailings impoundment, and the location of monitoring wells associated with the UMETCO mill tailings impoundment ACL. The text in ER Section 3.1.8.2 and TR Section 2.4.2 has also been updated.</p>	<p>See response to RAI 17</p>
<p>RAI 32 <u>Description of Deficiency</u> 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.</p> <p><u>Basis for Request</u> 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</p>	<p>CAMECO RESPONSE: Cameco has identified mineral resources in the area which may become Mine Unit 5. However, the development of Mine Unit 5 will not take place for an estimated 10 to 15 years or more after the beginning of production, depending on various factors including the price of uranium and the economics associated with the ore contained within Mine Unit 5. Cameco has not yet performed any detailed geological or hydrological analysis of the ore zone contained within Mine Unit 5, so cannot provide the requested information at this time. Cameco will assess the detailed site conditions for Mine Unit 5 during the mine unit 5 geological and hydrological delineation process, which typically occurs one to two years prior to commencing production in a mine unit. During this process, Cameco will characterize the geological and hydrological nature of the mine unit, including the potential</p>	<p>See response to RAI 17</p>

<p>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.</p> <p><u>Formulation of RAI</u> 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.</p>	<p>influence of faulting, historical mining operations and the impacts to/from the Umetco tailings/ACL situation. Ground water modeling will be a part of this evaluation. All information related to the questions raised in RAI-32 will be provided with the hydrological testing document and the subsequent wellfield data package that will be submitted to the LQD for review and comment prior to construction of the mine unit.</p>	
<p>Section 4 – Effluent Control Systems</p>		<p>—</p>
<p>RAI 33</p>	<p>Response deemed sufficient by NRC</p>	<p>—</p>
<p>RAI 34</p>	<p>Response deemed sufficient by NRC</p>	<p>—</p>
<p>Section 5 - Operations</p>		<p>—</p>
<p>RAI 35</p>	<p>Response deemed sufficient by NRC</p>	<p>—</p>
<p>RAI 36</p>		<p>Response to be included in next submittal</p>
<p>RAI 37</p>		<p>Response to be included in next submittal</p>
<p>RAI 38</p>		<p>Response to be included in next submittal</p>
<p>RAI 39</p>		<p>Response to be included in next submittal</p>
<p>RAI 40</p>		<p>Response to be included in next submittal</p>
<p>RAI 41</p>	<p>Response deemed sufficient by NRC</p>	<p>—</p>
<p>RAI 42</p>	<p>Response deemed sufficient by NRC</p>	<p>—</p>
<p>RAI 43</p>		<p>Response to be included in next submittal</p>
<p>RAI 44</p>		<p>Response to be included in next submittal</p>
<p>RAI 45</p>		<p>Response to be included in next submittal</p>
<p>RAI 46</p>		<p>Response to be included in next submittal</p>
<p>RAI 47</p>		<p>Response to be included in next submittal</p>
<p>RAI 48</p>		<p>Response to be included in next submittal</p>
<p>RAI 49</p>	<p>Response deemed sufficient by NRC</p>	<p>—</p>
<p>RAI 50</p>	<p>Response deemed sufficient by NRC</p>	<p>—</p>

RAI 51	Response deemed sufficient by NRC	—
RAI 52		Response to be included in next submittal
RAI 53		Response to be included in next submittal
Section 6 – Ground Water Quality Restoration, Surface Reclamation, and Facility Decommissioning		
RAI 54	Response deemed sufficient by NRC	—
RAI 55	Response deemed sufficient by NRC	—
RAI 56	Response deemed sufficient by NRC	—
RAI 57	Response deemed sufficient by NRC	—
<p>RAI 58 <u>Description of Deficiency</u> 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.</p> <p><u>Basis of Request</u> 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.</p> <p><u>Formulation of RAI</u> 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.</p>	<p>CAMECO RESPONSE: Cameco will consult with NRC prior to performing additional restoration stability monitoring quarterly after the first four quarters of monitoring to determine if additional monitoring will be required. Should the stability monitoring show that the mine unit is not stable, Cameco will continue to monitor quarterly for up to three additional years. After three years Cameco will discuss the statistical analysis of the data, an alternative monitoring plan, and a corrective action plan as part of an ACL application to the NRC. Cameco will apply appropriate ground water statistical and modeling methodologies to analyze the groundwater quality data and to determine any potential trends. Additional language has been added to the description of the restoration stability sampling program provided in TR Section 6.1.5.2.</p>	<p>The minimum period for stability monitoring is one year as defined by the current WDEQ Permit to Mine 633. The stability report for Mine Unit One assumed that the one year would include five sampling events which would be one end of mining sample and four quarterly samples going forward. In practice, eight rounds of sampling was completed on Mine Unit One to improve the quality of the statistical analysis. Cameco has demonstrated with the Mine Unit One ACL application that sufficient stability samples will be taken to obtain a robust statistical analysis of the restored mine units (up to Three years.) Additionally, there is a ground water monitoring program for mine unit after an ACL is approved. The monitoring program for Mine Unit One is proposed to be monitored for an additional three years following the approval of the ACL application. The final number of samples required for the stability statistical analysis will be determined on a mine unit by mine unit basis. A clarification of the stability sampling program has been included in Section 6.1.5.2.</p>
RAI 59	Response deemed sufficient by NRC	—
<p>RAI 60 <u>Description of Deficiency</u> Section 6.4 of the TR is not consistent with acceptance criterion (3) of Section 6.4.3 of the SRP.</p> <p><u>Basis for Request</u> 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.</p> <p><u>Formulation of RAI</u> Please ensure that procedures for conducting post-reclamation and decommissioning radiological surveys meets the acceptance criteria provided 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 benchmark approach provided in Appendix E of the SRP, including demonstration of As Low As Is</p>	<p>CAMECO RESPONSE: Please see responses to RAI 38 and RAI 45.</p>	<p>Cameco was required by WDEQ to pick up a few spills after their occurrence. While the areas were scanned and the material removed was sampled before shipping Cameco does not consider the areas clean for decommissioning. Cameco has the areas in question mapped and they will be included in the final decommissioning plan and testing program.</p>

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		—
	Responses deemed sufficient by NRC	—