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Responses to NRC Requests for Additional Information Dated February 12, 2016 Sweetwater Uranium Project Docket Number: 40-8584 Source Material License SUA-1350

June 2016

Prepared for:

Kennecott Uranium Company
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Rawlins, Wyoming 82301-1500

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Signature Page

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The Nuclear Regulatory Commission (NRC) in a letter dated February 12, 2016 prepared a second Request for Additional Information (RAI) regarding Kennecott Uranium Company's (KUC's) source material license application request for the Sweetwater Uranium Project, License SUA-1350. Each RAI, and the corresponding response, is presented herein—the RAI is listed in bold font with the response immediately following. Supporting figures are embedded in the responses. All references and attachments are provided at the end of the document.

COMPLIANCE WITH THE REQUIREMENTS OF 10 CFR 51.60

RAI 1

Provide the Environmental Report (ER) or a supplement to an ER for the July 24, 2014 license renewal following the guidance in NUREG-1748, *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs* (NRC, 2003).

KUC has prepared under separate cover a stand-alone document in the form of a Supplemental Environmental Report (ER). The Supplemental ER primarily incorporates by reference existing information presented in previously submitted reports by the licensee to the NRC, or in NRC documents prepared in response to those submittals. The Supplemental ER was prepared in accordance with guidance provided in NUREG-1748.

RAI 2

The request for license renewal (KUC, 2014) includes Section 1.3 "Proposed Action." However Section 1.3 only talks about proposed activities. Identify and discuss based on the guidance provided in NUREG-1748 the following: a) proposed action, b) no-action alternative, and c) other reasonable alternatives to the proposed action.

The Supplemental ER presents the proposed action, the no action alternative, and a discussion of other reasonable alternatives in Sections 2.1 and 2.2.

RAI 3

Regarding the zoning of facility site and the vicinity provide the following: a) the current zoning of the land the facility lies on, and b) the current zoning of the land within 5 miles from the site.

The Supplemental ER presents the current Sweetwater County zoning in Section 3.1.

RAI 4

Regarding waste management provide the following: a) the estimated amount of waste (solid and liquid) generated per year when the facility goes into operation mode; b) the estimated amount of waste (solid and liquid) generated per year while the facility is in standby mode; c) for (a) and (b) above, i) the off-site waste disposal locations, and ii) the number of vehicles expected to be used on an annual basis for the transportation of wastes to off-site locations; and d) environmental impacts for i) on-site waste disposal and ii) off-site waste disposal.

The Supplemental ER presents a discussion of wastes and potential environmental impacts for wastes in Sections 3.12 and 4.13.

RAI 5

For the environmental impacts on water resources provide the following: a) is the current contamination discussed in (KUC, 2014) from i) an existing leak, ii) a previous leakage that has been repaired, or iii) a combination of (i) and (ii)?; and iv) if the answer for (a) is (a,ii) provide the technical basis as to why the contaminants have not been contained for more than 30 years since the leakage from the tailings impoundment synthetic liner was repaired in 1984, despite that a Corrective Action Program is in place to contain the contamination; b) address impacts of contaminants leakage on surface water and ground water resources for i) standby mode, and ii) future operation mode as more contaminants will be generated; c) address spread of the contaminants discussed in (KUC, 2014) beyond the site boundary including the

following: i) impacts on surface water resources, ii) impacts on ground water resources, iii) monitoring measures, and iv) mitigation measures.

Response to RAI 5, a, i)

The current constituents in the groundwater discussed in KUC (2014a) are a combination of natural background and a previous leak in the southeast corner of the tailings impoundment and the mill's catchment basin in the early 1980s The leaks and resulting groundwater condition are discussed in *Final: Ground Water Plume Interpretation* (Telesto, 2009).

Response to RAI 5, a, ii)

The historical leak from the tailings impoundment was repaired soon after it was discovered. Continual monitoring has not detected any further leakage and remnant constituents in the vadose zone are not transported in large enough quantities to further impact the underlying Battle Spring Aquifer (Telesto, 2015b). The catchment basin was in use during milling operations and no fluids have been contained within it since the mill went into standby status in April 1983 (Telesto, 2009). The catchment basin has been removed during the course of soil remediation in this area (KUC, 2008) and the mill will not use a similar catchment basin when operations resume. Therefore, from the standpoint of the facilities, fluids are being contained.

Furthermore, within the Battle Spring Aquifer, the leaked constituents have been contained. The fluids within the aquifer have been fingerprinted (Telesto, 2009; Telesto, 2015a; Telesto, 2015b). Telesto (2009) evaluated signatures in the water quality data for monitoring wells around the existing tailings impoundment, catchment basin area, and diesel contamination area. Telesto noted that sulfate in excess of 400 mg/L in groundwater is almost exclusively found in site monitoring wells (TMWs), and not in background wells as reported by Shepherd Miller, Inc. (1994). Groundwater samples in TMWs sometimes had high sulfate concentrations but relatively lower uranium concentrations, which is indicative of process waters with uranium removed. Additionally, the ratio of sulfate to total dissolved solids (TDS) of approximately 0.5 is a strong indicator of process waters.

Telesto (2009) noted a distinct relationship that the sulfate to TDS ratio was consistently at 0.5 when sulfate concentrations exceeded 400 mg/L, and at much lower ratios when sulfate concentrations were less. Thus, Telesto concluded that the primary fingerprint of process-affected liquids in the groundwater is sulfate above 400 mg/L.

The corrective action plan (CAP) has been in place since the early 1980s and has created a groundwater sink. The escaped fluids (as identified by the fingerprint) have migrated within this groundwater sink for the past 30 years, and are making their way to the CAP's extraction wells. Therefore, the leaked fluids are currently and will continue to be contained within the CAP influence area (Telesto, 2015b). Due to the natural mineralization and structure of the Battle Spring Aquifer, we anticipate that it will be tens of years before the fingerprinted groundwater is removed from the aquifer (Telesto, 2009; Telesto, 2015b).

There is a **chance** that some of the fluids have migrated beyond the NRC's bonded area boundary. KUC has put forth a plan (Telesto, 2015b) to the NRC to characterize this potential and is awaiting concurrence. Depending on the results, KUC is committed to expanding the CAP to ensure continued containment should it be determined that remnant process fluids have traveled beyond the current CAP influence.

Response to RAI 5, b)

No surface water impacts have resulted from historical leakage. The impacts of past leakage on groundwater resources is well documented (see Supplemental ER Sections 3.4 and 4.4). Groundwater impacts from historical leakage have been and will continue to be mitigated through KUC's CAP regardless of standby or operational status.

The likelihood of future operational fluids contaminating groundwater or surface water resources is low. Through design in accordance with 10 CFR 40 Appendix A and past lessons learned, KUC has developed plans for future tailings impoundment and evaporation pond operations, monitoring, and reclamation (and the NRC has concurred in their 1999 Environmental Assessment Finding of No Significant Impact) that the project as designed will:

- Comply with 10 CFR 40 Appendix A, [double synthetic liners with leak detection between, over three feet of clay as a barrier below the bottom synthetic liner (Shepherd Miller, Inc., 1997c; NRC, 1999)]
- Address the natural environmental and operational causes of past failures

Therefore, under either scenario, past leakage is currently and will continue to be contained and mitigated, and no future impacts from continued operations are anticipated.

Response to RAI 5, c, i and ii)

Figure 1 provides a synopsis of the current groundwater impacts from the historical tailings and catchment basin releases. The area of influence from the tailings release is contained beneath the tailings impoundment footprint and extends to the west approximately 500 feet. The area of influence from the catchment basin release is currently projected to extend approximately 250 feet west of the site boundary (defined as the NRC bonded area boundary). There is a **chance** that some of the fluids have migrated beyond the NRC's bonded area boundary. KUC has put forth a plan (Telesto, 2015b) to the NRC to characterize this potential and is awaiting concurrence. Depending on the results, KUC is committed to expanding the CAP to ensure continued containment should it be determined that remnant process fluids have traveled beyond the current CAP influence.

Telesto (2009) describes the contaminant fate and transport mechanisms that resulted in the distributions shown in Figure 1. No surface waters exist in the vicinity and therefore, no impacts to surface waters have taken place due to the historical releases from the catchment basin and tailings.

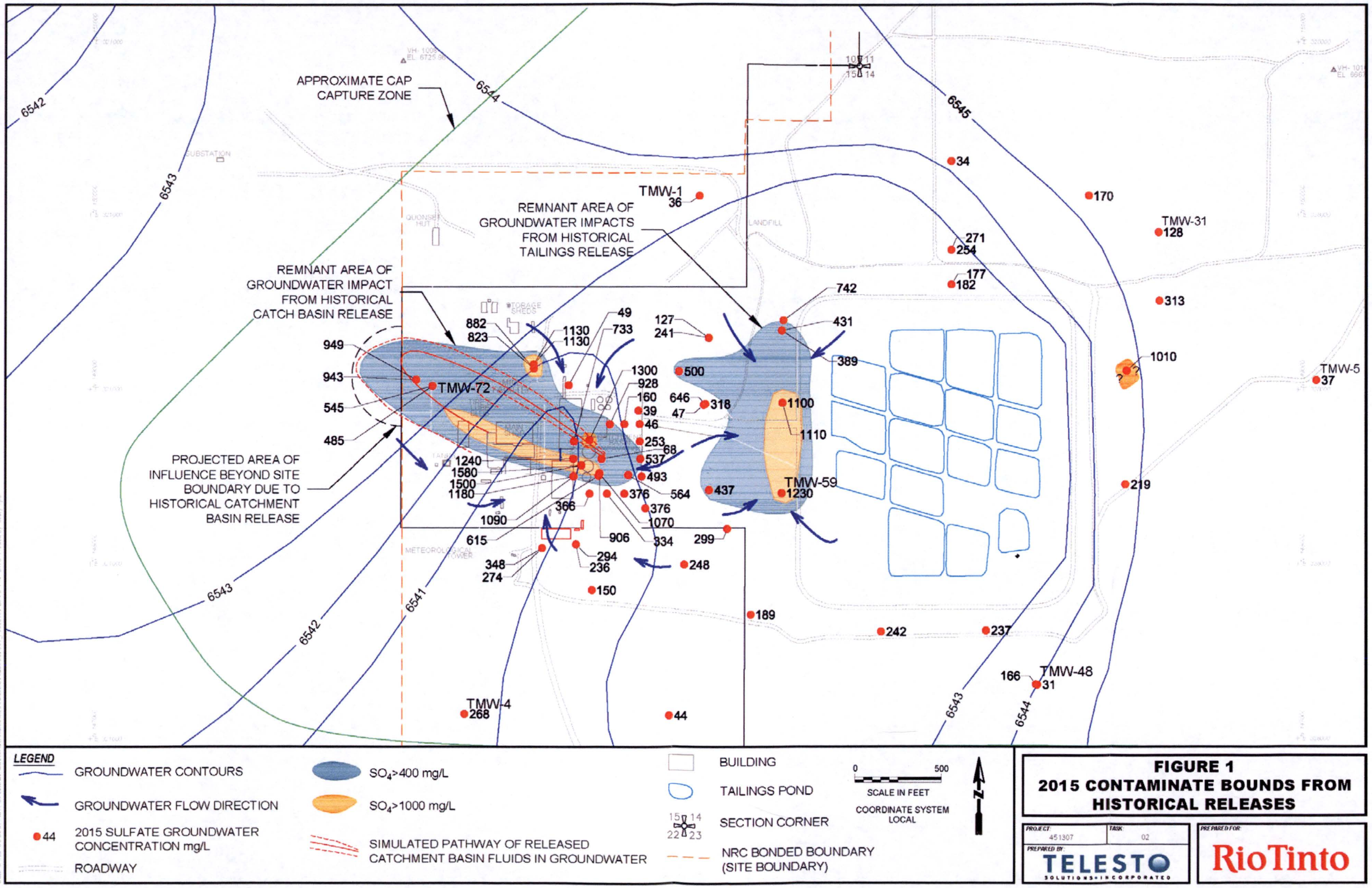

Figure 1 2015 Contaminant Bounds from Historical Releases

Response to RAI 5, c, iii)

KUC will continue to monitor groundwater throughout its operational boundary irrespective of operational status. The spot sulfate concentrations shown in Figure 1 are an example of recent monitoring efforts. KUC has proposed to extend the monitoring system to the west of the site boundary in order to determine if effects from catchment basin seepage are within the projected area of influence as shown in Figure 1, and is awaiting NRC concurrence with the plan.

Response to RAI 5, c, iv)

The CAP, approved by the NRC, is the mitigation measure implemented by KUC to contain both the tailings and catchment basin releases. The primary component of the CAP is hydraulic containment, which (based upon existing measurements and groundwater simulations) appears to be functioning as planned. Figure 1 shows the current capture zone of the CAP system.

Sulfate above 400 mg/L in the groundwater system is the key indicator parameter (fingerprint) of groundwater that has been influenced by operational releases (Telesto, 2009). KUC will consider the influences of historical releases of operational fluids mitigated when sulfate concentrations in the aquifer reach concentrations below 400 mg/L. The time to reach a mitigated status is decades into the future due to:

- Low groundwater gradients and resulting velocities
- Historical changes in groundwater flow directions that created areas of stagnation where movement of operational water in the groundwater system was further retarded
- Typical response of capture systems seen in contaminant plumes where newly introduced constituents transport into non-impacted pore space and can only be removed through a much slower diffusion driven process

KUC is committed to continued operation of the CAP regardless of the operational status of the mill. Use of the CAP to supply mill feed water (with a commensurate increase in the pumpback rate from the present one) has been considered for resumed operation of the mill. Such an increase in the pumpback rate may hasten the remediation process.

RAI 6

Address impacts on water quality due to future operational mode for groundwater contamination for the following: a) surface water resources, b) ground water resources, and c) Sweetwater Uranium Project's wells described in (KUC, 2014a) including the following: i) the potable water wells used as sources of drinking water in the area, ii) the three water wells with tanks for livestock and wildlife watering in the general area, iii) the wells equipped with solar powered submersible pumps for livestock and wildlife watering in the general area, and iv) the other wells in the area, including wells on Bureau of Land Management lands.

The Supplemental ER presents a discussion of water quality and potential environmental impacts to water quality in Sections 3.4 and 4.4.

RAI 7

For soil contamination address the following: a) provide the current status of soil contamination, b) provide remediation measures used to reduce soil contamination levels, and c) in the responses to items (a) and (b) include the current status and remediation measures of surface and subsurface contamination discussed in the "Response to Comments Regarding Natural Uranium and Thorium-230 Remediation in Subsurface Soils," (KUC, 2005).

The Supplemental ER presents a discussion of regional soils and historically contaminated site soils, and potential environmental impacts on soils in Sections 3.3 and 4.3, respectively. Section 5.0 discusses mitigation efforts to remediate historically contaminated site soils.

RAI 8

The Request for License Renewal Source Material (KUC 2014) states that staffing on site at its present level of standby mode is four (4) KUC employees. What is the expected number of employees during future operations?

The Supplemental ER presents anticipated numbers of employees in the discussion of the proposed action in Sections 1.2 and 4.0.

RAI 9

Provide the following transportation information: a) provide the following for the roads used to access the facility: i) the names of the roads, ii) the condition of the roads, iii) current use/traffic of these roads; b) number of vehicles in and out of the facility for each road from (a, i) from above during: i) standby mode, and ii) future operation mode; and c) transportation impacts for (b, i) and (b, ii) from above.

The Supplemental ER presents a discussion of transportation and potential impacts upon the transportation network in Sections 3.2 and 4.2.

RAI 10

Provide the following information for visual or scenic resources: a) all nearby natural or man-made features as distinct visual or scenic resources within 50 miles from the facility site; and b) the impact of the facility on visual or scenic resources.

The Supplemental ER presents a discussion of visual or scenic resources and potential impacts on these resources in Sections 3.9 and 4.9.

RAI 11

The facility has not been operated for several decades thus: a) are there any activities to prepare the facility and equipment before the facility begins future operations; b) what is the impact of the activities to the environment; c) what is the current condition of equipment; d) is the equipment operational; and e) if the equipment is not operational what is needed to make them operational and what is the impact to the environment?

Measures to be taken to make the mill operational again are discussed in the Supplemental ER in Sections 2.1.2 and 3.12, and potential environmental impacts of these measures are discussed in Section 4.13.

RAI 12

The Council on Environmental Quality regulations implementing NEPA define cumulative effects as "the impact on the environment which results from the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). Provide the following: a) current and reasonably foreseeable future projects within 50 miles from the site and; b) cumulative impacts of the proposed action for all resources.

Current and reasonably foreseeable future projects and potential cumulative effects are discussed in Section 2.3 of the Supplemental ER.

RAI 13

Provide mitigation measures for all resources.

Mitigation measures are discussed in Section 5.0 of the Supplemental ER.

SAFETY REVIEW

RAI 1

The applicant should document the results of review of data sources (e.g., latest USGS seismic hazard map), publications and other resources that may update or change the site characterization information for the following: a) adjacent lands and waters, b) population distributions, c) meteorology, d) geology/hydrogeology, and e) seismicity.

The Supplemental ER presents updated or otherwise modified site characterization throughout its Section 3.0.

RAI 2

The applicant should identify how the proposed location of the new tailings impoundment, or an alternative location, will satisfy the POC and detection monitoring requirements of 10 CFR 40, Appendix A, Criteria 5B(1), and 7A.

POC Requirement

KUC satisfies the point of compliance (POC) requirements of 10 CFR 40, Appendix, Criteria 5B(1) and 7(A) through engineering design, and approved points of compliance monitoring. The design reduces the likelihood of a leak and improves the capacity to detect a leak should one occur.

KUC proposed a design of new tailings impoundments to be in conformance with the 13 criteria of 10 CFR 40 Appendix A and proposed a location for new tailings impoundment(s) which, for the purpose of tailings water management and leak detection, would address two primary objectives: 1) minimize the opportunity for tailings fluid releases, and 2) provide the earliest practicable warning in the event of leakage. The NRC reviewed KUC's Final Design volumes and subsequently prepared its 1999 EA (NRC, 1999), concluding:

> *"Because of new technology and an improved design, ground water in the vicinity of the Site should not be adversely impacted by the resumption of mill operations.*

The new tailings impoundment will be lined with a layered system composed of two flexible membrane synthetic liners over a three-foot minimum thickness of compacted clay, as specified in Final Design Volumes I (Figure 4-1), IV, and VII (KUC, 1997 g, c, f). A leak detection and recovery system installed between the two synthetic liners will be monitored regularly by the licensee. In addition, ground-water monitoring wells will be located immediately down gradient of the tailings impoundment to detect any potential ground-water contamination as early as possible, as required by 10 CFR 40, Appendix A, and 40 CFR 264.221.

"Management of the tailings impoundment during site operations is also designed to minimize the potential for ground-water contamination. The tailings impoundment is designed to dewater tailings through the use of a process water recovery system (PWRS). The PWRS will be installed above the liner and beneath the tailings, to continually dewater the tailings above the liner. This will further protect ground water by eliminating a hydraulic head in the tailings pile which could enhance infiltration of the tailings fluid into the area surrounding the tailings pile."

The liner design, detailed in the Final Design Volume IV (Shepherd Miller, Inc., 1997a), includes a PWRS to limit head over the liner system, with recovered water pumped either to evaporation ponds or recycled to the mill for reuse. The liner system includes three barriers to downward movement of tailings fluid:

- A 60 mil geosynthetic high density polyethylene liner
- A 40 mil geosynthetic high density polyethylene liner
- A three-foot thick clay layer, with a field permeability equal to or less than 1×10^{-7} cm/sec

The top pair of liners are separated by a leak detection and recovery system (LDRS). The underlying clay layer provides both restriction to flow due to the low permeability but also attenuation capacity for positively charged ions (e.g., uranium, radium).

Three monitoring wells are proposed as the earliest practicable indication of the unlikely event of tailings fluid leaking through all three liner layers. The three monitoring wells meet objectives of 10 CFR 40, Appendix A, Criteria 5B(1), to "*...provide the earliest practicable warning that the impoundment is releasing hazardous constituents to the ground water*" and *"...provide prompt indication of ground-water contamination on the hydraulically downgradient edge of the disposal area."*

Kennecott proposed, and the NRC approved, monitoring wells TMWs 31, 75, and 78 as the POC monitoring locations for the first new tailings impoundment. TMWs 75 and 78 would be located closest to the LDRS collection sump, which would be located in the southwest corner of the first impoundment. Each of these wells would require an upward extension of their casing because each is located within the footprint of the exterior side slopes of the impoundment—thus, each monitoring well is very close to the storage cell. In the event that a leak is detected at any of these monitoring wells, a corrective action program can be put in place.

These three monitoring wells are generally outside of the area of groundwater that has been impacted by historical releases as indicated in the 2015 CAP review maps. All three (3) wells are outside of the 400 mg/L sulfate contour, which signifies the edge of impacted groundwater from historical releases as defined in response to RAI No. 5 presented previously in this document. Additionally, the wells are outside of the area of historically elevated uranium concentrations, and TMWs-31 and 78 are beyond the area of historically elevated Radium-226/228 and TDS. TMW-75 exhibits Radium-226/228 concentrations below those reported in the historically elevated areas, and reports TDS concentrations slightly over 500 ppm. All three monitoring wells have historically (30 years of data exist for these wells) exhibited low concentrations of the three indicator parameters identified for detecting a potential leak from the new tailings impoundments.

As required in 10 CFR 40, Appendix A, Criteria 7A, KUC proposed and the NRC accepted three indicator parameters for detection of a leak. These three indicator parameters were proposed in the Background Ground Water Quality and Detection Standards Addendum to the Revised Environmental Report (Shepherd Miller, Inc., 1996): 1) pH due to the acidity of the mill tailings, 2) conductivity, due to its proportionality to ions in the tailings fluid and as a ready contrast to low conductivity levels in the groundwater system, and 3) chloride, due to high concentrations in the mill tailings and its highly dispersive properties. These three indicator parameters provide a marked contrast between tailings fluid and the natural groundwater system, even for groundwater at the edge of the area affected by the

1983 leak. Thus, progression of a significant leak from the impoundment could be quickly detected.

Detection Monitoring

The monitoring of fluid levels in the PWRS would provide the first warning of a potential leak, and to determine if action is necessary to modify the water management plan for the tailings impoundment. In addition to the POC monitoring wells for detecting a leak and the PWRS monitoring, the tailings facility liner design provides a high level of leak detection. In the event of a leak in the top liner, the LDRS will drain fluids to a sump from which collected fluids can be evacuated as indicated in the Final Design Volume VII (Shepherd Miller, Inc., 1997b). Once constructed and the tailings facilities begin operation, KUC would monitor the sump as part of their routine monitoring program. The significance of a leak would be measured by the quantity of fluid detected in the sump. Shepherd Miller, Inc. (1997b) calculated three quantities of a potential leak:

1. A de minimis, or the minimum expected quantity of fluid seepage
2. A design-level leakage rate
3. An action leakage rate (ALR) between the de minimis and design-level leakage rate.

The ALR would trigger action by KUC to: 1) provide notice to the NRC, 2) actively pump from the LDRS, and 3) institute daily monitoring of LDRS fluid levels. The objective of these responses to a detected ALR would be to minimize head over the lower geosynthetic liner and reduce the potential for leakage beneath the secondary liner synthetic liner.

The primary operational rationale for proposing the location of new tailings north and east of the existing impoundment is proximity to the mill. A more distant location would require a longer tailings delivery line and greater potential for leakage therefrom, especially in cold weather. Longer tailings lines also have a greater potential for plugging. Thus, the more protective location for the tailings impoundments against potential impact to local water resources is to place them as close as reasonably achievable to the mill, and to the existing impoundment.

RAI 3

The applicant needs to provide a copy of the actual MILDOS input parameters for each receptor location that computed the annual average Rn-222 concentrations using the actual 2014 source terms from the tailings impoundment from the MILDOS-AREA computer code.

A hard copy of the MILDOS-AREA code input and output parameters were submitted to the NRC by cover letter dated March 29, 2016 (KUC, 2016).

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