Rio Algom Mining LLC

January 13, 2017

Mr. Jeffrey Whited
Materials Decommissioning Branch
Division of Decommissioning, Uranium Recovery and Waste Programs
Office of Nuclear Material Safety and Safeguards
Two White Flint North, Mailstop T-8F05,
11545 Rockville Pike
Rockville, MD 20852
Docket Number: 40-8905

Response to NRC Request for Additional Information dated December 14, 2016 RE: Request for Cessation of Components of the RAML Environmental Monitoring Program at the Ambrosia Lake Facility License Number SUA-1473

Dear Mr. Whited,

By letter dated December 14, 2016, Rio Algom Mining LLC (RAML) received from the U.S. Nuclear Regulatory Commission (NRC) a request for additional information (RAI) regarding RAML's request to discontinue components of the environmental monitoring program at the Ambrosia Lake Facility. The NRC, as expressed in this letter, has no concerns with the discontinuance of 1) quarterly environmental dose monitoring using passive dosimeters at air sampling locations, 2) quarterly vegetation sampling at air sampling locations, 3) annual soil sampling at air sampling locations, and 4) annual sediment sampling. The cessation of these monitoring activities will be effective starting January 1, 2017.

The NRC RAI regarding RAML's request to discontinue 1) quarterly airborne radon-222 sampling and 2) quarterly airborne radioparticulate sampling is presented and addressed below.

NRC Request for Additional Information:

"Please explain why the data show compliance with the public dose limits and justify not monitoring for airborne particulate in the unrestricted areas surrounding the site. It is expected that the licensee will provide calculated exposures to the nearest resident for the most recent one-year period, the calculation method utilized, and a statement identifying any assumptions used for the calculations."

RAML Response:

The data presented in RAML's request for the cessation of monitoring were intended to show monitoring trends and environmental levels over time, not to demonstrate compliance with public dose limits. RAML demonstrates compliance with public dose limits (as it has for the past 10 years) by using the option in 10 CFR 20.1302 (b)(1) which provides for demonstrating by measurement or calculation that the total effective dose equivalent to the individual likely to receive the highest dose from the licensed operation does not exceed the annual dose limit.

The method used to demonstrate compliance with public dose along with underlying assumptions, is presented below.

Assumptions for this method are:

- The Substation location shown on Figure 2 of RAML's request for cessation is used to conservatively estimate background for the site. It is conservative since it likely does not capture airborne releases from some of the unlicensed sources of TENORM north and west of the site. Therefore, it underestimates the true background condition.

- The Section 17 VH 6 location shown on Figure 2 of RAML's request for cessation is representative of the highest potentially exposed individual. This location is near the closest resident to the site.

- Dose Conversion Factors (DCFs) derived from Effluent Concentrations in 10 CFR 20, Appendix B, Table 2 are used, with the exception of radon-222 and its decay products. The DCF for radon-222 and its decay products was adopted from ICRP Publication 65 "Protection Against Radon-222 at Home and at Work."

The *dose from airborne radioparticulates* is calculated using the following equation.

$$D_R = (C_{RR} - C_{RB}) \times DCF_R \qquad \text{(Equation 1)}$$

Where:

D_R = Dose to nearest resident from radionuclide R ($\frac{\text{mrem}}{\text{year}}$)

C_{RR} = Annual average concentration of radionuclide R at nearest resident location ($\frac{\text{uCi}}{\text{ml}}$)

C_{RB} = Annual average concentration of radionuclide R at background location ($\frac{\text{uCi}}{\text{ml}}$)

DCF_R = Dose Conversion Factor for radionuclide R (mrem/year per $\frac{\text{uCi}}{\text{ml}}$)

The units are millirem per year (mrem/year) and microcuries per milliliter (μCi/ml). The total dose, $\sum D_R$, from airborne radioparticulates is the sum of those contributed by natural uranium, thorium-230, radium-226, and lead-210.

The *dose from radon and its short-lived decay products* is calculated using the following equation.

$$D_{Rn} = \frac{(C_R - C_B) \times EF}{100} \times \frac{8760}{170} \times OF \times DCF_{WLM} \qquad \text{(Equation 2)}$$

Where:

D_{Rn} = Dose to nearest resident from radon-222 and its decay products

C_R = annual average concentration of radon-222 at nearest resident (pCi/L)

C_B = annual average concentration of radon-222 at background location (pCi/L)

EF = equilibrium fraction of radon-222 decay products. (Note: 0.21 has been used at the facility)

8760 = the number of hours in a year

170 = the number of working hours in a month used to calculate a "Working Level Month" (WLM)

OF = the fraction of time the resident is at home (0.75 has been used at the facility)

DCF_{WLM} = DCF of 1000 mrem/WLM

The unit not defined previously is picocuries per liter (pCi/L).

The *external dose* is calculated using the following equation.

$$D_E = (D_{ER} - D_{EB}) \times 4 \times OF \qquad \text{(Equation 3)}$$

Where:

D_E = External ose to nearest resident

D_{ER} = Average quarterly external dose measured at the nearest resident $(\frac{\text{mrem}}{\text{quarter}})$

D_{EB} = Average quarterly external dose measured at the backgroun loation$(\frac{\text{mrem}}{\text{quater}})$

OF = the fraction of time the resident is at home (0.75 has been used historically)

4 = the number of quarters per year

The total dose is the sum of Equations 1 through 3; i.e., $\sum D_R + D_{Rn} + D_E$.

Table 1 lists the values used in these equations and results for Year 2015. The total dose to the nearest resident is 28.2 mrem/year, of which 86.3 percent is attributable to radon-222 and its decay products. The remaining doses were from the external pathway and inhalation of long-lived radionuclides. The latter contributed less than one percent of the total dose.

RAML also evaluates annually other scenarios for public dose assessment: e.g., an occasional visitor and delivery person. The doses for these each of these potential receptors are less than 10 percent of estimate for the nearest resident. The contributions by each pathway to the respective doses are similar to those for the nearest resident.

Based on the site-specific data adopted in the calculation and conservative assumptions used to estimate the dose to the highest exposed individual, the dose is below the 100 mrem/year limit to the public. Thus, the data show compliance with the public dose limits and justify not monitoring for radon-222 and airborne radioparticulates in the unrestricted areas surrounding the site. For these reasons, we believe RAML has complied with the requirements of 10 CFR 20.1302, and we respectfully repeat our request for the cessation of monitoring for radon-222 and airborne radioparticulates.

We look forward to the NRC's prompt review and approval of this request. Please contact me at (209)736-4803 with any questions.

Best Regards,
Rio Algom Mining LLC

Theresa Ballaine
Manager

cc: NRC Document Management
Mike Schierman, Environmental Restoration Group

Table 1. Values and results associated with Equations 1 through 3

Pathway				
	Radionuclide	Variable	Value or Result (bolded)	Unit
Inhalation of radioparticulates (Equation 1)	Natural uranium	C_{RB}	1.7×10^{-18}	µCi/ml
		C_{RR}	0	µCi/ml
		DCF_R	5.6×10^{14}	mrem/year per µCi/ml
		D_R	**0**	**mrem/year**
	Thorium-230	C_{RB}	6.9×10^{-18}	µCi/ml
		C_{RR}	1.5×10^{-18}	µCi/ml
		DCF_R	2.5×10^{15}	mrem/year per µCi/ml
		D_R	**0**	**mrem/year**
	Radium-226	C_{RB}	2.7×10^{-18}	µCi/ml
		C_{RR}	2.2×10^{-18}	µCi/ml
		DCF_R	5.6×10^{13}	mrem/year per µCi/ml
		D_R	**0**	**mrem/year**
	Lead-210	C_{RB}	5.5×10^{-16}	µCi/ml
		C_{RR}	9.5×10^{-16}	µCi/ml
		DCF_R	8.3×10^{13}	mrem/year per µCi/ml
		D_R	**0.03**	**mrem/year**
		$\sum D_R$	**0.03**	**mrem/year**
Inhalation of Radon-222 and decay Products (Equation 2)	Radon-222	C_B	0.6	pCi/L
		C_R	0.9	pCi/l
		OF	0.75	unitless
		EF	0.21	unitless
		DCF_{WLM}	1000	mrem per WLM
		D_{Rn}	**24.35**	**mrem/year**
External Dose (Equation 3)		D_{ER}	8.2	mrem/quarter
		D_{EB}	3.1	mrem/quarter
		OF	0.75	unitless
		D_E	**3.8**	**mrem/year**