40-8905

RIO ALGOM MINING LLC's RESPONSE TO AGREEMENTS REACHED DURING ITS MEETING WITH THE NUCLEAR REGULATORY COMMISSION ON AUGUST 12, 2003

The purpose of this document is to request revisions to the following two pending Alternate Concentration Limit (ACL) applications: 1) *Corrective Action Program and Alternate Concentration Limits Petition for Uppermost Bedrock Units Ambrosia Lake Uranium Mill Facility Near Grants, New Mexico* (QMC, 2000) and 2) *Application for Alternate Concentration Limits in the Alluvial Materials at the Quivira Mill Facility Ambrosia Lake, New Mexico* (QMC, 2001).

During an August 12, 2003 meeting between Rio Algom Mining, LLC, (RAM) and the U.S. Nuclear Regulatory Commission (NRC) at the Ambrosia Lake Facility, tentative agreement was reached on a number of issues that required NRC endorsement before the ACL applications could be approved. An NRC letter to RAM dated August 22, 2003 and an accompanying NRC Trip Report formalized agreements reached at the meeting. An NRC summary of agreements reached (taken from the Trip Report) is provided below.

> *"Specifically, it was tentatively agreed, pending final regulatory review, that the following wells could be used for POCs:*
>
> | | |
> |---|---|
> | *Alluvium:* | *31-61 (RAM will propose a couple of additional POC locations)* |
> | *Tres Hermanos A (TRA):* | *31-01* |
> | *Tres Hermanos B (TRB):* | *31-67 & 36-02. Rio Algom will investigate replacing 31-66 with 31-02.* |
> | *Dakota:* | *36-06* |
>
> *Other wells currently designated as POC wells would be used as trend wells. Because POC wells are assigned in various license conditions, RAM will need to amend its ACL application to request these changes.*
>
> *ACTIONS:*
>
> *Rio Algom Mining, LLC, is to provide the following information in the form*

NMSS01

of a revised application:

1. *Designation of revised POC wells and add another POC well for the alluvium.*
2. *Redefine other current POC wells as trend wells.*
3. *Investigate the need for point of exposure wells for the bedrock aquifers and consider a trend well for TRA.*
4. *Revise bedrock aquifer ACLs to reflect a total risk of 10^4.*
5. *Develop a post remediation graded groundwater monitoring plan.*

Within five weeks the NRC will provide the following:

1. *Review of the attenuation and retardation factors.*
2. *Evaluate the proposed scenarios in the alluvium with the proposed ACLs.*

NRC staff suggested that Rio Algom delay its submission until NRC completes its assigned actions."

An e-mail from John Lusher (NRC) to Paul Goranson (RAM) dated 09/02/2003 (Attachment 1) indicated that NRC reviewers would accept a value of 50 as an appropriately conservative retardation factor for use in modeling attenuation of groundwater constituents in bedrock and alluvial materials. The e-mail noted that reviewers believed that RAM's cleanup goals could be met using an even more conservative retardation factor of 20.

The following paragraphs constitute a formal response to action items assigned to RAM in the NRC's summary of agreements presented above. RAM requests that U.S. NRC Materials License # SUA-1473 (license) be modified to reflect changes in monitoring plan (i.e., POC and monitoring locations (trend wells), analytes and sampling schedule) described below.

1. RAM accepts designation of the following monitor wells as Point of Compliance (POC) wells:

   Alluvial Monitor Well 31-61,

   TRA Monitor Well 31-01,

   TRB Monitor Wells 31-67 and 36-02, and

   Dakota Monitor Well 36-06.

In addition, as discussed in telephone conversations between Bill von Till and Paul Goranson, RAM proposes Alluvial Monitor well S-9 as an additional POC well in the Alluvium, and replacement of TRB Monitor Well 31-66 with TRB Monitor Well 31-02 as a TRB POC well.

2. RAM proposes that the following license mandated POC wells be reclassified as trend wells:

   Alluvial Monitor Well 32-59,
   TRB Monitor Well 36-01, and
   Dakota Monitor Wells 30-02, 30-48, and 32-45.

   RAM further proposes that Alluvial Monitor Well 5-08, which is not required to be monitored by license, be designated as a trend well in the Alluvium in order to monitor concentrations of constituents near the POE. NRC Reviewers have concluded that there is no evidence that current concentrations of constituents of concern in this well arrived via groundwater transport from the Rio Algom facility (NRC, 2003). Therefore, RAM proposes that only uranium (most easily transported of the constituents of concern) concentration trends in this well will be considered in compliance decisions.

3. Groundwater flow in bedrock units is toward the northeast, away from potential milling related sources of constituents. Therefore, POE locations of primary concern are those across the northernmost boundary of the withdrawal area (Map 1-1, QMC, 2000). Due to drainage through vent holes and mineshafts, groundwater availability is limited in bedrock units at the northernmost boundary. As a result, POE wells would be difficult to establish and be of limited usefulness. A number of Dakota and TRB trend wells exist upgradient of the northernmost boundary of the withdrawal area, allowing confidence that health based levels of constituents of concern will not be exceeded at POE locations. RAM is proposing a similar trend well for the TRA in the next paragraph. Therefore, RAM believes

that there is no need for POE wells at the northernmost boundary of the withdrawal area.

RAM proposes TRA Monitor Well 30-01 as a trend well in the TRA. This well is the farthest down gradient TRA well that still contains water. Monitor Well 30-01 contained approximately 42 feet of water in 1989 and levels have declined to approximately 15 feet in 1999. It will likely go dry within the next several years, but will give confidence that constituents of concern have not migrated to the northernmost POE location in the meantime. When it does go dry, it will serve as an indicator that the groundwater in TRA will not impact the northernmost POE location.

4. As requested by NRC, RAM proposes revised ACLs for the bedrock units (presented in Table 1) to reflect a total risk of 10^{-4} at the POE. These values result from rerunning the Solute transport model (Beljin and van der Heijde, 1998) for these units, using parameters described in RAM, 2003, but replacing the retardation factor with a value of 50 per NRC reviewers.

Table 1. Modeled bedrock attenuation factor of 0.0147 (retardation Factor of 50), based on modeling a distance of approximately 4,700 feet (no POC is less than this distance from a POE), applied to health-based concentrations at the POE.

		Proposed ACLs		
Constituent	Health Based Concentration at POE	Dakota Sandstone	Tres Hermanos A	Tres Hermanos B
U-nat, mg/L	0.024	1.6		1.6
Th-230, pCi/L	13.9	945	945	945
Ra-226 and -228, pCi/L	3.2	218	218	218
Pb-210, pCi/L	1.3	88	88	88
Nickel, mg/L	0.1	6.8		6.8

RAM also proposes revised ACLs for the Alluvium to reflect the addition of Alluvial POC Well S-9 (Table 2). As described above for bedrock modeling, these values result from rerunning Alluvial Solute transport models using parameters described in RAM, 2003. Changes for these runs incorporate a conservative retardation factor of 20 per NRC reviewers, and a distance from the POE of 4000 feet to reflect the distance of proposed new Alluvial POC Well S-9 from the POE.

Table 2. Modeled Alluvial attenuation factor of 0.001 (retardation factor of 20), based on modeling from proposed Alluvial POC Well S-9, approximately 4,000 feet from the POE, applied to health-based concentrations at the POE.

Constituent	Health Based Concentration at POE	Proposed ACLs
Mo (mg/L)	0.18	176
Ni (mg/L)	0.1	98
Se (mg/L)	0.05	49
Gross Alpha (pCi/L)	8.57	8,402
Ra-226 + 228 (pCi/L)	3.23	3,167
Th-230 (pCi/L)	13.9	13,627
U (mg/L)	0.024	23
Pb-210 (pCi/L)	1.3	1,274

5. RAM requests that, upon ACL approval, the current groundwater corrective action program be terminated and the materials license for the Ambrosia Lake facility be modified to reflect the following post remediation groundwater monitoring plan.

<u>Groundwater Monitoring Plan</u>

On the recommendation of NRC consultants, a number of monitoring wells that are currently required for the groundwater monitoring program in the materials license as POC wells have been designated as trend wells. Monitor wells designated as background wells in the materials license have been omitted in this proposed post remediation groundwater monitoring plan.

Schedule

Subsequent to ACL approval, monitoring will occur twice a year for the first two years and once during the third year. Thereafter, monitoring will occur once every three years until the site is transferred to the DOE for long-term surveillance and maintenance. RAM believes that three years between monitoring events is justified based on the average rate of groundwater flow in bedrock and alluvial units. Calibration of flow and transport models suggests average flow rates of approximately 125 feet per year in bedrock units and 182 feet per year in the Alluvium. These values suggest that the groundwater in the bedrock units would move approximately 375 feet in three years and alluvial groundwater would move approximately 550 feet. Applying an attenuation factor of 10 to flow velocity (much lower than predicted), implies that constituents of concern would move less than 55 feet during the three year period

Monitoring Locations

Table 3 lists the monitoring locations that will be included in each monitoring event.

Table 3. Monitor wells proposed for the post remediation groundwater monitoring plan requested by the NRC.

Dakota:		TRA		TRB		Alluvium	
Trend Wells	POC Well	Trend Wells	POC Well	Trend Well	POC Wells	Trend Wells	POC Wells
30-02	36-06	30-01	31-01	36-01	36-02	32-59	31-61
30-48					31-02	5-08	S-9
32-45					31-67		

Analytes

Table 4 lists analytes to be measured during each event.

Table 4. Analytes proposed for the post remediation groundwater monitoring plan requested by the NRC.

Dakota	TRA	TRB	Alluvium
Chloride (mg/L)	Chloride (mg/L)	Chloride (mg/L)	Chloride (mg/L)
pH (s.u.)	pH (s.u.)	pH (s.u.)	pH (s.u.)
			Gross Alpha (pCi/L)
U-nat (mg/L)		U-nat (mg/L)	U-nat (mg/L)
Th-230 (pCi/L)	Th-230 (pCi/L)	Th-230 (pCi/L)	Th-230 (pCi/L)
Ra-226 + 228 (pCi/L)	Ra-226 + 228 (pCi/L)	Ra-226 + 228 (pCi/L)	Ra-226 + 228 (pCi/L)
Pb-210 (pCi/L)	Pb-210 (pCi/L)	Pb-210 (pCi/L)	Pb-210 (pCi/L)
Nickel (mg/L)		Nickel (mg/L)	Ni (mg/L)
			Se (mg/L)
			Mo (mg/L)

REFERENCES

Beljin, M.S. and P.K.M. van der Heijde, 1998. "SOLUTE v 4.06: A Program Package of Analytical Models for Solute Transport in Ground-Water." Golden, Colorado: International Ground Water Modeling Center.

NRC, 2003. Draft Evaluation of Alternate Concentration Limit Applications, Rio Algom Mining LLC Mill Facility, Ambrosia Lake, New Mexico, U.S. Nuclear Regulatory Commission Contract NRC–02–98–002, Prepared by the Center for Nuclear Waste Regulatory Analyses, San Antonio, Texas.

QMC, 2000. "Corrective Action Program and Alternate Concentration Limits Petition for Uppermost Bedrock Units Ambrosia Lake Uranium Mill Facility Near Grants, New Mexico. Grants, New Mexico: Quivira Mining Company. 2000.

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RAM, 2003. "Response to Request for Additional Information—Corrective Action Program and Alternate Concentration Limits Petition for Uppermost Bedrock Units Ambrosia Lake Uranium Mill Facility near Grants, New Mexico; and Application for Alternate Concentration Limits in the Alluvial Materials at the Quivira Mill Facility Ambrosia Lake, New Mexico." Version 1.1. Oklahoma City, Oklahoma: Rio Algom Mining LLC. 2003.

ATTACHMENT 1

"John Lusher"
<JHL@nrc.gov>
09/02/2003 09:46 AM

To: <pgoranson@ramc.net>
cc:
Subject: Fwd: Retardation at Ambrosia Lake

----- Message from on -----

John and Bill,

Jim and I have been working on the question of allowing Rio Algom to use a retardation factor of 100 in their attenuation calculations, and we've come to some conclusions.

For a variety of reasons, a retardation factor of 100 is simply too marginal to feel comfortable with. We have settled on 50 as a value we can accept. And we think Rio Algom can use 50 to get to ACLs that they feel they can meet.

1. Bedrock

A retardation factor of 100 for sandstone reasonably corresponds to a Kd of 12 ml/g. So our approach to the question was to ask: for the range of conditions in the bedrock aquifers, is a Kd of 12 ml/g or higher a reasonable bound for uranium? Other staff here at the CNWRA have done a great deal of work on uranium sorption (Pabalan, Bertetti, Turner), so we consulted them and their most recent publications. We feel their papers better represent the current state of understanding better than the references used by Rio Algom.

For clean fine-grained quartz, in pH space uranium Kd peaks at about 40 ml/g at pH 6.7. The value drops off at higher and lower pH. At pH above 7.5, and below 5, Kd sinks below 10 ml/g. These are real sandstones, and not pure quartz, so these Kd's may be lower bounds. Factors that will make the Kd actually higher include smaller grains, high-surface-area minerals such as clays, and iron oxides. However, if the waters are rich in carbonate/bicarbonate, Kd will be pulled down some. Unfortunately, we don't have the right water chemistry data from the site to know what carbonate contents are like.

Taking all this into consideration, we view pH 5 to 7.5 as our "comfort zone" for Kd being higher than 12 ml/g and, thus, R greater than 100. But many of the wells in the bedrock aquifer, especially in the TRA and Dakota, have had pH above 7.5 - and Dakota POC well 36-06 has had no pH higher than 5.8.

This Dakota POC well has recently ranged from 3 to 4.2 pH. POE well 36-04 is recently in the "comfort zone," but POC well 30-02 is in the high 7's. Because Kd is going down so precipitously above pH 7.5, and below pH 5, we are not comfortable assuming an Rd of 100 throughout the Dakota. After much discussion, we feel 50 is more defensible. Note that this appears to satisfy a protective uranium concentration of 0.025 mg/L at the Dakota POE for their requested ACL of 0.81 mg/L at POC 36-06.

The TRA and TRB have a little more comfort margin for us, because they are finer-grained than the Dakota and we have seen iron oxides in them. The TRA has had some high pH (e.g., POC 30-02 >8), but TRB has not. Thus, we wouldn't argue too strenuously against Rd = 100 for the TRB - but we're not sure they need it to be that high, anyway. It would be simplest if they used 50 throughout.

2. Alluvium

The alluvium is worse for Kd in one sense: Many, but not all, of the downstream wells (5-01, 5-02, 5-03, 5-04, 5-08) have recently had pH well over 7.5. On the other hand, POC wells 31-61 and 32-59 are within the sub-7.5 comfort zone. Thus, it's not clear what pH range is appropriate. We also have a small amount of geochemical evidence that some of these waters are rich in carbonate/bicarbonate - tending to lower Kd. On the other hand, the alluvium is finer-grained than the bedrock sandstones and contains iron oxides - tending to higher Kd. Using similar logic applied to the bedrock Kd, we believe an Rd of 50 is defensible for alluvium. Jim calculated that this would get them below protective concentrations at the POE given their requested ACLs (RAI response). In fact, a more conservative Rd of around 20 would also work for alluvium.

A final question: my notes from the site visit indicate that you are OK with their approach to using the Title I data to set alluvium ACLs, as long as they can show them to be protective. Is this correct?

David

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