October 7, 2002

Water Resources Division
Department of Indian Affairs and Northern Development
3rd Floor, Bellanca Building
Box 1500
Yellowknife, N.W.T.
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Attention: David Milburn

Dear David:

Re: Review of CanTung Tailings Geochemistry

Lorax Environmental Services Ltd. (Lorax) was requested by Water Resources to review a suite of geochemical data presented in several reports on the CanTung tailings at Tungsten, NWT. The objectives of the review were to assess and comment on the data, and the criteria used for assessing the acid-generating potential of the tailings within the context of long-term geochemical stability.

The documents reviewed included:

1. "*Assessment of the Results of Recent Geochemical Testing of the CanTung Tailings*" (Robertson Geoconsultants Inc.; 2001);

2. "*CanTung Mine Abandonment and Restoration Plan*" (EBA Engineering Consultants Ltd; 2001);

3. "*2000 Annual Report – Water License N3L2-0004, Tungsten, NWT*" (North American Tungsten Corporation Ltd; 2001); and,

4. "*CanTung Mine Reclamation Cost Estimate - DRAFT*" (Brodie Consulting Ltd., 2002)

It is understood that this letter will be appended to the latter document as an independent assessment of the data and interpretation presented in the reports 1 through 3 regarding tailings reactivity. This assessment is limited to the geochemical data provided within the above noted reports and does not comment on the environmental implication of acidic drainage as appropriate assimilative capacity data were not provided.

Comments

Mineralogically, the CanTung deposit is described as scheelite within a gangue of moderate grade skarn minerals such as pyroxene, garnet, quartz and calcite. The ore zones occur where skarn silicates in the ore-bearing limestone are replaced by massive pyrrhotite. Tailings generated from such a deposit would likely host abundant sulphide and carbonate minerals. Where tailings disposal is to occur under subaerial conditions, such a mineralogical framework would warrant concern for the potential of acid-generation and would typically trigger an ARD assessment program as was the case for this site.

The geochemical data describing CanTung tailings reactivity are primarily static (acid-base-accounting or ABA data). Such data represent the first stages of an ARD assessment program and form the basis of predictions of reactivity. In cases where the ABA data are ambiguous (*i.e.,* there is neither an overwhelming excess of acid potential (AP) or neutralization potential (NP)), kinetic tests would be run to assess the site-specific rates of sulphide oxidation relative to loss of neutralizing minerals or NP.

Kinetic tests were not run for the CanTung tailings. Instead, an argument has been made to suggest that an NP/AP cutoff (neutralization potential/acid potential, also called the net potential ratio or NPR) of 1.2:1 is appropriate to these and other tailings. In other words, it is suggested in the reports that tailings with an NPR > 1.2 will remain net neutral while those with an NPR < 1.2 may become acidic. The arguments in support of this number relates to the fine-grained nature of tailings relative to waste rock (which typically invokes a safe NPR of 3:1 in the absence of kinetic data) and the commensurate increase in availability of neutralizing minerals found in tailings. While this may be true for some tailings, it is by no means global. Other factors (*e.g.,* carbonate dissolution) contribute to the loss of NP in a rock besides the neutralization of acid. Indeed, the notion of an appropriate NPR for tailings of 1.2 is presented and qualified in the document, *Guidelines for ARD Prediction in the North*, which states, "*For tailings, an NP/AP ratio of 1.2:1 or a positive NNP* ***may*** *acceptably define non-acid generating rock*" (emphasis added). The value of 1.2 is not unconditionally endorsed as a "safe" cutoff for all materials. Moreover, recent kinetic tests have demonstrated that some tailings may have NPR cutoff values considerably higher than 1.2 (Lorax, unpublished data).

In other words, using an NPR of 1.2 to define acid-generating from non-acid-generating tailings is not sufficiently conservative in the absence of kinetic data; and it is thus possible that some fraction of the CanTung tailings classified as net neutral are in fact ultimately acid-generating. Indeed, the only manner in which an NPR cutoff could be convincingly applied would be with supporting kinetic data, which define the relative rates of sulphide oxidation and NP depletion. Such data are not available for the CanTung tailings.

Irrespective of the precise quantity of tailings which eventually become acidic, the data of the above reports illustrate that a significant fraction of the tailings are currently acidic or potentially acid generating (Robertson Geoconsultants, 2001). Despite acidic conditions within the tailings, the Flat River does not appear to be deleteriously impacted at this time although the water quality data base is sparse; the plan to leave those tailings in place may

prove less damaging than allowing releases of metals and acid associated with rehandling. However, that impacts to the receiving environment are not currently visible does not preclude a manifestation in the future. In particular, the tailings ponds represent the greatest unknown liability as the onset to acidic conditions could markedly increase the rate of sulphide oxidation and loadings to ground and surface water; it is suggested that close attention be paid to these existing facilities. By extension, it is possible that fractions of waste rock, exposed pit walls and/or underground workings are predisposed to acid-generation and warrant similar attention.

Conclusion

The notions forwarded in the various reports (*i.e.,* that various fractions of tailings may not ultimately liberate acid) are plausible but are as yet unsubstantiated by data. It has been demonstrated that significant fractions of the tailings are indeed acid-generating, and without kinetic data to the contrary, it should be assumed that the NP/AP cutoff ratio of 1.2:1 is insufficiently conservative. The most recent data indicate that more tailings will become acidic as neutralizing minerals are exhausted (Figure 2.2; Robertson Geoconsultants, 2001). It is conceivable that even more tailings than predicted will turn acidic based on the NP/AP ratio of 1.2:1, thereby making the potential geochemical evolution of all ponds less certain.

Since there is currently insufficient data to suggest that additional mitigation strategies will not be required for the tailings ponds in the future, it would be prudent to either:

a) run kinetic tests on the tailings to better define which tailings are ultimately acid-generating; or,

b) emplace appropriate contingency strategies such that future acid generation from the tailings ponds can be mitigated.

Please feel free to contact me if you have any questions.

Yours very truly,
LORAX ENVIRONMENTAL SERVICES LTD.

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