August 15, 2012

Mackenzie Valley Environmental Review Board
5102 - 50th Ave.
Yellowknife, NT X1A 2N7

Attention: Mr. Paul Mercredi
Environmental Assessment Officer

Subject: Day 1 Technical Sessions Homework items #1-8

Dear Mr. Mercredi:

Avalon is pleased to provide the following answers to Homework items #1 through 8 as a result of our technical sessions held on August 14, 2012.

Homework Item #1

Chromium, with respect to Avalon's proposed Site Specific Water Quality Objectives (SSWQO) (as presented in Avalon's presentation during the technical session of Aug 14, 2012) and for the purpose of determining which CCME guideline value(s) to use for chromium; is the form of chromium listed in the table hexavalent or trivalent?

Avalon Response Item #1

Until such time as the breakdown between Chromium VI and Chromium III is determined and it is demonstrated that Drizzle Lake background concentrations do not exceed it, Avalon agrees as a precaution, to conform with the CCME guideline of 1 µgr/l chrome VI standard. Otherwise, Avalon agrees to conform with the 8.9 µgr/l chrome III guideline and the 1µgr/l chrome III guideline.

Homework Item #2

Nitrate as N, are the values of Nitrate as N in the proposed SSWQO table (as presented in Avalon's presentation during the technical session of Aug 14, 2012) consistent with CCME values an order of magnituge higher?

Avalon Response Item #2

As per the CCME guidelines, upon confirmation that Drizzle Lake background does not exceed it, Avalon is committed to conformance with the two nitrate standards. They are:

1) Long term. In the long term Avalon commits to conform with the nitrate standard of 13 mg/l, or 2.93 mg/l as nitrogen
2) Short term. Avalon commits to conform with the short term guideline of 550 mg/l nitrate, or 124 mg/l nitrate as nitrogen.

Nitrite

As per the CCM guideline, upon confirmation that the natural background concentration in Drizzle Lake does not exceed it, agrees to conform with the CCME standard of 0.06 mg/l nitrite, or 0.018 mg/l nitrite as nitrogen

Homework Item #3

Avalon to provide TDS values for Drizzle Lake.

Avalon Response Item #3

Baseline water quality results obtained during the period September 2009 to October 2010 were reported by Stantec in Volume 3 of their Environmental Baseline report series which has been presented to the MVEIRB as Appendix A-1 of the DAR.

During that period of time Total Dissolved Solids (TDS) and other water quality parameters were sampled at Drizzle Lake (Station UN-13) in September 2009 and in April, June, September and October 2010.

Based on the 5 sets of samples collected during this period of time the following are the summarized results for TDS

- Maximum value recorded – 285 mg/l
- Minimum value recorded – 151 mg/l
- Mean value – 193 mg/l
- Median value – 179 mg/l
- Standard deviation – 53 mg/l

Homework Item #4

What assumptions were made and what has changed in Avalon's downstream water modelling for Drizzle and Thor Lake.

Avalon Response Item #4

The water quality modelling began by considering first the dilution of the tailings effluent as it moved through the system, using the 5-day decant values to represent the fact that suspended solids would have at least 5 days to settle out in the Tailings Management Facility before the effluent moved on to the polishing pond, and then the Drizzle-Murky-Thor chain of lakes. For

that first simulation, a value of 1.0 was used as the concentration of the analyte in the tailings feed to the TMF. Dilution in any part of the system, say Thor Lake, was then the input value of 1.0, divided by the computed concentration.

Next, the recycling of Thor lake water through the plant was added to the simulation. The incorrect initial implementation of this step was the cause of the erroneous calculations presented in May [and in some responses to earlier Requests for information]. When discussing the recycling aspect of the simulation with Avalon's third party technical consultant, I used zinc, 0.007 mg/L in the 5-day decant, as an example: "if after a few years, the Thor Lake zinc concentration has risen from 0.0 to 0.001 (no background values considered at this stage), would the plant add 0.007 to the 0.001 in the feed, so that it discharged effluent with a concentration of 0.008?" Avalon's consultant thought that this may be correct and agreed it was conservative. We used this concept, of adding the Thor Lake concentration to 0.007 for zinc, say, as our algorithm for the recycle process. Unfortunately, the model was coded with 0.007, rather than the nominal value of 1.0, as the basic contribution of the plant process to the effluent. Consequently, the model computed the concentration of a scalar which started out at 0.007, rising somewhat over 20 years because of the recycling. However, when post-processing the modelled concentrations to dilutions, we inadvertently assumed the initial concentration was 1.0, not 0.007, which gave us dilutions that were about 140 times too high. These high dilutions formed the basis of the numbers reported in May.

In preparation for this technical workshop, we re-checked the dilution calculations, having a suspicion, also mentioned in some information requests, that computed dilutions were too high. We used a spreadsheet calculation, the content of Homework Question No. 5, to determine that the concentration in the TMF after one year, assuming an input concentration of 1.0, was of the order of 0.13, not 0.00091, as presented in May. This calculation then led us to trace the details of how the effluent concentration evolved in the first computational cell in the TMF, which revealed the hard-coded value of 0.007. It was then a simple matter to re-compute dilutions, using the correct starting value of 0.007.

A second part of this homework question concerned why the ratio between the previous and new concentrations wasn't constant, as one would expect based on the above discussion. The reason is that the ratio of background concentration to the 5-day decant value is not a constant, but varies from analyte to analyte. Thus, some analyte concentrations are dominated by values, some by 5-day decant values, and others are in between. Since the background stayed constant between the two sets of runs, but the dilution-modelled values changed by a large constant ratio, their combination cannot be expected to preserve the ratio between the earlier and the present calculations.

Homework Item #5

Avalon to present a simple calculation of the approximate values of dilution ratios used for tracer modeling studies.

Avalon Response Item #5

The following table provides the basic assumptions concerning the dilutions achieved in the TMF:

Tailings Management Facility Discharge and Physical Characteristics

Plant Inflow	0.012	m3/s
Inflow Concentration	1.0	
TMF Volume	2460160	m3
Net Natural Inflows	0.002183	m3/s
Concentration in Natural Inflows	0.0	
Water Loss to Deposited Solids	0.0079	m3/s
Water Loss Concentration	0.0	

Concentration Evolution in the TMF

Year	*Qin*	*Qout*	*Flux_in*	*Conc in Tailing*	*Flux_out*
0	0.0063	0.0063	189216	0.0000	0
0.5	0.0063	0.0063	189216	0.0769	17201
1	0.0063	0.0063	189216	**0.1468**	32838

In the above table, Qin and Qout are in m3/s; Flux_in and Flux_out are the amount of contaminant (Q x conc) delivered or removed in the time-step, in this case half a year. The Conc in Tailings increments the existing amount (previous conc times volume) by the net flux, and divides the result by the TMF volume.

The resulting TMF concentration after one year is 0.1468, close to the more exact value of 0.13 computed by the full model, and well away from the earlier value of 0.00091.

Homework Item #6

Avalon to provide presentation to the Review Board.

Avalon Response Item #6

Completed August 14, 2012

Homework Item #7

Avalon will confirm the lowest detection limit used for calculating Mercury for the SSWQO and whether this is the “low” or “ultra-low” detection limit.

Avalon Response Item #7

Completed August 14, 2012

Homework Item #8

Avalon to provide the 5 day decant information in the SSWQO table as found in the technical session presentation of Aug 14 2012.

Avalon Response Item #8

The five day decant nutrient concentrations used in the August 14 SSWQO presentation were based on the following numbers:

- NO2 as N - <0.6 mg/l
- NO3 as N - <0.05 mg/l
- Total Reactive P - 0.10 mg/l
- NH3+NH4 as N - <0.1 mg/l

Avalon appreciates the opportunity to provide this update to the MVEIRB and trust that this will meet the Board’s needs.

Yours truly,

David Swisher
VP Operations
Avalon Rare Metals Inc.