**Additional Information Request #18**

*COPC Loading Rates and Water Quality*

**Related Comments:**
CEAR #599 (Ministry of the Environment)
CEAR #600 (Environment Canada)
CEAR #601 (Natural Resources Canada)

SIR #4 included the Panel's request to consider and respond to Natural Resources Canada (NRCan)'s opinion regarding the need to remove the correction factor of 0.01 pertaining to the very fine particle size fractions applied to obtain the field COPC mass loading of waste rock in the mine rock storage area.

In its response, SCI stated its opinion that it is not appropriate to remove the adjustment factor for the particle size distribution differences between that expected in the blast rock and that measured in the humidity cells, for the reasons cited by SCI.

NRCan stated that while it is satisfied with the SCI response, uncertainty may still exist with respect to the particle size correction factor and recommended that, should the project proceed, SCI obtain an actual particle size distribution of blast rock fragments during the early stages of mine development and operation to address any outstanding differences of opinion between SCI and NRCan in this regard.

NRCan's concerns were primarily focused on the MRSA. The Ontario Ministry of the Environment (MOE) commented that although the uncertainty referred to by NRCan affects decisions on the potential for impact resulting from uncollected/untreated seepage, there are also implications as to the degree of treatment needed for the final PSMF effluent and the potential for the by-products of effluent treatment (i.e. TDS) to impact on water quality and mixing of Hare Lake.

In its response to SIR#4, SCI provided data on projected COPC concentrations from the MRSA drainage and on water quality in the Pic River. Environment Canada has requested clarification concerning the values of various COPC concentrations appearing in Tables 1b, 1c, and 1d of SCI's response.

Given the uncertainty in COPC loading predictions and the unknown potential impacts to water quality:

- With respect to Tables 1b, 1c, and 1d, provide a rationale for the consistent concentrations of aluminum and iron over the different scenarios.

**SCI Response**

The concentration results in Tables 1b, 1c and 1d were developed for sensitivity scenarios that considered the effect of temperature and particle size of the mine rock in the MRSA on rates of COPC leaching (also known as loading rates). All COPCs that are controlled by loading rates will therefore be affected by the adjustment factors related to temperature and particle size. Only two COPCs, aluminum (Al) and iron (Fe), are not controlled by rates of leaching (loading). Both aluminum and iron are, rather, controlled by solubility of solid phases that are commonly referred to as hydroxides and represented by the simple formulae $Al(OH)_3$ and $Fe(OH)_3$. The chemistry of aluminum and iron hydroxides is widely recognised and the solubilities are known to be a function of pH (Stumm and Morgan, 1996). Although the precise solubilities of aluminum and iron cannot be predicted from theory, experimental results were used to estimate the concentrations of those COPCs as described in SID 5 – Section 4.3.1 (EcoMetrix, 2012). The data for estimating the constant concentrations were taken from the results of the humidity cell tests on mine rock that showed relatively consistent concentrations for all humidity cells as shown in SID 5.

**References**

Stumm, W. and J.J. Morgan, 1996. Aquatic Chemistry – Chemical Equilibria and Rates in Natural Waters (3rd. Ed.), Wiley-Interscience, 1022pp.