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Memorandum

To	Matthew McElwaine - PWGSC, Janice Lee - PWGSC	Page	1
CC	Barry Fedorak, Caitlin Moore - AECOM		
Subject	CAM-A Sturt Point Borrow Source Geochemistry		
From	Cathy Corrigan		
Date	February 14, 2014	Project Number	60300481

The Water License issued for the remediation of the CAM-A site, WL#1BR-STU1318, specifies the need to demonstrate that borrow sources for aggregate production do not have acid generating or metal leaching properties (Clause 2, Part E). In response to this clause, AECOM provides the following the discussion regarding geochemistry, the potential for ARD at the site, and the need for testing.

The geochemistry of ARD can be explained by two main reactions: the breakdown of sulphide minerals in the presence of oxygen and water (chemical weathering) results in the generation of acid, and the creation of acidic conditions more readily solubilizes metals that have low potential for mobility under neutral or alkaline conditions. Sulphide minerals are metal-sulphur compounds and are naturally present in the environment. They are particularly enriched in certain rock types, and form the primary minerals in many metal ore deposits. Sulphide minerals are formed under reducing conditions; as a consequence, they are not stable in atmospheric conditions. The chemical weathering of sulphide minerals is therefore a naturally occurring, common process in a surficial environment where sulphide minerals are present. The difference between the common occurrence of weathering of sulphide minerals and of ARD is a matter of scale. The British Columbia Department of Energy and Mines provides this useful definition of ARD:

> "Metal leaching and acid generation are naturally occurring processes which may have negative impacts on the receiving environment. The environmental impact of ML/ARD will depend on their magnitude, the sensitivity of the receiving environment and the degree of neutralization, dilution and/or attenuation. Factors which enhance metal leaching include rapidly weathering metal-containing minerals, drainage conditions that increase solubility and high flow rates through contaminated materials."

ARD is typically associated with mining. This is because the process of mining – the extraction and crushing of the bedrock to release the ore – creates optimal conditions to rapidly weather minerals: subsurface rock becomes exposed to atmospheric conditions at surface and is broken down into granular material thereby creating huge surface areas available to both air and oxygenated surface water. Furthermore, metal mines typically contain a high proportion of sulphide minerals. Thus, the bedrock geochemistry and the mining process itself are the primary factors that lead to ARD generation.

Surface deposits – both bedrock and overburden – have been subject to weathering for thousands of years since glacial retreat. During yearly freshet and heavy precipitation events, water flow is generally extensive, with precipitation being oxygenated. There is little organic material at surface at this site, the decomposition of which would consume dissolved oxygen in water. Based on these combined factors, minerals that are not stable at surface conditions (i.e. sulphides) are unlikely to be remaining in any significant volume in surface deposits. Indeed, a common occurrence in sulphide mineral deposits at surface is the creation of "gossans" which are surficial zones where all the sulphide minerals have been weathered away, oxide minerals have formed in place, and metals have been released and, transported downward through percolating groundwater until they are re-precipitated at depth where the geochemical conditions are reducing.

At Sturt Point, on Victoria Island, the bedrock is comprised of non-metamorphosed sedimentary rocks which are primarily limestone or dolostone. Both of these are carbonate rocks (meaning they are composed primarily of carbonate minerals). Carbonate minerals are the very minerals that neutralize any potential acidity that is created during chemical weathering. These types of rocks have little to no sulphide minerals and very low metal content. The risk of acid-generation or metal leaching from quarrying of this bedrock is considered extremely low to nil. Furthermore, all of the borrow sources identified for use at the CAM-A site are granular surface deposits. There is, therefore, no reason, from a geochemical perspective, to expect the development of ARD conditions from borrow extraction at this site. Consequently, no testing for acid-base accounting or metal leaching potential is considered warranted.

I trust that this information meets your requirements. Please contact me or Barry Fedorak should you require additional information.

Sincerely,
AECOM Canada Ltd.

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