CHALLENGES IN USING LABORATORY-SCALE WASTE ROCK TESTING TO DEFINE THE GEOCHEMICAL BEHAVIOUR OF WASTE ROCK PILES[1]

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Abstract. Laboratory-scale testing to characterize the acid rock drainage (ARD) and metal leaching (ML) properties of waste rock is routinely conducted to provide preliminary estimates of its potential environmental behaviour in disposal facilities. The laboratory-scale testing typically includes acid-base accounting, short-term leaching, elemental analysis, mineralogy and longer-term leaching to estimate kinetic behaviour. All of these tests are performed on small masses of rock that are collected to represent the compositional range and spatial distribution of the lithologies present, with consideration of the mass of waste rock excavated from a lithology.

Due to budgetary restrictions of the mining company or aggressive scheduling to obtain necessary permits, the initial laboratory-scale tests are sometimes all that are available to estimate the behaviour of the waste rock in the field. However, there are inherent differences between the laboratory-scale data and the field scale.

First, there is the sheer difference in scale. In the laboratory, sample masses are limited to less than 1 kg. In the field, waste rock piles can reach hundreds to millions of tonnes. While great care is taken to collect samples to properly represent the waste, the number of sample collected will in no way match the mass of waste rock to be extracted.

Second, laboratory tests are generally designed to enhance ARD and ML with small and uniform grain sizes. This results in enhanced oxidation rate and metal leaching. In the field, waste rock piles have a very broad range of particle sizes. While the finer fraction controls the bulk of the reactions, there is a large component of coarser grained rock that does not contribute as significantly. Therefore, when comparing reaction rates per unit rock mass, the lab tests and field test are not directly applicable and need to be corrected for the differences in the grain sizes. Third, as the large waste rock piles grow in tonnage, they develop preferential flow pathways and unique hydrogeologies. This again limits the mass of rock that can contribute to ARD and ML. In the laboratory, this is not generally the case as all the tests are designed to effectively mix the rock and water.

To overcome these differences and to effectively use the laboratory data, correction factors can be used to account for the above. Alternatively, instead of loading rates based on mass, rates based on surface area may be used. The lab test results can be calibrated on small-scale field tests if available. In any of these cases, there is some component of reliance on professional judgment, other mining experiences and literature that is required to "make the leap" from lab to field.

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