

Bench Scale Hexavalent Chromium Removal with a Biochemical Reactor¹

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Abstract: Circum-neutral mining influenced water (MIW) in runoff at an active nickel and cobalt mine in Madagascar exhibits elevated hexavalent chromium levels of about 2.0 mg L⁻¹. A low-grade ore stockpile and some site geologic characteristics contribute to the metal load that appears to vary with runoff rates and the volume of stored water in the drainage basin dam. This situation makes compliance unpredictable and difficult to remedy. The mine adopted a proactive approach to the issue and commissioned an on-site test to evaluate the effectiveness of the biochemical reactor (BCR) technology in reducing chromium levels at the site.

The BCR portion of the bench-scale test apparatus is comprised of seven 200-liter plastic drums each receiving a measured flow. All the BCR units are bottom-fed with water. Six receive MIW and the seventh functions as a control and receives “clean” water. The six “MIW” BCR drums are filled with three different media mixtures. Half of the drums have plants growing on the media surface; the corresponding “duplicates” for each mixture do not have plants. The non-plant BCR set effluents are fed to an additional series of open tanks that are filled with native soil and wetland plants for additional aerobic polishing. Mine personnel maintain the test system, measure field parameter data, and collect water samples for analysis.

The hydraulic retention time (HRT) in the BCR units is relatively short. The initial HRT was set to 48 hours and was progressively shorted to about five hours in the final two weeks of the 16-week test. Preliminary data show the BCR technology is appropriate and test effluents meet the environmental standards. These positive test results supported the design of a larger scale passive treatment system which is scheduled to be constructed at the site in 2016.

Additional Key Words: Passive Treatment, BCR, Madagascar, Nickel

Optional Data: Project Location Latitude: 18.85°S Longitude 48.29°E

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