Bioremediation and Sustainable Environmental Technologies—2017. Fourth International Symposium on Bioremediation and Sustainable Environmental Technologies (Miami, FL; May 2017). ©2017 Battelle Memorial Institute, Columbus, OH, www.battelle.org/biosymp. A. Barton and S. Rosansky (Chairs)

Laboratory Testing of Remedial Approaches for Heavy Hydrocarbons-Impacted Soil and Sediment

Tom Simpkin (tom.simpkin@ch2m.com) (CH2M, Denver, CO, USA)

Background/Objectives. Heavy hydrocarbon-impacted soils and sediments are often found at oil production facilities due to past operation practices that were standards of the industry at the time. These impacted soils and sediments have the potential to cause human health and ecological risk such that remediation may be warranted. Developing cost effective remediation strategies can be challenging for these sites depending on the nature of the crude oil originally released, the extent of weathering that has occurred, the nature of the ecological systems, the cleanup standards applied, and the physical setting of the sites.

Approach/Activities. This paper will summarize the laboratory testing of a few technologies for crude oil impacted soils and sediments present at sites in a jungle environment. Bioremediation and bioremediation enhanced with oxidation were evaluated for impacted soils. Landfarming or biopiles was the bioremediation approach evaluated. Bioremediation enhanced with oxidation was selected due to the known limitations of bioremediation alone with heavy hydrocarbons.

An in situ bioremediation approach was tested for the impacted sediment. The approach involved aeration of water overlying the sediments with the objective of allowing diffusion of oxygen into the sediments. This type of approach was selected since it would be less disruptive on the environment and is one of the few approaches that could be used in this physical setting (for example, wet, soft sediments high in natural organic material).

Results/Lessons Learned. This presentation will summarize the results of the laboratory tests. The results of the soil bioremediation laboratory tests suggest that rates of reductions in the hydrocarbons are relatively slow, with at most 60 percent reduction in six months. Attempts to enhanced the biodegradation with oxidation were not successful. However, relatively low doses of oxidants were tested, to keep the dosages in an economic and practical range. A separate test of oxidation only was conducted at high dosage. Approximately stoichiometric reductions in hydrocarbons, based on the dose of oxidant added, were measured. These results suggest that a simple, low intensity, longer term bioremediation approach might be appropriate for these remote settings.

The sediment bioremediation test appeared to be moderately effective, with the extent of hydrocarbon degradation ranging from 30 to 60 percent in three months. Direct scale up of the rates of from these small lab tests is not possible, so plans have been developed to perform field pilot tests of these approaches.