Enhanced Bioremediation of a Consortium of Contaminants at a Historic Chemical-Production Facility

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Background/Objectives. An aerobic bioreactor study seeded with sewage sludge had been conducted to determine an efficient remediation method for targeting a variety of chlorinated compounds at a former specialty chemicals and adhesives manufacturing plant located in the southeastern United States. Although not the primary objective, observations suggested that the biological degradation of 1,4-dioxane (1,4-DX), bis(2-chloroethoxy)methane (BCEM), and bis(2-chloroethyl) ether (BCEE) might be occurring. This preliminary bioreactor information was then combined with results from separate laboratory studies conducted by the Facility, which used specific bioaugmented isolates, ultimately resulting in a field-scale pilot study to test the enhanced in situ biodegradation of target compounds. This project is significant because it demonstrates the pathway needed to successfully transition a set of chance observations into a customized field-scale assessment. The ability to effectively biodegrade this consortium of contaminants in situ will result in substantial cost savings over the lifespan of this project.

Approach/Activities. Information gleaned during an aerobic bioreactor study and the bench microcosm studies led to a field pilot study at the site. During these laboratory microcosms, extracted groundwater was used to determine microbial tolerances for key environmental metrics found at the Facility. Additional molecular studies were simultaneously performed to discern microbial information critical to a successful pilot study. Together, these laboratory studies resulted in a customized, site-specific profile of the conditions most likely to provide optimized in situ enhanced biodegradation of targeted site constituents. This profile was then translated into a field-scale pilot test, which is already demonstrating to be successful.

Results/Lessons Learned. This project dramatically underscores the benefit of performing often-neglected efforts during the planning stages of a pilot test. Traditionally, a pilot study bases its approach on estimates and assumptions taken from other locations. If these presumptions do not match actual site conditions, however, a pilot study can easily fail. Furthermore, this failure can often not be detected for extended periods of time, during which extensive project resources have been consumed. In contrast, by basing a field-scale pilot study on bench-tested, site-specific insights, the results have a much higher chance of success when transitioned from the lab into the field. As such, these efforts are rewarded over the lifecycle of the project. This presentation will outline this process, as well as the results of a field-scale bioaugmentation pilot-study targeting a consortium of contaminants at a historic site.