

Monitoring Site Microbial Ecology after an *In Situ* Chemical Oxidation Treatment

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In situ chemical oxidation (ISCO) has been increasingly used at sites with petroleum hydrocarbon, chlorinated solvent, and mixed plumes as a source reduction technology to achieve rapid destruction of contaminants and decrease overall time to site closure. While effective for source reduction, ISCO alone may not achieve remediation goals and supplemental measures such as enhanced natural attenuation via bioremediation and/or monitored natural attenuation (MNA) may be required to reach groundwater maximum contaminant levels (MCLs).

In treatment trains involving ISCO and biologically based polishing steps the chemical oxidation step can interfere with biological processes via physical and chemical means. On the physical side temperature is the major concern. On the chemical side, depending on the nature of the treatment, the ability for oxygen, sulfate and manganese to interfere with biodegradation are issues while the free radicals themselves can negatively impact the relevant microbial ecology.

In the current study at a site in California, Bio-Trap samplers were obtained from a benzene contaminated site both prior to and following ISCO treatment with persulfate activated with catalyzed hydrogen peroxide. Phospholipid fatty acid and qPCR results revealed the short- and long-term impacts of ISCO treatment on the microbes. The results at two and five months post-ISCO showed some variability, however, several trends were apparent. Most importantly in relationship to project objectives, it was clear that there was good microbial survivability post-ISCO, such that biological processes could be managed forward at will. In some cases there was an actual increase in microbial growth that correlated with dissolved oxygen measurements which were a function of the hydrogen peroxide application. Organisms that are more sensitive to free-radicals such as eukaryotes, and organisms that are more sensitive to both free radicals and oxygen, such as anaerobes, exhibited the expected declines in the population sub-analysis.