

Comparing Microbial Profiles from Five Service Station Sites

Jack Sheldon (jack.sheldon@anteagroup.com) (Antea Group, West Des Moines, IA, USA)
Jeff Friedman (jeff.friedman@anteagroup.com) (Antea Group, Long Beach, CA, USA)

Background/Objectives. Understanding the microbial profile of a site is valuable as a component of the site conceptual model development and as an important parameter in evaluating natural attenuation or the performance of bio-amendments. Molecular biological tools (MBTs) and their accompanying sample collection methods have made microbial data collection easy and efficient. Recent establishment of more robust databases have also increased the value of collecting microbial data and comparing to other site across the country.

Approach/Activities. This presentation will describe the microbial data collected from a portfolio of five gasoline service station sites in southern California. Each site was well characterized and had numerous remedies employed over a half dozen years for soil and groundwater cleanup. Each site had TPH-gasoline and BTEX as primary constituents in soil and groundwater, and MTBE. TBA and naphthalene were present as secondary constituents at some of those sites. In a polishing mode, each site was injected with multiple rounds of oxygen release compound and desorption/oxidation amendment. In addition to contaminant concentration analysis, field parameter measurement, and geochemical analysis, microbial data were also collected. The microbial data were collected by using special filter devices to capture microbes pumped across the filter under low flow conditions. The filters were analyzed by a quantitative polymerase chain reaction (qPCR) method with DNA targets for total Eubacteria, aerobic gene functions for gasoline degradation, and for some of the sites, other specialized microbial targets.

Results/Lessons Learned. By tracking the microbial targets at baseline and then bimonthly post-injection, more complete microbial profiles were obtained for each of the sites. When combined with the field parameters and geochemical analysis, the microbial profiles became valuable in understanding performance of the polishing technique and the efficiency of generating more robust aerobic conditions at each site. Comparisons of the cells/ml and gene copies/ml results of different microbial targets will be presented from the five sites through the various injection lifecycles. Comparisons of the specific geochemical parameters and the microbial profiles will also be presented.

For one site, understanding the microbial profile became the critical piece of knowledge in understanding poor performance of the polishing technique. The profile pointed to an unusual interaction between methanogenic and methanotrophic bacteria that had to be addressed to get the polishing technique back on track. This unique situation will also be described with supporting carbon dioxide and methane data.

Overall, the value of site microbial profiles through the use of MBTs cannot be understated and should be standard operating procedures at all environmental sites.