Identification of Actionable Data for Maintenance Permeable Reactive Biobarriers

Matthew Burns (matt.burns@wsp.com) and Michael Brown (michael.j.brown@wsp.com)
(WSP, Boston, MA, USA)

Background/Objectives. Permeable reactive biobarriers have been installed at numerous sites to treat contaminated groundwater before impacting receptors. Biobarriers installed to treat chlorinated solvents along the sequential reductive pathway (hydrogenolysis) often contain consumable amendments including microbial food source (electron donor), micronutrients, microbial augments and pH buffers. At most of these sites, contaminant transport velocity is such that the limited in situ longevity of the amendments requires maintenance amendment applications to maintain ideal conditions needed for complete treatment. Amendment longevity concerns are heightened by the recent practice of enhancing reactive barrier amendment formulations with activated carbon products as many long-term electron donors (e.g., vegetable oils) competitively sorb to the activated carbon and exclude sorption of targeted contaminants. Diagnostic data that indicate when maintenance injections are needed is key to performance of permeable reactive biobarriers and protecting receptors.

Approach/Activities. Long-term monitoring costs add up. Curtailing the analytical programs of unnecessary parameters is an often used strategy to control costs. But the cost of system failure is high too. Identifying the most actionable data, especially those that are less costly, is key to an efficient performance monitoring program at biobarrier sites.

The authors evaluated long-term performance monitoring data from several sites where initial performance to design parameters was analytically confirmed. Analytical parameters varied from site to site but all included conventional data and advanced diagnostics such as quantitative polymerase chain reaction (qPCR) and compound-specific isotopic analysis (CSIA). Correlations among various types of field measurements and laboratory analyses were evaluated to determine whether a limited set of indicators could provide the information required to identify degraded performance and appropriate timing for maintenance injections.

Results/Lessons Learned. The data from several biobarrier sites and found field-collected parameters, such as pH and oxidation reduction potential (ORP), and contaminant concentration trends provide the most consistently actionable data. Laboratory data, including volatile fatty acids and abundance of target microbes, also identified deficiencies but at higher price points. Data supporting an optimized approach that balances costs, sample collection frequency of primary and secondary parameters, and data certainty will be presented.