Focus on Geology to Improve In Situ Remediation Outcomes: Perspectives for the Remediation Engineer

Paul M. Dombrowski, P.E. (pdombrowski@isotec-inc.com) (ISOTEC, Lawrenceville, NJ, USA)

Background/Objectives. In situ remediation technologies utilize chemical, biological, and physical treatment processes and have been demonstrated to be effective for treating a wide range of contaminant types. Implementing in-situ remediation is a commonly applied approach due to limited site disruption, reduced exposure to contamination, and ability to combine with other technologies. Although costs for injection remedial approaches are generally lower than other treatment approaches (excavation, pump and treat or other mechanical systems), the combined costs of design, implementation, and monitoring spur the requirement for successful outcomes.

Approach/Activities. In situ treatment and injection of remediation chemicals can be performed with viewpoint of “let’s see what happens” or “it worked at another site so let’s do it again.” Alternatively, when treatment is tailored to be site-specific considering soil lithology, heterogeneities, and contaminant fate and distribution, in situ injection remediation technologies have the potential for achieving rapid reduction in contaminant concentrations and yield more contaminant destruction per dollar spent. Enhanced site characterizations and high density sampling are tools to support remediation planning. Although at many sites, schedule, cost, access or other reasons force remedial decisions and design with limited available data. Further, heterogeneities in the subsurface vertically and horizontally prevent a complete view of the subsurface for any treatment area. Therefore, remediation engineers must process the available data into design of systems. In-depth evaluation of geologic and hydrogeologic data is a critical step in remediation design, especially grain size, lithology, interfaces between soil types, and organic content.

Results/Lessons Learned. Geology-focused remediation design can improve remediation success rate and/or reduce treatment volumes, in turn reducing overall cost and remediation time. This presentation will share lessons learned from actual sites where geology-focused approaches were utilized for highly successful remediation results, including projects with fast-track schedules, inside and adjacent to buildings, in very low permeability soils (e.g., clay, tills), isolated contaminated intervals, very high contaminant concentrations, and/or where multiple amendments applied at a given site. Collaborative interpretation of available site data, which may or may not include boring logs, soil concentrations, groundwater concentrations, photoionization detector readings, field screening, high density interface probes, hydraulic conductivity measurements will be discussed for these sites and how they are used to optimize in-situ remediation. The importance of injection volumes, injection methods, injection spacing, and vertical injection intervals will be elaborated on with demonstration through numerous case studies. In addition, guidance for field investigations to support remedial design will be presented.