Post-Injection Evaluation of In Situ Chemical Reduction as Treatment Remedy for Nitro-Aromatic Compounds

Charles A. Montero, PG (charles.montero@wsp.com) (WSP UAS Environment & Infrastructure, Austin, TX, USA)
Charlie Macon, PG (cmacon@bbaengineering.com) (Bullock, Bennett & Associates LLC, Bertram, TX, USA)
Bill Lundy, PhD (wlundy@cool-ox.com) (DeepEarth Technologies, Inc., Tinley Park, IL, USA)

Background. An in situ chemical reduction (ISCR) work plan has been developed to address impacted soil and groundwater in the vicinity of a Resource Conservation and Recovery Act (RCRA) facility's former nitro-aromatic compounds manufacturing and railcar loading operations area. Environmental assessment activities conducted in the area of concern have included two RCRA Facility Investigations (RFIs) dated 1992 and 1998, evaluated under both the former Texas Risk Reduction rules, and under the current Texas Risk Reduction Program (TRRP), as well as the ongoing groundwater corrective action program monitoring and reporting activities under the facility's RCRA Compliance Plan. Persistent groundwater protection standards (GWPS) exceedances have been observed in groundwater samples from monitoring wells in the railcar loading area, since the 1980s. Nitro-aromatic compound concentrations in groundwater remain close to those observed in 1992 groundwater event samples in one monitoring well, while concentrations have generally increased in a second monitoring well.

ISCR has been selected as a potential response action to reduce source area chemicals of concern (COCs) that are impacting groundwater at the subject facility. The ISCR work plan uses a patented reagent solution to reduce nitro-aromatic compound concentrations, as well as other associated COCs. The referenced patented reagent solution has successfully and effectively promoted the reduction (i.e., destruction) of a broad group of organic chemical constituents including hydrocarbons, organo-halides, and nitrogenous organic compounds. The ultimate byproducts of the selected chemical degradation process are nitrate, nitrite, and carbon dioxide.

Approach. The objective of the ISCR work plan is to assess the efficacy of applying a patented reagent solution to source areas soils and groundwater to destroy nitro-aromatic compound concentrations, as well as other associated COCs by chemical reaction. Direct chemical injection will be used to introduce the patented reagent into the source "hot spot" area to treat the unsaturated and saturated soil column from approximately 10 to 37 feet below grade, i.e., the base of the sand-rich shallow water bearing zone. The reagent injection methodology will utilize a direct push technology (DPT) drilling rig (i.e., GeoProbe® or similar manufacturer) to install temporary injection points (IPs) to treat an area of approximately 340 square feet. Prior to and after implementing the treatment activity, groundwater and soil samples will be collected from locations within the treatment boundary and analyzed for site-specific nitro-aromatic compounds, nitrate, nitrite, total organic carbon, and pH. The planned treatment grid within an elliptical area includes two existing monitoring wells and a sufficient density of IPs to saturate the area to assure contact with the contaminated matrix.

The planned activity will allow for varied application techniques and reagent formulations to optimize the efficiency of a larger scale application treatment event, if necessary, with the projected goal of effectively reducing the source area COC concentrations.

Results. The results of the above-described work plan will be submitted to the TCEQ. The discussion the field and laboratory testing results, and conclusions and recommendations.