Use of High-Resolution Tool to Refine Data for Application in Remediation Project

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Background/Objectives. The subject area is a former industrial site located in a highly valuable commercial/residential zone in the city of São Paulo, in the state of São Paulo (SP), in Brazil. The site covers an approximate area of 4.7 hectares, and was operational between 1958 and 2004. The site's production process consisted of the remanufacture of automotive products such as alternators, starters, horns, fan motors. The main source area is in a shed that was used for production, and where chlorinated solvents were handled. In geological terms, the area shows a layer of backfill overlying a layer of organic clay until ~3.5 m bgs, under which there is an alluvial (sandy) layer that ends at ~6 m bgs, where it interfaces with the weathered rock in the zone of concern. The target zone considered for remediation was the aquifer's alluvial portion, where the primary concentrations of chlorinated organic compounds were historically detected in the site. The site was the object of traditional investigations until 2014, when it was monitored for the last time and the application of thermal remediation and in situ chemical oxidation was proposed. The use of a high-resolution tool was aimed at validating the target areas for each remediation technique.

Approach/Activities. High-resolution mapping was done using Membrane Interface Probe / Hydraulic Profiling Tool (MiHPT), with three detectors: photoionization detector (PID) to detect double-bound compounds (e.g., benzenes and chlorinated ethenes), flame ionization detector (FID) to detect petroleum hydrocarbons, and halogen specific detector (XSD) to detect halogens (e.g., chlorinated organic compounds). The assessment of the drilled materials was based on data from an electric conductivity (EC) dipole combined with results obtained using HPT, that through measurements of counterpressure to water injection can indicate permeability's changes in the subsurface. A total of 88 boreholes were advanced, adding up to approximately 600 meters. The signals from the equipment were validated through the collection of groundwater and soil samples.

Results/Lessons Learned. Analysis of MiHPT results indicated that the three detectors (PID, FID and XSD) showed similar responses, suggesting the existence of halogenated (chlorinated) compounds, as well as aromatic compounds and/or compounds from the alkene family. It was also noted that detections in the alluvial soil were less frequent than those in weathered rock (interval ~7.0 m bgs to 8.0 m bgs), with lower intensity peaks. The chemical analyses made in the soil and groundwater confirmed the MiHPT signals. The use of MiHPT enabled the revision of the site's conceptual model and a new design of the initial remediation project. This significantly decreased the area initially estimated for remediation. It also altered the zone of concern for the action of these techniques, since current findings suggest that the highest concentrations are concentrated in a deeper and less permeable layer of the aquifer (weathered rock).