Provect-IR® – *In Situ* Chemical Reduction (ISCR) of Chlorinated Solvent Source Area

Former Manufacturing Plant – São Paulo, Brazil
Contaminants of Interest –Tetrachloroethylene (PCE), Trichloroethylene (TCE), cis-1,2-Dichloroethene (cis-1,2 DCE), Vinyl Chloride (VC), and 1,1,2,2-Tetrachloroethane (1,1,2,2-TeCA)

Project Summary

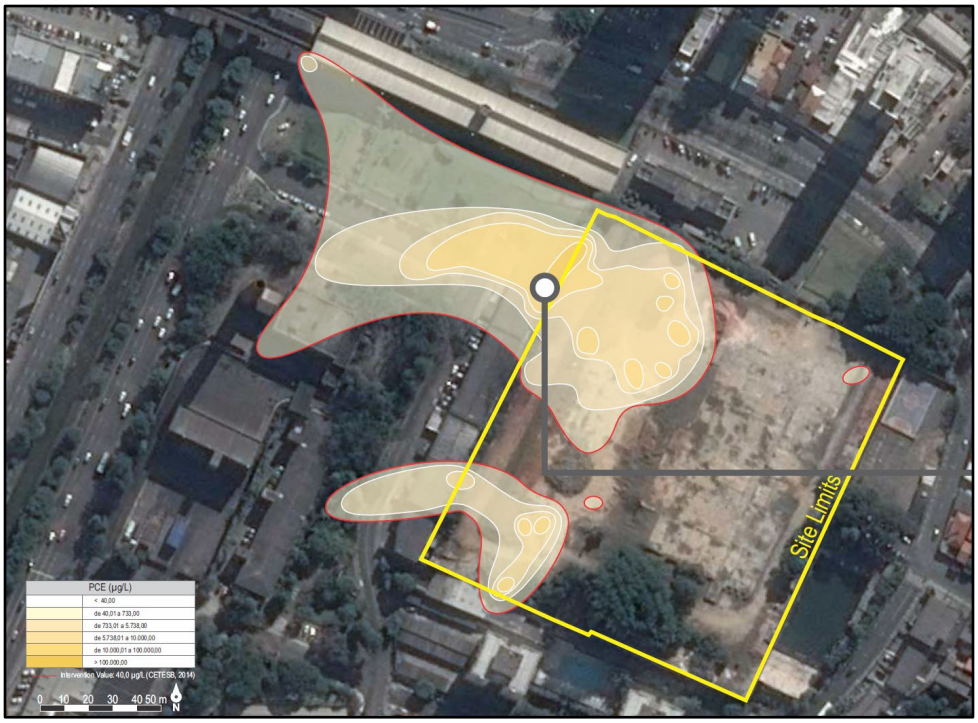
This site is a former appliance manufacturing plant located in São Paulo, Brazil that was contaminated due to business operations. Soil and groundwater were impacted with chlorinated volatile organic compounds (CVOCs), including tetrachloroethylene (PCE), trichloroethylene (TCE), cis-1,2-Dichloroethene (cis-1,2 DCE), vinyl chloride (VC), and 1,1,2,2-Tetrachloroethane (1,1,2,2-TeCA). PCE was the most widespread and concentrated contaminant of interest in groundwater exceeding concentrations of 200,000 ug/L. The hydrogeological model is complex, with the vertical treatment zone being divided into four hydraulic layers with confining clay zones. The shallowest zone was considered most important for remediation due to the potential for vapor intrusion impacts.

Remediation Plan

The remediation plan developed by SGW Services (São Paulo, Brazil) included the combination of multiple technologies to remediate soil and groundwater across the 10,500 sq meter (113,000 sq ft) plume. Excavation was utilized to remove densely impacted clay soils where injections were not feasible. Multi-phase extraction was used in local hot spots, with soil vapor extraction was used in the neighboring buildings to mitigate potential exposure to residents. *In situ* chemical reduction (ISCR) with Provect-IR® was utilized in the majority of the plume across multiple vertical hydraulic zones. The efficacy of Provect-IR® was first confirmed via bench testing, which was followed by field-scale pilot tests. The pilot test results were utilized to develop the full-scale remediation plan. The final remediation plan included 300 tons (600,000 lbs) of Provect-IR® that was injected via 537 direct push points ranging in depth from 4 to 17 meters (13 to 56 ft) below ground surface (m bgs).

Provect-IR Applied via Direct Push Points

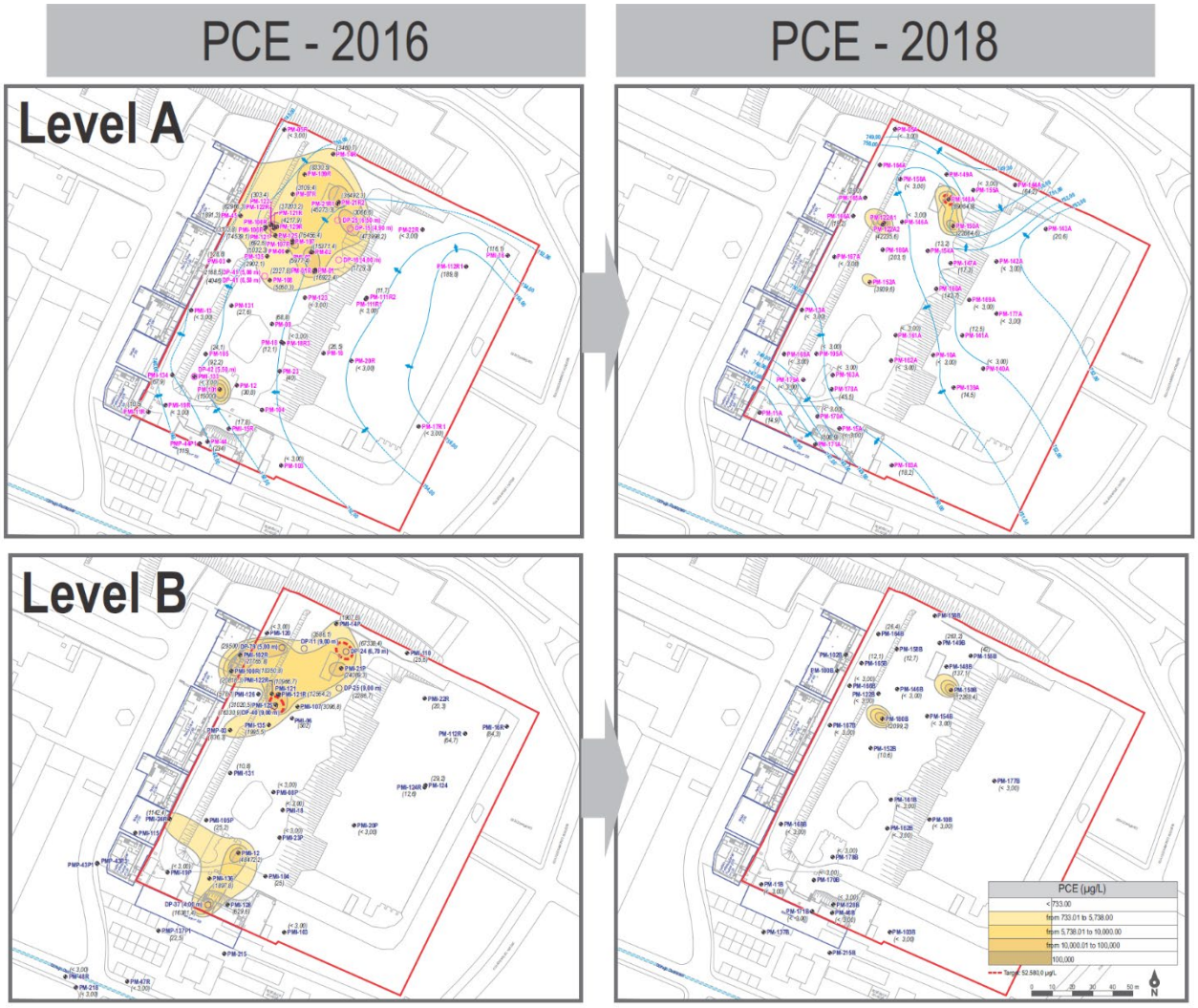
Provect-IR® is a site-specific blend of unique reagents combined into a single product that optimizes the *in situ* reductive dechlorination of chlorinated VOC contamination in both soil and groundwater. This technology works by promoting synergistic interactions between zero valent iron (ZVI), hydrophilic, nutrient rich organic carbon sources, chemical oxygen scavengers, vitamins, and mineral sources. This patented combination of natural and food grade amendments promotes ISCR conditions for rapid and effective destruction of the targeted contaminants. Additionally, Provect-IR® is the only ISCR reagent to simultaneously inhibit the production of methane during the requisite carbon fermentation process, which promotes more efficient use of the hydrogen donor while avoiding negative drawbacks associated with elevated methane.



PCE Plume Extent

Treatment Program Results

Following the application of Provect-IR®, monthly pH and ORP readings were collected to confirm that conditions conducive to ISCR had been established. As anticipated, groundwater conditions rapidly became anaerobic following Provect-IR® injection, and total CVOCs in soil and groundwater were reduced by 89%. Many of the targeted monitoring wells had all CVOC concentrations below the calculated site-specific target levels (SSTLs), with only a few monitoring wells still exhibiting cis-1,2 DCE and VC concentrations above SSTLs. However, the cis-1,2 DCE and VC concentrations were significantly below baseline concentrations. Additionally, there has been no observed rebound in the parent compounds. The figures below outline the significant PCE plume contraction following the remedial efforts. Current site conditions continue to exhibit favorable ISCR geochemistry with further contaminant reductions anticipated.



This case study was developed by Provectus in collaboration with SGW Services.

SGW Services is a Brazilian environmental consultancy specialized in engineering, assessment and remediation of contaminated areas, audit, and licensing. With solid technical skills and experience with environmental projects in Brazil and Latin America, SGW operates in the most diverse sectors of market in an efficient, transparent, and responsible way.

Please contact Provectus at (815) 650-2230 or via email at info@provectusenv.com for additional information regarding this project or our technologies.