

## **Excavation, Groundwater Extraction, In situ Bioremediation, and In Situ Chemical Oxidation to Treat Large Commingled cVOC Plumes**

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**Background/Objectives.** At the former Fort Gillem located in Forest Park, Georgia, a large chlorinated volatile organic (cVOC) groundwater plume is present and is being treated by addressing contaminants in the soil and in both the saturated overburden and bedrock groundwater units. Historically, disposal areas were on the property and have contributed to the dilute groundwater plume observed on and off the former Fort Gillem.

The concentrations of total VOC range from levels near the site remediation goals to over 110,000 µg/L. The cVOC plume consists of 1,1,2,2-tetrachloroethane (TeCA), trichloroethene (TCE), carbon tetrachloride, and degradation products. To reduce cVOCs to below the remediation goals, which are near the maximum contaminant levels (MCL) and prevent contaminants from continuing to migrate downgradient, multiple approaches have been used, which include excavations, dual phase extraction (DPE) systems, in situ bioremediation (ISB), and in situ chemical oxidation (ISCO).

**Approach/Activities.** To reduce cVOC mass in soils that are contributing to large groundwater plumes, excavations and dual phase extraction (DPE) systems have been implemented. On the south side of the former Fort Gillem a dual phase extraction system was used to treat both soil and groundwater, along with creating hydraulic control. On the north side of the former Fort Gillem, a groundwater extraction system was used to reduce mass and provide hydraulic control. ISB biobarriers have been installed both on and offsite using over 400 injection points to deliver over 2.5 million gallons of amendments consisting of emulsified vegetable oil (EVO), buffer, nutrients, and the microbial culture SDC-9™. Most recently, ISCO, using base activated sodium persulfate has also been used to treat both soil and groundwater in small areas of elevated concentrations.

**Results/Lessons Learned.** Over 6,400 pounds of total cVOCs have been removed from the groundwater using the DPE and groundwater extraction wells. The excavations have removed over 104,000 tons of contaminated soils in the last few years. The ISB biobarriers have been in place for 4 years and have reduced contaminant levels up to 99.8% in some wells. ISCO has also reduced contaminant levels in both soil and groundwater. The combination of these technologies has allowed the Army to turn off groundwater extraction systems and transfer ~160 acres of land to private industry. Also, the combination of ISB and extraction technologies has posed some unique challenges, including increased contaminant mass being observed, which were not foreseen. Sampling of soil and groundwater is being conducted to aid in determining remedy effectiveness. This presentation will provide an overview of the combined technologies used to treat the plumes at the former Fort Gillem, discuss current contaminant concentrations, and site goals.