Grants Chlorinated Solvents

Thermal-Biostimulation-In Situ Chemical Oxidation-Vapor Intrusion Mitigation

Site Name: Grants Chlorinated Solvents
Site Location: Grants, New Mexico
Technology Used:

- Electrical Resistive Heating (ET-DSP™)
- Biostimulation
- In Situ Chemical Oxidation (ISCO)
- Vapor Intrusion Mitigation

Regulatory Program: U.S. EPA Superfund NPL site
Remediation Scale: Full
Project Duration: 2009 to Present

Site Information: The Grants Chlorinated Solvents Plume Site (GCSP) is located within the city limits of Grants, Cibola County, New Mexico. It is located in a mixed commercial and residential area. The groundwater plume is approximately 2,500 feet long and extends to 100 feet below ground surface (bgs).

Contaminants: The source of the contamination is believed to be an operating and an abandoned dry cleaning facility. The contaminants of concern (COCs) are tetrachloroethene (PCE) and its degradation products trichloroethene (TCE), *cis*-1,2-dichloroethene (*cis*-DCE), *trans*-1,2-dichloroethene (*trans*-DCE), and vinyl chloride. Other COCs are benzene, bromoform, and xylenes that are the result of leaking petroleum underground storage tanks (UST). These contaminants will be addressed as part of the UST cleanup efforts. Figure 1 presents a site conceptual model of contaminant distribution.

Dense non-aqueous phase liquid (DNAPL) is present at the site and has created a dissolved plume that is approximately 2,500 feet long and at least 100 feet deep (Perlmutter et al. 2012). The maximum concentration of PCE detected in groundwater was 51 mg/L (EPA 2012).

Hydrogeology: The site is underlain by interbedded layers of silt/clay with silty sand and sand (Figure 1). The San Andres Limestone—Glorieta Sandstone bedrock occurs at depths between 100 and 150 feet bgs. Groundwater is

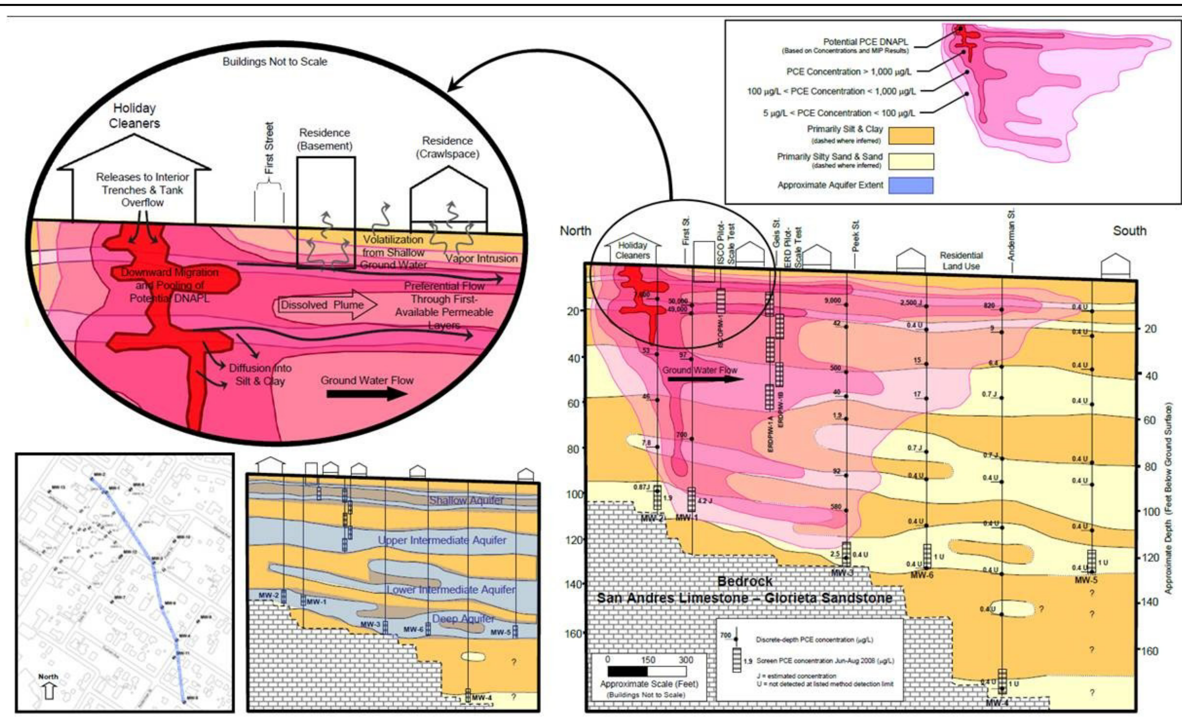

Figure 1. Site Conceptual Model.

Source: Perlmutter 2012

found at a depth of approximately 5-6 feet bgs and flows in a southeast direction.

Project Goals: The remedial action objectives for the 2006 Record of Decision were:

Water—Protect human health from exposure to chemical constituents in concentrations above Maximum Contaminant Levels (MCLs) or Applicable or Relevant and Appropriate Requirements (ARARs).

- Restore the groundwater at the GCSP Site such that it contains concentrations of the COCs less than the applicable MCLs or ARARs in a timely manner.
- Prevent DNAPL, if present, from causing concentrations of COCs in groundwater to exceed MCLs or ARARs.
- Reduce the concentration of COCs in groundwater to mitigate vapor intrusion.

Soil—Prevent the groundwater from being impacted above MCLs through transport of COCs from the unsaturated zone.

- Protect human health from exposure to chemical constituents in soil.
- Reduce the concentration of COCs in soil and soil vapor to mitigate the vapor intrusion pathway.

Vapor Intrusion—Prevent vapor intrusion into structures that results in human exposure to vapor-phase COCs in excess of a $1x10^{-5}$ excess lifetime cancer risk.

Cleanup Approach: The COC concentrations in the shallow groundwater were causing a vapor intrusion risk to residential properties overlying the plume. Fifteen houses were equipped with a vapor intrusion mitigation system in 2009. This type of system uses a fan to vent air from beneath a floor slab or within a crawl space to the outside of a building (Figure 2). The systems will remain operational until contaminant concentrations in the soil and groundwater no longer pose a risk.

The PCE concentrations found exceeded 30% of its solubility implying the presence of DNAPL under the active drycleaner. In addition, the subsurface is comprised of both permeable and tight soils. The contaminants will enter the tight soils through diffusion and slow advection. Once inside the tight soils they will become a source of contamination to the groundwater in the permeable soils through back diffusion. There are a limited number of remedial technologies that can effectively treat tight soils in situ. An electrical resistive heating system (ET-DSP™) was chosen to address the approximately 30,400 ft^2 source area (33,300 yd^3) at this site.

Figure 2. Example Fan and Exhaust Vent for Active Vapor Intrusion Mitigation System.

The ET-DSP™ system uses stacked electrodes within a boring, which are operated with innovative power distribution, electrical phasing, and water recirculation to maintain controlled heating within a heterogeneous formation (Perlmutter et al. 2012).

Two hundred fifty eight electrodes were installed in 121 boreholes, generally on 20-foot centers (Figure 3). The deepest boreholes were to 40 feet bgs. The area under the operating drycleaner, which most likely contained DNAPL, also had to be addressed without affecting the drycleaner operations. This was accomplished by constructing a false floor in the building that would allow shallow extraction wells and electrodes and associated wiring to be placed without endangering the employees. Intermediate and deep interval electrodes, extraction wells, and temperature sensors were installed under the building using angled drilling techniques (Figure 4). In all, 26 vapor extraction wells and 64 multiphase wells were installed on the site. The multiphase wells were used to lower the water table as well as collect contaminated water and vapors. The target temperature for the soil was 90° to 100° C. Heating began in December 2011 and continued until June 2012. Aboveground treatment included a vapor granulated activated carbon system and an oil-water separator, followed by an air stripper and a liquid granulated carbon unit.

Figure 3. Electrode Field.
Source: EPA 2012a


Figure 4. Angle Drilling.
Source: Perlmutter et al. 2012

Pilot studies were conducted using ISCO and enhanced reductive dechlorination (ERD). The studies showed that in the Grants plume setting, ERD would be superior to ISCO. Therefore, biostimulation using emulsified oil was chosen as the method for addressing the dissolved phase plume at the site. Eight biobarrier transects of nested injection wells (573 wells in total (EPA 2012b)) were installed on 20-foot centers to address the plume (Perlmutter et al. 2012). Full-scale injection of approximately 4,600 gallons of biodegradable vegetable oil amendment into approximately 400 non-source zone wells occurred between March and April of 2012 (Figure 5). Following the completion of electrical resistive heating, additional injection wells were installed in the source zone. Injections into these wells occurred October 6 to October 26 (EPA 2012a). Additional injections will continue about every 24 months until remediation standards are met (EDNM 2012).


Figure 5. Emulsified Oil Injection Trailer.
Source: EPA 2012b

Project Results: The ET-DSP™ system ered about 1,000 pounds of contaminants from the source area. The biobarriers have been successful in reducing the contaminant concentrations in the plume.

Sources:

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