GTR | Case Study:

MCB Camp Pendleton

Site Information

The Camp Pendleton Site encompassed approximately 4,800 square feet (sq ft), including a vehicle maintenance and repair area, a vehicle painting shop, a vehicle wash rack, an elevated ramp for lubricating vehicle, and a service station for fuel storage and dispensing. Heterogeneous silts, clays, sand and gravel lenses predominated the site's lithology from surface to 50 ft bgs. Groundwater was encountered at approximately 25 ft bgs.

GEO Environmental Remediation Company implemented in situ thermal conduction heating (TCH) to aggressively treat the subsurface PCE, TCE, Vinyl Chloride, Benzene and Naphthalene contamination in 2016.

Remedial Objectives

The goal of the project was to reduce the contaminant mass of PCE, TCE and Vinyl Chloride in soil and groundwater by 95% or greater (by mass) and to reduce the contaminant mass of BTEX compounds and Naphthalene by 90% or greater (by mass).

Project Description

Active heating with GTR™ well systems was performed from just below ground surface to a mean depth of approximately 40 feet bgs. The in situ thermal remediation well field was composed of:

•TCH Wells (vertical): 80 TCH heater wells (natural gas powered) heated the subsurface from just below the ground surface to a mean depth of 40 ft bgs;

•MPE Wells (vertical): 33 Multiple-Phase Extraction (MPE) wells operated in the thermal treatment zone, acting as the primary contaminant extraction points;

•SVE Wells (horizontal): Shallow horizontal vacuum extraction points were laid atop the ground surface in gravel (just below the insulating surface cover) to provide pneumatic control of the upper most heated zone;

•Temperature & Pressure Monitoring Points: 4 temperature and pressure monitoring points were used to document subsurface heating progression at depths of 3, 10, 20, 30 and 35 - 40 ft bgs within the treatment zone;

ISTR Overview

Location: Oceanside, Ca

History: Fuel Storage

Treatment Zone: 4,800 ft^2 to a depth of 35 ft bgs

Lithology: Heterogeneous silts, clays, sand and gravel lenses

Contaminants:
PCE, TCE, Vinyl Chloride, BTEX Compounds and Napthalene

Heater Wells: 80

Target Temp: 100˚C

Remediation Results:
> 99% Mass Removal

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In Situ Thermal Remediation (ISTR) Design

Treatment area: 4,800 sq. ft.

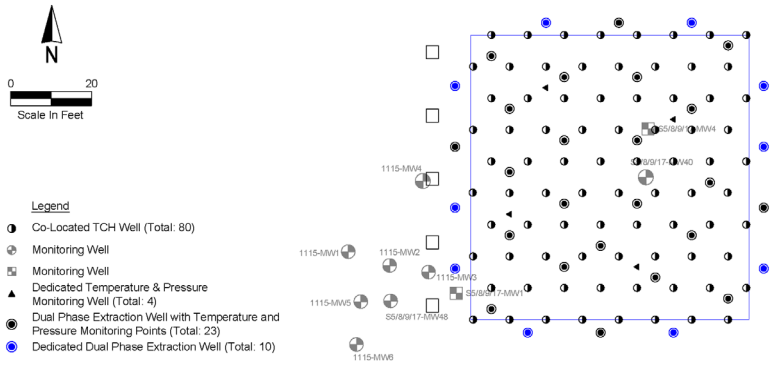
Upper depth of treatment: 0 ft bgs

Lower depth of treatment: 35 ft bgs

Treatment volume: 6,222 cubic yards (cu yd)

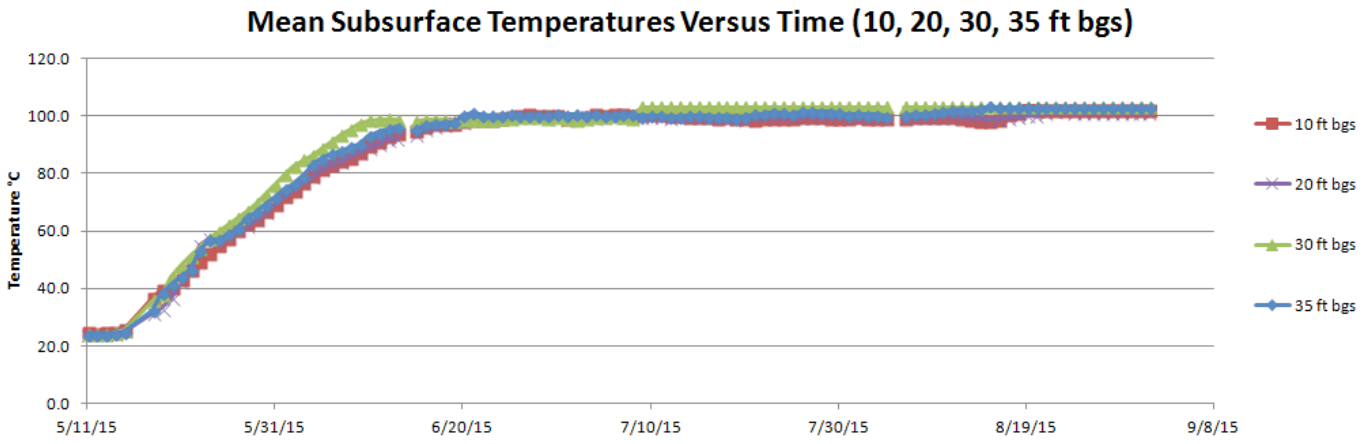
Estimated combined COC mass: 52,000 pounds

Duration: 113 day active heating period



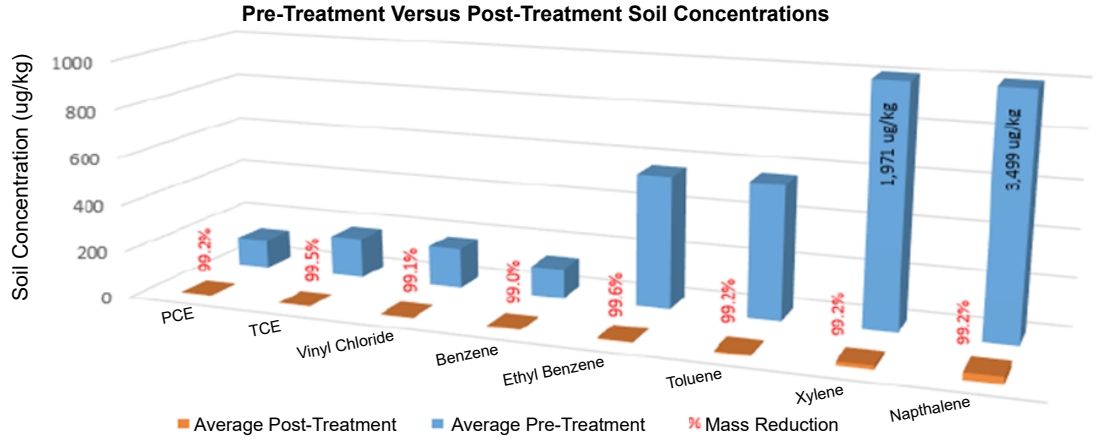
MPE & ISTR Operational Data

For 20 days, the MPE system ran without heating in order to establish hydraulic and pneumatic controls. Once heating began, the target treatment temperature of 100 °C was attained and maintained to provide subsurface steam sweeping. This temperature resulted in contaminants being mobilized, desorbed and volatilized, and subsequently removed from the subsurface via the MPE and SVE wells. GEO provided a guarantee for the target treatment temperature and heating duration at the project. The different treated depths heated relatively uniformly, and the target treatment temperature was achieved almost one week ahead of schedule.



Project Results

Over the course of 113 days of active subsurface heating, over 52,000 pounds of chlorinated and petroleum contaminants were removed from the treatment zone. Mean reductions of >99% by mass were achieved for PCE, TCE, Vinyl Chloride, BTEX compounds and Naphthalene in both soil and groundwater.



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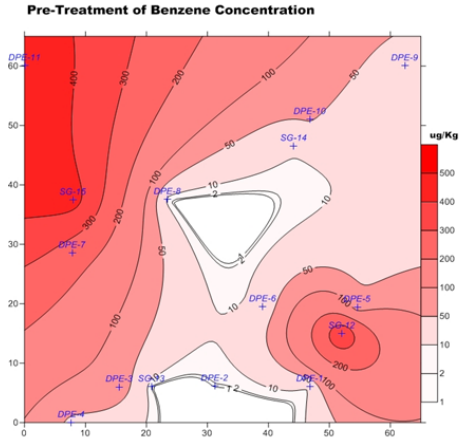
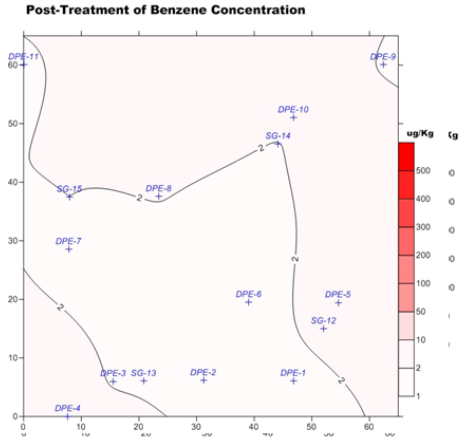
Pre-Treatment Versus Post-Treatment

The aerial maps below show a comparison of pre-treatment and post-treatment mean soil concentrations throughout the thermal treatment volume.

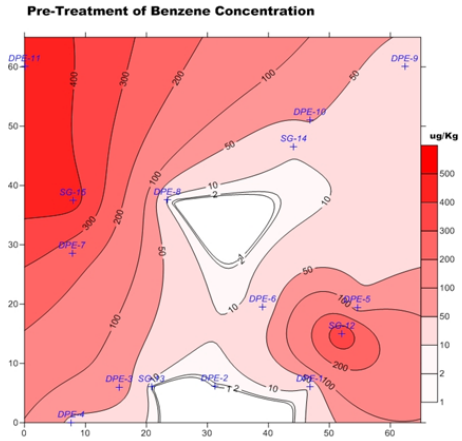
Pre-Treatment of Benzene Concentration



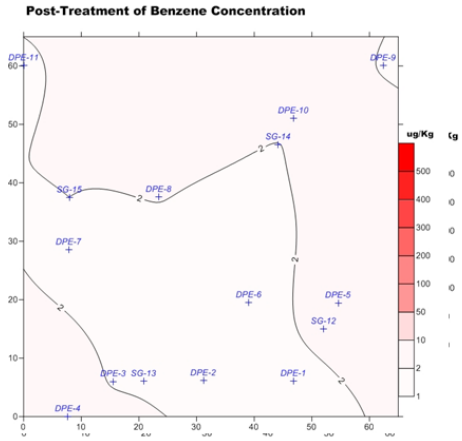
Post-Treatment of Benzene Concentration



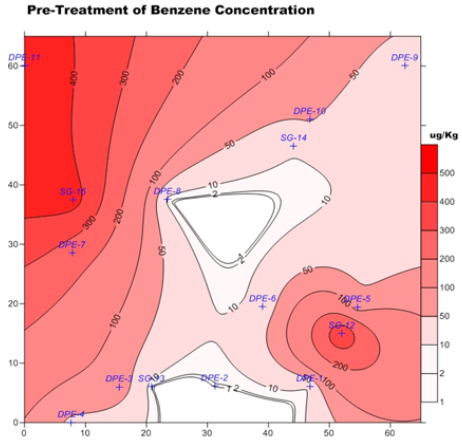
Pre-Treatment of Benzene Concentration



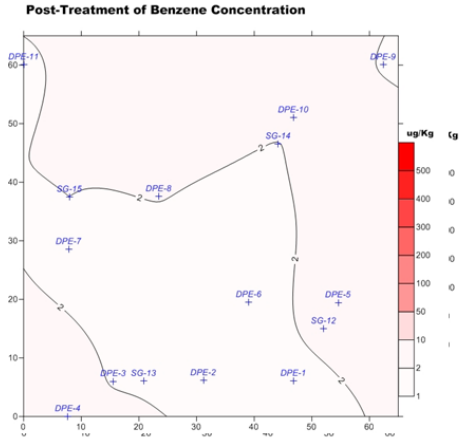
Post-Treatment of Benzene Concentration



Pre-Treatment of Benzene Concentration



Post-Treatment of Benzene Concentration



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