

Case Study

Ex Situ Soil Treatment using the VTX Process

Introduction

An illegal hazardous waste dump site containing a wide variety of hydrocarbon and chlorinated solvent waste was discovered in Rhode Island in 1991. The site contained a fabricated underground storage tank (UST) and a drain field constructed of a 4" iron pipe manifold with holes bored in the piping at regular intervals. The piping was laid in trenches of approximate one meter depth. The total area of immediate impact was approximately 50 meters by 40 meters. The depth of heavily contaminated soil to be treated was approximately 3 meters at the deepest point where groundwater was contact was made.

A wide variety of contaminants was dumped into the system over time, including TCE, PCE, TCE and DCB among many others. Levels of contaminants were very high in places reaching concentration levels in excess of 4000 ppm. Much of the contamination reached groundwater which has since migrated off site in a plume approximately 600 yards long.

The objective of the *ex situ* treatment portion of this project was to remove and treat the heavily contaminated soil within the source area. The volume of soil excavated for treatment was approximately 3000 tons.

Description of Soil

The soil at this site was primarily sandy silt and glacial till. The soil was quite permeable which explains why more soil was not contaminated at this site. The contaminants did not migrate horizontally to any significant degree within the soil above groundwater level.

Method of Soil Treatment

Excavated soils were stockpiled within a lined and bermed storage area prior to treatment. The soil was covered with high density PVC liner material to minimize volatile emissions.

An extensive system of volatile emissions monitoring was established on the perimeter of the site and along-side the treatment area. Testing was regularly done to assure that volatile emissions were not exceeding established limits for the activities on-site. Water was sprayed over the soil pile on a regular basis in order foster minimized vaporization.

The stockpiled contaminated soil was loaded onto excavators, sprayed with water as needed to minimize vaporization and placed into a soil shredder/screen. Screening was necessary to remove large rocks and debris and to shred the soil into particles of 2" or less for application of the oxidation chemistry. Once the soil was shredded and screened, it was forced down through a spray application shroud designed to apply VTX and hydrogen peroxide, at the appropriate dosage, evenly onto the soil. Soil moisture levels were increased at this point to a level approaching saturation. Once treated the soil was removed from the equipment to a storage area for testing after a minimum twenty-four hour treatment time.

Results

The results for the various contaminant level classes are presented in the following tables.

Approximately 500 tons of the 3000 tons of soil treated needed to be reprocessed in order to achieve treatment goals (Tables 1 and 4).

Treatment Results 1

Description of material:

Soil from area with previous high readings during site studies.

Contaminant	Pre Treatment ppm.	1st Post Treatment ppm (average).	2nd Post Treatment ppm (average).	% Reduction
1,1,1 Trichloroethane	4310.0	83.13	1.24	>99.9%
1,1 Dichloroethane	33.2	0.83	ND (Non Detect)	100%
1,2 Dichlorobenzene	31.2	1.12	ND	100%
Tetrachloroethane	132.0	1.87	ND	100%
Trichloroethene	835.0	26.90	0.40	>99.9%

Treatment Results 2

Description of material:

Soil from area with previous moderate readings during site studies.

Contaminant	Pre Treatment ppm.	Post Treatment ppm (average).	% Reduction
1,1,1 Trichloroethane	38.40	0.979	97.5%
1,1 Dichloroethane	1.08	ND	100%
1,2 Dichloroethane	0.183	ND	100%
1,2,4 Trimethylbenzene	0.208	ND	100%
1,2 Dichlorobenzene	0.103	ND	100%
1,3,5 Trimethylbenzene	0.0958	ND	100%
4 Isopropyltoluene	0.0561	ND	100%
cis-1,2 Dichloroethene	2.97	ND	100%
Ethylbenzene	0.125	ND	100%
Napthalene	0.107	ND	100%
sec-Butylbenzene	0.0388	ND	100%
Tetrachloroethane	0.307	ND	100%
Toluene	0.0338	ND	100%
Trans 1,2 Dichloroethene	0.0335	ND	100%
Trichloroethene	63.0	2.87	95.4%
Xylenes	0.598	ND	100%

Treatment Results 3

Description of material:

Soil with low contaminant levels.

Contaminant	Pre Treatment ppm	Post Treatment ppm (average).	% Reduction
1,1,1 Trichloroethane	0.442	ND	100%
1,1 Dichloroethane	0.0316	ND	100%
cis-1,2 Dichloroethene	0.110	ND	100%
Trichloroethene	0.534	ND	100%

Treatment Results 4

Description of material:

'Hot' soil from area under concrete pad.

Contaminant	Pre Treatment Ppm.	1st Post Treatment ppm (average).	2nd Post Treatment ppm (average).	% Reduction
1,1,1 Trichloroethane	1,320.00	154.0	3.08	>99.7%
1,1 Dichloroethane	9.99	ND	ND	100%
1,1 Dichloroethene	24.3	6.22	0.83	96.5%
Cis-1.2 Dichloroethene	6.83	ND	ND	100%
Tetrachloroethene	15.1	4.65	0.94	93.7%
Toluene	3.37	ND	ND	100%
Trichloroethene	110.0	29.2	ND	100%

Summary

All soil process was treated to within the clean standards established by the state regulatory agency. All soil was returned to the excavation site as clean fill.

The treatment project was completed within two weeks at a substantial savings in cost to any competing technology or disposal option.