In Situ Conductive Heating of a Chlorinated Hydrocarbon-Impacted Dutch Site: Lessons Learned

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Background/Objectives. In the Dutch town of Maarheeze, soil and groundwater at a site previously owned by an electronics/lighting company (the Company) have been contaminated with chlorinated volatile organic compounds (CVOCs), mainly PCE, TCE and 1,2 cis-DCE. On the site large amounts of PCE and TCE were stored in USTs. Vessels were cleaned, refilled and distributed to clients. The site is currently owned by a housing developer, but the Company was still responsible for the contamination. Redevelopment of the site was planned for the short term and all infrastructure would be demolished and removed. This served as a good opportunity for the Company to remediate the site.

Approach/Activities. CVOCs were present in high concentrations in soil (max PCE 1,000 mg/kg) and groundwater (max 1,2 cis DCE 380,000 µg/L). The soil can be described as a heterogeneous 15 m thick cover layer consisting of different layers of silty sands, loam and peat overlying a 15 m thick aquifer. The groundwater is located at 1 to 1.5 m bg. In the source area the contamination had penetrated the cover layer just down to the aquifer at about 14 to 15 m bg. A total volume of approximately 20,000 m^3 contaminated soil and groundwater had to be treated. The relatively large depth, the heterogeneity of the soil and contaminant distribution and the tight time schedule made the Company decide to use a fast and robust remediation technique. In situ thermal remediation was selected as the appropriate approach.

Results/Lessons Learned. The remediation was performed by thermal conductive heating, a technique using heaters to heat the soil via conduction. A total number of 217 heaters treated two source areas of approximately 1,000 m^2 each. The remediation target values were risk based and stringent (e.g., 0.5 mg/kg PCE). The remediation was well prepared; buildings and underground structures were removed which made treatment less complicated and the target treatment zone was well defined. A comprehensive risk analysis was performed to minimize technical and project risks.

However, the project experienced problems with rising groundwater during operation. Because of in-situ steam production, the groundwater was able to rise and flooded the extraction layer provided on top of the polluted areas. This resulted in a number of issues that had to be solved. To prevent flooding, hot groundwater was extracted from the treatment zones, requiring enlargements of the treatment system and leading to increased energy loss from the site.

Eventually the remediation has been finished in full compliance with the target values although the remediation took longer than anticipated. This poster illustrates that in situ remediations not always run as expected and will focus on how was dealt with the unexpected events.