

Application of Poly Remediation Technologies for Petroleum-Contaminated Sites

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Background/Objectives. A petrochemical industry site may experience the event of oil leaking due to the disrepair of tank and pipeline, and result in the contamination of soil and groundwater. The contaminated sites mentioned above are usually in operation in Taiwan. Owing to the usage of facilities and buildings, the plan of excavation with on site and off site remediation technology can't be adopted. This study is to present a series of poly remediation technologies according to the properties of the site and implement the proper technologies by regions and stages for the improvement of contamination. We hope to find the solution between environmental protection and economic development.

Approach/Activities. In order to achieve the remedial goal of different stages, the poly remediation technologies are compiled with the concept of remediation treatment chain and choosing the optimal technology in accordance with the variations and distribution of contamination during the remediation period. The purpose is to improve the efficiency and reduce the cost of work. First of all, it should be considered whether there is free-phase oil contamination in the hot spot zone and recover the free product as soon as possible. After the recovery of free product, surfactant flushing was used for further remediation about the residual phase of contamination on the saturated zone and continued reducing the concentration of contaminant. In situ chemical oxidation (ISCO) was used for treatment of the dissolved organic contaminant and the contamination of groundwater. Bioremediation was eventually adopted for low concentrations of contaminant in the late stage of remediation. Furthermore, thermal enhanced soil vapor extraction (SVE) could be chosen for contamination of the unsaturated zone in accordance with above remediation of saturated zone at the same time.

Results/Lessons Learned. The poly remediation technologies mentioned above have been successfully applied to a petrochemical contaminated site in Taiwan. The contaminants of concern were benzene, toluene, ethylbenzene and xylene (BTEX). Steam enhanced soil vapor extraction (SVE) was used for the remediation of the unsaturated zone and the removal rate of contamination was more than 90%. The volatile organic compound from the off gas condensed into free product and recovered back to the manufacturing process of factory. Surfactant flushing was chosen for the hot spot zone and the concentration of total petroleum hydrocarbon (TPH) has decreased from 18,000 mg/kg to 2,000 mg/kg after flushing work. There was no residual phase of contamination observed in the soil. Fenton-like technology of ISCO was used for the contamination of groundwater with three stages of injection and the removal rate of BTEX was more than 90% in groundwater. In addition, there was no rebound of concentration observed in monitoring wells at the end of injection. This case study showed the excellent performance of poly remediation technologies for petroleum contaminated sites.