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Monitoring the decontamination of a site polluted by DNAPLs

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The aim of this study is to monitor the decontamination of a site polluted by DNAPLs coming from an automotive industry. The contamination was caused by the poor management of the waste generated by the industrial activity, which was discharged into a seepage pit. As a result, soil contamination was produced in the seepage pit area and a plume of DNAPLs-contaminated groundwater was generated. To recover the original environmental quality, a dual action was proposed: in the first place, the removal of the source of contamination and in the second one, the treatment of the DNAPLs plume. The elimination of the source of contamination consisted on a selective excavation of the seepage pit and an offsite management of the contaminated land. To restore the groundwater quality, a passive treatment system using a permeable reactive barrier (PRB) of zero valent iron (ZVI) was implemented.

In order to determine the efficiency of the remediation actions, a chemical, isotopic and hydrogeological control of the main solvents detected in groundwater (perchloroethylene -PCE-, trichloroethene -TCE- and cis-dichloroethylene -cis-DCE-) has been established.

Results show a decrease in PCE concentration that has been attributed to the removal of the source more than to a degradation process. However, the presence of PCE by-products, TCE and cis-DCE, might indicate a possible PCE biotic degradation. δ13CPCE values analyzed upstream and downstream of the barrier don't show isotopic changes associated to the PRB (values are around -20‰ in all the sampling points).

TCE might have experienced a natural advanced degradation process according to the high concentration of cis-DCE found prior the installation of the PRB and the isotopic enrichment in δ13CTCE in some specific areas of the plume (-19.9‰ in the source and -16‰ before the barrier). Slight isotopic changes have been observed in the water flow in a far distance after the barrier (-15.4‰.

δ13Ccis-DCE experienced an enrichment upstream to downstream of the barrier (from -15.5‰ to -11.5‰ indicating that a possible abiotic degradation due to the PRB is being produced. However, an enrichment in δ13Ccis-DCE from the focus area to the barrier (from -19.9‰ to -15.5‰ was also detected, suggesting that biotic degradation of cis-DCE is occurring in the field.

As a conclusion, preliminary concentration and isotopic results seem to indicate that the PRB does not intercept the whole contaminated plume. The installation of a monitoring system of multilevel piezometers of new construction around the PRB has been proposed in order to study in detail the underground sections most affected by pollution and help to define patterns of migration of DNAPLs in the subsurface, giving the possibility to improve the design of the ZVI-PRB.