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Combining non-invasive techniques for delimitation and monitoring of chlorinated solvents in groundwater

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Large numbers of polluted areas cause leakage of hazardous pollutants into our groundwater. Remediated actions are needed in a vast number of areas to prevent degradation of the quality of our water resources. As excavation of polluted masses is problematic as it often moves the pollutants from one site to another (in best case off site treatment is carried out), in-situ remediation and monitoring thereof needs further development. In general, we need to further develop and improve how we retrieve information on the status of the underground system. This is needed to avoid costly and hazardous shipments associated with excavations and to avoid unnecessary exposure when handling polluted masses. Easier, cheaper, more comprehensive and nondestructive monitoring techniques are needed for evaluation of remediation degree, degradation status of the contaminants and the remaining groundwater contaminant plume.
We investigate the possibility to combine two investigation techniques, which are invasive to a very low degree and can give a very good visualization and evaluation of pollutant status underground and changes therein in time. The two methods we have combined are Direct Current resistivity and time-domain Induced Polarization tomography (DCIP) and Compound Specific Isotope Analysis (CSIA) and their use within the context of DNAPL contaminated sites. DCIP is a non-invasive and non-destructive geoelectrical measurement method with emerging new techniques for 4D mapping for promising visualization of underground hydrogeochemical structures and spatial distribution of contaminants. The strength of CSIA is that inherent degradation-relatable isotopic information of contaminant molecules remains unaffected as opposed to the commonly used concentration-based studies. Our aim is to evaluate the possibilities of gas sampling on the ground surface for this technique to become non-invasive and usable without interfering ground conditions.Drillings together with soil and groundwater sampling provide reference data within the project and for calibrating interpretations.

In our studies, we show the results from DCIP measurements from two different areasin sothern Sweden with chlorinated solvent contamination. From one of the areas, a pilot test on stimulation reductive dechlorination has been carried out and the treated area reveals sharp anomalies in the DCIP response. Time lapse measurements show changes within the stimulated area and this could be used to follow remediation changes and i.e. groundwater quality changes. Tests with DCIP time lapse are also carried out in the second area together with multiple CSIA analyses of groundwater samples and ongoing is the planning for the gas samples. Evaluation of the possible uses, benefits and limitations of the technique for monitoring changes and delimit polluted areas to be able to monitor and follow groundwater quality changes is ongoing.