

# Development of an innovative methodology for monitoring of in situ remediation of chlorinated solvents – the MIRACHL-project

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## Background

Dense Non Aqueous Phase Liquids (DNAPL) such as chlorinated solvents are common pollutants stemming from different types of industries including dry cleaning facilities, and reports on cases showing serious risk to soil and ground water are frequent on a global scale. DNAPLs are especially problematic as they are denser than water and move down through the groundwater, not always following the groundwater flow but are mainly driven by gravitational forces. Difficulties associated with remediation activities of DNAPLs are many, especially delineation of the source plume, and understanding of the migration of contaminated groundwater in the underground. Therefore, the Swedish national environmental authority, (SEPA) has called for new and innovative in-situ remediation techniques.

The MIRACHL-project (monitoring of in situ remediation of chlorinated hydrocarbon contaminants - <http://mirachl.com/>) are focused on developing new and innovative methods for better understanding of the transport and fate of chlorinated solvents in soil and groundwater. The MIRACHL-project combine three methods; i) geoelectrical imaging by the geophysical method Direct Current resistivity and Induced Polarisation (DCIP), ii) Physical and BioGeochemical Characterisation (PBGC) and iii) the method Compound-specific isotope analysis (CSIA). The MIRACHL-project, based at the Engineering Geology at Lund University, is a collaborative project including several other universities and other relevant organizations, In particular, the collaboration on field sites with the Geological Survey of Sweden (SGU) is of great importance.

## Aim

In the MIRACHL project we develop an integrated methodology based on three methods, i.e., Direct Current resistivity and Induced Polarisation (DCIP), Physical and BioGeochemical Characterisation (PBGC) and the method Compound-specific isotope analysis (CSIA), to better understand and map in situ remediation processes. A

combination of continuous geo-electrical observations during the decontamination, together with the analysis of biogeochemistry and isotope fractionation, provides opportunities to follow transport and fate of chlorinated solvents during different types of in-situ remediation processes.

The MIRACHL-project started in 2016 and will continue until 2022. In 2017, the MIRACHL methodology was established at two sites in collaboration with SGU, i.e., in Hagfors and Alingsås. At both site contaminations coming from dry cleaning facilities are in focus. The geology and hydrogeology is very different at these sites and the presentation will show the status in mapping and monitoring the ongoing remediation at the sites.

### **Conclusion**

Initial studies performed at a site in Kristianstad (Färgaren 3) show the combination of DCIP, PBGC, and CSIA are promising methodology for mapping of transport and fate of chlorinated solvents. We will present on-going research on two sites where contamination from chlorinated solvents are in focus, i.e, contamination due to dry cleaning activities in Hagfors and Alingsås.

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