A large-scale leakage of tetrachloroethene (PCE) solvents broke out in Alingsås dry-cleaning facility (Alingsås Tvätteri) in the 1970s. The leakage itself, as well as the insufficient emergency treatment chosen for this accident resulted in the long-lasting effect on the local underground environment. They are unlike for example buried duds, which cause instant damages once accidentally exploded. Instead, these contaminants can disseminate in the soil, dissolve and float with groundwater, as well as evaporate in the air in the long run. Any human being's possible direct contacts with these contaminated media will raise the chance of cancer without spontaneous awareness.

Unfortunately, such contaminated sites are not rare in Sweden, with over 82000 similar sites documented by Naturvårdsverket (2014). To realize the non-toxic environment target by 2020 in Sweden, numerous remediation projects are being and to be carried out on these identified contaminated sites. Among all possible solutions, the trendiest in-situ remediation approach got involved in a lot of debates and arguments which did not stop until the recent decade. Although the effectiveness was demonstrated in several scientific papers, an efficient but non-destructive method is in great demand to better monitor the remediation process at different stages.

To pursue this purpose, the five-year "MIRACHL" project was thus established and several contaminated sites, Alingsås dry-cleaning facility included, were chosen as researching targets. The main methods used to monitor the remediation process are Electrical resistivity tomography (ERT) and Induced polarization (IP), with geo- and biological monitoring. With these two methods, the subsurface constitution can be depicted in 2D or 3D profiles by the electrical properties of different materials. At the Alingsås site, the degradation activities are to be enhanced by the microbial injections, and the first pilot injection was conducted in November 2017. With the degradation process going on, the subsurface depiction by electrical properties is supposed to witness changes. However, ahead of the comparison over following time steps, a refined 3D geological model of the initial state is demanded, to attain a better understanding of the site. The construction of such refined 3D geological model is also the main task of this master's thesis work.

The refined 3D geological model was built up via GeoScene3D, a software developed by I-GIS, a Danish company. This modelling software provides the possibility of visualising various data in one complete geological model. In this master's thesis work, the refined geological model consists of six types of data: the ERT and IP measurement results before the pilot microbial injection, the geochemistry data derived from Groundwater samplings, and Membrane Interface Probe Soundings (MIP-Soundings), the geological layer information derived from the previous borehole logs, terrain boundary data provided by Lantmäteriet, underground pipelines, and inspected groundwater levels. A short video clip was also made to better display the model. The link to the video is https://youtu.be/3QST47BfpIo. The main idea of the project is the integration of all these data for a more complete understanding of the site.

Through the visualisation in the GeoScene3D, it can be clearly observed that high contamination zones concentrate on the bottom areas of the unconsolidated layer. At some locations, the high contamination zones are even touching the bedrock surface. The primary and secondary degradation products can be extensively found at the site while the high concentrated tertiary degradation products can only be found at one edge probe of this set of measurement. The link between the electrical measurements results and geochemistry data remain unclear. The three-dimensional effects from the nearby building, as well as the limited information of the underground pipeline, contribute to uncertainties in this initial stage. However, with the degradation process proceeding and more information provided by the monitoring system, it is still exciting to see the outcome of the "MIRACHL" project. The official website of this project can be found at this link: http://mirachl.com/.

Resource:

NATURVÅRDSVERKET 2014. Lägesbeskrivning av arbetet med efterbehandling av förorenade områden. Case number: NV-06370-13. Stockholm: Naturvårdsverket.