

## Integrity of clay till aquitards to DNAPL migration: Assessment using current and emerging characterization tools - DTU Orbit (09/11/2017)

### Integrity of clay till aquitards to DNAPL migration: Assessment using current and emerging characterization tools

Field investigations were carried out to determine the occurrence of tetrachloroethene (PCE) dense non-aqueous phase liquid (DNAPL), the source zone architecture and the aquitard integrity at a 30-50 year old DNAPL release site. The DNAPL source zone is located in the clay till unit overlying a limestone aquifer. The DNAPL source zone architecture was investigated through a multiple-lines-of-evidence approach using various characterization tools; the most favorable combination of tools for the DNAPL characterization was geophysical investigations, Membrane Interface Probe (MIP), core subsampling with quantification of chlorinated solvents, hydrophobic dye test with Sudan IV and Flexible Liner Underground Technologies (FLUTE) NAPL liners with activated carbon felt (FACT). While the occurrence of DNAPL was best determined by quantification of chlorinated solvents in soil samples supported by the hydrophobic dye tests (Sudan IV and NAPL FLUTE), the conceptual understanding of source zone architecture was greatly assisted by the indirect continuous characterization tools. Although mobile or high residual DNAPL ( $St > 1\%$ ) only occurred in 11% of the source zone samples (intact cores), they comprised 86% of the total PCE mass. The data set, and associated data analysis, supported vertical migration of DNAPL through fractures in the upper part of the clay till, horizontal migration along high permeability features around the redox boundary in the clay till, and to some extent vertical migration through the fractures in the reduced part of the clay till aquitard to the underlying limestone aquifer. The aquitard integrity to DNAPL migration was found to be compromised at a thickness of reduced clay till of less than 2 m.

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