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## **DETECTING DNAPL's WITH THE USE OF GEO-ELECTRICAL MEASUREMENTS BETWEEN BOREHOLES**

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The detection of contamination sources zones containing DNAPL's is one of the major bottlenecks in the remediation of polluted sites. When the location of the sources is not known the layout of remediation or control measures can be wrong resulting in the continued spread of pollutants (e.g. PCE and TCE). Effective mapping of the source zone of groundwater pollution with traditional 1D techniques (samples) is often financially not feasible. Electrical Resistivity Tomography (ERT) is an alternative geophysical technique that can detect and monitor pure DNAPL's in the subsoil. ERT measurements are geo-electrical measurements between boreholes that contain multi-electrode (24 to 32) cables. The outcome is a 2D profile with the real electrical resistivity of the subsoil between two boreholes over the depth section at which the electrodes are located. Geo-electrical detection of DNAPL's is done on the basis of the increase of the specific electrical resistivity of the soil when pure DNAPL's are present.

The technique has been applied at three different polluted sites in the Netherlands. ERT was able to detect DNAPL's in common Dutch soil types (water saturated: sand, silt, clay, peat and sand-gravel mixtures). ERT also functions well at polluted sites with a lot of underground infrastructure (cables, pipes, concrete, cellars, etc). One of the unexpected outcomes from the measurements is that the DNAPL is not always located, as expected beforehand, on low permeable clay/peat layers but also within generally permeable sand layers. This valuable information on DNAPL movement has been used for positioning the abstraction filters for the remediation system.

At the third demonstration site a practical innovation on the placement of electrodes in the subsoil has also been successfully demonstrated. The electrodes can now be placed into the subsoil by means of a Cone Penetration Test instead of a screened borehole. The advantages are: a costs reduction and a risk reduction of vertical spread of pollutants with a CPT is much less compared to making a borehole.

In September/October 2007 ERT is going to be used to monitor the in-situ remediation of a DNAPL. If available some first results of the monitoring will be presented at the conference.