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Integration of innovative soil characterisation technologies High Resolution Seismic imaging (HRS) and Rapid Optical Screening Tool (ROST-CPT / Membrane Interface Probe (MIP-CPT)

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Currently even on large, complex and seriously contaminated sites a considerable part (if not all) of the characterisation effort is undertaken applying classical techniques (soil borings, screened wells and analytical lab analysis).

This is unfortunate and surprising in the perspective of warnings in handbooks (a.o. Pankow & Cherry: Dense Chlorinated Solvents) and in papers like NOBIS 95-2-10 Characterisation of DNAPL sites (DNAPLKAR). To be more specific Pankow & Cherry state that: “At many sites that are contaminated with chlorinated solvent compounds, there is no direct visual evidence of solvent in the form of dense non-aqueous phase liquid (DNAPL) either in soil cores or in monitoring wells. A lack of direct evidence does not, however, necessarily mean that DNAPL material is not in the subsurface.” In the NOBIS report the authors stress that there is no saying which contaminant level in groundwater pumped from screened wells is indicative of the presence of DNAPL. Even when the screen cuts the DNAPL this contaminant level may be as low as in the order of 10% of the solubility of the contaminant.

In short, although the unnoticed presence of DNAPL is by far the largest risk for remediations to fail, or for costs to be excessively more than planned, there are few (if any) methodologies to assess the presence (or absence) of DNAPL.

We present a combination of innovative characterisation tools to appraise and validate the spatial distribution of DNAPL’s, i.e. High Resolution Seismic (HRS) to appraise this distribution and CPT testing using the Rapid Optical Screening Tool (ROST) if oil like substances are involved or Membrane Interface Probe (MIP) if (semi-)volatile compounds like chlorinated VOC’s are involved, to validate the findings at key points.

RRI has applied the HRS technology on approx. 50 sites in the US and were the first in 1994 to prove that DNAPL can be imaged. Interestingly, where the above mentioned NOBIS report suggests that HRS would only be of help beyond the 30 m bgs depth mark, in reality HRS will disclose the spatial distribution of the DNAPL irrespective of its depth. Currently HRS has been applied by RRI on 5 sites in western Europe.

Although it may be ludicrous to find DNAPL at less than 2 m bgs (better use a spade) or to bother about DNAPL when it is deeper than say 200 meters bgs (who worries, unless threatened facilities are downstream), these pose no limits to HRS.

MWH has applied Fugro’s ROST and MIP CPT very successfully on several sites. From these applications you would be tempted to conclude that at a respective portion of most seriously contaminated sites, where only classical characterisation tools are applied, you will find DNAPL beyond the currently mapped contaminated zone. ROST- and MIP-CPT work has also indicated that the spatial distribution of DNAPL and more generally of contaminants is extremely unpredictable. These contaminants may be even upstream the source area, if the groundwater flow is established incorrectly (as regularly happens in Dutch contaminated soil surveying practice), or may be below a thick clay layer, if that layer is extrapolated from some kilometers (which also happens).

RRI and MWH claim that expedited soil surveying using state of the art technologies benefits the client (regularly the tax payer). Remediations will not fail, instead they can be optimised and will thus cost less. We propose a combination of HRS and ROST/MIP to accomplish this. In a presentation we will outline the possibilities of the combination of HRS and ROST-CPT/MIP-CPT and discuss the developments needed to bring this combination to a grown-up method.