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Minimally invasive characterization of a hydrocarbon contaminated site: the Trecate example.

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Conventional techniques for site characterization are time consuming, cost intensive, and often do not adequately support decision making. New techniques are, therefore, necessary, particularly those that allow a stepwise site characterization strategy with possible feed-backs and focussed adjustments. Among such techniques, a prominent role is to be assigned to a range of near-surface geophysical techniques. Ground penetrating radar (GPR), electrical resistivity tomography (ERT), induced polarization (IP) and self potential (SP) are among the techniques that best lend themselves to these applications. In order to address the above needs, the EU FP7 called for projects that would contribute towards the "Development of technologies and tools for soil contamination assessment and site characterization, towards sustainable remediation" (Topic 6.3.1.2.2). The project ModelPROBE, led by the UFZ, is among the projects funded and started its activities in June 2008. The idea behind ModelPROBE is to integrate advanced geophysical site characterization techniques with new types of biological analyses as screening techniques. The general, methodological aims of ModelPROBE needed to be tested on well characterized contaminated sites. One such site is located close to Trecate (Novara – NW Italy). In 1994 the site was the scene of a crude oil spill following an oil well blowout from an exploration well. The incident resulted in approximately 15,000 m3 of middleweight crude oil being released overland, contaminating both soil and groundwater. The site is characterized by a thick sequence of poorly sorted silty sands and gravels in extensive lenses, typical of braided river sediments. An artificial layer of clayey-silty material, about 2 m thick, originally placed as a liner for rice paddies, overlies most of the site. The main zone of hydrocarbon contamination at the site covers approximately 96 hectares and is characterised by an anoxic electrochemically reductive groundwater plume. Here we present the first results of the geophysical investigations at the Trecate field site. The investigations include surface GPR, ERT, IP, SIP and SP surveys, together with direct push sampling and EC logs and limited cross-hole measurements. Many of the geophysical measurements have been conducted in time-lapse mode in order to separate static and dynamic signals, the latter particularly linked to strong seasonal changes in water table elevations. The goal was to identify (a) the structural characteristics that controlled the contaminant penetration into the subsurface and its current possible movements, and (b) assess possible correlation between measured geophysical properties and contamination levels and/or biodegradation of contaminants. Our results confirm that geophysics can have a key role in the definition of structures and their role in hydraulics and contamination. The knowledge of structure is essential to understand the contamination distribution of any site. Possible evidence of a direct link between contamination and geophysical signal is still to be confirmed.