



State of subsoil in a former petrol station: physicochemical characterization and hydrocarbon contamination evaluation

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Former petrol stations are, possibly, potential hydrocarbon contaminated soil areas due to leakage in Underground Storage Tanks and fuel dispensing activities. Volatile Organic Compounds (VOCs) in gasoline, like benzene and semi-volatile organics in diesel, are carcinogenic and very toxic substances which can involve a serious risk for ecosystem and human health. Based on Electrical Resistivity Tomography 2D results from a previous work, there have been selected three potentially contaminated goal areas in a former petrol station located in SE Spain in order to obtain soil samples by drilling and to assess the gasoline and diesel contamination. A special sampling design was carried out and soil samples for VOCs were preserved at field with a KCl solution to minimize volatilization losses. It had been chosen Headspace-GC-MS as the better technique to quantify individual VOCs and GC-FID to get a Total Petroleum Hydrocarbon (TPH) assessment after a solid/fluid pressurized extraction. The physicochemical characterization of the subsoil was performed to know how humidity, clay content or pH data could be related to the presence of hydrocarbons in the soil samples.

Results show that VOCs concentrations in subsoil samples of the petrol station are around ppb levels. TPH ranged between 17 mg/kg soil and 93 mg/kg soil (ppm levels) what involves diesel and gasoline leaks due to these detected residual concentrations in the subsoil. The maximum value was found at 6 m deep in an intermediate zone between Underground Storage Tanks positions (located at 4 m deep). Therefore, these results confirm that organic compounds transference with strong vertical component has taken place.

It has been observed that humidity minimum values in the subsoil are related to TPH maximum values that could be explained because of the vapour phase and the retention of hydrocarbon in soil increases when humidity goes down. Adsorption of hydrocarbons in the subsoil tend to be pH-dependent and clay content dependent: maximum of adsorption taken place at minimum pH what encourage protonation and minimum clay content in the subsoil make organic compounds infiltration downstream easier.

It could be noticed the importance of physicochemical subsoil characterization and contamination assessment in the subsoil of petrol stations in order to avoid the hydrocarbons pollution of the groundwater. Then plan the best remediation technique according to this characterization taking into account the residual hydrocarbon concentration in the subsoil and the associated risk for human and ecosystems.