Geophysical studies for soil and subsoil degradation assessment

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The extremely variable geological medium and the high diversity of threats (landslides, contaminations, etc) that affect its functions make difficult to build a strategy for the protection of soil, subsoil and underground water. High precision geophysical measurements techniques are currently tested and continuously improved in some complex research-development Romanian projects: a) Advanced system of seismic monitoring for industrial zones with high risk – SAMONZIR (CERES-2CEx 06-11-46/2006)**;** b) Hydrogeophysical researches on the space and time monitoring of polluted zones with hydrocarbons and residual waters in the area of Astra, Petrotel, Petrobrazi and Vega refineries – GEOMON (MENER-725/2006); c) Applied geophysical techniques for the strategy of soil and subsoil protection – GEOSOL (UEFISCSU /2007) . The data gathered till this moment in the mentioned research programs show that in environmental problems geophysical information are many times useful for a better soil and subsoil management.

Geophysical studies for hydrocarbon contaminated sites

The management of the light non aqueous phase liquids_ LNAPL_ (gasoline, diesel, heating oil, lubricants) contamination sites is not an easy task, as it requires knowledge of chemistry, geology, hydrogeology, biology and soil science. At this moment the programs applied for locating the spatial extend of the hydrocarbon contaminating plumes are expensive because they are based upon direct biochemical analysis methods of soil and water samples, taken from the surface or boreholes. This studying technique gives only punctual information. The borehole executed for assay the soil and underground water samples is not only expensive but the borehole itself can become a source for spreading the contamination into the geological medium. Due to this reasons the non-destructive and non-invasive techniques (geophysical techniques) may be applied in such environmental problems as a first investigation tool. Based on the modified physical properties of soil, due to the presence of the contaminant solution, the geoelectrical measurements can provide a general image of the ground and groundwater contamination. The geoelectrical data obtained after the survey executed in the contaminated test-areas near the refineries Astra, Petrotel, Petrobrazi si Vega showed the presence of the contaminated plume, and the next step is to develop a program for monitoring large contaminated areas and to attest its viability. As in these test areas the refined petroleum products had been released in significant quantities in the soil, the LNAPL had reach the underwater table and begun to migrate along. The migration of the contaminant plume and the continuous mass transfer (dissolution and volatilization of some organic compounds) make difficult to decide the right remediation strategy.

The future investigation program for the contaminated test-sites consist in executing hydrogeological boreholes to verify the geophysical data and to constrain and verify the geophysical models of the **spatial and temporal** extent of the contaminant plume during the geophysical monitoring. The monitoring program consists in repeating the geoelectrical measurements (induced polarization -IP, vertical electrical sounding-VES, electrical resistivity tomography-ERT) with different measuring systems.

The preliminary results suggest that is possible to elaborate an efficient and cost-effective system for the determination of spatial and temporal extent of the polluted plume using geophysical information.