Characterization of the fluvial sediments: field determination of TPH concentration with Hanby Environmental Test kit

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Introduction: On 13 July, 2003 a serious fire accident occurred at an Italian lubricant deposit, causing the unauthorized release of heavy TPHs, and of the combustion by-products and extinguishing water. Along the facility boundaries a small river flows, adopted for agricultural uses; the contamination reached the river and floated on the water surface. Emergency safety measures were applied to the river waters and sediments. After this incident, fluvial sediments characterization were carried out to map the extension of the residual contamination, along about 1200 m. The grid was extremely detailed with the aim of reducing as much as possible the volume of polluted sediments to be removed. Field tests have been adopted on the huge amount of samples, and lab validation of the results carried out on a percentage of significant samples.

Methods: For the mapping purpose, the interested area, downstream the facility, was subdue in four main sections, each section in smaller parts (25 m long each); in each of this sub-section four discrete samples were collected (α, β, γ, δ). Each sub-section was characterized through four discrete samples and one mixed sample. Sampling activities involved a hand auger (with core barrel for sandy soil or sediments). Surface sediment samples were collected to a depth of approximately 15 cm below ground level (b.g.). Each sample has been analyzed by Hanby Environmental Test kit (subsequently Hanby test).
The Hanby test can be easily used in field and provides quick analytical results regarding the concentration of organic compounds (hydrocarbons, aromatic compounds, PCB and others). The method used by the Hanby test is a colorimetric method: the color of the extracted (treated) solution indicates the type of compound present, and its intensity indicates the concentration. The Hanby Test range of use, expressed as an interval of TPH concentration, is approximately 1 – 1'000 mg/kg. The out-put of the Hanby Test is a concentration interval (1-10 mg/kg, 10-50 mg/kg, etc). In order to verify the field results, 10% of the samples were also analyzed in a certified laboratory (method EPA8440/1996). Same approach was adopted for all samples exciding the target limit (100 mg/kg).

Results: The laboratory results demonstrate that the Hanby test field analyses, for this contaminants, tends to overestimate the real hydrocarbon concentration values. In fact, many false positives, obtained with the Hanby test, were not confirmed by the laboratory analyses. As confirmation of this method for field screening purpose, no false negatives were identified. The following table resumes the validation results.

Hanby test results(mg/kg)	% of validation samples	% of false negatives	% of false positives
0-10	5	0	--
10-50	4	0	--
50-100	1	0	--
100-200	36	--	86,1
200-500	13	--	76,1
500-100	2	--	100

At the end of characterization, the cross check of preliminary field results with laboratory analyses identified 6 contaminated sub-section exceeding regulatory target limit for TPH on the river basin.

Discussion: Hanby Environmental Test Kit well performed during the project, allowing to send to the lab test only a minimum percentage of the total samples, and assuring that all the contaminated samples were identified. The adoption of the Hanby tests reduced both the whole analytic time (the entire procedure for one sample takes approximately 10 minutes) and the cost of the huge mapping activities. In this way costs and time of characterization have been minimized. This method appears to be conservative. Hamby test application resulted in a very detailed map of the contamination, based on a grid that, with normal procedure, would be extremely expensive.

References: [1] *HNU-Hanby Environmental Test Kit*, EPA/540/R-95/515, August, 1995; [2] *Evaluating the Hanby Test Kits for screening Soil and Groundwater for Total Petroleum Hydrocarbons Field Demonstration*, USACE, June 2000