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BOOK OF ABSTRACTS

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Delineation of Light Non-Aqueous Phase Liquids (LNAPLs) Using Laser-Induced Fluoresence (LIF) Probe - Pennsylvania, United States

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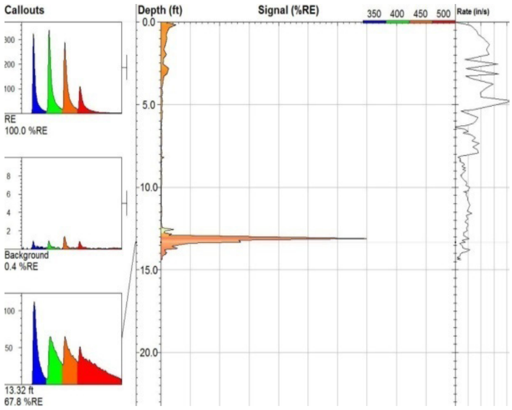

LIF Log Example from the Pennsylvania Site

An understanding of non-aqueous phase liquid (NAPL) distribution in the subsurface is a fundamental component of any hydrocarbon-contaminated site remediation strategy. This study emphasizes the potential of Laser-Induced Fluorescence sensor/probe (LIF) in the investigation of contaminated sites. The use of LIF advanced into the subsurface via direct push drilling technology enables the screening of residual and free-phase NAPLs by detecting polycyclic aromatic hydrocarbons (PAHs). Compared to traditional drilling and excavation methods, LIF investigations are faster and provide instantaneous output. Moreover, the direct push drilling technology without conventional core sampling provides highly accurate contaminant readings.

The LIF system utilized, at this diesel-contaminated site predominantly made of fine-grained sandstones in Pennsylvania, is the latest generation ultraviolet optical screening tool (UVOST) system developed by Dakota Technologies, Inc. Typical LIF/UVOST log from this study is shown in above-listed figure. It consists of a primary graph of total intensity fluorescence versus depth, and an information box with waveform "callouts". The depth is plotted on the Y axis and the combined total fluorescence intensity of the four monitored wavelengths is plotted on the X axis as a percentage of the normalized 100% Reference Emitter (RE) performance standard. Since different PAHs do not exhibit a linear correlation between fluorescence and increase in concentration it should be emphasized that the system response should be considered only qualitative and not quantitative. However, in some cases a change in PAH concentration may be inferred from the shift towards red waveform/channel on the LIF log. The current LIF sensors can be used to help identify the petroleum products including but not limited to gasoline, diesel, fuel oil, jet fuel, motor oil, cutting fluids, hydraulic fluid, and crude oil, but not individual chemicals present at the site [1].

The results of the LIF/UVOST investigation indicated that LNAPL was detected in 6 of 17 total LIF borings, with the RE responses ranged between 45% and 225%. This variation in signal response could be attributed to differing lithology or pore saturation values. The depth of contamination ranged from 3.9 to 4.6 m, with the exception was boring LIF-10 (3.2 and 3.5 m). The waveforms/channels(blue, green, orange, and red) likely differ due to variances in LNAPL saturation. The LNAPL readings were sporadic along the LIF investigation line (adjacent to a culvert), and indicated limited vertical extent of LNAPL concentrated mainly at the soil-groundwater interface. It was concluded that no substantial amount of LNAPL existed around the LIF investigation line along which contamination could migrate further. The use of LIF in the weathered portion of this fractured sandstone aquifer was limited to determining individual locations and depths of contamination along the presumed LNAPL migration path. In soils with intergranular porosity this technique can provide detailed insight into spatial distribution, and enable contouring of contamination occurrence.

Acknowledgements

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References

[1] *U.S. EPA CLU-IN (2015b). Hazardous Waste Cleanup Information. Laser-induced Fluorescence. Environmental Protection Agency.*