

Characterization of Soil Wettability Changes of a Diesel-Impacted Field Soil

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Summary

To date, most of the experimental research has focused on the migration and distribution of lab grade Non-Aqueous Phase Liquids (NAPLs) in quartz sand, which is often assumed to be water-wet. However, this may not be the case at many industrial field sites where NAPLs are not found as single pure phases but often consist of many compounds and the soil medium may not be strongly water-wet. As suggested by Dwarakanath et al. (2002), further work is required to characterize the soils and NAPLs found at industrial field sites through laboratory studies and further work is needed to develop or modify the constitutive relationships to better simulate NAPL migration and remediation at field sites. The research conducted as part of this study assessed the wettability variations of soils collected at a diesel-impacted site. Pressure cells were used to determine the capillary pressure-saturation (Pc-S) characteristics for a soil samples collected at a former truck stop where leakage had occurred from underground storage tanks. Soil samples were collected from the diesel impacted area and from adjacent areas which were not impacted by diesel. The (Pc-S) relationships were determined for three types of samples; air-dried contaminated soil, wet contaminated soil, and clean soil which served as a benchmark. Results indicated a difference in the wettability of the clean versus diesel-impacted soil (Figure 1) and in the (Pc-S) relationships between the clean soil sample and the contaminated soil samples (e.g. Figure 2). It can be seen in Figure 1 that water is drawn into the air-dried clean sand on the left whereas water initially pools on the air-dried diesel-impacted sand on the right. A series of (Pc-S) relationships for the air-dried contaminated soil indicated a greater retention of entrapped NAPL (i.e. diesel) in the contaminated soil sample than the clean soil, indicating that the wettability characteristics of the soil may have changed due to the prolonged exposure to the diesel. A sample result is provided in Figure 2. The altered wettability characteristics will impact the NAPL distribution and may reduce the efficiency of different remediation alternatives.



Figure 1: Indication of Wettability Changes: Clean Soil (left), Diesel-Impacted Soil (right)

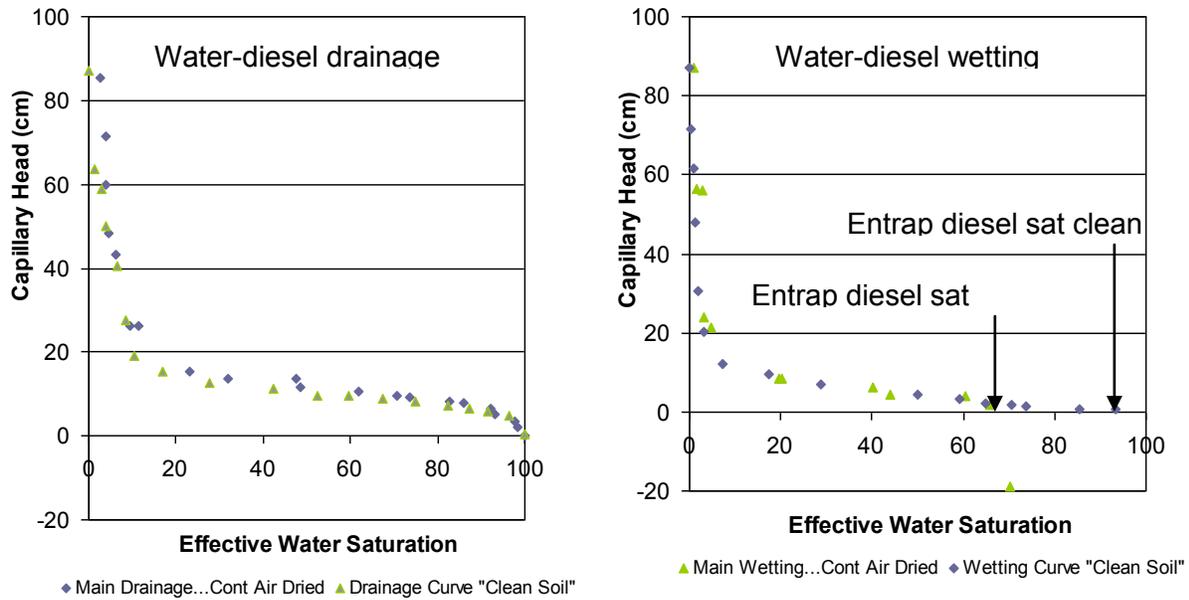


Figure 2: Capillary Pressure – Saturation Relationship for a Clean and Air-Dried, Diesel-Impacted Soil

Acknowledgements

The authors would like to thank Imperial Oil – Esso for providing funding for this research via a University Research Award provided to Dr. Van Geel.

References

Dwarakanath, V., R.E. Jackson and G.A. Pope, 2002. Influence of wettability on the recovery of NAPLs from alluvium. *Environ. Sci. and Techn.*, 36(2): 227-231.