

Can Geoelectrical Methods Be Used to Monitor NAPL Remediation?

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Why? EPA's Strategic Plan includes the research and development of improved methods for evaluating the long-term performance of non-aqueous phase liquid (NAPL) remediation.

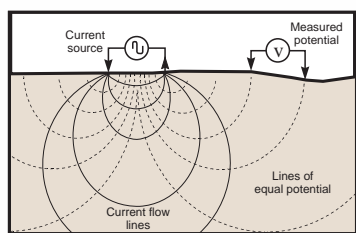
How? Direct current (DC) geoelectrical methods can detect changes in the electrical properties of the subsurface due to the remediation of light or dense non-aqueous phase liquids (LNAPL or DNAPL).

DC geoelectrical method?

Archie's Law

$$\rho_e = a \phi^{-m} S^{-n} \rho_w$$

ρ_e = resistivity of the earth
 ϕ = fractional pore volume (porosity)
 S = fraction of the pores containing fluid
 ρ_w = the resistivity of the fluid
 n, a and m are constants

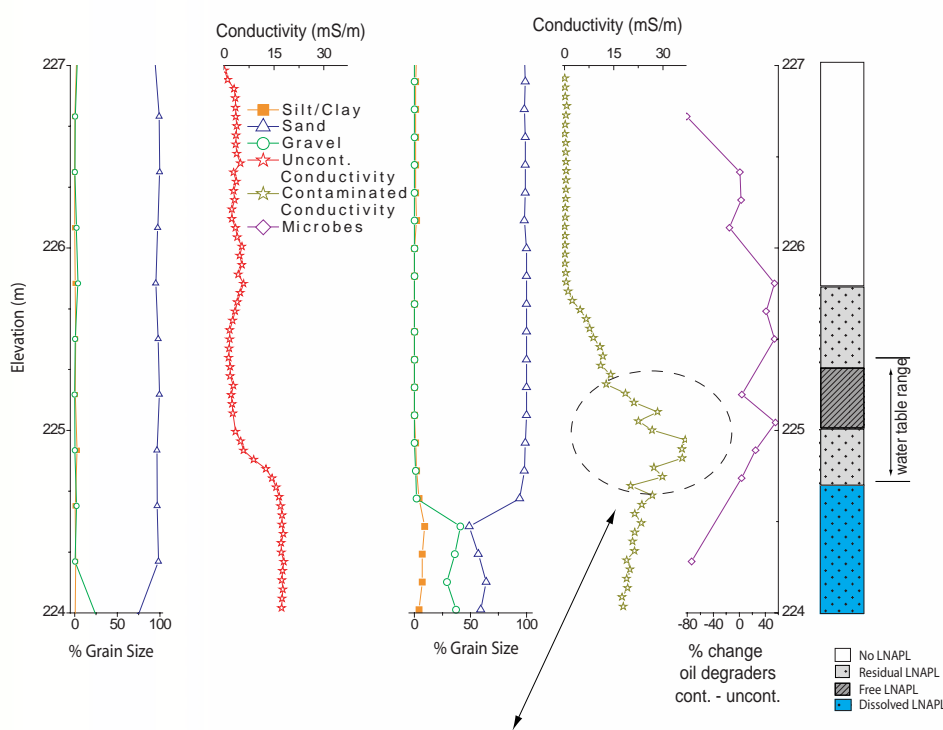


Measurements within a site will most likely have the same $\phi, S, n, a,$ and $m.$

Therefore, $\rho_e \propto \rho_w$

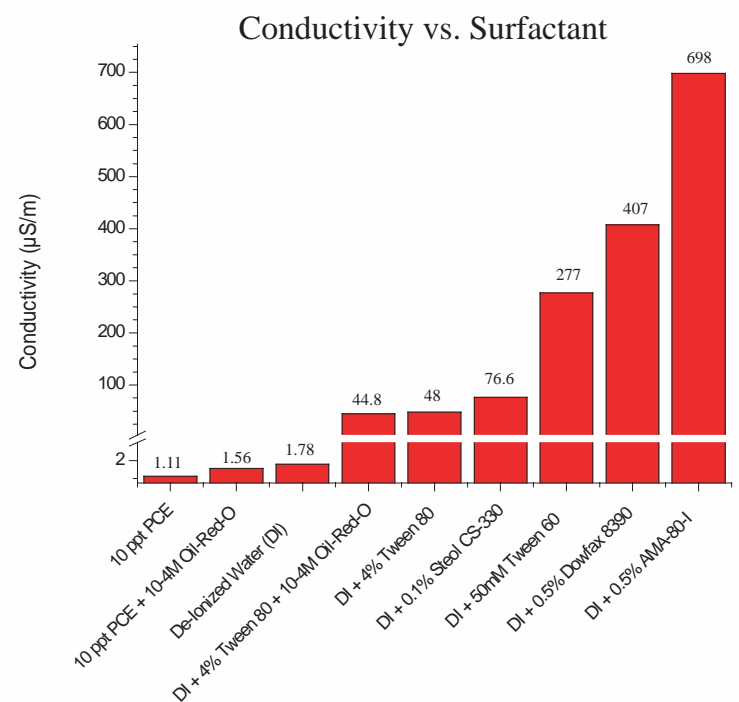
or the inverse, conductivity (σ), $\sigma_e \propto \sigma_w$

LNAPL Biodegradation



Anomalous high conductivity coincident with LNAPL zone and high population of oil degrading microbes.

DNAPL Surfactant Remediation



Surfactant mixtures increase water conductivity (σ_w). This suggests an increase in the geoelectrical conductivity (σ_e) and shows potential for the indirect geoelectrical measurement of surfactant remediation applications at DNAPL sites.

So what? (outcomes)

Results suggest DC geoelectrical measurements have the potential to indirectly monitor remediation. Geoelectrical methods may be used by OSWER and Regional Project Managers, for example, to monitor and characterize the remediation of LNAPL and/or DNAPL impacted sites. Furthermore, geoelectrical methods can be utilized as part of an integrated remediation plan because of their cost effective, efficient, and geographically remote acquisition capabilities.

Partnerships

U.S. EPA, ORD, NERL, ESD
 Western Michigan University
 University of Missouri-Rolla

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