

Statistical Tools for Developing Monitored Natural Attenuation Evidence: Beyond Time-Series Plots

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Background/Objectives. For any chlorinated solvent site, it is highly likely that monitored natural attenuation (MNA) will be a component of the path towards closure for the site, and will require review and approval of the regulatory agency. As many practitioners can attest to, simple time-series plots and basic trend analyses for each individual well just do not provide sufficient and conclusive evidence of decreasing and/or stable trends for a chlorinated solvent site. Variation in data related to seasonal fluctuations, asymptotic behavior of low dissolved concentrations, sampling and laboratory process(es), plume dynamics, impact related to remediation activities – all these factors complicate the evaluation of viability of MNA as path forward. The presentation of the data analyses and developing a robust case for MNA that includes line of evidence (LOE) evaluation in the regulatory report is another challenge which requires attention.

Approach/Activities. The presentation will discuss three case studies of MNA evaluation of chlorinated solvent sites, with varying degrees of residual concentrations, site setting, active remedial actions and source control measures. Robust data analyses were conducted to develop contaminant data-distribution, plume stability, and plume dynamics for the source and the tail. Trend analyses was strengthened by correcting for data variability using statistical methodologies. Site-wide analyses to establish evidence of a shrinking plume while also meeting the regulatory agency's requirement for individual monitor well analyses, was an important part of the overall approach. Data collection and analyses for the secondary and tertiary lines of evidence was conducted well in advance to support and strengthen the conclusion about validity of MNA as path forward for closure. Data presentation for regulatory reporting was key to effectively communicate the viability of MNA including prediction for future behavior of the plume.

Results/Lessons Learned. Agency approvals were received for two sites within a few months for long-term monitoring under MNA; third site is pending. Focusing on the overall objective of protection of human health and the environment enabled us to make a strong case for MNA, irrespective of the magnitude of the residual concentrations. Proactive thinking, with the end in mind, is critical so that all needed data, including the supporting data geochemical and microbiological data, is available to perform the MNA analyses.