

## Saturated Soil Sampling to Determine Effective Source Remedy Strategies

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**Background/Objectives.** Detailed characterization of source areas is critical to designing an effective remedy strategy, but most characterization approaches do not provide the resolution required to make informed decisions. When understanding mass distribution and the limitations imposed by hydrostratigraphy are critical, high-frequency saturated soil sampling is the only method that provides a quantitative evaluation of mass distribution in both high permeability (transport) and low permeability (slow advection and storage) hydrofacies zones present in a source area. Once collected, the high-density dataset can be coupled with soil-water partitioning analysis to estimate the dissolved phase mass present within each hydrofacies at unparalleled resolution. The distribution of source mass through all hydrofacies is diagnostic of plume maturity and is the foundation for evaluating stored mass that may complicate a remedy.

**Approach/Activities.** Saturated soil sampling is particularly well suited for evaluating source areas dominated by low permeability sediments that cannot be easily characterized with groundwater sampling. We recommend completing soil borings on a dense, adaptive grid with decision points based on real-time sample analysis provided by an on-site mobile laboratory. The value of this approach is threefold: 1) maximizes the value of each boring, 2) reduces the total number of borings to just those required to meet the objectives of the investigation, and 3) allows completion of the characterization in one mobilization. Detailed soil logging and geotechnical data collected in parallel with contaminant data provides the hydrostratigraphic context for the analytical results, as well as the site-specific parameters required to complete a soil-water partitioning evaluation. Converting total saturated soil concentration to an “equivalent groundwater” concentration is a reliable method for estimating dissolved phase impacts and provides a detailed evaluation of source mass in the same context as the downgradient the groundwater plume.

**Results/Lessons Learned.** Source characterization with saturated soil sampling is illustrated with a series of case-studies covering a variety of contaminants and geologic conditions. Saturated soil sampling is the only way to quantitatively measure mass in tough to sample storage and slow advection zones. The distribution of mass through all hydrofacies present in a source area has broad implications for potential treatment strategies. In all cases, the level of detail provided by the saturated soil sampling approach is invaluable for determining whether remediation is necessary or to evaluate potential efficacy of a proposed remedial strategy, or, in some cases simply demonstrating to regulatory agency that residual source mass poses minimal risk.