

Monitored Natural Attenuation and Health Risk Assessment for TPH

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Background/Objectives. Just as the consideration of the degradation products from chlorinated solvents needed to be taken into account when evaluating natural attenuation as a remedial alternative for chlorinated solvent spills, there is a growing body of science and a growing awareness that hydrocarbon degradation products need to be considered when evaluating natural attenuation as a remedial alternative for petroleum release sites. Even though the management of petroleum releases has long involved the concept of total petroleum hydrocarbons (TPH), the science and policies surrounding the issue of hydrocarbon degradation products is changing and new ways of approaching petroleum release sites are clearly under way.

Approach/Activities. TPH is unusual in that it is defined by the analytical method, but because there are a variety of analytical methods for TPH, the definition of “TPH” is necessarily ambiguous. Nonetheless, TPH is always a complex mixture comprised of hundreds, if not thousands, of individual chemicals. While the dominant class of chemicals making up TPH is hydrocarbons, TPH can also include a variety of polar compounds. The primary dilemma in managing petroleum release sites to date has been the decision to evaluate sites using indicator compounds, bulk TPH analyses or fractionated hydrocarbon analyses (e.g., alkane and aromatic fraction within specified carbon size ranges).

It has long been recognized that polar compounds can be part of the mixtures reported as “TPH” because of the presence of background polar compounds in environmental media (e.g., humic acids in soil) or because polar compounds are present in crude oil and residual products (e.g., bunker oil). Because polar compounds are not typically present in refined fuels fresh releases of refined fuels are not typically a source of polar compounds. There is a growing awareness, however, that as crude oil, residual products and refined petroleum undergo natural attenuation (i.e., weathering), the hydrocarbon constituents of these mixtures undergo chemical and microbial transformation creating polar compounds, including a variety of oxygenated species.

The polar compounds tend to be much more water soluble than the parent hydrocarbons and have a generally greater mobility in the environment. Characterizing the lateral and vertical extent of a petroleum release, and predicting its migration, can be a very different exercise if polar degradation products are considered. Similarly, the site conceptual model including consideration of migration routes, exposure pathways, and receptors can be different if polar degradation products are considered, rather than just the hydrocarbons. The uncertainty surrounding the toxic properties of the polar compounds complicates decisions about how to monitor such sites and about management decisions and risk communication beyond the traditional challenges of how to characterize and manage the parent hydrocarbon material.

Results/Lessons Learned. If natural attenuation is going to be considered as a management approach at a petroleum release site, one needs to identify the chemicals for which management is desired as well as the chemicals that actually will be monitored. The Interstate Technology & Regulatory Council (ITRC) is currently developing a guidance document, “TPH Risk Evaluation for Petroleum-Contaminated Sites” to support the management of TPH release sites; this document is expected to address the ways in which the evolving understanding of hydrocarbon degradation products will affect the management of petroleum release sites.