

Total Petroleum Hydrocarbons

What are Total Petroleum Hydrocarbons (TPH)?

- Petroleum-derived fuel hydrocarbon mixtures, such as kerosene, gasoline, and diesel
- Petroleum fuels, particularly diesel - historically used throughout Area IV to power vehicles, construction equipment, and back-up generators
- Historic use resulted in releases to the environment
- TPH analytical result - based on the range of carbon atoms in the sample (e.g., C15-C20)
- Lower carbon range (lighter) fractions - volatilize and degrade through time
- Heavier, higher carbon-range fractions – not as volatile and slower to degrade

What's in the soil?

- Area IV soils TPH consists of high molecular weight hydrocarbons, suggestive of residual range oil (RRO)
- RRO undergoes slow natural breakdown
- Polycyclic aromatic hydrocarbons (PAHs) and organic acids (natural oils) also found in soil
- Organic acids can indicate presence of Natural Organic Material (NOM)
- NOM can be soil or sediment organic matter (i.e., degradation products of plants and animals), or lipids that may be inadvertently included in the TPH measurement
- NOM fraction of TPH in the Area IV soil samples accounted for about 5 to 8% of the total TPH

Why is this an issue?

- NOM interferes with the analytical TPH signal and can impact the accuracy and precision of TPH analytical results, especially at lower concentrations
- NOM in a sample can result in a reported soil concentrations that are higher than that attributable to hydrocarbons from petroleum-based origins
- NOM impacts ability to determine if low levels of TPH are actually present as contamination

How was this issue addressed?

- Silica gel fractionation used in attempt to remove compounds associated with NOM prior to TPH analysis
- Silica gel approach had mixed results, with some samples showing some degree of NOM removal and others showing an increase in TPH
- Silica gel approach does not fully address the issue of interfering NOM, and may underestimate the contribution of NOM to future TPH measurements.

Another identified issue:

- High variability in measured TPH concentrations observed between laboratories, particularly at low concentrations
- Variability may be attributed to soil heterogeneity (localized presence of small rocks, varying fines, “tar balls”, etc.) as well as inherent difficulties of measuring low TPH concentrations

Conclusions:

- Difficult to accurately quantify low levels of TPH encountered during the Area IV study (100 to 300 mg/kg)
- Distinguishing where contamination actually exists at the Look-up table value (5 mg/kg) may not be possible due to the elevated variability of sample concentrations at these low levels