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Method Descriptions

TOV analytical methods provide an indirect indication of soil or groundwater contaminant concentrations by measuring the organic constituents that partition into the headspace. There are three general types of methods used with FIDs and PIDs--ambient air measurements, headspace screening, and headspace analysis. Each provides a varying degree of data quality.

Ambient Air Measurements

Ambient air measurements are performed by taking direct readings with either an FID or a PID in the air immediately above soil or groundwater samples. It is commonly used as a screening method to determine which soil or water samples should be analyzed with a higher data quality method. It is also used to help determine future sampling locations.

Headspace Screening

In order to perform a headspace screening, a soil or groundwater sample is placed in an airtight container, typically a glass jar or polyethylene bag, leaving one-half to one-third empty. The container is then either shaken, heated, or left to sit for a period of time in order to allow the hydrocarbons to partition into the headspace *(i.e.*, the air space above the sample). The headspace is then measured with an FID or PID. The use of a polyethylene bag allows for a steady sample flow rate to the instrument, however, hydrocarbons partitioning from the bag may affect the analysis so a blank sample should be tested and the results factored into the analyses.

This method involves a more controlled sample analysis than ambient air measurements. As a result, headspace screening provides more consistent readings that can be used for estimating relative concentrations. However, readings remain relatively inconsistent, because volatilization of contaminants is affected by:

- Soil type;
- Moisture content;
- Ambient air dilution into jar;
- Temperature variations; and
- Time to prepare and analyze sample.

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Headspace Analysis

Headspace analysis is similar to headspace screening but the procedures are more controlled and the results more accurate. A measured quantity of a soil or groundwater sample is placed in a polyethylene bag. For soil samples, a specified volume of deionized water is also placed in the bag in order to facilitate a more consistent partitioning of organic vapors. The bag is then inflated and the sample is agitated. After a specified time, an FID or PID is used to measure the headspace. QC procedures include the development of a calibration curve using field standards. These standards help in the interpretation of instrument responses and provide a comparison with samples of known concentrations.

Method Capabilities And Practical Considerations

Ambient air measurements are classified as DQL 1A analysis because these readings are highly variable and little or no QA/QC is used with sample analysis. The lower detection limit is generally around 100 ppm_v but may be significantly lower under ideal conditions (*e.g.*, no wind, no humidity, high O_2 levels). Headspace screening measurements are also only qualitative and fall within the DQL 1A range, however, their detection limits are generally between 10 and 100 ppm. Headspace analysis is classified as DQL 1B, semiquantitative, method because it provides an order of magnitude indication of contamination, but it does not provide information about the concentration of specific constituents. The lower detection limit with this method may be as low as 0.1 ppm for gasoline in water, but it is generally above 1 ppm. For all three methods, soil samples that are clay rich or contain high organic content may provide inconsistent results. In addition, gasoline should be relatively fresh or only slightly weathered for useful results.

TOV analysis is one of the least expensive analytical methods available. A summary of the capabilities and practical considerations of these three analytical methods using an FID or PID is summarized in Exhibit VI-10.

Turbidimetric Test Kits

Turbidimetric test kits are used for measuring the total petroleum hydrocarbon (TPH) content in soil. These test kits provide quantitative screening of soils for the presence of mid-range petroleum hydrocarbons (*e.g.*, diesel fuel, fuel oils, grease). Turbidimetric test kits can be used to identify source areas of contamination in the vadose zone. This method is also being adapted for analysis of TPH in water and may soon be commercially available.

LANL Order Reference

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