Sample Headspace Screening
FSOP 2.1.3 (March 8, 2011)
Ohio EPA Division of Environmental Response and Revitalization

1.0 Scope and Applicability

1.1 Headspace is the air space above a sample in a partially filled and sealed sample container. Field headspace screening of soil or other solid or liquid samples with a portable vapor/gas detector such as a photoionization detector (PID), flame ionization detector (FID), or other field screening instrument may be used to determine the relative concentrations of certain gasses or vapors in sample headspace.

1.2 Headspace screening can provide a basis for laboratory sample selection. By comparing relative concentrations of volatile contaminants among sample locations and depths, headspace screening is the preferred screening method for the selection of soil samples for volatile organic compound analysis. Depending on project data quality objectives, one or more sample screening methods may be appropriate. Other methods for selecting soil samples for laboratory analysis are discussed in FSOP 2.1.1, Soil Sampling and Screening.

2.0 Definitions

Not applicable

3.0 Health and Safety Considerations

3.1 Hazardous vapor or gas may be present in concentrations requiring use of personal protective equipment such as respiratory protection (refer to Table 1, FSOP 1.1, Initial Site Entry). Ambient (breathing zone) air conditions need to be monitored.

3.2 Consult the instrument manual to determine if the instrument is intrinsically safe prior to use in potentially flammable or combustible atmospheres.

4.0 Procedural Cautions

4.1 The user should be familiar with the operation of the instrument being used. Consult the instrument manual for operating and calibration instructions specific to the instrument prior to use. FSOP 3.1.1 (Photoionization Detector) provides general instructions for proper use of a PID for environmental site assessment activities.

4.2 PID and FID readings are not compound specific. These instruments must be calibrated using a relatively non-toxic gas such isobutylene and zeroed to a known clean or background air source. Readings are relative to the calibrant gas, and although the instruments display “ppm” or parts-per-million readings, the readings are actually ppm-calibration gas equivalents. Response to specific gases and vapors, if known to be present, may be estimated using response factors (a compound-specific number that provides an estimate of the actual gas or vapor concentration when multiplied by the instrument response).

4.3 PIDs only detect molecules that can be ionized. PIDs are equipped with ultraviolet lamps of different ionization energies (IE), typically 9.8 electron volt (eV), 10.2 eV, 10.6 eV, and 11.7 eV. The IE of the lamp must be higher than the ionization potential (IP) of the compound(s) being screened.

4.4 PID performance may be adversely affected by temperature fluctuations, and PID readings are significantly affected by the presence of water vapor and methane due to their high IEs (> 12 eV). An FID will perform better and generally is preferred in situations where large temperature fluctuations, very moist or humid conditions, or high methane concentrations are anticipated.

4.5 Excessively dusty environments may overwhelm a PID inlet filter and reduce performance by fouling the ionization chamber or lamp. Regularly inspect and change filters during PID use in excessively dusty environments.

4.6 Never allow the instrument probe to draw in liquid or solid material from the sample container, which may damage the instrument.

4.7 Always use a new clean plastic bag or other container (e.g., glass jar) for each headspace screening sample. Do not submit the portion of sample used for headspace screening to the laboratory for volatile organic compound analysis or any analysis that may be compromised due to cross contamination from the screening container. For example, plastic bags can be a source of phthalate cross contamination.

4.8 Screening directly from a soil core instead of headspace screening is generally unacceptable for laboratory sample selection purposes due to the dilution of vapors or gases by the ambient air.

5.0 Personnel Qualifications

Ohio EPA personnel performing field sampling activities must meet DERR's qualifications for performing work at uncontrolled hazardous waste sites.

6.0 Equipment and Supplies

6.1 Calibrant gasses (e.g., isobutylene for PID)
6.2 Clean containers such as sealable plastic bags or jars with foil or film covers
6.3 Hydrogen cylinder (for FID)
6.4 Log book, log sheets, or appropriate field form
6.5 Monitoring instrument with operation manual
6.6 Pens and markers
6.7 Personal protective equipment appropriate for site-specific work activities

7.0 Procedures

7.1 Calibrate the instrument before screening samples, and ensure that the instrument is zeroed or record background readings before screening.

7.2 Fill the sealable sample container approximately half full with the sample to be screened. Disaggregate soil or solid samples to the extent possible when placing the sample in the container.

7.3 Seal the container and shake for several seconds.

7.4 Place the container in an area of at least room temperature for at least ten minutes. In cold weather the sample container may need to be taken indoors or placed inside a vehicle to warm to approximately room temperature (65°-70° F).

7.5 Immediately prior to screening, shake the container for several seconds again. Open the seal slightly or pierce the foil/film cover with a small hole and insert the instrument probe into the headspace. Take care to not allow soil, water or other materials to enter the tip of the probe.

7.6 Observe and record the maximum instrument reading after placing the instrument probe into the container. This usually occurs within a few seconds of placing the probe into the container.

7.7 After withdrawing the probe, allow sufficient time for the instrument reading to return to zero or background level before screening the next sample.

8.0 Data and Records Management

Refer to FSOP 1.3, Field Documentation.

9.0 Quality Control and Quality Assurance

Not applicable

10.0 Attachments

None

11.0 References

FSOP 1.1, Initial Site Entry

FSOP 1.3, Field Documentation

FSOP 2.1.1, Soil Sampling and Screening

FSOP 3.1.1, Photoionization Detector