

SCREENING SOLID SAMPLES FOR VOLATILE ORGANICS

SW-846 is not intended to be an analytical training manual. Therefore, method procedures are written based on the assumption that they will be performed by analysts who are formally trained in at least the basic principles of chemical analysis and in the use of the subject technology.

In addition, SW-846 methods, with the exception of required method use for the analysis of method-defined parameters, are intended to be guidance methods which contain general information on how to perform an analytical procedure or technique which a laboratory can use as a basic starting point for generating its own detailed Standard Operating Procedure (SOP), either for its own general use or for a specific project application. The performance data included in this method are for guidance purposes only, and are not intended to be and must not be used as absolute QC acceptance criteria for purposes of laboratory accreditation.

## 1.0 SCOPE AND APPLICATION

1.1 This method is a *screening* procedure for estimating the total concentration of volatile organic compounds (VOCs) in soil and solid samples. It is *strictly* a *screening* procedure and is designed primarily for field use. In order for this screening procedure to be effective, the VOCs of interest at the site must be known in advance *and* must be detectable by the photoionization detector (PID) used in this procedure.

1.2 The results of this screening procedure may be used to guide other sample collection activities, particularly the collection of soil samples to be analyzed by the closed-system purge-and-trap technique described in Method 5035 or the headspace technique described in Method 5021. The results of this screening procedure may be used to distinguish between samples that are suitable for the "low concentration" procedures in Methods 5035 or 5021, versus those samples that contain sufficiently high concentrations of VOCs that they should be prepared using the "high concentration" procedures in those methods. This screening procedure may have other uses as well.

1.3 This procedure must *not* be used to decide that a sample or site is free of VOC contamination, or to decide that samples need not be collected for quantitative VOC analysis. Rather, it is a screening procedure that may be used to choose an appropriate size sample for analysis using Methods 5035, 5021, or other preparative procedures for VOCs. The appropriate choice of sample size benefits the overall data collection activity by ensuring that adequate sensitivity can be achieved, while providing reasonable protection against overloading the analytical instrumentation used in quantitative purge-and-trap or headspace analyses. Use of this procedure may provide cost savings by minimizing the total number of aliquots of *each sample* that have to be collected for analysis by such quantitative laboratory-based techniques.

**CAUTION:** This screening procedure must NOT be used to decide whether to collect samples.

1.4 Prior to employing this method, analysts are advised to consult the manufacturer's instructions for additional information on quality control procedures, development of QC acceptance criteria, calculations, and general guidance. Analysts also should consult the disclaimer statement at the front of the manual and the information in Chapter Two for guidance on the responsibilities of the analyst for demonstrating that the techniques employed are appropriate for the analytes of interest, in the matrix of interest, and at the levels of concern.

In addition, analysts and data users are advised that, except where explicitly specified in a regulation, the use of SW-846 methods is *not* mandatory in response to Federal testing requirements. The information contained in this method is provided by EPA as guidance to be used by the analyst and the regulated community in making judgments necessary to generate results that meet the data quality objectives for the intended application.

1.5 Use of this method is restricted to use by, or under supervision of, appropriately experienced and trained analysts. Each analyst must demonstrate the ability to generate acceptable results with this method.

## 2.0 SUMMARY OF METHOD

2.1 A sample of soil or other solid material is carefully collected with minimal disturbance that could cause loss of volatile constituents. Sample collection may be accomplished using a modified plastic syringe or commercially-available coring devices intended for this purpose.

2.2 The sample plug is immediately extruded into a glass vial containing organic-free reagent water. The vial is immediately covered with aluminum foil and a modified septum cap.

2.3 The sealed vial containing the sample is hand-shaken for 10 - 15 sec and the sample is visually examined to ensure that complete dispersion of the sample in the water has occurred.

2.4 The inlet tube of the portable photoionization detector (PID) is inserted through a pre-punched hole in the septum cap, through the aluminum foil, and into the headspace over the sample/water mixture.

2.5 The PID response is measured within 2 - 3 sec of puncturing the foil liner. The sample response is compared to a working standard containing the principal volatile contaminant of concern at the site or in the waste, and an *estimate* of total VOC concentration is calculated.

2.6 Based on project requirements, the total VOC estimate may be used to determine the most appropriate weight of samples for analyses using Method 5035 or 5021, as described in those procedures.

## 3.0 DEFINITIONS

3.1 Screening -- A term used to describe a test procedure that is designed to provide semiquantitative or range-finding results. A screening procedure will typically employ a single-point calibration. The calibration point is related to a specific decision, e.g., is the sample result above or below a given concentration?

3.2 Also refer to Chapter One and the manufacturer's instructions for other definitions that may be relevant to this procedure.

## 4.0 INTERFERENCES

4.1 This method is a screening procedure and is subject to a wide variety of potential interferences. Users must be aware of the limitations of this procedure and use it accordingly.

4.2 The response of a photoionization detector varies greatly with the nature of the volatile organic compound. While the PID response to halogenated volatiles and aromatics may be fairly similar between similar compounds, the PID response to alkanes may be lower by an order of magnitude or more. As a result, knowledge of the site-specific contaminant(s) of concern will be essential to successful application of this procedure.

4.3 Because this procedure is employed in the field, it is essential that the PID not be exposed to sources of organic vapors such as motor vehicle exhaust, solvents used for equipment decontamination, or other sources of VOCs. Such exposure could cause the results to be positively biased.

## 5.0 SAFETY

This method does not address all safety issues associated with its use. Also, this method does not specify the use of any hazardous reagents or equipment beyond very small amounts of standards containing VOCs. It is intended for field use, and as such, should not present any additional safety concerns beyond those inherent in the collection of environmental samples that may contain hazardous materials. The user is responsible for maintaining a safe work environment.

## 6.0 EQUIPMENT AND SUPPLIES

The mention of trade names or commercial products in this manual is for illustrative purposes only, and does not constitute an EPA endorsement or exclusive recommendation for use. The products and instrument settings cited in SW-846 methods represent those products and settings used during method development or subsequently evaluated by the Agency. Glassware, reagents, supplies, equipment, and settings other than those listed in this manual may be employed provided that method performance appropriate for the intended application has been demonstrated and documented.

6.1 VOA vials -- 40- or 44-mL glass vials fitted with polytetrafluoroethylene (PTFE)-lined septa.

6.2 Hole punch -- 5- to 6-mm ID, capable of piercing the septum of a VOA vial cap.

6.3 Aluminum foil -- Light gauge, cut in 3 x 3-cm squares. Food service aluminum foil is sufficient. Do NOT rinse the foil with solvent.

6.4 Coring tool for discrete soil samples -- Disposable 10-mL plastic syringes with the Luer tip and rubber plunger cap removed (modified), or an equivalent metal tube fitted with a plunger. The outer diameter of coring tool should be smaller than the mouth of the VOA vial. Commercial stainless steel samplers fitted with plungers are also available.

6.5 Portable balance -- For field use, capable of weighing to 0.5 g.

6.6 Balance weights -- Balances employed in the field should be checked against an appropriate reference weight at least once daily, prior to weighing any samples, or as described

in the sampling plan. The specific weights used will depend on the total weight of the sample container, sample, reagent water added, cap, and septum.

6.7 Portable photoionization detector (PID) -- Hand-held PID analyzer equipped with a 10.6 eV or greater electrode discharge tube, inlet flow rate of greater than 200 mL/min, and sample inlet tube of 3-mm to 4-mm OD and at least 3 cm in length. A digital display is preferred for ease of use.

6.8 Glass microsyringe -- 10- $\mu$ L capacity, for preparation of working standards.

6.9 Automatic pipetting device -- 10-mL capacity, used to add reagent water to the VOA vials prior to going into the field. Any suitable device may be employed.

## 7.0 REAGENTS AND STANDARDS

7.1 Reagent grade chemicals must be used in all tests. Unless otherwise indicated, all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without decreasing the accuracy of the determination. Reagents should be stored in glass to prevent the leaching of contaminants from plastic containers.

7.2 Organic-free reagent water -- All references to water in this method refer to organic-free reagent water, as defined in Chapter One.

7.3 Calibration gas for PID -- A convenient, portable, source of a calibration gas is needed for the PID, e.g., a lecture bottle containing 100 ppm of isobutylene in air. Other calibration gases recommended by the manufacturer of the PID may also be used. The cylinder needs to be equipped with a valve or regulator suitable for dispensing small quantities of gas.

7.4 Solvent for working standards -- Polypropylene glycol (PPG) or similarity low vapor pressure organic solvent. Used to prepare working standards containing the principal VOC of interest at the site.

7.5 VOC standards -- Reagent-grade neat materials. The specific compound used for preparation of the working standard will be site-specific. Given that this is a screening procedure, higher purity materials are not necessary.

7.5.1 The stock and working standards should consist of the principal VOC of site interest. Therefore, in order for this screening procedure to be effective, the VOC(s) of interest at the site must be known in advance of screening and must be detectable by the PID. The stock standard is prepared in PPG or other low vapor pressure solvent. The working standard is prepared by spiking a volume of the stock standard into reagent water.

### 7.5.2 Stock standard

The stock standard should be prepared such that a 1- to 2- $\mu$ L volume of the *working* standard (Sec. 7.5.3) added to 10 mL of reagent water and 5 g of uncontaminated soil results in a concentration of 200  $\mu$ g/kg. The concentration of the stock standard should be back-calculated from that of the working standard. The total volume of the stock standard need not be large. For example, a 2- or 4- $\mu$ L volume of neat reagent added to 2.5 mL of PPG would be appropriate for many common chlorinated and aromatic

compounds. The density of the neat VOC is used to determine the stock standard concentration. In the case of trichloroethene (TCE), the following example illustrates a useful stock standard concentration.

$$\frac{1.464 \text{ g/mL} \times 0.002 \text{ mL}}{2.5 \text{ mL}} \times 1000 \text{ mg/g} = 1.17 \text{ mg/mL TCE stock solution}$$

where 1.464 g/mL is the density of the neat TCE and 2.5 mL is the volume of PPG. Given the spiking volume of TCE is insignificant as compared to that for PPG, for this example the total volume of PPG is still considered 2.5 mL.

Other volumes and concentrations may be employed, as appropriate. TCE is used in this equation *strictly* as an example. The stock and working standards must be prepared with the site-specific VOC(s) of concern.

### 7.5.3 Working standard

The preparation of soil samples by Method 5035 differentiates between "low" and "high" concentration samples at a break point of approximately 200 µg/kg. Because the low concentration sample is purged in the sample vial and cannot be diluted, it is important to screen samples to prevent overloading the purge-and-trap system and the detector. It is also important to screen samples to minimize the number of samples that must be reanalyzed because the results were above the calibration range of the instrument. The 200 µg/kg concentration also represents a common (but not absolute) upper calibration limit for GC/MS procedures such as Method 8260.

As a result, the working standard for this screening procedure should generally result in a concentration of 200 µg/kg, when a 1- to 2-µL volume of the working standard is added to a VOA vial containing 10 mL of reagent water and approximately 5 g of soil. In the case of trichloroethene (TCE), the following example illustrates a useful working standard concentration, based on the stock standard example in Sec. 7.5.2.

$$\frac{1.17 \text{ mg/mL TCE stock solution} \times 0.001 \text{ mL}}{5 \text{ g sample}} \times 1000 \text{ µg/mg} = 0.2 \text{ µg/g} = 200 \text{ µg/kg}$$

where 1 µL (0.001 mL) of the stock standard is used to prepare the working standard. Other volumes and concentrations may be employed, as appropriate. TCE is used in this equation *strictly* as an example. The stock and working standards must be prepared with the site-specific VOC(s) of concern.

Ideally, the field personnel should consult with the laboratory that will perform the analyses by Method 5021 or 5035 to determine the upper limit of the calibration range that the laboratory actually employs for those analyses. The actual concentration of the working standard should then be adjusted to be within about ±10% of that concentration.

## 8.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

Sample collection, preservation, and storage considerations may vary by EPA program and may be specified in the regulation that requires compliance monitoring for a given

contaminant. Where sample collection and handling considerations are specified in the regulation, follow those directions. Otherwise, use the following sample collection and handling guidelines.

8.1 For additional guidance, see the introductory material to Chapter Four, "Organic Analytes," Sec. 4.1.

## 8.2 VOA vial preparation

The modifications to the VOA vials that are used for both working standards and samples entail punching a 5- to 6-mm hole through the center of the PTFE-faced silicon septum, adding approximately 10 mL of reagent water, covering the glass rim of each VOA vial with a 3 x 3-cm square of light gauge aluminum foil, and applying the septum and cap (see Figure 1). The hole through the septum is designed to permit the inlet tube of the PID to pass through into the headspace above the sample. To minimize the potential for on-site contamination, the vials should be prepared prior to going into the field in a relatively controlled environment such as a laboratory, an on-site trailer, or other appropriate facility that is not used to store solvents, fuels, or other volatile materials.

8.2.1 Punch a 5- to 6-mm hole through the PTFE-faced septum of the VOA vial. If a large number of vials are prepared at once, all the septa can be punched in sequence.

8.2.2 Using an automatic pipettor or other suitable device, add approximately 10 mL of reagent water to each vial.

8.2.3 Cover the glass rim of the vial with a 3x3-cm square of aluminum foil, pressing the foil down along the sides of the vial so that it conforms to the threads for the cap.

8.2.4 Apply the septum and the cap to the vial. Do not over tighten the cap. Look through the hole in the septum to ensure that the foil did not tear when the cap was applied.

## 8.3 Sample collection

The native structure of the material being sampled for screening should be kept intact, with as little disaggregation as possible during the collection and transfer process. This can often be accomplished with a coring tool designed to obtain a discrete sample. For example, a modified 10-mL syringe is a practical tool for obtaining a 5-g sample. This device is transparent and comes with gradient markings so that the volume/weight relationship for a given material can easily be established with a portable balance.

This procedure is designed around a 5-g sample, however, larger sample sizes can be employed at the discretion of the field personnel. For example, larger samples may be appropriate for VOCs to which the PID does not respond strongly. If samples larger than 5 g are needed, more than one corer can be used, or several transfers can be made with a single corer. However, larger diameter syringes are often impractical because they will not fit into the mouth of the VOA vial. Larger samples may also need the use of more reagent water in the vial.

The location of samples taken for both screening purposes and laboratory analysis should be as close as possible to each other (generally within 10-cm radius), and from the same stratum. Prior to preparing (or exposing) a fresh sampling surface, for instance, opening a split

spoon, or scrapping away the top layer of a material, the cap and aluminum foil should be removed from the screening VOA vial.

To obtain a sample, the corer should be inserted perpendicular to the surface presented (unless the depth is inadequate or if the material is very dry, in which case a lateral insertion could be used). After retrieving a discrete sample, the core barrel should be inserted into the mouth of the screening VOA vial and the sample extruded. When extruding the sample plug from the corer, precautions should be taken to avoid contact between the corer and the reagent grade water. Once the sample has been extruded into the vial, the aluminum foil and cap are quickly returned to the vial. This collection and transfer process should take less than 10 sec, and the sample weight only has to be approximate (e.g.,  $5 \pm 1$  g).

Given the potential for loss of VOCs, each sample should be collected and screened one at a time. Do not collect samples from multiple locations and then screen them all. The total elapsed time from exposing the sample surface, through collecting the sample for screening, screening that sample, and collecting the appropriate size samples for laboratory analysis should be less than 2 min.

#### 8.4 Sample handling

Because the sample that is screened will not be analyzed further, no additional sample handling steps are necessary for that aliquot. The used sample volume (after screening) may be disposed of by any appropriate means.

Refer to Methods 5000, 5021, and 5035 for the procedures for preservation and shipment of the samples for laboratory analyses.

### 9.0 QUALITY CONTROL

Because this is a screening procedure designed for field use, the quality control considerations are significantly less stringent than those employed for quantitative trace analyses. The principal quality control considerations involve the calibration of the PID, as described in Sec. 11.1. Also, refer to Chapter One for additional guidance on quality assurance (QA) and quality control (QC) protocols that may be applicable. Any effort involving the collection of analytical data should include development of a structured and systematic planning document, such as a Quality Assurance Project Plan (QAPP) or a Sampling and Analysis Plan (SAP), which translates project objectives and specifications into directions for those that will implement the project and assess the results.

### 10.0 CALIBRATION AND STANDARDIZATION

See Sec. 11.1 for information on calibration and standardization.

### 11.0 PROCEDURE

#### 11.1 Calibration

The PID is calibrated in two ways, as described below in Secs. 11.1.1 and 11.1.2. The first step is to calibrate the PID daily with a standard gas (see Sec. 7.3). The second calibration step involves the use of a working standard containing the site-specific VOC of concern, and is performed more frequently.

### 11.1.1 Daily calibration

At the beginning of each day of field activity, the PID is calibrated using a cylinder of standard gas (see Sec. 7.3). This single-point calibration may be performed before going into the field, and ensures that the PID is functioning and provides an appropriate response. Follow the manufacturer's instructions for performing this calibration and evaluating the response.

### 11.1.2 Site-specific calibration

The PID is also calibrated on-site, using a working standard (Sec. 7.5.3) that contains the site-specific VOC of concern. This single-point calibration is used to estimate sample VOC concentrations. It must be performed under the same conditions used for sample screening, in order to normalize the influences of meteorological and working conditions on the PID response. This calibration should be performed at least once an hour during sample screening.

Depending on the VOC of site-specific concern and the nature of the matrix to be screened, it may be necessary to include an aliquot of uncontaminated sample matrix in the working standards. Otherwise, the working standard may be prepared from reagent water spiked with the stock standard containing the site-specific VOC of concern.

11.1.2.1 The VOA vials used for the working standard are prepared in the same fashion as those for sample, e.g., a hole is punched through the septum, 10 mL of reagent water is added, and the vial is covered with aluminum foil, as described in Sec. 8.2.

11.1.2.2 Working standards are prepared daily by adding microliter amounts (1 to 2  $\mu\text{L}$ ) of the PPG-based stock standard containing the principal analyte of interest to VOA vials containing 10 mL of reagent water and 5 g of the uncontaminated site specific matrix (if necessary), resulting in a concentration of about 200  $\mu\text{g}/\text{kg}$  (see Sec. 7.5.2 and 7.5.3 regarding the use of other concentrations). Immediately after spiking, these vials are covered with a single sheet of aluminum foil which is tightly held in position with a modified septum (hole punched in middle) and a screw cap.

11.1.2.3 The contents of the working standards should be thoroughly mixed by hand shaking, then transported to the location of the sampling activity, stored out of direct sunlight, and allowed to equilibrate for 1 hr prior to use. Prepare one vial of working standard for each hour of screening time. Standards are prepared daily. Unused vials of working standard should be discarded at the end of the day.

11.1.2.4 The sample matrix can have a significant effect on the screening procedure. The organic carbon content of the soil will affect the partitioning of the VOCs between the sample and the reagent water. The decision to include the sample matrix in the working standard is a site-specific one. For analytes with high vapor pressures and/or low octanol water partition coefficients, and sample matrices with low organic carbon contents, it may not be necessary to include the sample matrix in the working standards. This should be established on a site-by-site basis, by comparing the mean of triplicate working standards with and without the sample matrix. As a general rule, if the means differ by more than 20%, then it is recommended that the sample matrix be included in the working standards.



11.1.2.5 The sample weight, and correspondingly, the volume of working standard can be altered depending on the response of PID to the principal analyte of site interest in the matrix of concern. The PID response to the working standard should be at least 10x greater than its response to a blank (comprised of reagent water, uncontaminated sample matrix, and an appropriate volume of PPG).

11.1.2.6 Before the analysis of the working standard, hand shake the VOA vial for 10 to 15 sec. Then visually check the vial for both the complete dispersion of the sample matrix and for particles adhering to the aluminum foil cap liner (knock large particles off the aluminum foil if present). Cohesive materials, such as silts and clays, do not break apart rapidly upon shaking and may need more than 15 sec for complete dispersion.

After this visual check, push the inlet tube of the PID through the foil liner, to a set position about 3 cm below the rim. The maximum PID response will be achieved within 2 to 3 sec of punching through the foil liner. Record the response of the working standard.

11.2 A total VOC screening analysis should be performed at each sampling location in order to establish how to handle and prepare the discrete samples for laboratory analysis (using the low or high concentration procedure). Given the potential for loss of VOCs during the sample handling process, the equipment for screening should be set up and operating prior to exposing the sample to the atmosphere. Therefore, before opening a split spoon, scrapping a fresh surface on a pit wall, removing surface vegetation and the appropriate amount of top soil for a surface grid location, or removing the first several inches of some other type of waste material, the PID should be operating and have been calibrated as described in Sec. 11.1. The screening vials should be prepared as described in Sec. 8.2, prior to going into the field.

11.3 Prior to exposing a fresh surface of the sample, analyze the working standard. If the working standard has been analyzed within the past hour, additional analyses of the standard may not be necessary, unless the sampling location or matrix has changed. To analyze the working standard, push the inlet tube of the PID through the foil liner of the vial containing the working standard and position the tube about 3 cm below the rim of the vial. The maximum PID response should occur within 2 to 3 sec of puncturing the foil liner. Record the result.

11.4 Once a fresh surface has been exposed, a sample should be quickly obtained, transferred to a screening VOA vial, and the vial sealed. Sample collection procedures are described in greater detail in Sec. 8.0.

11.5 Once the sample for screening has been extruded from the coring tool into the vial, seal the vial with the aluminum foil and the modified septum cap. Hand shake the vial for 10 to 15 sec. Examine the vial to ensure that the sample has been dispersed in the reagent water and that there are no lumps of sample adhering to the aluminum foil liner.

11.6 Push the inlet tube of the PID through the foil liner of the vial containing the sample and position the tube about 3 cm below the rim of the vial. Record the maximum PID response, which should occur within 2 to 3 sec of puncturing the foil liner.

11.7 Estimate the total VOC concentration of the sample by comparing the responses of the sample and the working standard. If the sample response is greater than the response for working standard, then record the sample result as "greater than X," where "X" is the

concentration of the working standard. Conversely, if the sample response is less than the response for the working standard, then record the result as "less than X."

**NOTE:** While it is useful to record the actual PID reading as well, field personnel are *strongly* advised of the limitations of this screening procedure and they must not place undue significance on any numerical PID result.

11.8 Use this estimate to determine the appropriate sample size for the aliquot sent to the laboratory for quantitative analysis.

11.8.1 If the sample PID response is less than the response of working standard, then the estimated VOC concentration of the sample is below the concentration of the working standard. Collect a sample for the low-level closed-system purge-and-trap procedure described in Method 5035 or the low-level headspace procedure described in Method 5021.

11.8.2 If the sample PID response is greater than the response of working standard, then the estimated VOC concentration of the sample is above the concentration of the working standard. Collect a sample for the high-level methanol extraction procedure described in Method 5035 or the high-level headspace procedure described in Method 5021.

11.8.3 In the event that the sample response is within a factor of 2 (e.g., 0.5 to 2 times) of the working standard, it may be advisable to collect samples for analysis by both procedures. The decision may also be based on previous experience at a specific site or with a specific waste, and a different safety factor may be appropriate.

**NOTE:** This concentration estimate is used **ONLY** for determining the appropriate sample size for quantitative laboratory analysis. This procedure must **NOT** be used to decide whether to collect samples.

11.9 The total elapsed time between exposing a fresh surface, screening a sample, and obtaining samples for laboratory analysis should be less than 2 min.

11.10 Once the sample for laboratory analysis has been collected, dispose of the screening sample in the vial in an appropriate manner.

11.11 There are no calculations associated with this screening procedure. The sample concentration is estimated by simple comparison to the response of the working standard, and the results are reported as either greater than or less than the concentration of the working standard. It cannot be overemphasized that this procedure is a screening procedure and must not be used to decide that a sample or site is free of VOC contamination, or to decide whether samples need to be collected for quantitative VOC analysis.

## 12.0 DATA ANALYSIS AND CALCULATIONS

See Sec. 11.11.

## 13.0 METHOD PERFORMANCE

13.1 Performance data and related information are provided in SW-846 methods only as examples and guidance. The data do not represent required performance criteria for users of

the methods. Instead, performance criteria should be developed on a project-specific basis, and the laboratory should establish in-house QC performance criteria for the application of this method. These performance data are not intended to be and must not be used as absolute QC acceptance criteria for purposes of laboratory accreditation.

13.2 Table 1 contains example data from a field investigation that employed this screening procedure and the corresponding fixed laboratory analyses of the samples. Laboratory analyses were conducted for eight volatile organic compounds, using a GC/PID/FID technique. The samples were prepared by either the "low concentration" or "high concentration" techniques described in Method 5021. The conclusions regarding the appropriate laboratory preparative technique are based on analyses of the samples using Method 8260, not the GC/PID/FID technique that was actually employed in this demonstration, and assumes an upper limit of the calibration range of 200 µg/kg for each target compound. These data are provided for guidance purposes only.

## 14.0 POLLUTION PREVENTION

14.1 Pollution prevention encompasses any technique that reduces or eliminates the quantity and/or toxicity of a waste at the point of generation. Numerous opportunities for pollution prevention exist in analytical operations. EPA has established a preferred hierarchy of environmental management techniques that places pollution prevention as the management option of first choice. Whenever feasible, personnel should use pollution prevention techniques to address their waste generation. When wastes cannot be feasibly reduced at the source, the Agency recommends recycling as the next best option.

14.2 For information about pollution prevention that may be applicable to laboratories and research institutions consult *Less is Better: Laboratory Chemical Management for Waste Reduction* available from the American Chemical Society's Department of Government Relations and Science Policy, 1155 16th St., N.W. Washington, D.C. 20036, <http://www.acs.org>.

14.3 This procedure generally conforms with EPA's pollution prevention initiatives, in that it may be used to minimize the number of sample aliquots collected at a site and shipped to a laboratory, thereby reducing the need to dispose of sample materials following laboratory analysis.

## 15.0 WASTE MANAGEMENT

Aside from the working standards in reagent water, the only waste generated by the use of this procedure is the used sample following screening. The used sample consists of the solid material that was added to the vial and approximately 10 mL of reagent water. The used sample should be disposed of in a manner consistent with Federal, state, and local regulations.

## 16.0 REFERENCES

1. Alan D. Hewitt and Nicole J. E. Lukash, "Estimating the Total Concentration of Volatile Organic Compounds in Soil, A Decision Tool for Sample Handling," SR97-12, U. S. Army Cold Regions Research and Engineering Laboratory, Hanover, NH, April 1997.

## 17.0 TABLES, DIAGRAMS, FLOW CHARTS, AND VALIDATION DATA

The following pages contain the table and figure referenced by this method.

TABLE 1  
EXAMPLE PERFORMANCE DATA FOR VOC SCREENING PROCEDURE

| Sample No. | PID Response for 200 ppb of TCE | Sample PID Response | Lab Prep Method (Low/High) | Laboratory GC/PID/FID Results (µg/kg) |         |         |         |               |              |          | Lab Prep Appropriate? (Y/N) |
|------------|---------------------------------|---------------------|----------------------------|---------------------------------------|---------|---------|---------|---------------|--------------|----------|-----------------------------|
|            |                                 |                     |                            | CDCE                                  | TCE     | Toluene | PCE     | Ethyl Benzene | (p+m)-Xylene | o-Xylene |                             |
| 1          | 6.5                             | 0.0                 | Low                        | --                                    | --      | --      | < 3     | --            | --           | --       | Y                           |
| 2          | 6.5                             | 0.0                 | Low                        | --                                    | --      | --      | --      | < 3           | --           | --       | Y                           |
| 3          | 6.5                             | 0.4                 | Low                        | --                                    | 20      | 150     | 8       | 74            | 76           | 82       | Y                           |
| 4          | 6.5                             | 790                 | High                       | --                                    | 5,200   | 29,000  | --      | 15,000        | 15,000       | 3,500    | Y                           |
| 5          | 6.5                             | 480                 | High                       | --                                    | --      | --      | 140,000 | --            | --           | --       | Y                           |
| 6          | 7.0                             | 1400                | High                       | --                                    | 250,000 | 19,000  | 240,000 | 33,000        | 76,000       | 68,000   | Y                           |
| 7          | 8.0                             | 26                  | High                       | --                                    | --      | --      | 7,400   | --            | --           | --       | Y                           |
| 8          | 8.0                             | 2.2                 | Low                        | 40                                    | 20      | --      | 170     | --            | --           | --       | Y                           |
| 9          | 8.0                             | 12                  | High                       | --                                    | --      | --      | 1,000   | --            | --           | --       | Y                           |
| 10         | 6.3                             | 4.4                 | Low                        | --                                    | --      | --      | 240     | --            | --           | --       | N                           |

The PID response was checked against the 200 ppb TCE standard prior to the analysis of Sample 1, and then again before Samples 6, 7, and 10.

CDCE = cis-1,2-Dichloroethene  
TCE = Trichloroethene  
PCE = Perchloroethylene

*These data are provided strictly as an example, for guidance purposes. PID responses for other samples, other instruments, and other analytes will differ.*

The conclusion regarding the appropriate laboratory preparative technique is based on analysis of the samples using Method 8260, and assuming an upper limit of the calibration range of 200 µg/kg for each target compound. Different conclusions might be drawn for other determinative methods and/or calibration ranges.

FIGURE 1

MODIFIED VOA VIAL USED FOR SCREENING SAMPLES

