TNRCC Guidance on the Use of EPA Method SW-846 5035
Closed System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples

1.0 Introduction

A large body of evidence from both the federal and private sectors indicates the collection of unpreserved bulk samples from solid matrices (e.g., soil) for volatile analysis yields results that can be significantly biased low due to the loss of volatile organic compounds (VOCs) occuring during the sample collection, handling, storage, and laboratory subsampling process. Research studies indicate losses of as much as 3-orders of magnitude between duplicate samples, i.e., results from on-site of the sample compared to results from a duplicate of the sample collected using bulk sampling techniques and analyzed off-site by a fixed laboratory. These losses exhibit both random and systematic errors which may be attributed to

- the disruption of the soil structure integrity which
  - increases the surface area from which volatilization can occur and
  - increases the presence of oxygen in the solid matrix promoting microbial degradation,
- lack of sample seal integrity, and/or
- losses occuring during laboratory subsampling procedures.

On June 13, 1997, the EPA promulgated Methods 5000 and 5035 in Update III of SW-846. These methods include procedures for collecting, preserving, handling, and preparing samples from solid matrices to minimize the loss of the VOCs. This TNRCC document provides guidance for implementing of Method 5035.

Unlike most analytical methods published in SW-846, Method 5035 impacts multiple technical disciplines. Therefore, successful implementation requires increased communication among members of the project team, including the laboratory. The final selection of sampling protocol should be based on input from all data users (e.g., project managers, risk assessors, and regulatory specialists) as well as the data collectors/generators (e.g., field teams and the laboratory). A systematic technical planning process, such as the Data Quality Objective (DQO) Process described in the EPA guidance, EPA QA/G4, will be helpful in identifying the project objectives and developing the sampling and analysis plans for the collection of soil samples for volatiles analysis. EPA QA/G4 can be found at http://www.epa.gov/quality/qa_docs.html. The attached Figure 1 illustrates a VOC analysis decision tree which can be used as a planning tool.

2.0 Implementation

The TNRCC strategy for mandatory implementation of Method 5035 will be announced at a later date.

3.0 Method 5035 Procedures

The recommended method of sample collection for both low and high concentration soils is closed-system field collection using volatile organic analysis (VOA) vials as outlined in Section 5.0 below. The intent of Method 5035 is to collect the sample in a manner causing the least amount of disturbance to the soil structure and to transfer and hermetically seal the sample in a sample container as quickly as possible. After sealing, the sample container is not opened until after the analysis of the sample is complete. The

procedures specified in Method 5035 for sample collection, sample preparation, and sample analysis should be followed except where deviation is allowed by this guidance. Bulk sampling can be used for sample points where the contamination is expected to be high, or where the procedure requires a sample volume that exceeds the 10 grams, e.g., TCLP determination, or where Method 5035 procedures cannot be used, such as in highly consolidated or highly unconsolidated matrices. This document supplements the method in order to resolve and clarify certain technical issues. This document does not replace Method 5035 and does not address all facets of soil and waste VOC sampling and analysis. Therefore, all organizations should have a copy of Method 5035 as provided in SW-846 and the August 7, 1998, clarification memo issued by EPA which can be found at http://www.epa.gov:80/epaoswer/hazwaste/test/memo7.pdf.

Method 5035 includes a procedure for preparing low concentration samples, i.e., soil samples expected to contain concentrations of VOCs between 5 ug/kg and 200 ug/kg, and a second procedure for high concentration samples, i.e., soil samples that are expected to contain greater than 200 ug/kg of VOCs. It is recommended that screening of samples, both in the field using an appropriate field instrument, and in the laboratory using a gas chromatographic screening method, be conducted prior to selecting the Method 5035 option to use on specific samples.

Additional guidance is available in the American Society Testing and Materials (ASTM) Method D4547-98 for sampling waste, soils, and sediments for VOCs. The ASTM method describes both the collection of the sample and the method of containing the sample for shipment to the laboratory but does not cover laboratory preparation of containers or solutions nor other laboratory techniques related to processing or analysis of the samples. The ASTM standard can be obtained directly from ASTM.

4.0 Sampling and Analysis Strategy

The selection of the appropriate analytical methodology depends upon the project objectives which include the analytical sensitivity requirements for the project and the identification of the VOCs present or anticipated at the site. When the nature of the contamination is not well known (e.g., during the initial assessment of the area of concern), method-specified target analyte lists are typically selected. However, in many situations a target analyte list can be reduced based upon historical knowledge or industrial process and waste disposal practices at the site. For example, if the analyte is not detected as a tentatively identified compound during initial investigation of the site and there is no other reason to suspect the presence of such a chemical, it may be appropriate to remove that analyte from the project analyte lists. The agency recommends that prior to analytical testing, the rationale for including analytes be carefully evaluated to ensure that all chemicals of concern are included on the analyte list and that chemicals requiring low-level analyses are appropriately identified.

During the planning process, the laboratory must clearly understand the sensitivity requirements for the project and should be consulted to ensure that the laboratory can meet the analytical levels of concern with its current method quantitation limits. The lowest concentration calibration standard that is analyzed during an initial calibration establishes the method quantitation limit based on the final volume of extract (or sample) described in the preparative method or employed by the laboratory. Note, the sample quantitation limits for the high-level method are typically 50 times higher than the sample quantitation limits for the low-level method. This difference is due to dilution of the sample in methanol.

As illustrated in the attached Figure 1, the high-level option can be used when either the project action levels *or* the site VOC concentrations are high. When the project action levels are low, samples for both high-level and low-level analyses should be collected or else field screening should be performed to determine whether samples for only high-level or low-level analysis should be collected. Screening at the laboratory is recommended regardless of whether samples were screened in the field.

[NOTE: If the sample is collected and preserved with methanol as a high-level sample and the action level for a chemical is less than the sample quantitation limit for a methanol extract, then non-detected results from the analysis for that chemical may not be useable. In such cases, it may be necessary 1) to recollect and reanalyze the sample using the low-level method; 2) to perform some method modification such as sample cleanup to achieve the project required quantitation limit; or 3) to use alternate technology (e.g., GCMS/SIM) to meet the data quality objectives.]

It is critical that all field and laboratory personnel be familiar with the use of Method 5035 protocols prior to actual sample collection and analysis.

5.0 Closed-System Field Collection Using Hermetically Sealed VOA vials or Hermetically Sealed Intermediate Sample Containers

5.1 The recommended sample collection procedure for both low and high concentration soils is to collect the sample using a coring device and to quickly extrude the sample core into a tared vial that does not contain preservative but does contain the stir bar, if applicable. The threads of the vial are inspected and quickly wiped clean. The vial is then sealed and chilled, held at 4±2°C, and shipped to the laboratory. The vial remains unopened until after the analysis is complete. The laboratory should analyze the sample within 2 days from the time of collection. Alternatively, the laboratory can freeze the sample within the 2 days to extend the holding time to 14 days from the date of collection (See Section 7.0 below). This collection procedure does not require the use of preservatives in the field and is an accepted modification of Method 5035.

5.2 Collection of the sample using an approved coring device that serves as an intermediate hermetically sealed sample container is an alternative to the procedure in Section 5.1 above. This type of sampling device should be used according to the manufacturer's instructions. Once the sample is received by the laboratory, the sample is extruded into a VOA vial and sealed. If analysis cannot be performed within 2 days from the date of collection, the sample can be frozen to extend the holding time to 14 days from the date of collection.

6.0 Field procedures

6.1 All containers and sampling devices must be pre-cleaned and/or be certified free of VOCs.

6.2 The sample vial should be a standard supply VOA vial with a polytetrafluoroethylene-lined (PTFE-lined) septum that can be hermetically sealed.

6.3 Prior to shipping sample vials to the field for use in sample collection, the vials should be prepared in a fixed laboratory or other controlled environment as described in Section 6.1 of Method 5035.

The tare weight of the sample vial including cap, septum, the stir bar, if applicable, any preservative, if applicable, and the label must be determined and recorded on the label. If methanol is used to preserve the samples in the field, the vial can only be used after the field team confirms the tare weight to be within ± 0.1 grams of the original tare weight. The balance used to verify the tare weight in the field must be calibrated against an appropriate reference weight at least daily prior to weighing the vials. Calibration and tare weight records should accompany the sample set. Note: Clean gloves should be worn when handling tared vials.

6.4 Exposure to air must be minimized by obtaining the sample directly from the source using a coring device or a commercially designed sampling device and by transferring the sample as quickly as possible to the VOA vial or sealing the sampling device [Section 5.2] immediately.

6.4.1 The VOA vial must be hermetically sealed immediately after extruding the sample into the vial. Therefore, the vial should be quickly wiped free of any particulate matter that would compromise the integrity of the vial seal.

6.4.2 The coring/sampling device must be designed to fit tightly against the mouth of a tared VOA vial or be small enough to be inserted into the vial.

6.4.3 The coring device can be used to collect multiple aliquots from the same sample point provided the integrity of the coring device is not compromised.

6.4.4 If the coring device is designed and approved to be used as a temporary storage device for transport to the laboratory, the manufacturer's instructions should be followed.

6.4.5 If a bulk sample is being collected, the 2 ounce sample jar should be filled to capacity to minimize the head space in the sample container.

6.5 The sample size collected should be approximately 5 grams (10 grams for TPH analysis by TNRCC 1005 and 1006). The coring device should be calibrated and should be designed to minimize the disturbance of the sample during collection. Several calibrated coring devices are available commercially.

6.5.5 If the sampling team is not using a coring/sampling device that is calibrated to 5 grams, the TNRCC recommends that, prior to collecting any samples, the sampling team practice collecting 5 ± 0.5 grams using the sampling device and a balance as described in Section 6.2.1.4 of Method 5035.

6.5.6 For non-cohesive soils and waste (e.g., dry sand and fly ash), for highly cohesive materials (e.g., concrete and rock), and for soils that have high compressive and shear strength, the sample should be quickly transferred into a 2 ounce jar using a scoop or spatula. Enough sample should be collected such that the head space in the jar is minimized.

6.6 A bulk sample with no preservative should be collected to use for screening purposes. After the sample is screened in the laboratory, the sample can be used to determine the percent moisture, to

run the MS/MSD, to check reactivity with sodium bisulfate, and/or to determine the appropriate extraction solvent, as necessary.

6.7 In the low-level option, the entire sample is consumed during the analysis. Therefore, it is recommended that a total of three samples be collected at each sample point; allowing one sample for the analysis, one sample in case a dilution is required, and one sample for reanalysis, if necessary.

6.8 For samples with high concentrations of volatile compounds, the sample is extracted with methanol and the extract is used for dilutions and/or reanalysis. Therefore only two high level samples are recommended; one sample for analysis and one sample for reanalysis, if necessary.

[NOTE: If a project-specified action level is less than the laboratory's quantitation limit for non-detected results using a methanol extract, then it may be necessary to recollect the sample using the low-level method of collection and preservation. Therefore, to avoid having to resample, the TNRCC recommends that the planning team identify the chemicals of concern and communicate with the field team and the laboratory to verify that methanol extracted samples will meet the project objectives.]

6.9 The use of an analytical balance in the field is required to check the tare weight when methanol preservation is used. For other sample collection procedures, balances may be used to verify that an adequate volume (weight) of soil is collected. The initial soil sample size will affect the quantitation limit that can be achieved on the sample.

6.10 All samples must be properly packaged and chilled to 4±2°C immediately upon collection.

6.11 During sample shipment, all conditions relating to the isolation/segregation of the samples from potential contaminants (gasoline/diesel engines or generators, highly contaminated samples, etc.) must be observed.

6.12 <u>Field Preservation with Sodium Bisulfate for Low Concentration Soils</u>

6.12.1 The use of sodium bisulfate in the field as a preservative is not recommended. Its use is limited to non- or low-calcareous soil samples, i.e., samples that do not effervesce when mixed with a sodium bisulfate solution at the concentration specified in Sections 6.1.1.2 and 6.1.1.3 in Method 5035. If preservation with sodium bisulfate is specified for the project, then prior to sample collection, the field team must verify that the soil does not react with sodium bisulfate.

[NOTE: Potential sampling and safety hazards may exist when using sodium bisulfate as a preservative. See Sections 10.0, 11.0, and 12.0 below regarding shipping considerations, safety issues, and potential interactions with matrices.]

6.12.2 The sample must be collected using a coring device. The core should be extruded into a tared VOA vial containing the sodium bisulfate solution at the method specified

concentration. The septum seal should be immediately screwed on tightly taking care to ensure that the bottle threads are free of particulate matter (e.g., soil particles). Once the sample is collected and preserved with the sodium bisulfate, the vial should be placed inside a cooler containing sufficient ice to hold the sample at 4±2°C during shipment to the laboratory. The laboratory should analyze the sample within 14 days from the date of sample collection. The vial must be sealed properly and must remain sealed until after the analysis is complete.

[NOTE: If the sample effervesces when mixed with the sodium bisulfate solution, a sealed vial could explode during shipment due to the gas produced from the effervescence.]

6.13 Field Preservation with Methanol

6.13.1 The use of methanol as a preservative in the field is not recommended because of the shipping and handling requirements.

6.13.2 If methanol is used as a field preservative, the use of methanol as a preservative introduces a significant dilution factor (e.g., a dilution factor of 50 for a 1:1 sample/solvent ratio) which will raise the sample quantitation limit. Precautions should be taken by the planning team and the field team to ensure that the project and analytical objectives are clearly understood. Note should be made of all chemicals of concern that have action levels below 200 ug/kg, and discussions with the laboratory should be initiated to ensure the laboratory has the capability of achieving adequate quantitation limits for those chemicals in a methanol extract. If the laboratory's quantitation limit for a methanol extract is greater than the action level for a chemical, non-detected results for that chemical may not be useable, and re-collection of the sample may be necessary using the low-level techniques. The overall performance of the procedure must be able to meet the objectives for the project (e.g., sensitivity requirements), therefore, methanol preservation should be limited to

- Samples that have VOC concentrations greater than 200 ug/kg, or
- Samples for which the laboratory's quantitation limits for the chemicals of concern in a methanol extract are less than the action levels for those chemicals.

6.13.3 Care must be taken in the field to avoid the introduction of contamination from external sources such as vehicular emissions or dust. Therefore, when samples are preserved with methanol in the field, a methanol blank should be exposed to field conditions during the sample collection process.

6.13.4 The default sample to solvent ratio in Method 5035 is 2:1. This ratio can be adjusted (e.g., to a 1:1 ratio) provided it can be demonstrated the amount of solvent is sufficient to submerge the entire plug of typical soil in the vial and still allow for free liquid to be present. If field preservation with methanol is selected, the decision on the ratio should be made with some knowledge of the soil characteristics at the site.

6.13.5 Samples and/or vials containing methanol may require special handling/disposal procedures, e.g., unused methanol can be recycled. However, samples containing methanol are hazardous waste due to the ignitability characteristic and must be disposed of accordingly.

6.13.6 Depending on the quantity and method of packaging, shipments of vials containing methanol may need to meet DOT hazardous materials regulations. See Section 10.0 below for regulatory considerations for sample shipment. It should be noted that DOT regulations associated with the use of preservatives in the field may be avoided by using the field procedures in Section 5.0 above.

6.13.7 The label must include combined tare weight of the vial (with the cap and septum), the methanol, the label, and if applicable, the stir bar.

6.13.8 The tare weight of each vial must be checked in the field on the day of sample collection prior to use of the vial. The tare weight check must be within ± 0.1 grams of the tare weight noted on the label. If the tare weight check is not within this allowable variance, the vial should not be used. All laboratory and field tare weights must be recorded in the field logbook.

6.13.9 The balance used to verify the tare weight in the field must be checked against an appropriate reference weight at least daily and prior to weighing the vials. Calibration and tare weight records should accompany the sample set.

7.0 Laboratory Operations

7.1 The laboratory must measure and record the sample weight upon receipt.

7.2 The laboratory should check the integrity of the seal on the vials and note if there is any damage to, or problem with, the seal. Improperly sealed samples should not be used for analysis. If an integrity problem with the seal is discovered after the analysis of a sample, the results should be flagged and the problem noted in the laboratory case narrative.

7.3 All samples must be analyzed within the holding times.

7.3.1 The holding time for samples with no chemical preservative is 2 days at 4±2 °C. The holding time can be extended to 14 days from the date of collection if the sample is preserved within the 2 days by

7.3.1.1 the TNRCC recommended procedure of freezing and holding the sample in the VOA vial at -12±2 °C, or

7.3.1.2 preserving the sample in the laboratory with sodium bisulfate at the method specified concentration by using a gas-tight syringe with a 22 gauge or thinner needle to inject the acid through the septum of the VOA vial, and then holding the preserved sample at 4±2 °C, or

7.3.1.3 if the laboratory has the capability to meet the sensitivity requirements for the project using a methanol-extracted sample, the laboratory can preserve the sample with methanol by using a gas-tight syringe with a 22 gauge or thinner needle to inject the alcohol through the septum of the VOA vial and then holding the preserved sample at 4±2 °C.

7.3.2 The holding time for samples preserved in the field or the laboratory with methanol or sodium bisulfate is 14 days from the day of collection if held at 4±2 °C.

7.3.3 The holding time for bulk samples intended for analysis is 2 days from the time of collection. Alternatively, the laboratory can subsample the bulk sample by 1) taking a "plug" from the center area of the sample, 2) placing the "plug" into a tared VOA vial, and 3) preserving the sample with methanol. Once preserved in methanol, the sample can be held at 4±2 °C for 14 days from the date of collection.

7.4 All additions to the sample for low-level analysis, i.e., preservative, surrogates, water, and internal standards, must be introduced through the septum with a gas-tight syringe using a 22-gauge or thinner needle so that the air displaced as a result of the additions is trapped as part of the analysis

7.5 During sample storage, all conditions relating to the isolation/segregation of the samples from potential sources of volatile compound cross-contamination must be observed.

7.6 The heated purge should conform to the requirements specified in the method for temperature and duration.

7.7 The sample must be agitated during the purging process of low concentration soils.

7.8 For the high-level method, the test to determine the solvent to use should be performed on the bulk sample. The appropriate solvent should be added to the vial, and the sample should be analyzed or stored at 4±2°C and analyzed within 14 days of sample collection.

8.0 **Procedures for Oily Wastes** - Follow the prescribed procedures for sample collection, preparation, and analysis in Section 6.2.4 of Method 5035. Samples for TCLP determinations should be bulk samples, because a minimum of 100 grams is required for the leachate test.

9.0 Quality Control

9.1 The laboratory quality control measures specified throughout Method 5035 must be followed.

9.2 Field quality control measures should include a trip blank in every sample shuttle that contains samples for volatile analysis regardless of the sample collection technique, field blanks (especially when methanol is used as a preservative in the field) on a 5% frequency or as specified in project plans, and field duplicates on a 5 to 10% frequency or as specified in project plans.

9.3 The laboratory must report the method of collection, preservation, and preparation on the analytical results sheet. The results should be reported on a dry weight basis.

10.0 Regulatory Considerations for Sample Shipping for Method 5035

When samples are collected and preserved in the field using methanol or sodium bisulfate, Department of Transportation (DOT) shipping requirements (as well as health and safety issues) need to be taken into account for these preservatives. Depending on the quantity and method of packaging, these preservatives may be DOT Hazardous Materials and may be subject to the DOT and International Air Transportation Association (IATA) hazardous materials regulations.

When it is necessary to preserve samples in the field, three sample shipment scenarios are possible: 1) small quantity exception; 2) limited quantity DOT hazardous material; or 3) fully regulated DOT hazardous material. These three options and associated requirements are outlined below.

10.1 Shipment as a Small Quantity Exception:

The recommended way to ship methanol or sodium bisulfate preserved samples is in accordance with 49 CFR 173.4 under the small quantity exception. If the criteria of this regulation as described below are met, shippers are not subject to other DOT Hazardous Materials Regulations or the associated personnel training. The packaging must meet the following criteria:

Table 10.1 - Shipping requirements for small quantity exception under 49 CFR 173.4

Criteria	Requirement	Regulation
Inner Container Quantity Limit	30 mL or 30 g per inner container	49 CFR 173.4(a)(1)(i)
Total Net Inner Quantity Package Limit	500 mL	IATA Dangerous Goods Regulations
Package Certification	A strong outside package with adequate absorbent material or cushioning	49 CFR 173.4(a)(10)
Shipping Paper	Not Required, but air waybill must be marked “Dangerous Goods in Excepted Quantities”	IATA (Section 2.7.6)
Marking	certification	40CFR 173.4(a)(10)
Labeling	Not Required	
Placarding	Not Required	
DOT HMR Training	Not Required	

Note: DOT considers the 30 mL inner container limit to include both methanol and soil, because by definition the content of the vial is a slurry containing free liquid. Therefore, in order to not exceed this 30 mL criteria and assuming a 1:1 ratio of methanol to soil, the recommended volume of methanol should not exceed 10 mL. The absolute volume would be 15 mL of methanol and 15 grams of soil.

10.2 Shipment as Limited Quantity Exception

Methanol or sodium bisulfate preserved samples greater than 49 CFR 173.4 inner-container quantities (i.e., 30 mL) will void the 49 CFR 173.4 small quantity exception and samples should be shipped in accordance with the following DOT Limited Quantity Exception criteria:

Table 10.2 - Shipping requirements for Limited Quantity Exception under 49 CFR 172.101

Criteria	**Requirement**	**Regulation**
Inner Container Limit	(ground) Table, Column 8A criteria (air) Table, Column 9A/9B criteria	49 CFR 172.101
Outer Container Limit	(ground) Table, Column 8A criteria (air) Table, Column 9A/9B criteria	49 CFR 172.101
Package Certification	Table, Column 8A criteria	49 CFR 172.101
Shipping Paper	Required	
Marking	PSN, UN#, orientation arrows, shippers name & address	
Labeling	Required for air transportation - Table, Column 6	49 CFR 172.101
Placarding	Not required	
DOT HMR Training	Required	49 CFR 172.700

10.3 DOT Regulated Hazardous Materials Shipments, Fully Regulated

If shippers do not take a limited quantity exception and their materials are regulated in commerce, they must have DOT specification packages and will have to consider the "cooler" a DOT overpack in accordance with 49 CFR 173.25.

Table 10.3 Shipping requirements for Regulated Hazardous Materials Shipments

Criteria	**Requirement**	**Regulation**
Inner Container Limit	(air) Table, Column 9A/9B criteria	49 CFR 172.101
Outer Container Limit	(air) Table, Column 9A/9B criteria	49 CFR 172.101
Package Certification	UN specification Table, Column 8B criteria	49 CFR 172.101
Shipping Paper	Required	
Marking	PSN, UN#, orientation arrows, shippers name & address, inner packages comply with prescribed specifications	49 CFR 173.25(a)(4)
Labeling	As required in Table, Column	49 CFR 172.101
Placarding	As required	49 CFR 172.500

Criteria	Requirement	Regulation
DOT HMR Training	Required	49 CFR 172.700

11.0 Site Safety

Methanol is a toxic and flammable liquid. Therefore, methanol must be handled with all safety precautions related to toxic and flammable liquids. Inhalation of methanol vapors must be avoided. Vials must be opened and closed quickly during the sample collection procedure. Methanol must be handled in a ventilated area. Protective gloves should be worn when vials containing methanol are handled. Methanol should be stored away form open flames, areas of extreme heat, and other ignition sources. Vials containing methanol should be refrigerated (e.g., stored in coolers with ice).

Sodium bisulfate is a strong mineral acid and must be handled with all safety precautions related to acids. Contact with the skin and eyes should be avoided. Protective gloves and eye protection should be worn when handling vials containing sodium bisulfate.

12.0 Possible Chemical Interactions:

Although not substantiated, two occurrences with methanol and sodium bisulfate have been observed that would affect sample results. In the first case, soils that contain aluminum silicates may act as a catalyst in the conversion of methanol to acetone. In the second case, soils such as lignite or peat contain a polymeric constituent known as humic acid that may interact with sodium bisulfate to form acetone. The possible mechanisms for these interactions are being researched. Therefore, until these two mechanisms can be confirmed or denied, projects should be evaluated with respect to acetone being a site chemical.

13.0 Cost for Implementing Method 5035:

Additional costs will be associated with the implementation of Method 5035.

The major laboratory cost associated with this method is the cost of the auto-sampler that has the capability of agitating and heating the sample during the purging process. This cost is approximately $25,000.

Field costs associated with preservation in the field with methanol or sodium bisulfate are significant. Preservation in the field may take up to an additional 200 percent of time to collect, preserve, and weigh the sample vials because of the immediate need to both collect and preserve the soil samples, which may require an additional person in the field. The personnel responsible for preserving and weighing the samples should be experienced in analytical techniques. Since methanol acts as an absorbent to volatile vapors, ambient blanks will also be necessary at the cost of one volatile analysis. The cost to ship the Small Quantity Exception is equivalent to shipping hermetically sealed vials with no preservatives. However, the surcharge to ship as Limited Quantity Exception can more than double the cost. Therefore, the actual cost impact to a project is more significant for field preservation than shipment in the hermetically sealed vials. Also, considerations must be made for samples from a soil boring when the samples to be sent for analysis are based on field screening results. Method 5035 protocol requires all samples be collected in hermetically sealed vials or be field preserved. The net result will be that the samples collected but not sent for analysis must be discarded. If these excess samples are field preserved, they must be managed as a hazardous waste

(e.g., lab packed) unless excluded because the criteria of a conditionally exempt small quantity generator's wastes are met.

Field costs associated with collecting the sample in a core device that can be used as an intermediate storage container are dependent upon the cost of the sampling device and the number of samples to be collected. Each sample point will require at a minimum 2 sampling devices and at a maximum 7 sampling devices.

Field costs associated with collecting the sample using a coring device and VOA vials are dependent upon the cost of the coring device and the VOA vials. Each sample point will require at a minimum two VOA vials and at a maximum seven. The coring device can be used to collect multiple aliquots from the same sample point provided the integrity of the coring device is not compromised.

Figure 1: VOC Analysis Decision Tree

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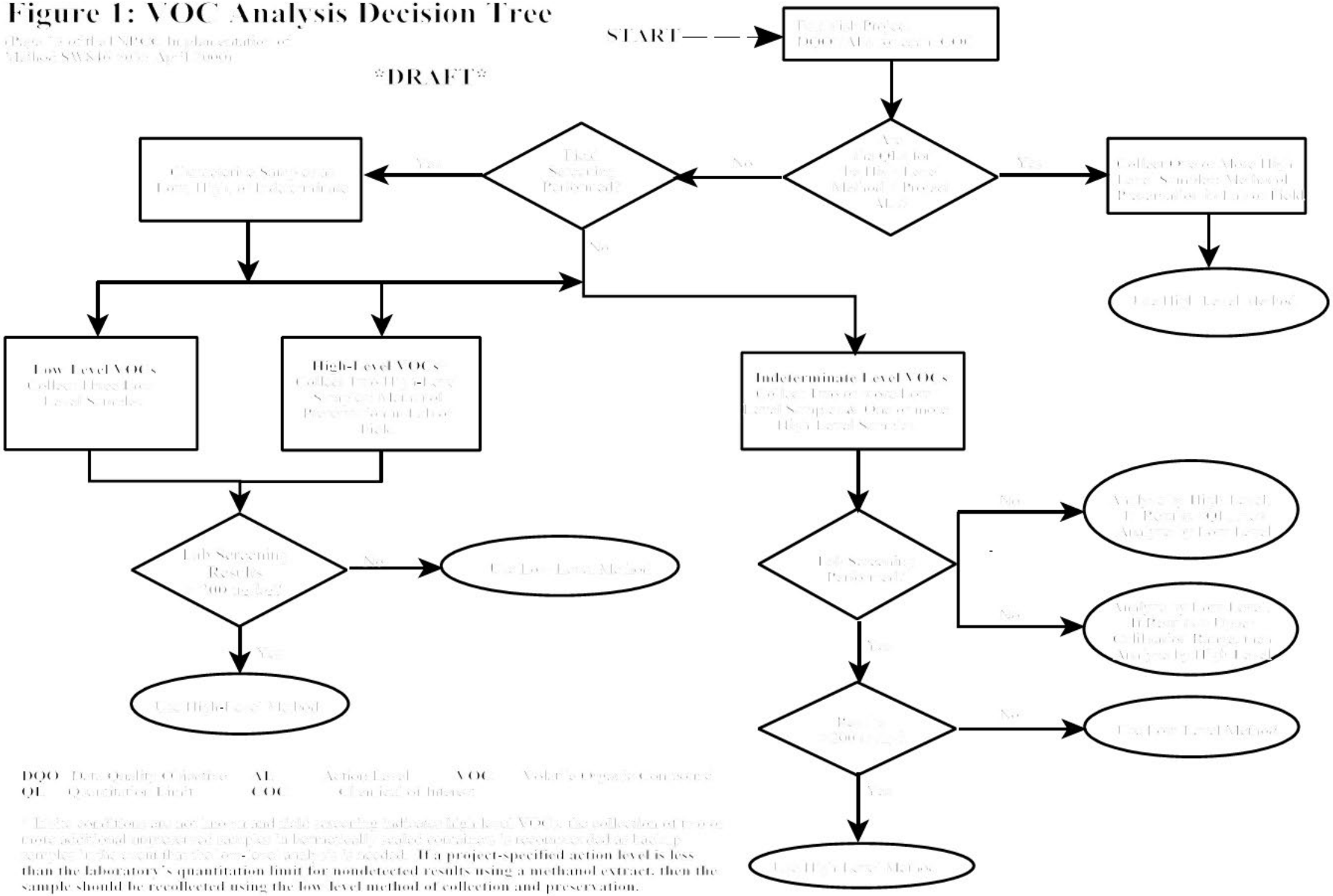

DQO Data Quality Objective **AL** Action Level **VOC** Volatile Organic Compound
QL Quantitation Limit **COC** Chemical of Interest

* If site conditions are not known and field screening indicates high level VOCs, the collection of two or more additional unpreserved samples in hermetically sealed containers is recommended as backup samples in the event that the low-level analysis is needed. **If a project-specified action level is less than the laboratory's quantitation limit for nondetected results using a methanol extract, then the sample should be recollected using the low level method of collection and preservation.**