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Standard Guide for Sampling of Drums and Similar Containers by Field Personnel[1]

This standard is issued under the fixed designation D6063; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide covers information, including flow charts, for field personnel to follow in order to collect samples from drums and similar containers.

1.2 The purpose of this guide is to help field personnel in planning and obtaining samples from drums and similar containers, using equipment and techniques that will ensure that the objectives of the sampling activity will be met. It can also be used as a training tool.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* See specific Warnings in 7.4.3 and 7.4.4.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C783 Practice for Core Sampling of Graphite Electrodes
D1452 Practice for Soil Exploration and Sampling by Auger Borings
D1586 Test Method for Penetration Test (SPT) and Split-Barrel Sampling of Soils
D1587 Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes
D2113 Practice for Rock Core Drilling and Sampling of Rock for Site Investigation
D4448 Guide for Sampling Ground-Water Monitoring Wells
D4687 Guide for General Planning of Waste Sampling
D4700 Guide for Soil Sampling from the Vadose Zone
D4823 Guide for Core Sampling Submerged, Unconsolidated Sediments
D4840 Guide for Sample Chain-of-Custody Procedures
D5088 Practice for Decontamination of Field Equipment Used at Waste Sites
D5283 Practice for Generation of Environmental Data Related to Waste Management Activities: Quality Assurance and Quality Control Planning and Implementation
D5358 Practice for Sampling with a Dipper or Pond Sampler
D5451 Practice for Sampling Using a Trier Sampler
D5495 Practice for Sampling With a Composite Liquid Waste Sampler (COLIWASA)

3. Terminology

3.1 *Definitions:*

3.1.1 *bung*, *n*—usually a 2-in. (5-cm) or ¾-in. (1.3-cm) diameter threaded plug specifically designed to close a bung hole.

3.1.2 *bung hole*, *n*—an opening in a barrel or drum through which it can be filled, emptied or vented.

3.1.3 *consolidated solid*, *n—as used in this guide*, a compact solid not easily compressed or broken into smaller portions.

3.1.4 *drum*, *n—when used in the flow charts in this guide*, ~~the word implies any drum, barrel or non-bulk container of 5 to 110 gal (19 to 400 L) capacity.~~ —implies any drum, barrel or non-bulk container of 5 to 110 gal (19 to 400 L) capacity.

3.1.5 *representative sample*, *n*—a sample collected such that it reflects one or more characteristics of interest ~~of~~ (as defined by the ~~lot or~~project objectives) of the population from which it was collected.

3.1.6 *sample*, *n*—one or more items or portions collected from a lot or population.

[1] This guide is under the jurisdiction of ASTM Committee D34 on Waste Management and is the direct responsibility of Subcommittee D34.01.02 on Sampling Techniques.
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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.1.7 *sampler*, *n*—the device used to obtain a sample.

3.1.8 *sludge*, *n—as used in this guide*, any mixture of solids that settles out of solution; sludges contain liquids that are not apparent as free liquids.

3.1.9 *unconsolidated solid*, *n—as used in this guide*, uncemented or uncompacted material that is easily separated into smaller portions.

3.1.10 *work plans*, *n*—plans that are specific to sampling at a particular site; examples are Health and Safety Plans and Sampling and Analysis Plans.

4. Summary of Guide

4.1 This guide uses a decision-tree format to lead persons intending to sample waste materials from drums and similar containers through a series of questions. The answers to the questions result in recommended actions, including the selection of appropriate sampling equipment. Brief instructions on the use of the equipment are included.

4.2 This guide addresses commonly used sampling equipment and devices; it is not intended to cover all that might be purchased or custom made.

5. Significance and Use

5.1 This guide is intended to assist field personnel in obtaining samples from drums and similar containers for field and laboratory analysis. The need for accurate data and the costs associated with sampling and analysis make it essential that samples be taken correctly before submitting them for chemical analysis or physical testing, or both. Incorrect sampling can invalidate resulting data.

5.2 This guide may be used by personnel who have no formal workplan. It draws their attention to issues that must be addressed before, during, and after taking a sample. It provides guidance in choosing the sampling technique and equipment suitable for specific situations. It can serve as a training tool for those who are unfamiliar with sampling. It is recommended that this guide be used as a supplement to a written workplan.

5.3 Some sections of this guide contain flow charts (see Figs. 1-5) that must be worked through, starting from the top of each page. By answering the questions in the diamond-shaped boxes, and following the appropriate arrows, the person planning to sample will be guided towards the most suitable procedures and equipment. The numbers at the bottom of some boxes refer to corresponding paragraphs in the text, which provide information to help the person sampling answer the questions.

5.4 Figs. 6-15 are examples of types of equipment. Similar devices that do the same job in the same way are not intended to be excluded.

6. Objectives of Sampling

6.1 The purpose of sampling is to collect a representative sample of all or part of the contents of the drum or similar container, to determine the physical and chemical characteristics of those contents (see Fig. 1). This information may then be used to:

6.1.1 Select suitable methods of treatment and disposal of the contents,

6.1.2 Provide evidence for use in a court of law,

6.1.3 Comply with regulations, such as those for the transportation of hazardous materials,

6.1.4 Confirm that the drums contain what is written on the label, manifest or other type of documentation, and

6.1.5 Find out if any drums in a lot contain different materials from the majority.

6.2 In most cases there is a written plan that describes the work to be done (Guide D4687). In other cases, there is no written plan and the instructions are only verbal.

6.3 If the objectives of sampling are unclear or unknown to the field personnel, they should question their supervisor or project manager about the objectives. Well-informed field personnel are then alert to unforeseen circumstances or events that might invalidate the samples.

7. Pre-Sampling Inspection

7.1 Information about the contents of the drums may be available from (see Fig. 2):

7.1.1 Previous analysis of drum contents from the same source,

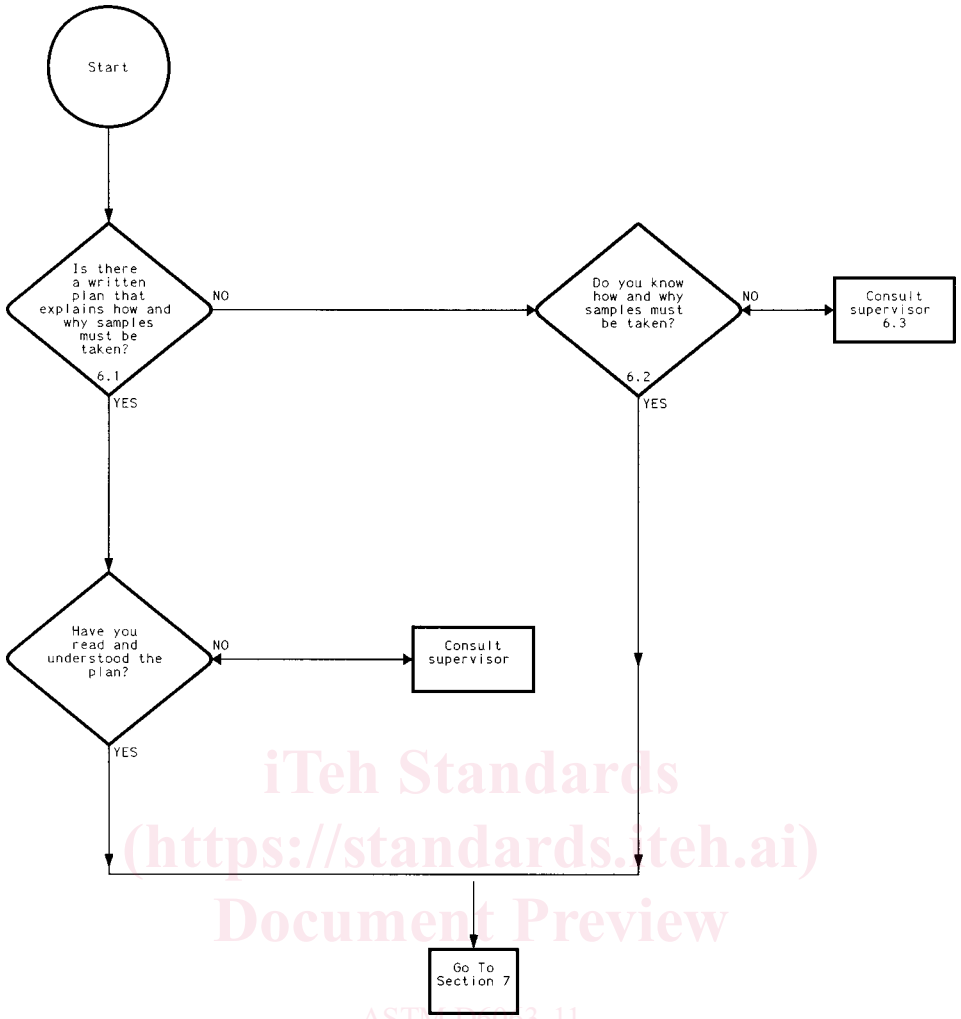
7.1.2 The supplier/source of the material in the drums,

7.1.3 Manifest (shipping) documents,

7.1.4 Labels and other markings on the drums, or

7.1.5 Knowledge of the waste generating process.

7.2 Personnel doing the pre-sampling and sampling must be aware of any special procedures that are to be followed at a given site. Workplans include a worker health and safety section because there are potential hazards associated with opening drums as



NOTE 1—This flow chart should be used with Section 6 in the text.

FIG. 1 Objectives of Sampling

well as with potentially hazardous contents.[3,4] Examples of special procedures are change of clothing, use of safety equipment of various kinds, evacuation procedures, fire and explosion procedures and vehicle cleaning procedures such as water washing before leaving the site or storage area, and many others that would be site or storage specific.

7.3 If you are certain that the drum does not contain radioactive material and the workplan does not require you to check for radioactivity, proceed to 7.4.

7.3.1 Many facilities are not licensed to handle radioactive materials and are legally obliged to prove that they do not knowingly accept them. Some facilities are licensed to handle radioactive materials; they need to have a measure of how radioactive the material is for the safety of their workers.

7.3.2 Hand-held monitors that check for radioactivity should always be used if you suspect that radioactive material might be present or if the workplan requires it. It is important that the monitor has been calibrated correctly, according to the manufacturer's instructions. Monitoring should be done only by those with the appropriate written procedures, training and equipment.

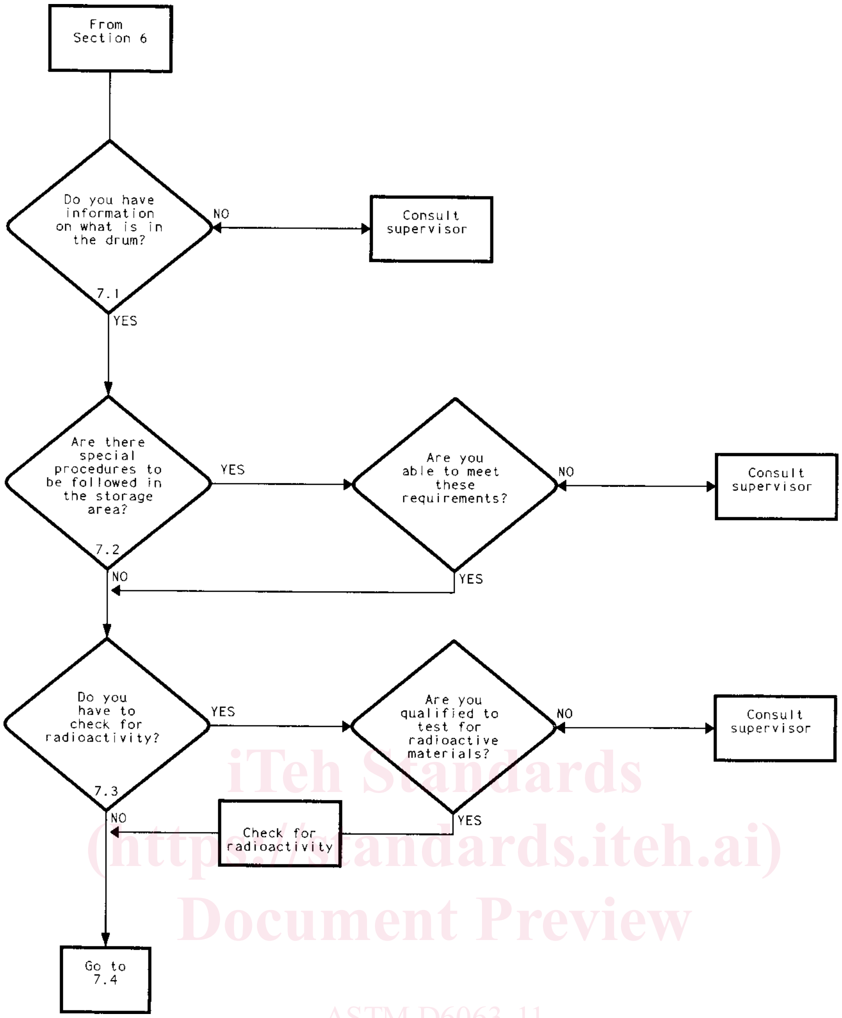
7.3.3 It is prudent to monitor a storage area before entering it. If radioactive material is found to be present when it should not be, leave the area immediately, post warning signs to alert other workers, and consult your supervisor.

7.4 Drums may contain flammable materials, strong oxidizers or reducing materials, light-sensitive materials, corrosive acids or bases, and materials sensitive to moisture or movement, or both. All of these drums require special handling, including segregation, when possible.

7.4.1 Many solvents, like benzene, evaporate into air space in and around the drum where the ~~vapour~~vapor may be easily ignited.

[3] *Drum Handling Practices at Hazardous Waste Sites*, EPA/600/2-86/013, January 1986.

[4] *Field Sampling Procedures Manual*~~, Third Edition, New Jersey Department of Environmental Protection, Division of Hazardous Site Mitigation, February 1988.~~, New Jersey Department of Environmental Protection, Division of Remedial Support, August 2005 (available online).



NOTE 1—This flow chart should be used with Sections 7.1 to 7.3 in the text.

FIG. 2 Pre-Sampling Inspection

7.4.2 If you are sampling a potentially flammable or unknown material, non-sparking tools should be used and the drums should be grounded.

7.4.3 If the drums are stored in a closed room or confined space, the air in the area should be tested by a hand-held monitor to check for flammable vapors. It is important that the monitor has been calibrated according to the manufacturer's instructions. The monitoring should be done by those with the appropriate training and written procedures. (**Warning**—Flammable materials should be sampled in a well-ventilated area. There are other safety considerations that must be considered regarding confined spaces. It may be necessary to check for explosivity or oxygen levels.)

7.4.4 Labels on drums of waste materials may not be accurate. Unless the drums come from a reliable source, for example, the generator of the material and the process that created the waste are known to you, it is prudent to assume that the labels may not match the contents. (**Warning**—Attempting to open a drum that is in poor condition can expose a worker to the possibility of a serious, even fatal, accident. Special precautions should be taken when the bungs are rusted or corroded since the drum top may give way, exposing the worker to vapor or liquid. Overpacking before sampling should be considered for drums in poor condition.)

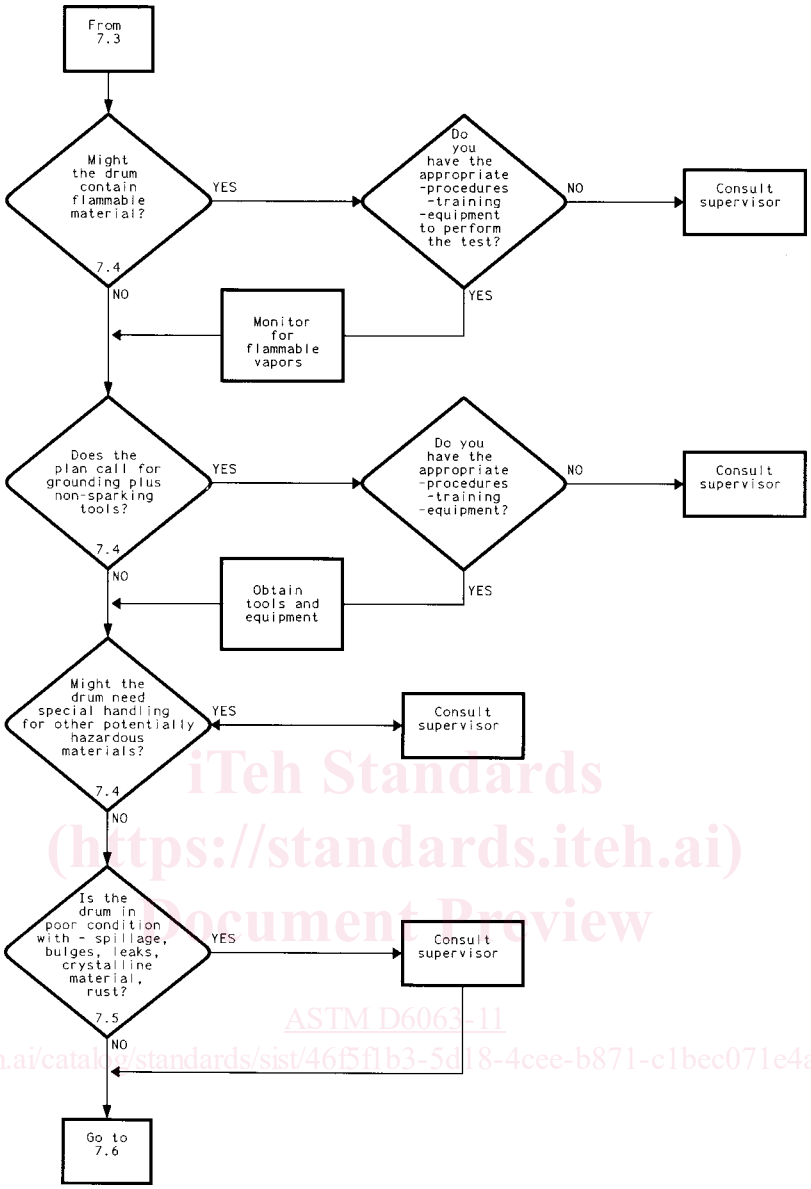
7.5 It is not always necessary to sample every drum in a lot. The workplans provide direction as to how many, and possibly which, drums should be sampled. Each drum that will be sampled must be identified in a unique way in case a second sample has to be taken later. Colored labels, crayons, paint sticks or pens, or stencil~~l~~ed paint can be used to identify drums. Any new identification system should not cover the existing labels or identifiers.

7.6 Sometimes drums have to be moved to another location for sampling; this is known as "drum ~~staging".~~staging." This is required if:

7.6.1 Sampling the drum in its present location poses a high risk to surrounding property ~~and~~or individuals, or both,

7.6.2 The drum cannot be accessed for sampling in its current location, or

7.6.3 Exposure to climatic conditions alter the sample, for example, formation of ice; or create a health and safety risk, for example, the sun heating a drum containing solvents.



NOTE 1—This flow chart should be used with Sections 7.3 to 7.5 in the text.

FIG. 2 Pre-Sampling Inspection *(continued)*

7.7 The physical condition of drums must be evaluated before attempting to open or move them (see Warning in 7.4.4). Drum carriers, which lock on the drum lip, should not be used to move the drum if the condition is poor.

7.8 Materials in layers, such as oil with water, can become mixed together when moved. If you want to sample each layer separately, the material may need time to settle before opening and sampling the drum.

8. Selection of Suitable Sampling Procedure

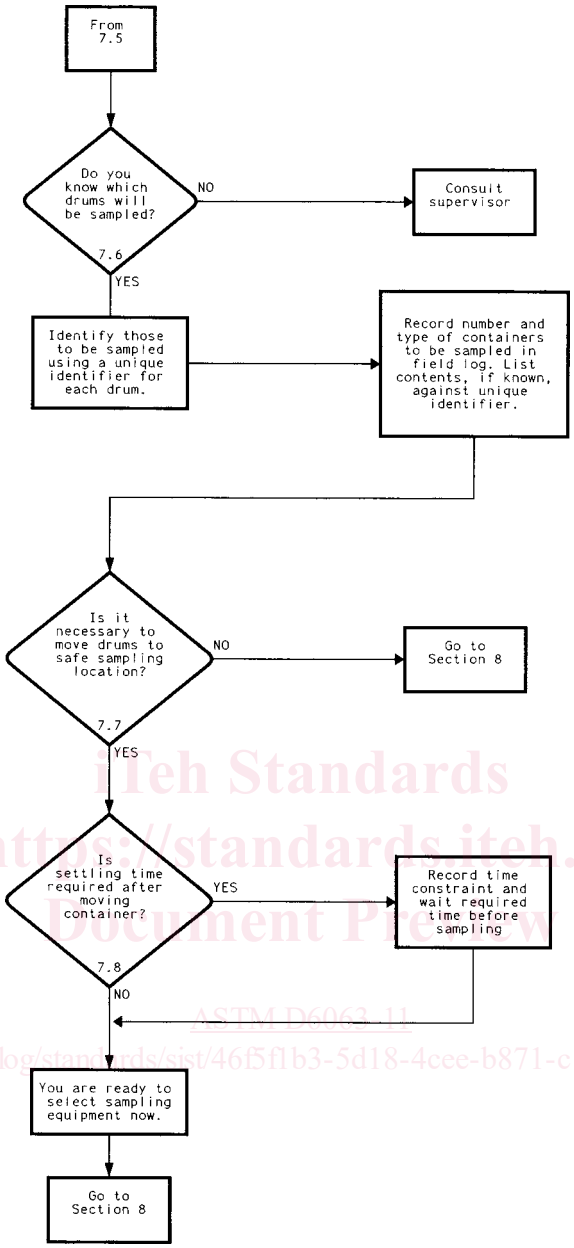
8.1 The physical state(s) of the material(s) being sampled is an important criterion when sampling (see Fig. 3).

8.2 A drum containing one liquid, such as water, or a mixture of liquids, such as a stable emulsion like hand cream, that does not separate into two layers regardless of time, is said to contain one phase. A drum containing two liquids, such as oil and water, which form two distinct layers when they are not stirred is said to contain two phases.

8.3 When it is necessary to know the amounts of solid and liquid layers in a drum, a calibrated measuring device or the sampling equipment (for example, a COLIWASA) can be inserted into the opened drum (see Section 12) and the liquid level measured.

8.4 Although sludges behave like sticky solids and are not usually pumped, they can contain quite a high proportion of liquids, such as oil or water, which is not visible as free liquid.

8.5 An unconsolidated solid is a material like sand or a powder. A consolidated solid consists of material, like sandstone or concrete.



NOTE 1—This flow chart should be used with Sections 7.6 to 7.8 in the text.

FIG. 2 Pre-Sampling Inspection *(continued)*

8.5.1 A drum containing mixed materials, such as disposable personal protective equipment and laboratory supplies, is treated as one with unconsolidated solids.

8.6 If the waste material is likely to attack the sampling equipment, such as an acid corroding a metal thief:

8.6.1 The equipment may partially dissolve, adding constituents, such as metals to the sample. Faulty conclusions may be drawn about the composition of the sample, leading to costly and unnecessary remedial actions, and

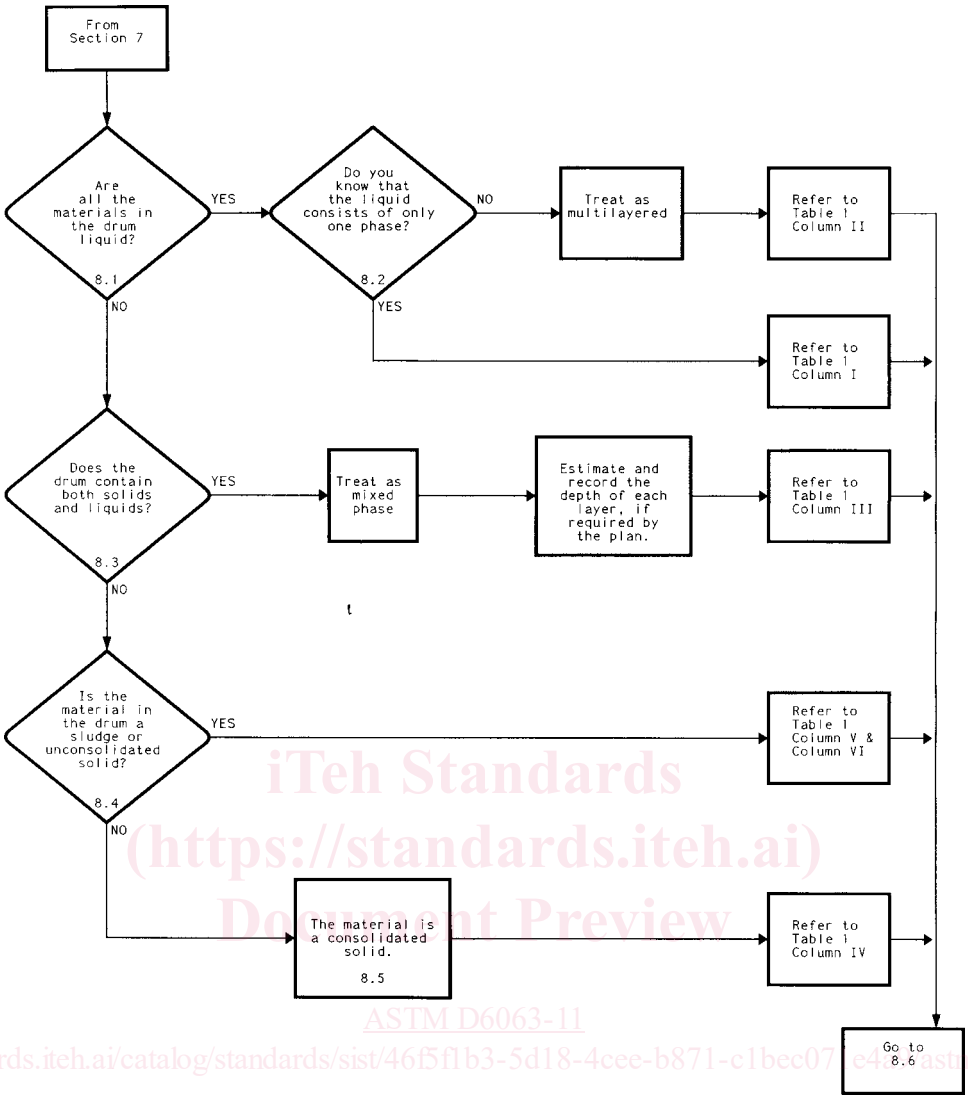
8.6.2 The equipment will have to be replaced frequently, adding costs to the project.

8.7 When selecting equipment, it is important to be aware of the limitations of the tools. The design of some equipment can result in part of the material not being sampled. For example, if the size of the opening(s) that allow the sample to enter a trier is smaller than some of the particles in the drum, the sample will not be representative.

8.7.1 Volatile organic constituents are likely to be lost if the sampling equipment causes a buildup of heat or agitation of the sample, as will exposure to air for more than a very short time or storage in a sample container with a headspace above the sample.

8.7.2 See Table 1 for more information on the limitations of sampling equipment.

8.8 When the quantity of material that is removed from a drum by the equipment will not provide enough for the laboratory to perform all the required tests, a number of subsamples must be taken and combined. In doing this it is critical not to disturb layers; this could result in an unsuitable sample.



NOTE 1—This flow chart should be used with Sections 8.1 to 8.5 in the text.

FIG. 3 Selection of Suitable Sampling Procedure

8.9 Pumps may require electricity to operate. If the sampling location is outdoors, they may need to be protected from the weather. If flammable vapors were observed in 7.4, consult your supervisor about sources of ignition, such as pumps, electrical connections and switches.

8.10 Consideration should be given to having a separate clean sampling device for each drum since this eliminates cross-contamination and may be more efficient than cleaning one sampling device after each drum. It is generally easier to clean the sampling devices and other equipment in the laboratory or another suitable place where solvent disposal and drying equipment are readily available.

8.11 It is worthwhile to make a comparison of the costs of cleaning or decontaminating equipment, or both, including disposal of the cleaning agents, versus using disposable equipment when selecting and preparing equipment. The initial purchase price of the equipment may also be a factor in the selection. There may be more than one suitable device (see Table 2).

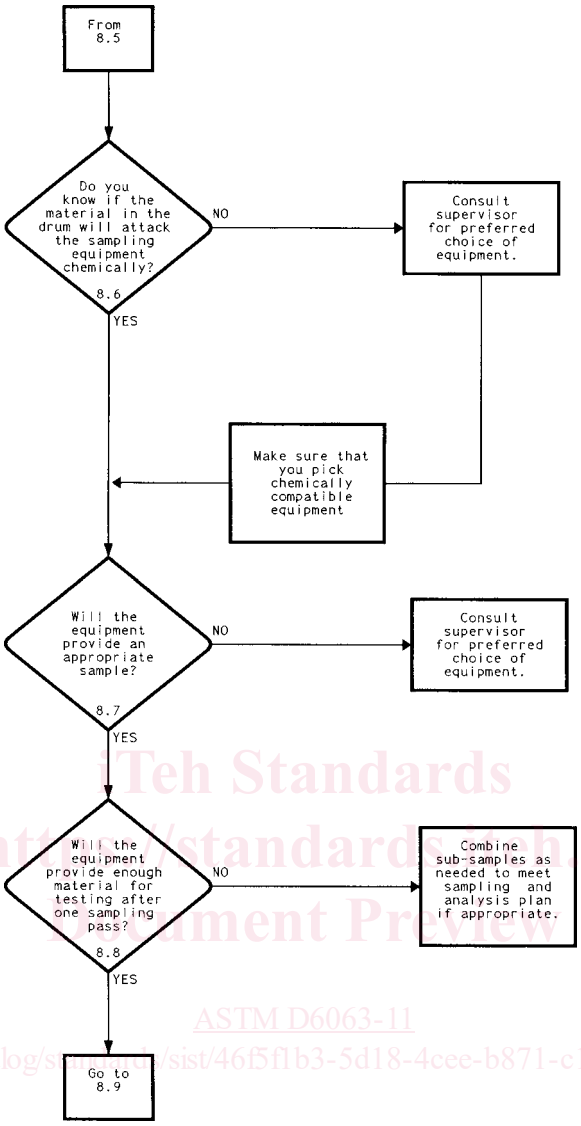
8.12 Table 1 and Table 2 list equipment that is commonly used for sampling liquid and solid wastes, and their limitations. They contain more than one type of equipment for some types of waste materials but are not intended to include all possible equipment or devices.

8.12.1 Other factors that will guide you in making the final choice follow in Section 13.

9. Preparation of Sampling Equipment

9.1 Damaged sampling equipment can affect the sample, for example, dull cutting edges or chipped glass parts. It may also be a safety hazard for the worker (see Fig. 4).

9.2 Cleaning and decontamination procedures should be identified in the plan (see Practice D5088).



NOTE 1—This flow chart should be used with Sections 8.6 to 8.8 in the text.

FIG. 3 Selection of Suitable Sampling Procedure *(continued)*

9.3 Check the workplan for preservatives, cooling/refrigeration, holding times, type and size of sample container, packaging, and shipping requirements. If the samples are going to be analyzed for volatile organic compounds, such as gasoline, special bottles must be used.

9.4 If the samples are going to be analyzed for trace amounts of volatile organic compounds, such as solvents, plan to fill and seal the special sample bottles required for this analysis first, before filling the other sample containers.

9.5 Personal safety equipment will vary depending on the hazards associated with the task. It must comply with the health and safety requirements of the organization that employs you.

9.5.1 Basic safety equipment includes:

9.5.1.1 Safety glasses,

9.5.1.2 Synthetic rubber gloves,

9.5.1.3 Safety shoes or boots, and

9.5.1.4 Protective clothing.

9.5.2 More hazardous situations may require equipment such as:

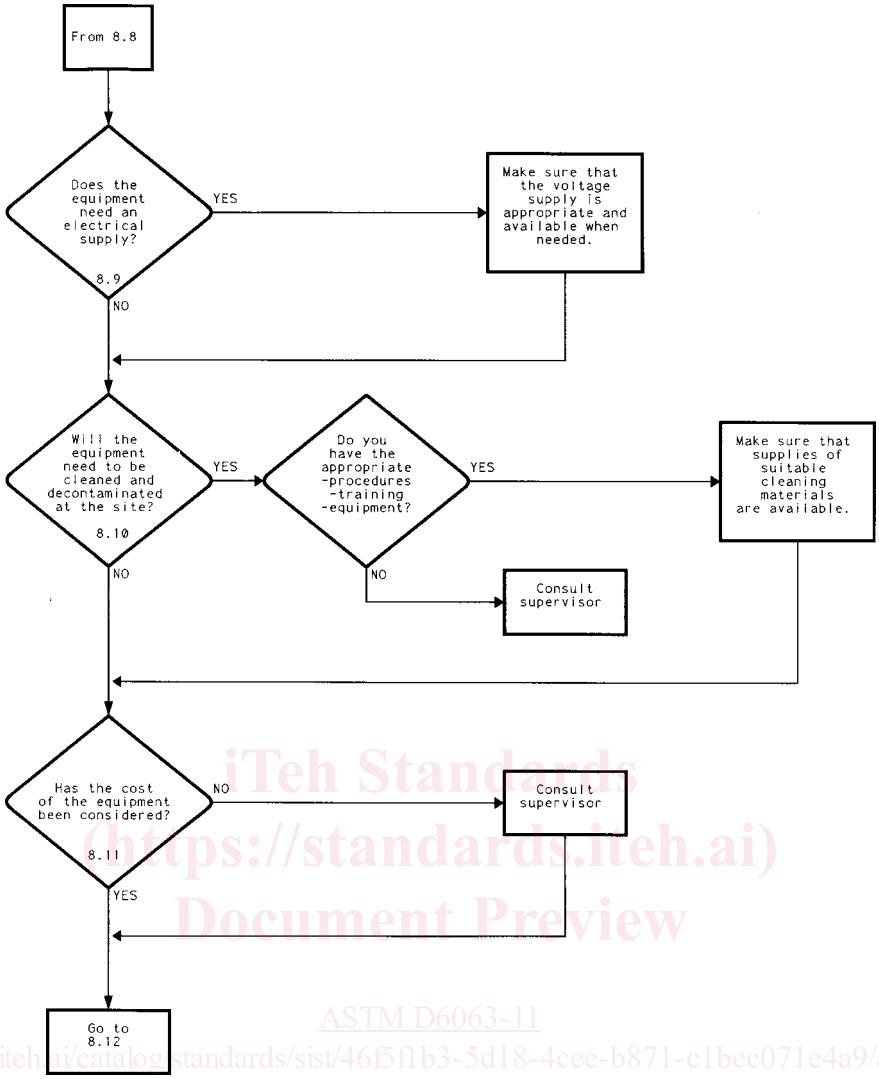
9.5.2.1 Hard hat,

9.5.2.2 Respirators,

9.5.2.3 Face shields,

9.5.2.4 Chemically-resistant suits,

9.5.2.5 Self-contained breathing apparatus, and



NOTE 1—This flow chart should be used with Sections 8.9 to 8.11 in the text.

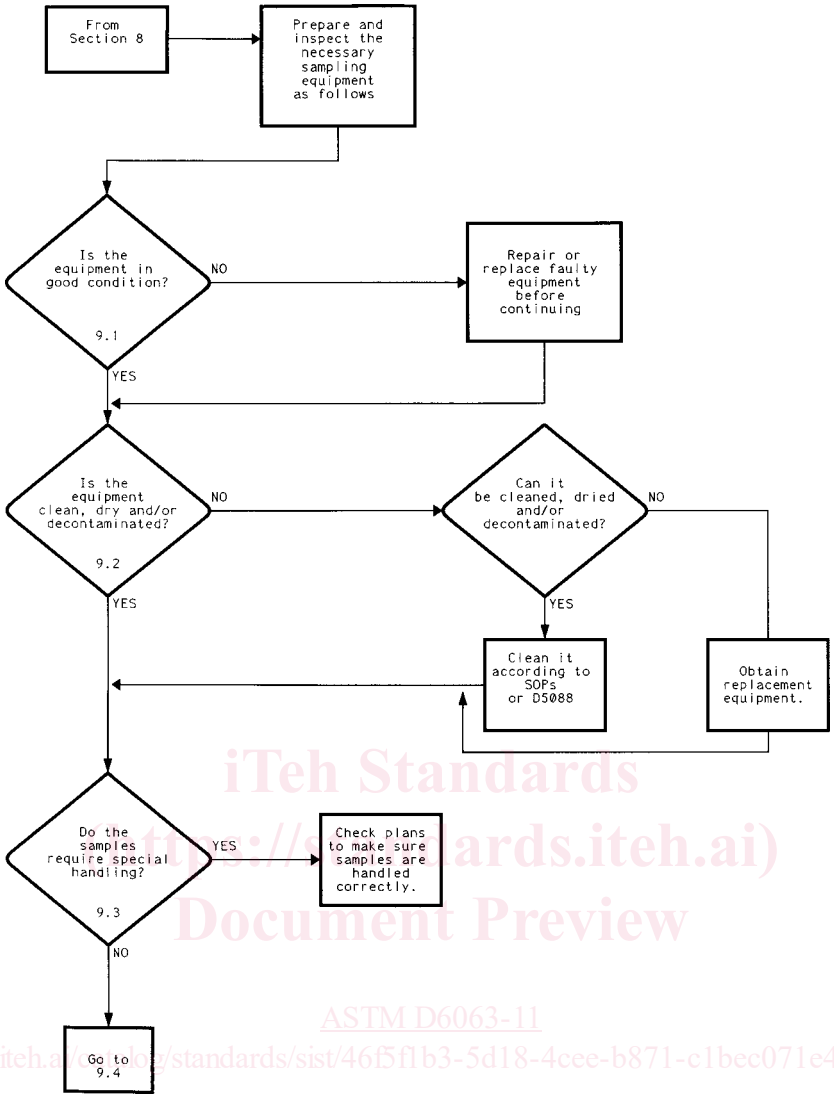
FIG. 3 Selection of Suitable Sampling Procedure *(continued)*

9.5.2.6 Two way radio communication.

9.5.3 If appropriate, segregate the drums and surrounding area from casual intrusion by using barricades or caution tape.

9.5.4 When sampling inside buildings, ventilation may be desirable.

9.6 Records that associate a sample with a drum are usually required. A field technician's log and chain of custody forms are commonly used (see Section 10).



NOTE 1—This flow chart should be used with Sections 9.1 to 9.3 in the text.

FIG. 4 Preparation of Sampling Equipment

10. Report

10.1 *Chain of Custody Forms*:

10.1.1 The purpose of chain of custody forms is to show that the samples analyzed are the same ones that were collected. They are required for regulatory purposes. They serve as legal documentation that sample ~~integrity~~custody was maintained. When complete, they should show that there were no lapses in accountability. It is not always necessary to use chain of custody procedures but some form of sample tracking is necessary.

10.1.2 A chain of custody form may originate with the laboratory at the time the sample containers are prepared or in the field after the sample has been taken. Each time the samples change hands, the chain of custody form must be signed. The originator of the chain of custody keeps one copy to confirm that the samples were passed on and to whom; they may have been given directly to the laboratory or to a courier. The completed form, with all remaining copies intact, must accompany the samples. Copies of the custody forms will be returned to the parties involved, to confirm that the samples have been received at the laboratory.

10.1.3 Sometimes security seals are placed over the caps of empty, clean sample containers and signed off by the laboratory. The person sampling must break these seals in order to fill the containers. Security seals may also be attached after the sample container has been filled. The date, time of sampling and name of the person sampling are then written on the seals. The purpose of the seal is to indicate possible tampering with the sample. (See Guide D4840~~.)~~ .) Other tamper-evident methods, such as tamper-evident bags, may be utilized also.

10.2 *Field Log*:

10.2.1 Ideally, a field log is maintained in a bound book with printed page numbers. Information should be recorded in indelible ink. Errors should be crossed out with a single line and initial~~l~~ed/date~~l~~ed. Items normally documented include: