Designation: D7831 – 13

Standard Practice for Sampling of Tanks by Field Personnel[1]

This standard is issued under the fixed designation D7831; 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 practice covers information for field personnel to follow in order to collect samples from tanks.

1.2 The purpose of this practice is to help field personnel in planning and obtaining samples from vertical and horizontal tanks, open-topped rectangular/square tanks, railroad and truck tankers, vacuum trucks and tanks with multiple compartments using equipment and techniques that will assist in meeting the sampling objectives.

1.3 The practice is applicable to hazardous materials, products, raw materials, by-product, or waste.

1.4 Sampling from circulating pump discharge valves and tank transfer lines are not addressed in this practice.

1.5 *Units*—The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.6 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D4687 Guide for General Planning of Waste Sampling
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
D5495 Practice for Sampling With a Composite Liquid Waste Sampler (COLIWASA)
D5681 Terminology for Waste and Waste Management
D5792 Practice for Generation of Environmental Data Related to Waste Management Activities: Development of Data Quality Objectives
D6232 Guide for Selection of Sampling Equipment for Waste and Contaminated Media Data Collection Activities
D6759 Practice for Sampling Liquids Using Grab and Discrete Depth Samplers
D7353 Practice for Sampling of Liquids in Waste Management Activities Using a Peristaltic Pump

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this guide, refer to Terminology D5681.

3.1.2 *tank, n*—stationary device designed to contain an accumulated material that is constructed of non-earthen materials that provide structural support.

3.1.2.1 *Discussion*—It may be appropriate to consider various containers (portable devices), such as roll offs, tanker trucks, and rail tank cars, as tanks for sampling purposes, even if they meet a regulatory definition of a container.

4. Summary of Practice

4.1 This practice addresses sampling planning including pre-sampling and site inspections.

4.2 This practice lists some of the factors that should be considered when collecting tank content samples.

4.3 Sampling procedures for the equipment needed to sample vertical and horizontal tanks, open-topped rectangular/square tanks, railroad and truck tankers, vacuum trucks and tanks with multiple compartments are presented.

4.4 Sampling procedures to sample single and stratified materials and wastes are addressed.

4.5 It is not intended to cover all equipment that might be purchased or custom made, nor does the guide address every sampling situation that is encountered in the field.

5. Significance and Use

5.1 This practice is intended to assist field personnel in obtaining samples from tanks for laboratory analysis. The cost

[1] This practice 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.

associated with sampling and analysis make it essential that samples be taken correctly before submitting them for chemical analysis, physical testing, or both. Incorrect sampling can invalidate resulting data.

5.2 This practice provides guidance in choosing the sampling technique and equipment suitable for specific situations. It is recommended that this guide be used as a supplement to a written field sampling plan.

5.3 The procedures for sampling tanks using a COLIWASA, liquid profiler sampler, Bacon Bomb sampler, and peristaltic pump and tubing are delineated.

6. Objective of Sampling

6.1 The purpose of sampling is to collect a representative sample of all or part of the contents of the tank to determine the physical and chemical characteristics of those contents. 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 Confirm that the tank contains what is written on the inventory sheets,

6.1.4 Confirm that the tank car or truck contains what is written on the manifest or other type of documentation.

6.2 In most cases, there is a written plan that describes the work to be done (Practice 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 tanks may be available from:

7.1.1 Previous analysis of tank contents,

7.1.2 Records or knowledge of the plant process or other sources of the material in the tank,

7.1.3 Shipping manifest documents.

7.2 Personnel doing the pre-sampling and sampling must be aware of any special procedures that are to be followed at the given site. Work plans shall include a worker health and safety section because there are potential hazards associated with opening tanks as well as with potentially hazardous contents. Examples of special procedures are donning appropriate protective clothing, personal protective equipment, 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 Visually inspect the tank. The type of tank and construction material, along with any markings on the tank, may indicate information about the contents.

7.3.1 Special precautions should be taken when the tank is in poor condition such as a material leaking from the tank sides, pumps, and flanges. If the tank ladders are rusted or corroded, this might indicate that the tank manway or other covers may be difficult to open and the ladders unsafe to use.

7.3.2 Labels and records about a tank may not be accurate. This is especially true for tanks containing multiple waste materials or tanks that contain stratified materials.

7.4 Examples of different tanks, and tank-like containers, include:

7.4.1 Vertical tanks, often used for storage of petroleum and petroleum waste product and various other chemicals.

7.4.2 Horizontal tanks, common as railroad and truck tanker cars, vacuum trucks, and for storage of waste materials and products at facilities. Many of these tanks have multiple compartments and each compartment may need to be sampled separately.

7.4.3 Open-topped rectangular and square tanks, common at electroplating facilities and batch processing plants. These can also include concrete sumps with vertical walls.

7.5 The sampling tools, sampling equipment, and sample container shall be selected based on information gathered in the initial characterization of the tank, its contents and possible sampling points.

7.6 Potential sampling points should be evaluated for safety and accessibility.

7.6.1 Tools needed to remove the manway or other covers should be non-sparking and intrinsically safe.

7.7 The following information shall be gathered and recorded in the field logbook as applicable:

7.7.1 Tank type (that is, horizontal, vertical) dimensions, volume, and conditions (that is, corroded, rusted, leaking contents, and so forth). A sketch of the tank, showing dimensions and depths of contents should be recorded.

7.7.2 Physical characteristics (that is, color, viscosity, particle size, and so forth) and quantity and depth of containerized material.

7.7.3 All writing, stencils, labels, or other identifying markings on the tank (that is, flammability and or reactivity labels, product name and hazards, and so forth).

7.7.4 Appropriate screening instrument and method readings of the tank head space gases or contents, or both (for example, organic vapor analyzer and photo ionization detectors, combustible gas indicators (CGI), pH paper, or meter readings.

8. Selection of Suitable Sampling Procedure

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

8.2 A tank 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 tank 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 tank, a calibrated measuring device (tape measure weighted with a plumb bob) or the sampling

equipment, (for example, a COLIWASA or liquid profiler) can be inserted into the opened tank and the liquid level measured.

8.4 Tanks should be sampled via the top hatch, sampling port, or manway, and not at the bottom or side valves. Bottom and side valves could fail and cause a catastrophic release of material. If the tank contents are a single liquid and all safety concerns are known to be addressed, sampling from tank transfer valves, circulating pump discharge valves or other entry ports may be attempted. When sampling from the top of any tank, extreme caution should be used. The tops of many tanks have limited space and are not designed to support heavy loads which may require man-lifts. Long sampling devices (7-15 ft [2.2-4.6 m]) are easier to operate with two or more people.

8.5 For many sampling objectives or DQOs (Practice D5792) a full vertical column of tank contents should be collected as the sample. A COLIWASA or liquid profiler can be used to collect a column of liquid sample if the tank has a vertical dimension that is less than the maximum length of the available sampling instrument (usually 15 ft [4.6 m] or less). When using equipment that is designed to sample the vertical column of a liquid such as the COLIWASA or liquid profiler, it is important that all of the device's contents be emptied into the sample container so that all phases will be represented in the correct ratios. If more sample volume is needed for the analyses, only re-deploy the device if its entire contents can be placed in the sample container.

NOTE 1—Prior to sampling, the volume of the tank, sample container(s), and sampling equipment should be assessed and sized appropriately.

NOTE 2—COLIWASA and liquid profiler samplers, due to their design, usually discriminate against the very bottom of tank contents, by neglecting to sample the bottom materials. A peristaltic pump or other tank bottom samplers in D6232 could be used to sample tank bottoms.

8.6 Sampling depths greater than 15-ft (4.6-m) alternate equipment, such as a bacon bomb or peristaltic pump is required. See Guide D6232 and Practice D5759 for other devices.

8.7 Solids in tanks are sampled using core tube samplers, thin-walled tubes, and augers. If the tank is empty, shovels and scoops can be used.

8.8 A separate sample collected from the very top of the liquid level in the tank may be needed if "lighter" stratified materials/waste may be present, such as oils, alcohols, or benzene/toluene/xylene (BTX) compounds or bottom of the tank if "heavier" stratified materials/waste is present. The top and bottom of each interphase is generally determined to calculate the amount of each in the tank.

9. COLIWASA Sampling Device

9.1 There are two main types of COLIWASA: *(1)* A 4 ft (1.2-m) or less glass outer tube with a glass inter tube that seals either with a glass bulb or Fluoropolymer@seal (Fig. 1) and *(2)* an 8- to 15-ft (2.4- to 3-m) polypropylene/plastic type tube or "tank" sampler with a stopper at one end attached by a rod running the length of the tube to a locking mechanism at the other end (Fig. 2).

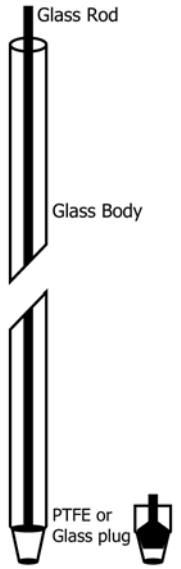


FIG. 1 COLIWASA

10. Procedure for the 4 ft (1.2-m) COLIWASA

10.1 Use a clean and properly functioning COLIWASA for sampling. It is essential that the stopper at the bottom of the sampling tube closes securely.

10.2 Open the COLIWASA by placing the stopper or inter tube mechanism in the open position.

10.3 Lower the tapered end of the outer sampling tube into the liquid waste at a rate that allows the liquid level inside and outside the tube to equalize. If the level of the liquid in the sample tube is lower than that outside the sampler, the sampling rate is too fast and a non-representative sample will result.

10.4 Continue lowering the sample tube until the bottom of the tank is felt. If sludge is encountered near the bottom of the tank, check sampling objectives to determine whether to collect the sludge or not. If the sludge is to be collected, continue sampling and include this material in the sample.

10.5 Use the stopper or tube mechanism to close the COLIWASA when it reaches the desired depth.

10.6 Slowly withdraw the sampler from the liquid, keeping the seal closed and holding the tube in a vertical position. Either wipe the exterior of the sampler tube with a disposable cloth or rag or allow excess liquid to drain back into the waste container (tank).

10.7 Place the lower end of the COLIWASA into the bottom of the sampling container and, slowly open the stopper or glass tube to discharge the sample.

10.8 Seal the sample container; attach the label and seal; record in the field logbook the sampling method and other important field information; and complete the chain-of-custody record if required.

10.9 Decontaminate the used equipment in accordance with Practice D5088.

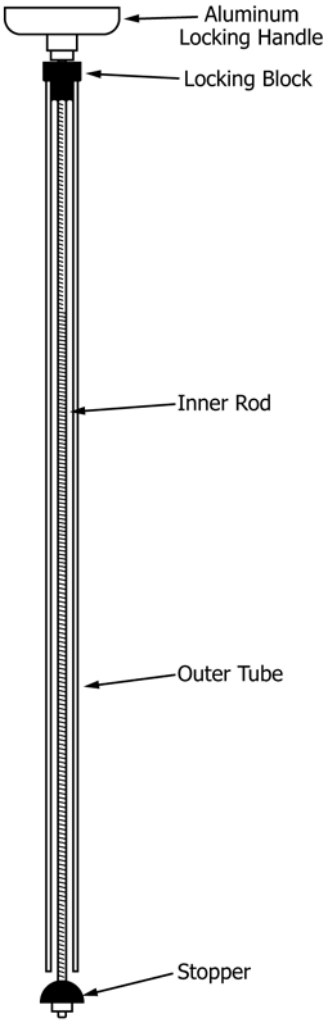


FIG. 2 Tank COLIWASA

11. Procedure for the 8 to 15 feet (2.4 to 4.6 m) COLIWASA

11.1 Use a clean and properly functioning COLIWASA. It is essential that the stopper at the bottom of the sampling tube closes securely.

11.2 Open the COLIWASA by placing the stopper mechanism in the open position.

11.3 Lower COLIWASA into the liquid waste at a rate that allows the liquid level inside and outside the tube to equalize. If the level of the liquid in the sample tube is lower than that outside the sampler, the sampling rate is too fast and a non-representative sample will result.

11.4 Continue lowering the sample tube until the bottom of the tank is felt. If sludge is encountered near the bottom of the tank, check sampling objectives to determine whether to collect the sludge or not. If the sludge is to be collected, continue sampling and include this material in the sample depending upon the sampling objectives.

11.5 Use the stopper mechanism to close the COLIWASA when it reaches the desired depth in the liquid or when the bottom of the tank is reached, the sampler is pushed downward against the stopper to close the sampler. The COLIWASA is then locked in the closed position, usually by turning the T-handle on the top.

11.6 Slowly withdraw the sampler from the liquid, keeping the seal closed and holding the tube in a vertical position. Either wipe the exterior of the sampler tube with a disposable cloth or rag or allow excess liquid to drain back into the waste container (tank).

11.7 Place the lower end of the COLIWASA into the bottom of the sampling container, slowly open the stopper to discharge the sample.

11.8 Seal the sample container; attach the label and seal; record in the field logbook the sampling method and other important field information; and complete the chain-of-custody if required.

11.9 Decontaminate the used equipment in accordance with Practice D5088.

12. Discrete Depth Devices (Bacon Bomb)

12.1 A Bacon Bomb sampler is designed to collect samples from discrete depths within a tank, therefore the sample may not be representative of the tank contents. It consists of a cylindrical reservoir chamber with a weighted plunger that seals the chamber. A line is attached to the weighted plunger which has a locking mechanism for discrete samples. The sampler is usually made of stainless steel or nickel-plated brass and bronze (Fig. 3).

13. Procedure for a Discrete Depth Sampler (Bacon Bomb)

13.1 There are two ways of filling this device: one is the button on the bottom of the valve which is activated by pressing the button against the tank side wall to open it and fill

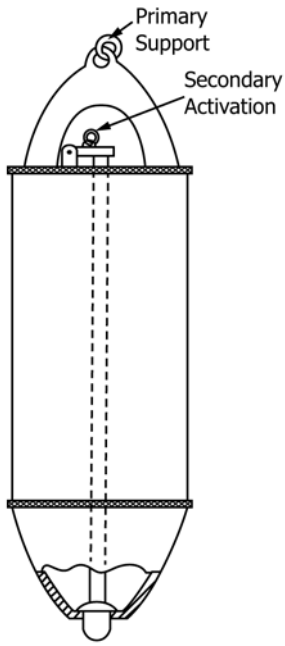


FIG. 3 Bacon Bomb

the chamber (bomb), this is the primary activation for this device. The second is the secondary activation using a secondary plunger line usually made of twine or string (see Fig. 3). References to the sample line may be ignored if it is not required.

13.2 Make certain the sampler is clean and functioning properly.

13.3 Attach a sampler line (usually a steel tape measure) and the secondary plunger line to the sampler if used.

13.4 Slowly lower the sampler using the sample line to the desired sample depth. Care must be taken to prevent the sampler line and the secondary plunger line from becoming tangled.

13.5 Pull up on the plunger line and allow the sampler to fill before releasing the plunger line to seal the sampler.

13.6 Retrieve the sampler using the sampler line. Use caution to not disturb the plunger line which could cause an accidental opening of the bottom valve.

13.7 Wipe the exterior of the sampler and position the sample over the sample container. Release the sample by pulling upon the plunger line slowly.

13.8 Seal the sample container; attach the label and seal; record in the field logbook the sampling method and other important field information; and complete the chain-of-custody if required.

13.9 Decontaminate the used equipment in accordance with Practice D5088.

14. Liquids Profiler Sampling Device

14.1 A liquids profiler is a device that allows sampling of liquids and settled solids/sludges (Fig. 4). There are various types of Sludge Judges available, though the most common type is a ¾- to 1¼-in. (2- to 3-cm) plastic tube with a float valve on the bottom. The sampler is marked in 1-ft (0.3-m) increments and is available from lengths of 5 to 15 ft (1.5 to 4.6 m), with extensions, if needed.

15. Procedure for Liquids Profiler Sampling

15.1 Make certain the sampler is clean and functioning properly.

15.2 Attach the trip line (usually twine or string) to the sampler.

15.3 Slowly lower the sampler to the desired sample depth.

15.4 Pull up on the attached trip line to set the check valve and trap the sample.

15.5 Retrieve the sampler from the tank.

15.6 Record in the field logbook any visible phases and solid/sludge layer that can be determined.

15.7 Wipe the exterior of the sampler tube with a disposable cloth or rag or allow excess liquid to drain back into the waste container (tank).

15.8 Release the sample into the sample container and seal.

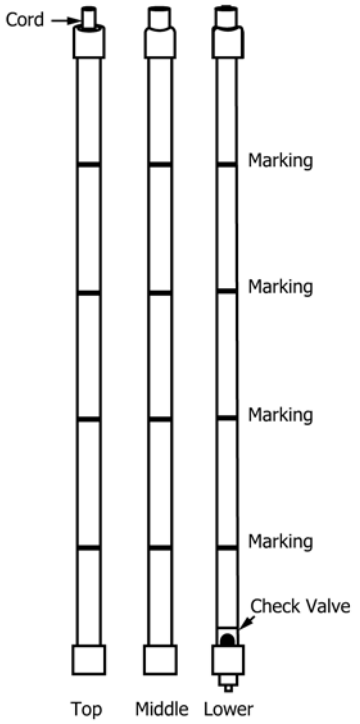


FIG. 4 Liquids Profiler

15.9 Attach the label and seal; record in the field logbook the sampling method and other important field information; and complete the chain-of-custody record if required.

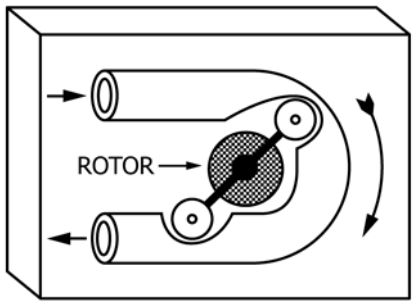
15.10 Decontaminate the used equipment in accordance with Practice D5088.

16. Pump and Tubing Sampling

16.1 There are conditions, such as ceiling clearance, which may prevent the use of the COLIWASA and other similar devices. Pumps such as a peristaltic pump (Fig. 5) can be used to sample light, viscous liquids. Sample aliquots of a known volume may be drawn from several discrete intervals within the tank and dispensed into one or more sample containers.

17. Procedures for Various Pump and Tubing Sampling

17.1 The procedures for different devices can be found in their specific standard and in Specification D6797 and Guide D6232.



(a) Basic Peristaltic Pump

FIG. 5 Peristaltic Pump

17.2 The following is a general procedure based on the peristaltic pump. (See Practice D7353 for detailed instructions and limitations.)

17.2.1 The pump's intake tubing is lowered into the liquid material to be sampled to a predetermined depth.

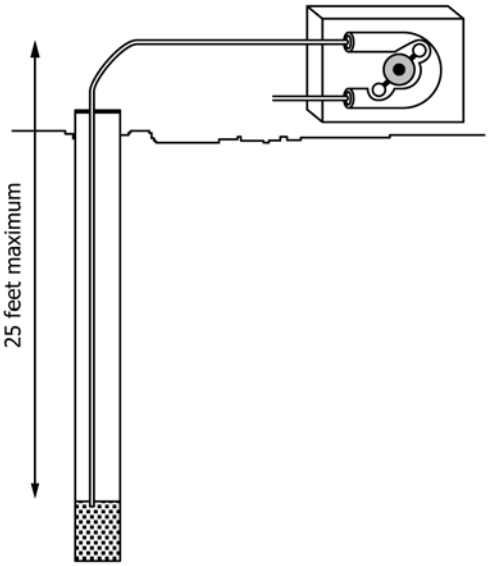
17.2.2 The pump is activated and the sample or sample aliquot is withdrawn directly into the sample container (Fig. 6).

17.2.3 Equal volumes can be taken from several depths after purging the tubing with air between different aliquot locations. The tubing should be rinsed with one to two volumes of the liquid to be sampled before sampling the next location in the tank.

17.2.4 Seal the sample container; attach the label and seal; record in the field logbook; and complete the chain-of-custody and record the sampling method used in the field logbook.

17.2.5 Decontaminate the used equipment in accordance with Practice D5088.

17.3 See Practice D6759 and Guide D6232 for other possible samplers.



(b) Configured for sample collection

FIG. 6 Peristaltic Pump Sampling

18. Keywords

18.1 railroad tanks; sampling; sampling tanks; storage tanks; stratified waste; truck tankers