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Standard Guide for Sampling Wastewater With Automatic Samplers¹

This standard is issued under the fixed designation D6538; 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 the selection and use of automatic wastewater samplers including procedures for their use in obtaining representative samples. Automatic wastewater samplers are intended for the unattended collection of samples that are representative of the parameters of interest in the wastewater body. While this guide primarily addresses the sampling of wastewater, the same automatic samplers may be used to sample process streams and natural water bodies.

1.2 The guide does not address general guidelines for planning waste sampling activities (see Guide [D4687](#)), development of data quality objectives (see Practice [D5792](#)), the design of monitoring systems and determination of the number of samples to collect (see Practice [D6311](#)), operational details of any specific type of sampler, in-situ measurement of parameters of interest, data assessment and statistical interpretation of resultant data (see Guide [D6233](#)), or sampling and field quality assurance (see Guide [D5612](#)). It also does not address sampling groundwater.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3.1 *Exception*—The inch-pound units given in parentheses are for information only.

1.4 *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

[D1129 Terminology Relating to Water](#)

[D3694 Practices for Preparation of Sample Containers and for Preservation of Organic Constituents](#)

[D3856 Guide for Management Systems in Laboratories Engaged in Analysis of Water](#)

[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](#)

[D5612 Guide for Quality Planning and Field Implementation of a Water Quality Measurement Program](#)

[D5681 Terminology for Waste and Waste Management](#)

[D5792 Practice for Generation of Environmental Data Related to Waste Management Activities: Development of Data Quality Objectives](#)

[D5851 Guide for Planning and Implementing a Water Monitoring Program](#)

[D5956 Guide for Sampling Strategies for Heterogeneous Wastes](#)

[D6233 Guide for Data Assessment for Environmental Waste Management Activities](#)

[D6311 Guide for Generation of Environmental Data Related to Waste Management Activities: Selection and Optimization of Sampling Design](#)

[E856 Definitions of Terms and Abbreviations Relating to Physical and Chemical Characteristics of Refuse Derived Fuel \(Withdrawn 2011\)](#)³

¹ This guide is under the jurisdiction of ASTM Committee [D34](#) on Waste Management and is the direct responsibility of Subcommittee [D34.01.03](#) on Sampling Equipment. Current edition approved Dec. 1, 2010/Sept. 1, 2012. Published January 2011/December 2012. Originally approved in 2000. Last previous edition approved in 2005/2010 as [D6538—00/D6538\(2005\)—10](#). DOI: [10.1520/D6538-10.1520/D6538-12](#).

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.

TABLE 1 Advantages and Disadvantages of Manual versus Automatic Sampling of Wastewater (3)

Type	Advantages	Disadvantages
Manual	Low capital cost	Increased variability due to sample handling Inconsistency in collection
	Personnel can compensate for various situations	
	Personnel can document unusual conditions	High cost of labor assuming composite or multiple grab samples are collected
	<u>No maintenance</u>	<u>Repetitious and monotonous task for personnel</u>
	<u>Low maintenance</u>	<u>Repetitious and monotonous task for personnel</u>
	Extra samples can be collected in a short time if necessary	
Automatic	Consistent samples	Considerable maintenance for batteries and cleaning; susceptible to plugging by solids
	Decreased variability caused by sample handling	Restricted in size to the general specifications
	Minimal labor requirement for sampling	Greater potential for sample contamination
	Capable of collecting multiple grab and multiple aliquot composite samples	May be subject to damage by vandals
		High capital cost

3. Terminology

3.1 *Definitions*—For definitions of terms used in this guide, refer to Terminology **D5681**.

4. Significance and Use

4.1 This guide provides persons responsible for designing and implementing wastewater sampling programs with a summary of the types of automatic wastewater samplers, discusses the advantages and disadvantages of the different types of samplers and addresses recommended procedures for their use. The field settings are primarily, but not limited to, open channel flows in enclosed (e.g., sewer) systems or open (e.g., streams or open ditches, and sampling pressure lines) systems.

5. Automatic Versus Manual Sampling (1, 2)³

5.1 The advantages and disadvantages of manual and automatic sampling are summarized in **Table 1**. The decision as to whether to use manual or automatic sampling involves many considerations in addition to equipment costs. In general, manual sampling is indicated when infrequent samples are required from a site, when biological or sediment samples, or both, are also required, when investigating special incidents, where sites will not allow the use of automatic devices, for most bacteriological sampling, where concentrations remain relatively constant, etc. The use of automatic samplers is indicated where frequent sampling is required at a given site, where long-term compositing is desired, where simultaneous sampling at many sites is necessary, etc. Automatic sampling is often the method of choice for storm-generated discharge studies, for longer outfall monitoring, for treatment plant efficiency studies, where 24-h composite samples are required, etc. The user should review **7.1.23** before selecting manual or automatic sampling.

6. Types of Samples Collected by Automatic Samplers

6.1 *Grab Samples*—As defined under the U.S. Environmental Protection Agency's (EPA) National Pollutant Discharge Elimination Program, grab samples are individual samples collected over a period of time not exceeding 15 min and are representative of conditions at the time of sampling (**4**). Grab samples are sometimes also called individual or discrete samples (**5**). Sequential grab samples are a series of grab samples collected at constant increments of either time or flow and provide a history of variation. Grab samples are appropriate when samples are needed to:

- 6.1.1 Characterize an effluent that is not continuous,
- 6.1.2 Provide information about instantaneous concentrations of pollutants,
- 6.1.3 Allow collection of samples of varied volume,
- 6.1.4 Corroborate composite samples,

³The last approved version of this historical standard is referenced on www.astm.org.

³ The boldface numbers given in parentheses refer to a list of references at the end of the standard.

6.1.5 Monitor parameters not amenable to compositing (for example, pH, temperature, dissolved oxygen, chlorine, purgeable organics (unless a specialized sampler is used), ~~oil and grease~~ and others specified by a permit which may include phenols, sulfites and hexavalent chromium).

6.1.6 Characterize a waste stream in detail where rapid fluctuations of parameters occur (sequential grabs).

6.2 *Composite Samples*—Composite samples are collected over time, either by continuous sampling or by mixing discrete samples, and represent the average characteristics of the waste stream during the compositing period. Composite samples are collected when stipulated in a permit, when average pollutant concentration during the compositing period is to be determined, and when wastewater characteristics are highly variable. There are four types of composite samples.

6.2.1 *Time Composite Samples*—This method requires discrete sample aliquots be collected in one container at constant time intervals. The method is appropriate when the flow of the stream is constant (flow rate does not vary more than $\pm 10\%$ of the average flow rate (4)) or when flow monitoring equipment is not available. The EPA allows time-proportional sampling and requires samples be collected every 15-min, on average, over a 24-h period.

6.2.2 *Flow-Proportional Composite Samples*—There are two methods used for this type of sample (4). The most commonly used method with automatic samplers collects a constant sample volume at varying time intervals proportional to stream flow based on input from a flow monitor (for example, a 200-mL aliquot is collected for every 5000 L of flow). In the other flow-proportional compositing method, the sample is collected by varying the volume of each aliquot as the flow varies, while maintaining a constant time interval between the aliquots.

6.2.3 *Sequential Composite Samples*—A sequential composite sample is composed of a series of short-period composites, each of which is held in an individual container, for example, four sample aliquots are composited (one every 15 min) to form hourly composites (4). The 24-h sequential composite is then manually made by compositing the individual 1-h composite sample.

6.2.4 *Continuous Composite Samples*—This method requires that the sample be collected continuously at a constant rate or proportional to flow (4). This method is seldom used with automatic samplers.

7. Attributes of Automatic Samplers

7.1 The EPA (6) developed a list of attributes of the ideal automatic sampler for their use and EPA Region 4 (7) and others (3) have noted other important attributes. These attributes and requirements may be specific to EPA's use and were primarily directed at suction lift type automatic samplers. Not all these sampler characteristics will be important to all users but their consideration may guide persons selecting automatic samplers. The desirable features of automatic samplers listed below have been summarized and combined from the referenced documents.

7.1.1 Capable of AC/DC operation with adequate dry battery energy storage for 120-h operation at 1-h sampling intervals.

7.1.2 Suitable for suspension in a standard manhole yet still accessible for inspection and sample removal. A secure harness or mounting device if the sampler is placed in a sewer.

7.1.3 Total weight, including batteries, less than 18 kg. Compact and portable enough for one-person installation.

7.1.4 Sample collection interval adjustable from 10 min to 4 h.

7.1.5 Capable of collecting a single 9.5-L (2.5-gal) sample and/or collecting 500-mL (0.13-gal) discrete samples in a minimum of 24 containers. The individual sample aliquot must be at least 100 mL.

7.1.6 Capable of multiplexing repeated aliquots into discrete bottles.

7.1.7 One intake hose with a minimum inner diameter of 0.64 cm (0.25 in) and a weighted, streamlined intake screen which will prevent accumulation of solids.

7.1.8 Intake hose liquid velocity adjustable from 0.6 to 3 m/s (2.0 to 10 ft/s) with dial setting.

7.1.9 Minimum lift capacity of 6.1 m (20 ft).

7.1.10 Explosion proof construction.

7.1.11 Watertight exterior case to protect components in the event of rain or submersion.

7.1.12 Exterior case capable of being locked, including lugs for attaching steel cable to prevent tampering and to provide security.

7.1.13 An integral sample container compartment capable of maintaining samples at 4 to 6°C for a period of 24 h at ambient temperatures up to 38°C.

7.1.14 Capable of operating in a temperature range from -10 to 40°C with the exception of the intake hose.

7.1.15 A purge cycle to flush the sample intake tubing before and after each collection interval, and a mechanism to sense and clear a plugged sample line and then collect the complete sample. Samplers may be programmed to perform an air purge before and after sampling, and a liquid rinse before and after a sample is drawn.

7.1.16 Capable of collecting flow-proportional and time-composite samples.

7.1.17 Materials of construction that contact the sample must not compromise the integrity of the sample for the intended use.

NOTE 1—Some references prohibited sample contact with metal (6) and contact with plastic or metal parts when parameters to be analyzed could be impacted by these materials (7).

7.1.18 Water velocity in intake hose (greater than 0.6 m/s [2.0 ft/s]) and aliquot volume are independent of lift heights experienced during the sampling event.

7.1.19 Overall construction, including casing, of materials resistant to corrosion (plastics, fiberglass, stainless steel).