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Standard Guide for Field Preservation of Groundwater Samples[1]

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1. Scope

1.1 This guide covers methods for field preservation of groundwater samples. Laboratory preservation methods are not described in this guide.

1.2 *This standard may involve hazardous materials, operations, and equipment. 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.*

1.3 *This guide offers an organized collection of information or a series of options and does not recommend a specific course of action. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this guide may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word" Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D3694 Practices for Preparation of Sample Containers and for Preservation of Organic Constituents

D5903 Guide for Planning and Preparing for a Groundwater Sampling Event

D6089 Guide for Documenting a Ground-Water Sampling Event

2.2 *Other Documents:*

Standard Methods for the Examination of Water and Wastewater, 20th ed., 1999[3]

International Air Transport Association Dangerous Goods Regulations[4]

U.S. EPA, Office of Solid Waste, SW-846, 3rd ed.

U.S. EPA, Title 40, Code of Federal Regulations, Part 136

U.S. EPA, Title 49, Code of Federal Regulations, Part 172

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *chemical preservation*—the addition of acidic, alkaline or biologically toxic compounds, or combination thereof, to a groundwater sample to prevent changes in chemical properties of the sample that may occur after collection.

3.1.2 *holding time*—the maximum amount of time that may transpire from the moment a sample container is filled to the time the sample is extracted or analyzed. Holding times are parameter-specific, variable in length, and defined by laboratory analytical methods.

3.1.3 *physical preservation*—methods that are implemented to protect the physical integrity of a groundwater sample from the time the sample is collected until the sample is analyzed.

3.1.4 *temperature blank*—a quality control sample that is transported with samples and is used by the laboratory performing sample analyses to verify that temperature-sensitive samples have been adequately cooled to 4°C for shipment to and arrival at the laboratory (see Note 1).

NOTE 1—Forms of temperature blank include: (*1*) using a commercially prepared, fluid-filled bottle containing a permanently fixed National Institute of Standards and Technology(NIST)-certified (or NIST-traceable) thermometer, the temperature of which is read directly by the laboratory; (*2*) submission of a designated sample container filled with water (for example, groundwater, distilled water, or deionized water) that is opened by the laboratory and immediately measured for temperature of the water using a National Institute of Standards and Technology-certified (or NIST-traceable) thermometer; or (*3*) submission of a designated container filled with water (for example, groundwater, distilled water, or deionized water) on which the laboratory uses a remote infrared temperature sensor to measure the temperature. Regardless of the method used, all measured

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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] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

[4] Available from the Superintendent of Documents, US Government Printing Office, Washington, DC 20402.

temperatures are compared against the required temperature for each sample (for example, 4°C) in conjunction with a previously defined window of acceptable variance from this required temperature as documented in the sampling and analysis plan.

4. Significance and Use

4.1 Groundwater samples are subject to chemical, physical, and biological change relative to in- situ conditions at the ground surfaces as a result of exposure to ambient conditions during sample collection (for example, pressure, temperature, ultraviolet radiation, atmospheric oxygen, and contaminants) **(1)** **(2)**.[5] Physical and chemical preservation of samples minimize further changes in sample chemistry that can occur from the moment the groundwater sample is retrieved, to the time it is removed from the sample container for extraction or analysis, or both. Measures also must be taken to preserve the physical integrity of the sample container.

4.2 The need for sample preservation for specific analytes should be defined prior to the sampling event and documented in the site-specific sampling and analysis plan in accordance with Guide D5903. The decision to preserve a sample should be made on a parameter-specific basis as defined by individual analytical methods.

5. Timing and Purpose of Groundwater Sample Preservation

5.1 Groundwater samples should be preserved in the field at the time of sample collection using physical means to prevent sample container breakage or temperature increases, and chemical means to minimize changes in groundwater sample chemistry prior to laboratory analysis.

6. Groundwater Sample Preservation Procedures

6.1 Groundwater sample preservation procedures are grouped into two general categories: (*1*) physical preservation and (*2*) chemical preservation. Preservation procedures should address the following details on a parameter-specific basis: sample container design and construction, protection from ultraviolet light, temperature control, chemical addition, and pH control measures **(2)**.

6.1.1 *Physical Preservation of Groundwater Samples*—Physical groundwater sample preservation methods include: (*1*) use of appropriate sample collection containers for each parameter being analyzed, (*2*) use of appropriate packing of sample containers for shipment to prevent sample container breakage and potential cross-contamination of samples during shipment, and (*3*) temperature control.

6.1.1.1 *Sample Container Selection* —Proper selection of containers for groundwater sample collection is an important means of protecting the integrity of the sample. Specifications on container design, including shape, volume, gas tightness, materials of construction, and use of cap liners, are defined for specific parameters or suites of parameters (for example, amber glass containers protect photosensitive analytes such as (PCBs) from chemical alteration). Specifications for sample container selection are documented in parameter-specific analytical methods (for example, ASTM, U.S. EPA SW846, AWWA Standard Methods) as well as in Federal (40 CFR Part 136), state, and local regulatory guidelines on groundwater sample collection and preservation. The type of sample containers to be used in a sampling event should be determined during sampling event planning in accordance with Guide D5903 and documented in the sampling and analysis plan as described in 8.1 of this guide and Guide D6089.

6.1.1.2 *Sample Container Packing and Shipping*—Field personnel should package and ship samples in compliance with all applicable regulations including the Department of Transportation (for example, Title 49 Code of Federal Regulations, Part 172) and the International Air Transportation Association (IATA). Sample containers should be shipped in a manner that will ensure the samples are received intact by the laboratory, at the appropriate temperature, and as soon as possible to allow sufficient time for the laboratory to perform the requested analyses within the holding time defined by the applicable laboratory analytical method for each parameter.

6.1.1.3 *Temperature Control*—Samples analyzed for some parameters (for example, nitrite) require temperature control. The temperature of these samples should be lowered to 4°C immediately after performing any field analyses required (for example, temperature or pH) and chemical preservation **(3)**. When necessary, temperature should be lowered as soon as possible and maintained at 4°C until the sample is analyzed. Sample temperatures can be lowered most efficiently using on-site refrigeration or wet ice. Wet ice may need to be replenished prior to shipping to maintain sample temperatures at 4°C. If required by regulation, dry ice may be used to cool samples, however, care should be taken to prevent sample freezing. Reuseable ice packs may be used to lower sample temperature, however, they often do not have the capacity to adequately lower or maintain temperatures, or both; consequently, their use is not recommended **(4)**. A temperature blank should be used with each shipping container of samples to determine actual sample temperatures at the time the sample shipment is received by the laboratory.

6.1.2 *Chemical Preservation of Groundwater Samples:*

6.1.2.1 Chemical preservation of groundwater samples involves the addition of one or more chemicals (reagent-grade or better) on a parameter-specific basis to protect sample integrity. Appendix X1 provides examples of common analyte-specific chemical preservation methods.

6.1.2.2 Chemical preservation is specified in numerous analytical methods as well as in various regulatory guidance documents. Chemicals can be used to adjust sample pH or inhibit microbial activity to prevent chemical alteration of samples. Initial pH of samples should be determined prior to chemical preservation so appropriate chemical adjustment can be made.

6.1.2.3 Groundwater samples can be chemically preserved in one of several ways: (*1*) titration of pH-adjusting compounds (for example, nitric acid) while monitoring pH change with a pH meter or narrow-range litmus paper; (*2*) addition of a premeasured volume of liquid preservative (for example, sulfuric acid) contained in glass vials or ampules to the sample

[5] The boldface numbers in parentheses refer to the list of references at the end of this standard.