Designation: D 5088 – 902

Standard Practices for Decontamination of Field Equipment Used at ~~Nonradioactive~~ Waste Sites[1]

This standard is issued under the fixed designation D 5088; 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 the decontamination of field equipment used in the sampling of soils, soil gas, sludges, surface water, and ground water at waste sites which are to undergo both physical and chemical analyses.

1.2 Th~~i~~ese practice ~~is~~ are applicable only at sites where chemical (organic and inorganic) wastes are a ~~concern and~~ concern. It is not intended for use at ~~radioactive or~~ radiological, mixed (chemical and ~~radioactive) waste~~ radiological), or biohazard sites.

1.3 Procedures are included for the decontamination of equipment which comes into contact with the sample matrix (sample contacting equipment) and for ancillary equipment that has not contacted the portion of sample to be analyzed (non-sample contacting equipment).

1.4 Th~~i~~ese practice ~~is~~ are based on commonly recognized methods by which equipment may be decontaminated. ~~When collecting environmental matrix samples, one should become familiar with the site specific conditions. Based on~~ The procedures described for sample contacting equipment are commonly prescribed, however there is a minimum of scientific data that supports

[1] This practice is under the jurisdiction of ASTM Committee D~~-~~18 on Soil and Rock and is the direct responsibility of Subcommittee D18.14 on Geotechnics of Waste Management.

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***A Summary of Changes section appears at the end of this standard.**

these ~~conditions and~~ methods (Mickam et al. 1989[2], Parker[34], 1995). Therefore the ~~purpose~~ user is reminded of the ~~sampling effort, the most suitable method~~ importance of QA/QC samples that document decontamination effectiveness and that these samples can be ~~selected~~ used to ~~maximize the integrity of analytical and physical testing results.~~ modify or enhance decontamination techniques. Decontamination at radiologically contaminated sites should refer to Practice D 5608.

1.5 This practice is applicable to most conventional sampling equipment constructed of metallic and synthetic materials. The manufacturer of a specific sampling apparatus should be contacted if there is concern regarding the reactivity of a decontamination rinsing agent with the equipment.

1.6 *This practice 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 judgement. Not all aspects of this practice 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 documents has been approved through the ASTM consensus process..*

1.7 *This standard does not purport to address the safety problems 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:*

D 653 Terminology Relating to Soil, Rock, and Contained Fluids[5]

D 5608 Practice for Decontamination of Field Equipment Used at Low Level Radioactive Waste Sites[5]

3. Terminology

3.1 *Definitions:*

3.1.1 *contaminant*—an undesirable substance not normally present or an unusually high concentration of a naturally occurring substance in water or soil.

3.1.2 *control rinse water*—water used for equipment washing and rinsing having a known chemistry.

3.1.3 *decontamination*—the process of removing or reducing to a known level undesirable physical or chemical constituents, or both, from a sampling apparatus to maximize the representativeness of physical or chemical analyses proposed for a given sample.

3.1.4 *non-sample contacting equipment*—related equipment associated with the sampling effort, but that does not directly contact the sample (for example, augers, drilling rods, excavations machinery).

3.1.5 *quality assurance/quality control (QA/QC)*—the efforts completed to evaluate the accuracy and precision of a sampling or testing procedure, or both.

3.1.6 *sample contacting equipment*—equpiment that comes in direct contact with the sample or portion of sample that will undergo chemical analyses or physical testing (for example, ground water well bailer, split-spoon sampler, soil gas sampling probe).

3.1.7 For definitions of other terms used in this practice, see Terminology D 653.

4. Summary of Practice

4.1 Two different procedures are presented for the decontamination of sample-contacting and non-sample contacting equipment. The procedures have been developed based on a review of current state and federal guidelines, as well as a summary of commonly employed procedures. In general, sample contacting equipment should be washed with a detergent solution followed by a series of control water, desorbing agents and deionized water rinses. Nonsample contacting equipment should be washed with a detergent solution and rinsed with control water. Although such techniques may be difficult to perform in the field, they may be necessary to most accurately evaluate low concentrations of the chemical constituent(s) of interest.

4.2 Prior to initiating a field program that will involve equipment decontamination, a site specific equipment decontamination protocol should be prepared for distribution to the individuals involved with the particular sampling program. Information to be presented in the protocol should include:

~~*Annual Book of ASTM Standards*~~

[2] Mickam, J.T., R. Bellandi, and E.C. Tifft, Jr., 1989, *Equipment Decontamination Procedures for Ground Water and Vadose Zone Monitoring Programs: Status and Prospects*, ~~Vol 04.08.~~ Ground Water Monitoring Review 9, No 2:100–121.

~~[3] Alquinox or Liquinox or similar solution has been found suitable for this purpose.~~

[3] Parker, L.V., 1996*A Literature Review on Decontaminating Groundwater Sampling Devices: Organic Contaminates.*CRREL Report 95–14, U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, NH.

~~[4] A drum approved by the Department of Transportation or similar container has been found suitable for this purpose.~~

[4] Parker, L.V., and T.A. Ranney, 1997a. *Decontamination Materials Used in Groundwater Sampling Devices.* CRREL Special Report 97–24, U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, NH.

[5] *Annual Book of ASTM Standards,* Vol 04.08.

4.2.1 Site location and description,

4.2.2 Statement of the sampling program objective and desired precision and accuracy, that is, is sampling effort for gross qualitative evaluation or for trace concentration, parameter specific evaluations,

4.2.3 Summary of available information regarding soil types, hydrogeology and anticipated chemistry of the materials to be sampled,

4.2.4 Listing of equipment to be used for sampling and materials needed for decontamination,

4.2.5 Detailed step by step procedure for equipment decontamination for each piece or type of equipment to be utilized and procedures for rinse fluids containment and disposal as appropriate,

4.2.6 Summary of QA/QC procedures and QA/QC samples to be collected to document decontamination completeness including specific type of chemical analyses and their associated detection limit, and

4.2.7 Outline of equipment decontamination verification report.

5. Significance and Use

5.1 An appropriately developed, executed and documented equipment decontamination procedure is an integral and essential part of waste site investigations. The benefits of its use include:

5.1.1 Minimizing the spread of contaminants within a study area and from site to site,

5.1.2 Reducing the potential for worker exposure by means of contact with contaminated sampling equipment, and

5.1.3 Improved data quality and reliability.

5.2 This practice is not a substitute for a well-documented Quality Assurance/Quality Control (QA/QC) program. Because the ultimate test of a decontamination procedure is its ability to minimize erroneous data, a reasonable QA/QC program must be implemented.

5.3 This practice may not be applicable to all waste sites. When a sampling effort is completed to determine only the general range of chemical concentrations of interest less rigorous decontamination procedures can be adequate. Investigators should have the flexibility to modify the decontamination procedures with due consideration for the sampling objective or if QA/QC documentation supports alternative decontamination methods.

5.4 At sites where the reactivity of sampling equipment to decontamination washes creates concern for the generation of undesirable chemical by-products, the use of dedicated sampling equipment should be considered.

5.5 This practice, where applicable, should be used before, between, and after the completion of sampling events.

5.6 These practices are appropriate for use at sites where chemical (organic and inorganic) contamination is known or expected. The application of these practices to other types of sites radiological, mixed (radiological and chemical), or biohazard contaminated sites may not be applicable. The application of these practices to these types of sites should be undertaken with care and consideration, along with QA/QC documentation that supports the effectiveness of these decontamination techniques.

6. Reagents

6.1 *Detergent*, non-phosphate detergent solution.[6]

6.2 *Acid rinse (inorganic desorbing agent)*, 10 % nitric or hydrochloric acid solution-made from reagent grade nitric or hydrochloric acid and deionized water (1 % is to be applied to low-carbon steel equipment).

6.3 *Solvent rinse (organic desorbing agent)*, isopropanol, acetone, or methanol; pesticide grade.

6.4 *Control rinse water*, preferably from a water system of known chemical composition.

6.5 *Deionized water*, organic-free reagent grade.

7. Procedure for Sample Contacting Equipment

7.1 At a minimum, sample contacting equipment should be washed with a detergent solution and rinsed with control water.

7.2 For programs requiring more rigorous decontamination to meet the sampling or QA/QC objectives, the following procedures are indicated:+. Table 1 provides applications of various solutions for decontamination of field equipment and materials. Table 2 provides commonly recommended decontamination procedures for various equipment and materials,

7.2.1 Wash with detergent solution, using a brush made of inert material to remove any particles or surface film.

7.2.1.1 For equipment that, because of internal mechanism or tubing cannot be adequately cleaned with a brush, the decontamination solutions should be circulated through the equipment.

7.2.2 Rinse thoroughly with control water.

7.2.3 Rinse with an inorganic desorbing agent (may be deleted if samples will not undergo inorganic chemical analysis). This rinse is effective only on non-metal surfaces.

7.2.4 Rinse with control water.

7.2.5 Rinse with organic desorbing agent (may be deleted if samples will not undergo organic chemical analyses).

7.2.6 Rinse with deionized water.

7.2.7 Allow equipment to air dry prior to next use.

[6] Liquinox or Detergent 8 or similar solution has been found suitable for this purpose. Detergent 8 is recommended for spray cleaning.

TABLE 1 Applications of Various Solutions for Decontamination of Field Equipment and Materials[A,B,C]

Solution	Concentrations	Remarks
Portable Water	Tap water (demonstrated to be analyte free)	Used under high pressure or steam to remove heavy mud and dirt, or to rinse off other solutions
Laboratory-grade water	Distilled Deionized Reagengrade distilled and deionized water	
Low sudsing non-phosphate detergents (Liquinox, Detergent 8)	Typical concentrations are 0.5 to 2% solution by volume	General all-purpose cleaner. Detergent 8 is recommended for spray cleaning.
Sodium carbonate (baking soda)	5 to 15% aqueous solution	Used to neutralize either acidic or strongly basic contaminants
Sodium carbonate (washing soda)	10 to 20% aqueous solution	Effective for neutralizing inorganic acids, organic acids, heavy metals, metal processing wastes.
Trisodium phosphate (TSP Oakite)	10% aqueous solution	Similar to sodium carbonate. Good rinsing solution for organic compounds (such as toluene, chloroform, TCE, PBBs, and PCBs).
Calcium hypochlorite (HTH)	10% aqueous solution	Disinfectant, bleaching, and oxidizing agent for pesticides, fungicides, chlorinated phenols, dioxins, cyanides, ammonia and other non-acidic inorganic wastes.
Hydrochloric acid, nitric acid	10% nitric 10% to 20% hydrochloric	Used for inorganic bases, alkali and caustic wastes
Citric, tartaric, oxalic acids or their respective salts	5% solution	Used to clean heavy-metal contaminants
Organic solvents	Concentrated	Used to remove organic compounds that have poor solubility in water, such as oil and grease. do not use a solvent that is one of the analytes of interest or interferes with analyses. Porous materials such as polymers can absorb these solvents.

[A] Examples of commonly recommended cleaning solvents include pesticide-grade" isopropanol, acetone, methanol, hexane, heptane, and ethanol.

[B] Adapted for Mickam et al. (1989), Moberly (1985), and Richter and Collentine (1983).

[C] Many of the solvents listed are themselves hazardous materials. Care should be taken in both use and disposal of these materials.

7.2.8 Wrap equipment for transport with inert material (aluminum foil or plastic wrap) to direct contact with potentially contaminated material.

7.3 *Nonsample Contact Equipment*:

7.3.1 Clean the equipment with portable power washer or steam cleaning machine. Alternatively, hand wash with brush using detergent solution.

7.3.2 Rinse with control water.

7.3.3 The more rigorous decontamination procedures may be employed if necessary to meet sampling or QA/QC objectives.

7.4 Depending on site conditions, it may be appropriate to contain spent decontamination rinse fluids. If this is the case the appropriate vessel[7] for fluid containment should be used depending on the ultimate disposition of the material.

7.5 Depending on site conditions, it may be desirable to perform all equipment decontamination at a centralized location as opposed to the location where the equipment was used. If this is the case, care must be taken to transport the equipment to the decontamination area such that the spread of contaminants is minimized.

8. Quality Assurance/Quality Control

8.1 It is important to document the effectiveness of the decontamination procedure. To that end the projects QA/QC program should include provisions for the collection of samples to evaluate the completeness of a specific decontamination procedure. This could include:

8.1.1 Collection of rinse or wipe samples before the initial equipment decontamination prior to its use for sampling to establish a base line level of contaminants residing on or in the equipment,

8.1.2 Collection of final rinse or wipe samples after equipment decontamination following its use, and

[7] A drum approved by the Department of Transportation or similar container has been found suitable for this purpose.

TABLE 2 Commonly Recommended Decontamination Procedures for Different Equipment and Different Materials of Construction[A,B]

NOTE—

	Soapy Water Wash	Tap Water Rinse	10% Nitric Acid Rinse[C]	Organic-Free Water Rinse	Rinse with Solvent	Air Dry for 24h	Oven Dry	Store in Aluminum Foil or Polyethylene	Discard After Use
Glass	1	2,4	3	5	6[D]	7		8	
Teflon	1	2,4	3	5	6[E]	7		8	
Metals and Stainless Steel	1	2		3	4[D]	5		6	
Teflon Tubing	1	2			3[E]		4[F]	5	
PVC Tubing				Use Only New PVC Tubing					1
Stainless Tubing	1	2		3	4[D]	5		6	
Glass Tubing	1	2,4	3	5	6[D]	7		3	
Well Sounders	1	2		3					
Submersible Pumps	1	2		3					

[A]These procedures are based on commonly recommended practices. It should be noted that there is not a lot of experimental data to support some of these practices. Mickam et al., 1989, Parker 1995, Parker and Ranney 1997a, 1997b in press.

[B]Sampling equipment that employs a process whereby potentially contaminated material passes through internal mechanical workings (pump, houisng, impellers, etc.) can be very difficult to decontaminate. This should be considered when identifying an appropriate decontamination procedure for equipment with internal sample contacting parts.

[C]This step is used in removing inorganic contaminants and can be eliminated if they are not of concern.

[D]Data by Parker and Ranney (in press, 1997a, 1997b) should show that solvent rinsing may not be needed.

[E]Data by Parker and Ranney (in press, 1997a, 1997b), show that oven drying may be more effective than an organic solvent rinse for removing sorbed organic contaminants.

[F]Excessive heat that could damage the polymer should not be used. Check manufacturer's recommendations for heat tolerance.

8.1.3 The frequency of sampling to demonstrate the completeness of equipment decontamination is dependent upon objectives of the project as they relate to QA/QC. At a minimum it is recommended after every ten decontamination washings.

9. Report

9.1 The activities completed for each equipment decontamination should be documented in writing. Included in this report should be the following information:

9.1.1 Site location, date, time, and weather,

9.1.2 Sample location where equipment was employed,

9.1.3 Location where decontamination was performed,

9.1.4 Individuals performing the decontamination,

9.1.5 Decontamination procedures,

9.1.6 Source of materials (solutions) used for decontamination,

9.1.7 Handling of rinse fluids and accumulates solids, if any, and

9.1.8 QA/QC sampling performed and analytical results of QA/QC samples whether completed in the field or laboratory subsequent to sampling event.

10. Keywords

10.1 contaminant; decontamination; sampling; waste

SUMMARY OF CHANGES

In accordance with Committee D18 policy, this section identifies the location of changes to this standard since the 90 edition that may impact the use of this standard.

(1) Revised title to reflect that radiological contamination exists at some level at all sites.
(2) Revised Section 1.2 to reflect that this practice may not be appropriate for radiological, mixed or biologically contaminated sites.
(3) Editorial changes to comply with current ASTM form and styleand D18 procedures.
(4) Added information on the importance of QA/QC process and samples.
(5) Added new section 5.6 to Significance and Use regarding applicability to radiological, mixed, and biologically contaminated sites.
(6)Added professional care caveat to Section 1.
(7) Removed Alquinox from footnote to section 6 as it is not a non-phosphate detergent. Added Detergent 8 as a replacement and information on its application.
(8) Section 7.2 added additional information on decontamination procedures and materials and Tables 1 and 2.
(9) Section 7.2.3 added that this rinse is only effective on non-metal components.
(10) Added Summary of Changes section.
(11)Added footnotes in 1.4.