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Standard Practices for Decontamination of Field Equipment Used at Low Level Radioactive Waste Sites[1]

This standard is issued under the fixed designation D 5608; 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 known or suspected of containing low level radioactive wastes.

1.2 This practice is applicable at sites where low level radioactive wastes are known or suspected to exist. This practice may also be applicable for the decontamination of equipment used in known or suspected transuranic, or mixed wastes when used by itself or in conjunction with Practice D 5088.

1.3 Procedures are contained in this practice for the decontamination of equipment that comes into contact with the sample matrix (sample contacting equipment), and for ancillary equipment that has not contacted the sample, but may have become contaminated during use (non-contacting equipment).

1.4 This practice is applicable to most conventional sampling equipment constructed of metallic and hard, smooth synthetic materials. Materials with rough or porous surfaces, or having a high sorption rate should not be used in radioactive waste sampling due to the difficulties with decontamination.

1.5 In those cases where sampling will be periodically performed, such as sampling of wells, consideration should be given to the use of dedicated sampling equipment if legitimate concerns exist for the production of undesirable or unmanageable waste byproducts, or both, during the decontamination of tools and equipment.

1.6 This practice does not address regulatory requirements for personnel protection or decontamination, or for the handling, labeling, shipping or storing of wastes, or samples. Specific radiological release requirements and limits must be determined by users in accordance with local, state and federal regulations.

1.7 For additional information see DOE Publication DOE/EH-0256T, DOE Order 5480.5, DOE Order 5480.11, and 10CFR, Part 83~~4~~5.

1.8 The values stated in SI units are to be regarded as the standard.

1.9 *This practice offers an organized collection of information or a series of options and does not recommend a specific course of action. This document can 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 document has been approved through the ASTM consensus process.*

1.10 *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.* Specific precautionary statements are given in Section 6.

2. Referenced Documents

2.1 *ASTM Standards:*

D 5088 Practice for the Decontamination of Field Equipment Used at ~~Nonradioactive~~ Waste Sites[2]

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[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.**

E 1168 Guide for Radiological Protection Training for Nuclear Facility Workers[3]

2.2 *United States Department of Energy Standards:*

DOE Publication DOE/EH-0256T Radiological Control Manual[4]

DOE Order 5480.5 Radiation Protection of the Public and the Environment[4]

DOE Order 5480.11 Radiological Protection for Occupational Workers[4]

2.3 *United States Code of Federal Regulations:*

10CFR, Part 8345, "Radiological Protection for Occupational Workers"[4]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *as low as reasonable achievable (ALARA)*—an approach to radiological control to manage exposures to the work force and to the general public at levels as low as is reasonable, taking into account social, technical, economic, practical and public policy. ALARA has the objective of maintaining doses at a level far below applicable controlling limits.

3.1.2 *barrier*—a physical separation, such as a fence, wall, or temporary enclosure to prevent uncontrolled access and release from an area.

3.1.3 *contamination*—either fixed or removable radioactive materials in or on an item.

3.1.4 *contamination reduction corridor*—a defined pathway through a hazardous waste site where decontamination occurs.

3.1.5 *decontamination*—the process of removing or reducing to a known level undesirable physical, chemical, or radiological constituents from equipment. Decontamination of sample contacting equipment maximizes the representativeness of the physical, chemical, or radioactive analyses proposed for a given sample.

3.1.6 *fixed contamination*—radioactive material that cannot be readily removed from surfaces by nondestructive means, such as casual contact, wiping, brushing, or washing.

3.1.7 *inorganic desorbing agents*—acid rinse solutions, typically of 10 % nitric or hydrochloric acid solutions made from reagent grade nitric or hydrochloric acid and deionized water (1 % should be applied to low-carbon steel equipment).

3.1.8 *mixed wastes*—wastes containing both radioactivity (as defined by the Atomic Energy Act) and quantities of Resource Conservation and Recovery Act (RCRA) listed wastes.

3.1.9 *non-contacting equipment*—equipment used in and around the sampling that may become contaminated, but that does not contact the sample at anytime. Examples would include drilling rigs, hand tools, drill rods, excavation equipment, or barrier materials.

3.1.10 *organic desorbing agents*—solvent rinse solutions of isopropanol, acetone, hexane, or methanol; pesticide grade.

3.1.11 *QC water (control rinse water)*—water having a known chemistry, free (below detection levels) of organic or radiological constituents. Deionized water of reagent grade is normally sufficient.

3.1.12 *radioactive waste*—waste containing radioactive elements or activation regulated under the Atomic Energy Act, and is of negligible economic value, considering the cost of recovery. Waste is classified into three levels, all of which are harmful. The classifications are:

3.1.12.1 *low level waste*—wastes usually containing small amounts of radioactivity in a large amount of material. Typically the radioactivity dissipates in a relatively short period of time, anywhere between 500 and 600 years, although some low level wastes may remain radioactive for longer periods. Examples of Low Level Wastes are Uranium mining and mill tailings, soils, equipment, sludges, or liquids contaminated with or mixed with radioactive materials. Naturally Occurring Radioactive Materials (NORM) also fall into this classification. Typical examples of NORM low level wastes include uranium and thorium bearing sludges from water purification plants, high grade uranium ores, and petroleum pipeline sludges.

3.1.12.2 *mid level (transuranic) wastes*—wastes containing contamination with radioactive man-made elements having atomic weights greater than uranium (hence the name trans (or beyond) uranic). Examples of mid level wastes include liquids, sludges, resins, or soils and equipment contaminated or mixed with plutonium or other man-made alpha emitting radionuclides with half-lives of greater than 20 years and concentrations greater than 100 nCi/g at the time of assay.

3.1.12.3 *high level wastes*—wastes of highly concentrated radionuclides with long half-lives. Examples of high level wastes include spent nuclear fuels, nuclear fuel reprocessing wastes, syrups, and resins.

3.1.13 *removable contamination*—radioactive material that can be removed from surfaces by nondestructive means, such as brushing, wiping, or washing.

3.1.14 *rinse water*—water having a known chemistry. Deionized or distilled water may be used when small quantities are required. When large quantities are required, potable water of a chemistry known to be free (below detection levels) of radioactive or chemical constituents can be used.

3.1.15 *sample contacting equipment*—equipment and tools that physically come in contact with a sample and that could allow cross-contamination from one sample to another. Examples include drive cylinders, bailers, sample handling, equipment, pumps, and sampling tubes.

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[2] *Annual Book of ASTM Standards*, Vol 04.09.

[3] *Annual Book of ASTM Standards*, Vol 12.02.

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

3.1.16 *survey*—a radiation measurement with instrumentation to evaluate and assess the presence of radioactive materials or other sources of radiation under a specific set of conditions, (also known as frisking).

3.1.17 *unrestricted release limit*—the maximum contamination that an item may exhibit to be released for uncontrolled use by the public. Release limits differ, based on the type of radioactive materials and the amount and type of emissions (gamma, alpha, beta).

3.1.18 *wipe test*—a radiation detection test performed to determine the amount of removable radioactive material per 100 cm^2 surface area by wiping with a dry filter or soft absorbent paper with moderate pressure and then assessing the amount of radioactivity with an instrument of appropriate efficiency. A radiological survey and a wipe test is generally required for release of any equipment from a radiological area to an uncontrolled area or for unrestricted use, (also known as swipe test).

4. Summary of Practice

4.1 This practice provides guidance and details for the development of a site and sampling event specific decontamination plan for use in the decontamination of field equipment used during sampling or other activities in areas known, or suspected of containing low-level radioactive wastes. Four techniques or ~~test~~ methods are provided, with the selection and use based on the type of contamination and the difficulty of removal.

4.2 Approaches and procedures are provided for decontamination of two classifications of equipment, sample-contacting and non-contacting.

4.3 This practice includes the principles of ALARA and waste minimization as well as the protection of sample data quality.

5. Significance and Use

5.1 The primary objectives of work at low-level radioactive waste sites are the protection of personnel, prevention of the spread of contamination, minimization of additional wastes, protection of sample data quality, and the unconditional release of equipment used.

5.2 Preventing the contamination of equipment used at low-level radioactive waste sites and the decontamination of contaminated equipment are key aspects of achieving these goals.

5.3 This practice provides guidance in the planning of work to prevent contamination and when necessary, for the decontamination of equipment that has become contaminated. The benefits include:

5.3.1 Minimizing the spread of contamination within a site and preventing the spread outside of the work area.

5.3.2 Reducing the potential exposure of workers during the work and the subsequent decontamination of equipment.

5.3.3 Minimizing the amounts of additional wastes generated during the work, including liquid, or mixed wastes, including separation of the waste types, such as protective clothing, cleaning equipment, cleaning solutions, and protective wraps and drapes.

5.3.4 Improving the quality of sample data and reliability.

5.4 This practice may not be applicable to all low-level radioactive waste sites, such as sites containing low-level radioactive wastes mixed with chemical or reactive wastes. Field personnel, with assistance from trained radiological control professionals, should have the flexibility to modify the decontamination procedures with due consideration for the sampling objectives, or if past experience supports alternative procedures for contamination protection or decontamination.

5.5 This practice does not address the monitoring, protection, or decontamination of personnel working with low-level radioactive wastes.

5.6 This practice does not address regulatory requirements that may control or restrict work, the need for permits or regulatory approvals, or the accumulation or handling of generated wastes.

6. Hazards

6.1 Equipment decontamination activities involving radioactive constituents provide numerous opportunities for personnel contamination and radiation exposure, the uncontrolled spread of contamination, and the unnecessary generation of additional radioactive or mixed wastes.

6.2 Personnel involved in the decontamination of field equipment used in a known or suspected radiologically contaminated site must be trained and qualified in the work being performed and in emergency procedures.

6.3 Any work performed in a known or suspected radiologically contaminated site should be under the continuous control of a trained ~~r~~ Radi~~ation~~logical Control ~~t~~ Technician.

6.4 Strict controls around the work area must be maintained at all times to prevent the access or egress of personnel, equipment, or samples to prevent unnecessary exposure, uncontrolled releases of contaminated equipment or personnel, and unnecessary contamination of equipment. The controls will include barriers, such as fences, temporary building, or other enclosures to prevent access or egress without proper monitoring and decontamination.

6.5 Personnel working in a radiologically contaminated area have the potential for receiving radiation exposure as well as internal and external contamination. Personnel shall be trained to the Site Specific Health and Safety Plan which specifies the required training, personnel protection, and dosimetry equipment required.

6.6 Some decontamination solutions may be hazardous to humans, or may be incompatible with personnel protective clothing normally worn. For example, organic solvents or acids may permeate or degrade protective clothing or equipment. Protective clothing worn during decontamination should be selected for wet work involving the specific chemicals and solutions to be used.

6.7 Chemicals and solutions used during decontamination may be hazardous. Personnel involved should be properly trained and provided with Material Safety Data Sheets (MSDSs), and the appropriate emergency equipment.

6.8 Some equipment will degrade or produce deleterious reactions when in contact with decontamination solutions. Equipment and decontamination solution compatibility and resistance should be considered when selecting equipment and the decontamination method.

6.9 Decontamination methods may be incompatible with hazardous substances being removed and cause reactions that produce heat, toxic fumes, or explosions. The potential for incompatible material reactions should be evaluated as a part of the decontamination process selection.

7. General Procedures

7.1 Adequate planning is required prior to any activity in an area known or suspected to contain low-level radioactive or other wastes and contamination. The development of an equipment decontamination plan should be a part of the activity planning. All personnel involved in the work should be familiar with the plan and trained in the specific decontamination procedures. Work and decontamination planning should include the following:

7.1.1 The site location, conditions, known areas of surface and subsurface contamination.

7.1.2 The type, activity level, potential locations of mixed, chemical, or reactive contamination or wastes,

7.1.3 The location of other physical hazards, such as underground utilities, overhead powerlines, and existing waste storage locations.

7.1.4 Emergency responses plans, including emergency decontamination of personnel or equipment, site evacuation and accountability, and response to fire, explosion, or other situations that may occur.

7.1.5 Equipment required to prevent contamination, decontaminate equipment, contain spills, or store contaminated equipment.

7.1.6 Adequacy of monitoring and safety personnel and equipment for the anticipated work, during both normal or emergency conditions,

7.1.7 Assignment of responsibilities, including defining responsibilities for safety, quality, and the work processes being planned.

7.1.8 Establishing the work control area barriers, signage, and controls for personnel, tools, and equipment entering the work area, and the contamination release limits that will be required for equipment, samples, tools, personnel, and wastes to be released from the control area. Personnel and equipment access and release log requirements should be considered, along with requirements for various types of work control permits,

7.1.9 Establishing the decontamination location(s) for the various tools, equipment, samples and personnel equipment, including contamination reduction corridors and decontamination pads for large equipment such as backhoes, drilling rigs, or trucks and vehicles. The benefits of decontaminating equipment near the point of use should be weighed against the risks of transporting equipment to a central decontamination location and potentially spreading contamination.

7.1.10 Establish a waste disposal plan for how the anticipated wastes will be stored, both temporarily and long-term, the anticipated means of disposal, storage, labeling, or manifesting, and the organizations and individuals who will be responsible. Evaluation of the need for, and benefits of the work or samples should be balanced against the costs and difficulty of handling the wastes that may be generated prior to performing any work.

7.1.11 Providing personnel and equipment resources for environmental monitoring requirements. These may include air monitoring or controls for airborne or windblown contamination, surface runoff controls, or other specific weather work restrictions, such as restricting or stopping work during or before expected windy or wet conditions.

7.1.12 Responsibilities and sequencing for the decontamination and removal of equipment and personnel, removal of barriers, storage of both solid and liquid wastes, and the return of the site to a pre-work condition.

7.1.13 Identifying the records that will be required and assigning responsibilities for the completion, review, protection, and retention of records that will be generated during the work, including decontamination. Typical records include (but are not limited to): records of the survey equipment, survey equipment calibration and operational checks, process and effluent monitoring, environmental monitoring, tool and waste monitoring equipment, types and amounts of waste generated, sample identification and analyses that can be used to characterize the wastes.

7.2 Waste minimization should be an integral part of the planning and work processes. The following waste minimization considerations should be factored into the work planning process:

7.2.1 Preventing the spread of contamination by sequencing work from the least contaminated to the most contaminated areas.

7.2.2 Maintaining a high level of site housekeeping and cleanliness.

7.2.3 Selecting materials and equipment that are easily cleaned and decontaminated for use within a contaminated area. Generally, these are hard, nonporous materials, or materials with protective coatings or paints. Prohibit the use of soft, or porous materials. The use of greases, solvents, or other chemicals should be restricted or prohibited whenever possible in radiologically contaminated areas due to their proclivity to become contaminated or to created mixed wastes. Some types of plastic will attract radiological contamination due to static electricity and their use should be restricted.

7.2.4 Pre-clean all equipment prior to entry into a radiologically contaminated area. Transporting soils, greases, or other materials into the controlled areas will only increase the amount of decontamination required and generate additional wastes. Clean equipment should be wrapped until use, particularly if it has potential to come in contact with samples. If unused, decontamination

prior to release will be eliminated. A best management practice is to radiologically verify equipment and tools are free of contamination prior to entry into a controlled area, particularly if the past use of the equipment is not known.

7.2.5 If an activity will be repeated frequently, such as sampling, consider the use of dedicated equipment that will remain in place and not require decontamination or become waste. In other cases, evaluate the availability of equipment which is already contaminated and can be used without contacting samples, such as drilling rigs, auger flights, or hand tools rather than bring clean equipment into the controlled areas.

7.2.6 Perform pre-work preparatory activities outside of the contaminated areas, such as taping labels to sample containers, wrapping, draping, or sealing equipment.

7.2.7 Minimize the use of liquids that have the potential to become contaminated. When the use of liquids is required, consider the possibilities for re-use, such as using final rinse waters later for initial washes. The use of evaporation ponds, filters, or other treatments may be used to reduce the amount of liquid wastes. Liquids from the various stages of decontamination, or from differing sections of a contamination reduction corridor should be kept separate for later reuse or treatment.

7.2.8 Survey any wastes prior to disposal or storage to prevent mixing clean and contaminated equipment or wastes. Drapes, wraps, tape, and other materials may not be contaminated and need not be disposed of as radiological wastes. In cases where only a portion is contaminated, the contaminated portion can be cut away or separated for disposal as radiologically contaminated wastes, with the remainder disposed of as uncontaminated waste.

7.2.9 When liquids or other materials are to be used for decontamination, verify that they are radiologically clean prior to use. Avoid using materials that contain significant amounts of naturally occurring radioactive matter and that may not be released from the work area.

7.2.10 Work areas around samples should be draped, or covered to prevent transport or spread of contamination that may affect the sample data quality.

7.2.11 Use rubber-tired equipment whenever possible. Avoid the use of tracked equipment, that has the tendency to spread contamination and are difficult to fully decontaminate.

8. Procedure for Sample Contacting Equipment

8.1 Decontaminate sample contacting equipment immediately after use and prior to use on the next sampling. If liquids are sampled, complete the decontamination before the liquids have dried on the surfaces, particularly on the internal of tubing, pumps, and other difficult to clean equipment. Prior to the initial use of sample contacting equipment, take baseline surveys, wipe tests, and collection of rinsate samples to establish an initial radiological and chemical baseline for the sampling equipment.

8.2 Determine effectiveness of equipment decontamination between uses within the work control area by performing radiation surveys to verify that contamination above background has been removed. Equipment that has been decontaminated must be both surveyed and wipe tested to verify that release limits have been met. Equipment that is found by the wipe test to be above release limits may be decontaminated again until releasable, or be handled and transported as radiologically contaminated equipment. If equipment is of high value, it may be possible to further decontaminate to release limits at a later date using chemicals, ultrasonic cleaning, electro-polishing, or other techniques outside the scope of this practice.

8.3 Four ~~test~~ methods of sample contacting equipment decontamination are presented. These ~~test~~ methods may be used individually or in combination to achieve a higher level of decontamination. The selection of ~~test~~ methods or combination of ~~test~~ methods will depend on the type of contaminants, the level of decontamination required, and the purpose of the decontamination. Remove loose or visible contamination by wiping or brushing. Pressurized water, or preferably steam cleaning may be appropriate to perform initial decontamination of equipment. The four ~~test~~ methods are:

8.4 *Method A: Decontamination Using QC Water*—This method is considered the minimum decontamination effort used to clean equipment. Its use is limited to those cases where the sampling equipment has contacted only relatively minimal contamination and there has been little likelihood of contact with organic substances.

8.4.1 *Apparatus*:

8.4.1.1 *QC Rinse Water*, adequate supplies.

8.4.1.2 *Wash bottles*, or pressure sprayer to dispense QC rinse water.

8.4.1.3 *Lint Free tissues or wipes*.

8.4.1.4 *Brushes and scrapers*, made of inert materials, which are free of contamination.

8.4.2 *Procedure*:

8.4.2.1 Remove any solid material from the equipment by scraping or brushing with implements made of inert, nonabsorbent materials.

8.4.2.2 Thoroughly rinse the piece of equipment with QC rinse water using a pressure sprayer or pressure from a wash bottle.

8.4.2.3 For equipment such as tubing and pumps that cannot be easily dismantled for cleaning with a pressure sprayer or wash bottle, circulate QC rinse water through the equipment.

8.4.2.4 Survey equipment for detectable radiation above the initial baseline. Collect QC water rinsate, or wipe samples for verification of decontamination effectiveness.

8.4.2.5 Allow to air dry or dry the equipment with lint-free wipes or tissues. Minimize the use of lint-free wipes or tissues to reduce waste production.

8.4.2.6 Store the equipment that will minimize possible recontamination by surface or atmospheric contaminants. This may be

accomplished by bagging, wrapping, or covering the equipment.

8.4.3 This method represents the minimum amount of decontamination that should be performed. Cross-contamination of samples is possible if organic or other substances were not removed physically, or by the rinse water.

8.5 *Method B: Decontamination Using Detergent and Rinse Water*—This decontamination method is used when material being sampled is not easily removed, is not removed using Method A, or tends to absorb onto the equipment. This method employs a mild detergent wash that can chemically remove contaminants.

8.5.1 *Apparatus*:

8.5.1.1 *Control Water and QC Rinse Water*, adequate supplies.

8.5.1.2 *Pressure Sprayer or Wash Bottle*.

8.5.1.3 *Lint-Free Wipes or Tissues*.

8.5.1.4 *Brushes and scrapers*, made of inert materials that are free of contamination.

8.5.1.5 *Detergent*, phosphate-free, biodegradable, and soluble in hot or cold water.[5]

8.5.2 *Procedure*:

8.5.2.1 Remove any solid material from the equipment by scraping or brushing with implements made of inert, nonabsorbent materials.

8.5.2.2 Wash and scrub the equipment thoroughly with the detergent using a brush.

8.5.2.3 Rinse the equipment thoroughly using rinse water.

8.5.2.4 For equipment such as tubing and pumps that cannot be easily dismantled for cleaning with a pressure sprayer, wash bottle or submersion, circulate the detergent solution through the equipment, followed by a QC rinse water rinse.

8.5.2.5 Survey equipment for detectable radiation above the initial baseline. Collect QC rinse water rinsate, or wipe samples for verification of decontamination effectiveness.

8.5.2.6 Allow to air dry or dry the equipment with lint-free wipes or tissues. Minimize the use of lint-free wipes or tissues to reduce waste production.

8.5.2.7 Store the equipment that will minimize possible recontamination by surface or atmospheric contaminants. This may be accomplished by bagging, wrapping, or covering the equipment.

8.5.3 This method has less potential for cross-contamination of samples than Method A, but may not be adequate to decontaminate equipment that is grossly contaminated. In these cases, Methods C and D should be added as necessary to achieve complete decontamination.

8.6 *Method C: Decontamination Using an Organic Desorbing Agent*—This method should be used in cases when the possibility of organic contamination in addition to radiological contamination has occurred or is suspected, or when Method A or B is not sufficient to successfully decontaminate the equipment. The choice of organic desorbing agent will depend on the kind of organic contaminant present and the analytical requirements of the samples being collected. Generally, a pesticide grade of methanol is recommended (methanol does not interfere with gas chro-matography/mass spectroscopy (GC/MS) analysis); however, stronger desorbing agents like acetone or hexane may be required for complete decontamination.

8.6.1 *Apparatus*:

8.6.1.1 *Rinse Water and QC Rinse Water*, adequate supply.

8.6.1.2 *Pressure Sprayer or Wash Bottles*.

8.6.1.3 *Wipes or Lint-Free Tissues*.

8.6.1.4 *Brushes and Scrapers*, made of inert materials that are free of contamination.

8.6.1.5 *Organic Desorbing Agent*, such as methanol, acetone, isopropanol, or hexane; pesticide grade.

8.6.2 *Procedure*:

8.6.2.1 Remove any solid material from the equipment by scraping or brushing with implements made of inert, nonabsorbent materials.

8.6.2.2 Wash with rinse water using a pressure sprayer or wash bottle.

8.6.2.3 Wash with the organic desorbing agent using a pressure sprayer or wash bottle. Precautions should be taken to protect skin from contact with organic agents.

8.6.2.4 Rinse with QC rinse water.

8.6.2.5 For equipment such as tubing and pumps that cannot be easily dismantled for cleaning with a pressure sprayer, wash bottle or submersion, circulate the decontamination solutions and rinses in the order listed through the equipment, followed by a QC water rinsing.

8.6.2.6 Survey equipment for detectable radiation above the initial baseline. Collect QC rinse water rinsate, or wipe samples for verification of decontamination effectiveness.

8.6.2.7 Dry the equipment with wipes or lint-free tissues, or allow to air dry.

8.6.2.8 Store the equipment that will minimize possible recontamination by surface or atmospheric contaminants. This may be accomplished by bagging, wrapping, or covering the equipment.

8.6.3 This method has less potential for cross contamination of samples than Method A or B, but has a potential risk of

[5] Isoclean, ~~Alquinox, or~~ Liquinox, ~~have~~ or Detergent 8 has been found suitable for this purpose. Detergent 8 is recommended for use with spray cleaning.

contaminating the samples with organic desorbing agents.

8.7 *Method D: Decontamination Using an Inorganic Desorbing Agent*—This method should be used to decontaminate when organic substances and radiological contamination have been absorbed onto sampling equipment and Methods A and B are not sufficient to remove the substances. This decontamination method has the least potential for cross-contamination of a sample with inorganic elements from the site, but has the potential for contaminating the sample with inorganic desorbing agents. Additionally, desorbing agents, such as the acids used in this test method may dissolve or leach elements or compounds from the next sample, and care must be taken to remove all acidic residues from the sampling equipment.

8.7.1 *Apparatus*:

8.7.1.1 *Rinse Water and QC Rinse Water*, adequate supplies.

8.7.1.2 *Pressure Sprayer or Wash Bottles*.

8.7.1.3 *Wipes or Lint-Free Tissues*.

8.7.1.4 *Brushes and Scrapers*, made of inert materials that are free of contamination.

8.7.1.5 *Adequate Supplies of Inorganic Desorbing Agents*—An inorganic desorbing agent may be a 10 % nitric or 10 % hydrochloric acid solution made from reagent grade stock and deionized water. For decontamination of low-carbon steels, a 1 % nitric solution ~~should~~ or a dilute solution of sodium hydroxide may be used. Other acids or ~~combinations of acids~~ corrosives prepared in a similar fashion may be ~~appropriate.~~ used.

8.7.2 *Procedure*:

8.7.2.1 Remove any solid material from the equipment by scraping or brushing with inert, nonabsorbent tools.

8.7.2.2 Wash the equipment thoroughly with QC rinse water using a pressure sprayer, wash bottles, or immersion.

8.7.2.3 Wash the equipment thoroughly with an inorganic desorbing agent using a pressure sprayer or wash bottle. Take precautions to protect skin from contact with the inorganic desorbing agents and from inhalation of fumes or mists.

8.7.2.4 Thoroughly rinse the equipment using rinse water, followed by QC rinse water.

8.7.2.5 For equipment such as tubing and pumps that cannot be easily dismantled for cleaning with a pressure sprayer, wash bottle or submersion, circulate the decontamination solutions and rinses in the order listed through the equipment, followed by a QC rinse water rinsing.

8.7.2.6 Survey equipment for detectable radiation above the initial baseline. Collect QC rinse water rinsate, or wipe samples for verification of decontamination effectiveness.

8.7.2.7 Dry the equipment with wipes or lint-free tissues, or allow to air dry.

8.7.2.8 Store the equipment that will minimize possible recontamination by surface or atmospheric contaminants. This may be accomplished by bagging, wrapping, or covering the equipment.

9. Procedure for Non-Sample Contacting Equipment

9.1 Non-sample contacting equipment should be decontaminated whenever the equipment is to be moved from the controlled work area. Partial decontamination may be appropriate if the equipment is to be moved from one controlled area to another, provided there is no loose contamination that could fall from the equipment, or at the completion of a day's work.

9.2 Remove any visible material adhering to the surface by wiping, brushing, or brooming. In some cases, this may be facilitated by allowing the equipment to air dry. Use soft brushes and avoid the use of hard wire brushes on soft materials that may embed the contamination. Survey the surface using the instrument(s) appropriate for the type of contamination (alpha, beta, or gamma). If no areas are above release limit, perform a wipe test for verification of the survey.

9.3 If areas are found by survey to be above release limits, observe those areas for any visible material adhering to the surface, discoloration, or corrosion and further wipe or brush the areas. Survey the areas again. If no areas are above release limits, perform wipe tests for verification of the survey.

9.3.1 If small areas are still found to be contaminated above release limits, moisten a lint-free paper wipe or towel with rinse water and wipe the area. Alternately, a small spray bottle can be used to wet the surface, and the area wiped dry. Survey to determine if equipment meets release criteria. Perform wipe tests to verify the survey.

9.3.2 For larger equipment, the equipment can either be dipped in a tub, bucket, or tank of water and wiped or air dried. Larger pieces of equipment can also be cleaned using high pressure/low volume water cleaners, or preferably steam cleaners using clean water, and brushing and wiping. Repeat cleaning and surveys until survey indicates that equipment meets release criteria. Perform a wipe test to verify the survey.

9.4 For equipment such as tubing and pumps that cannot be easily dismantled for cleaning, clean the exterior as described above and circulate rinse water through the equipment. Survey all exposed surfaces and verify by wipe test that release limits have been met. If equipment fails survey, repeat the cleaning using hot water or steam, and survey until equipment meets release limits. Dismantling may be required to allow for survey and wipe tests for verification prior to unrestricted release.

9.5 Heavy equipment, such as bulldozers, trucks, backhoes, drill rigs, drilling tools are difficult to decontaminate. Accordingly, equipment of this type should be wrapped, draped, or otherwise protected with disposable covers to prevent contamination. Prior to use, a baseline survey of the equipment should be conducted to determine if the equipment is contaminated from prior uses, and if so, to what extent. However, contamination will be unavoidable in many cases and decontamination will be required, either before, or after use, or both. Decontamination of heavy equipment is usually accomplished by physical cleaning, by high pressure water, or preferably steam cleaning with water or detergent solutions, or both, on a large decontamination pad or contamination

reduction corridor. The decontamination method that will be used is a function of the degree and nature of the contaminate, and the degree of decontamination that must be achieved. As a general rule, wet contamination will be kept wet and dry contamination will be kept dry. Wetting some compounds may cause chemical reactions that will react with the equipment and produce undesirable substances that are more difficult to remove and later handle as wastes. The following general steps may be used for decontaminating heavy equipment:

9.5.1 Physically remove any bulk material adhering to the contaminated item by use of a wire brush, stiff bristle brush, or scraper. Dry cleaning can be further accomplished using vacuum cleaners equipped with High Efficiency Particulate Air (HEPA) filters, or sand blasting equipment designed to collect all sand and blasting debris. Other tools, such as vacuuming needle guns have also been used successfully. All parts of the equipment, including undercarriage, chassis, and cab must be decontaminated. Air filters should be surveyed and if contaminated, removed and disposed of. A thorough visual inspection of the equipment, supplemented by surveys should be used to determine if the decontamination is successful or whether additional repeat decontamination is required.

9.5.2 For wet cleaning, use water or a ~~nonphosphate detergent~~ water/detergent solution (under pressure if necessary) to assist in the final removal of bulk materials.

9.6 Survey the equipment to verify that decontamination has been successful. If the survey indicates that equipment is clean, perform verification surveys and wipe tests. If the equipment survey still indicates the presence of contamination, continue decontamination using the following steps.

9.7 Steam clean the equipment, taking care to clean all surfaces.

9.8 Rinse with water.

9.9 Survey equipment to verify that decontamination has been successful. If the survey indicates that the equipment is still contaminated, repeat the cleaning process. For persistent or grossly contaminated areas, the use of a pesticide grade methanol rinse may be applied using wash bottles or pressure sprayers. In some cases, physical removal using files, fine mineral paper, wire brushes, or other mechanical tools may be required to remove localized imbedded contamination.

9.10 For unrestricted release, perform survey and wipe tests to verify that the equipment has been decontaminated to release limits.

9.11 Decontamination of heavy equipment will typically generate large volumes of contaminated liquids. Decontamination should take place on pads constructed for the purpose, with curbs, berms, and slopes to collect, control and contain the liquids. Cleaning and rinse solutions may be kept separate for later treatment. In some cases, the cleaning or rinse solutions may be recycled and reused. It is important to control the volume of decontamination solutions when expensive measures must be used for their disposal.

10. Quality Assurance/Quality Control

10.1 This practice is not a substitute for a well documented and implemented QA/QC program. The test of a decontamination procedure is the ability to evaluate and minimize erroneous sample data due to cross-contamination or nonrepresentative contamination.

10.2 *Sample Contacting Equipment*—The effectiveness of the decontamination process must be determined and documented to assess and protect the quality of the data derived from the samples. A project Quality Assurance/Quality Control (QA/QC) program should be in place prior to any sampling activity. The QA/QC program should include provisions for the collection of samples to evaluate the completeness and effectiveness of contamination prevention and decontamination. These provisions may include:

10.2.1 Requirements for pre-activity verification that radiological or chemical contamination does not exist, or if present, at what type and levels of contaminate residues residing in or on the sample contacting equipment.

10.2.2 Requirements for the collection of QC rinse water rinsate samples before initial sampling and periodically thereafter to determine the effectiveness of the decontamination.

10.2.3 The frequency of the sampling to demonstrate the completeness of sample contacting equipment decontamination is dependent on the data quality objectives of the project. As a minimum, it is recommended that a rinsate sample be collected and analyzed after every ten decontamination washings.

10.2.4 The use of trip blanks should be considered to determine whether contamination is being introduced into the samples at any point during the sampling process.

10.2.5 Field audits or surveillances of the sampling activities, including decontamination should be a part of a comprehensive QA/QC program. Field observation will ensure that decontamination practices are performed consistently and in accordance with procedures at all times, including when rinsate samples are taken, and that the rinsate samples are representative of the sampling process.

10.2.6 QA/QC in radiological work includes the verification that adequate and correct surveys, wipe tests, area controls, and personnel monitoring are performed to protect the personnel involved and to prevent environmental releases.

10.2.7 Requirements for documentation should be included in the sampling and analysis plan, health and safety plan, and the QA plans. Reviews of all completed documentation should be performed as a part of the sampling activity, and as a part of the data quality assessment that verifies the quality of the data.

10.3 *Non-Sample Contacting Equipment*—Non-sample contacting equipment contamination should have no effect on the quality of data derived from the samples, however, the QA/QC program should recognize the importance of controlling the spread

of contamination, the minimization of wastes, and the consequences of unknowingly releasing radiologically contaminated equipment to the public. The QA/QC program should include planning for decontamination activities, the verification and documentation during field activities that contamination has been controlled and that decontamination efforts are effective and complete.

11. Keywords

11.1 contaminate; contamination; control rinse water; control water; decontaminate; decontamination; equipment; radioactive; radiological; wastes; sampling

SUMMARY OF CHANGES

In accordance with Committee D18 policy, this section identifies the location of changes to this standard since the 1994 edition that may impact the use of this standard.

(1) Revised title to practices (plural).
(2) Corrected references to 10 CFR 835.
(3) Editorial changes to comply with current ASTM form and style and D18 Procedures.
(4) Editorial correction from “test methods” to “methods” in several sections.
(5) Added professional care caveat to Scope section.
(6) Corrected the position title from radiation control technician to Radiological Control Technician.
(7) Removed Alquinox from footnote 5 as it is not a non-phosphate detergent. Added Detergent 8 as a replacement and information on its application.
(8) Section 8.7.1.5 added the use of dilute sodium hydroxide (corrosive) for use on steels.
(9) Section 9.5.2 — deleted the requirements for nonphosphate detergents on non-sample contacting equipment.
(10) Section 9.9 added the use of physical tools for the removal of difficult to remove contamination on non-sample contacting equipment.
(11) Added Summary of Changes section.