Designation: D5608 – 10

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

This standard is issued under the fixed designation D5608; 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 These practices cover the decontamination of field equipment used in the sampling of soils, soil gas, sludges, surface water and groundwater 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 D5088.

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). For sample contacting equipment there are four separate procedures (Procedure A through D) in Section 8. For non-contacting equipment, one procedure is presented as covered in Section 9.

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 in the United States, see U.S. Department of Energy (DOE) 10 CFR Part 835 and U.S. Nuclear Regulatory Commission (NRC) 10 CFR Part 20.

1.8 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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 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 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:*[2]

D653 Terminology Relating to Soil, Rock, and Contained Fluids

D5088 Practice for Decontamination of Field Equipment Used at Waste Sites

[1] This practice is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.21 on Groundwater and Vadose Zone Investigations.

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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.

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

2.2 *United States Code of Federal Regulations:*[3]
10 CFR Part 20 Standards for Protection Against Radiation
10 CFR Part 835 Radiological Protection for Occupational Workers

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). The desorbing agent may include dilute sodium hydroxide.

3.1.8 *mixed wastes*—wastes containing both radioactivity (as defined by the United States Atomic Energy Act of 1954 as amended) and quantities of United States Environmental Protection Agency 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.

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 of negligible economic value, considering the cost of recovery or use. Waste can generally be 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 decays in a relatively short period of time, within 500 years, although some low level wastes may remain radioactive for much longer periods. Low level radioactive wastes are those that are not high or mid level wastes. 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.

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 *radiological control technician (RCT)*—Individuals who protect people and the environment from the unwanted effects of radiation through the principles of time, distance, and shielding. Also referred to by other titles including Radiation Safety Technicians, Health Physics Technician, Radiation Protection Technicians.

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

3.1.15 *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.

3.1.16 *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.

3.1.17 *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).

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

3.1.19 *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).

3.2 All other terms and definitions are in accordance with Terminology D653.

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 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, handling, or disposal 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 Radiological Control 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 personal 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 procedure.

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