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Standard Guide for Environmental Monitoring Plans for Decommissioning of Nuclear Facilities[1]

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1. Scope

1.1 This guide covers the development or assessment of environmental monitoring plans for decommissioning nuclear facilities. This guide addresses: (*1*) development of an environmental baseline prior to commencement of decommissioning activities; (*2*) determination of release paths from site activities and their associated exposure pathways in the environment; and (*3*) selection of appropriate sampling locations and media to ensure that all exposure pathways in the environment are monitored appropriately. This guide also addresses the interfaces between the environmental monitoring plan and other planning documents for site decommissioning, such as radiation protection, site characterization, and waste management plans, and federal, state, and local environmental protection laws and guidance. This guide is applicable up to the point of completing D&D activities and the reuse of the facility or area for other purposes.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E666 Practice for Calculating Absorbed Dose From Gamma or X Radiation

E668 Practice for Application of Thermoluminescence-Dosimetry (TLD) Systems for Determining Absorbed Dose in Radiation-Hardness Testing of Electronic Devices

~~E1167Guide for Radiation Protection Program for Decommissioning Operations~~

E~~1278Guide for Radioactive Pathway Methodology for Release of Sites Following Decommissioning~~ 1167 Guide for Radiation Protection Program for Decommissioning Operations

E1281 Guide for Nuclear Facility Decommissioning Plans

~~E1707~~ISO/ASTM 51707 Guide for Estimating Uncertainties in Dosimetry for Radiation Processing

2.2 *ANSI Standards:*

ANSI N 545 Environmental Application of Thermoluminescent Dosimetry[3]

ANSI N 13.1 Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities[3]

2.3 *Nuclear Regulatory Commission Document:*

NUREG CR-2082 Monitoring for Compliance with Decommissioning Termination Survey Criteria[4]

NUREG-1575 ~~Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), December 1997~~ Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), Revision 1, August 2000

2.4 *U.S. Government Documents:*

29 CFR Part 1910.120[4]

2.5 *U.S. EPA Documents:*

OSWER-9950.1 RCRA Ground-Water Monitoring Technical Enforcement Guidance Document[5]

~~SW-846Test Methods for Evaluating Solid Waste~~

SW-846 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods

40 CFR 302~~Notification of Releases or Threatened Releases of Hazardous Substances~~ Designation, Reportable Quantities, and Notifications

40 CFR 61 National Emission Standards for Hazardous Air Pollutants

[1] This guide is under the jurisdiction of ASTM Committee E10 on Nuclear Technology and Applications and is the direct responsibility of Subcommittee E10.03 on Radiological Protection for Decontamination ~~&~~and Decommissioning of Nuclear Facilities ~~&~~and Components.

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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, 11 W. 42nd St., 13th Floor, New York, NY 10036.

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

[5] Available from U.S. Environmental Protection Agency, 401 M St. SW, Washington, DC 20460.

40 CFR 58~~Air Monitoring of Hazardous Pollutants~~ Ambient Air Quality Surveillances

2.6 *American Public Health Association Document:*

Standard Methods for Examination of Water and Wastewater [6]

3. Terminology

3.1 *Definitions:*

3.1.1 *active phase*, *n*—time during which physical decontamination/dismantling operations are performed.

3.1.2 *characterization*, *n*—a systematic identification of the types, quantities, forms, and locations of contamination on the site.

3.1.3 *Data Quality Objectives (DQOs)*, *n*—quantitative and qualitative statements that specify the quality of data needed from a particular data collection activity.

3.1.4 *decommission*, *vt*—to remove safely from service and reduce residual radioactivity to a level that permits release of the property for unrestricted use and termination of any applicable licenses.

3.1.5 *decontamination*, *n*—activities employed to reduce the levels of (radioactive or hazardous chemical) contamination in or on structures, equipment, materials, and personnel. Typical forms of decontamination may include: (*1*) decontamination to support decommissioning objectives; (*2*) decontamination to reduce radiation levels in support of as low as reasonably achievable (ALARA) objectives; (*3*) decontamination to limit the spread of radiological contamination; (*4*) decontamination to support the unrestricted release of material and equipment; and (*5*) decontamination of personnel.

3.1.6 *monitoring*, *vt*—observing or taking measurements systematically over time to determine the status of and to detect significant changes in conditions or performance of a system, facility, or area.

3.1.7 *passive phase*, *n*—time of surveillance and maintenance from the time plant operations cease until decontamination/dismantling operations begin, and from the end of active decontamination/dismantling operations until the site is released for unrestricted use.

3.1.8 *radiological release criteria*, *n*—levels of residual radioactivity present at the completion of a decommissioning activity below which the site may be released to the general public for unrestricted use.

3.1.9 *hazardous material clean-up criteria*, *n*—the reduction of hazardous contaminants needed to reduce the risk identified in the baseline health-based risk assessment to a level consistent with Applicable and Relevant or Appropriate Requirement (ARAR) values.

3.1.10 *hazardous substance*, *n*—any material identified by the Environmental Protection Agency (EPA) in 40 CFR 262.

3.1.11 *restricted use*, *n*—organizational control is maintained over a property through physical barricades, signs and notices, or deed covenants that limit the full use of the property by an owner or prospective owner.

3.1.12 *unrestricted use*, *n*—control over the property is fully released for any use desired by the owner.

4. Summary of Guide

4.1 Nuclear facilities must have established plans for monitoring the environment surrounding the site as part of their license or technical specifications. These plans are designed to identify any release of radioactive or hazardous material and to assess the resulting impacts. Similar plans are required during decommissioning or site remediations to continue environmental monitoring, although the types of discharges and the affected pathways may be different from those monitored during facility operations.

4.2 In addition, limited environmental surveillance may have been performed since the facility operated. The existing environmental monitoring plans should be modified for decommissioning and reflect the current environment, potential release points, and affected pathways. If no environmental monitoring plan exists, one must be developed.

4.3 The decommissioning environmental monitoring plan must be consistent and complete to ensure the detection and mitigation of off-site impacts caused by radioactive or hazardous materials released from decommissioning activities at nuclear facilities.

5. Significance and Use

5.1 Use of this guide will ensure that the potential impact on the surrounding environment from planned decommissioning activities has been properly assessed.

5.2 Use of this guide will ensure that the adequacy of environmental sampling has been assessed for location, frequency, analytical techniques, and media type to monitor the environment and to detect site-related releases and their impact.

6. Organizational Interfaces

6.1 The environmental monitoring plan should coordinate with other decommissioning documents. Guide E1281 recommends that certain planning documents and implementation plans will be prepared prior to commencement of dismantlement actions. This guide ensures that the basic environmental monitoring planning elements and requirements are identified, examined, and addressed to accomplish the decommissioning activities. Other project plans and reports guide the operations and organization for the decommissioning project.

[6] Available from American Public Health Association, 1015 15th St. NW, Washington, DC 20005.

6.1.1 Planning and implementation documents define the activities around which the site environmental monitoring program will be developed. Documents that should be reviewed include the following:

6.1.1.1 Site Description and Operating History Reports,

6.1.1.2 Site Characterization Report,

6.1.1.3 Health Based Baseline Risk Assessment,

6.1.1.4 Planned Decommissioning Activities Document,

6.1.1.5 Licensing and Regulatory Issues Document,

6.1.1.6 Quality Assurance Document, and

6.1.1.7 Radiation Protection Document.

6.1.1.8 Appendix X1 contains brief overviews of these documents, as they contribute to the environmental plan.

7. Elements of an Environmental Monitoring Plan

7.1 Site environmental monitoring shall comply with a written plan. This plan must both direct the performance of monitoring and inform concerned individuals as to the intent and methodologies used in monitoring the environment. The plan must clearly define the scope of work activities, that is, describe the site, area, or room to be decommissioned. Guidance on the content and structure of the plan is outlined in 7.2-7.10.12. Additional guidance relative to the requirements for monitoring of environmental pollutants at facilities being decommissioned can be found in such references as , 40 CFR 61, and 40 CFR 58. These cover such topics as notification of the release of hazardous materials, emission standards for air pollutants, and air monitoring of these materials.

7.2 *Introduction and Objectives* —The introduction should address the history of actions leading to decommissioning, identify the organizations involved, describe the decommissioning process and required documentation, define the objective or purpose of the environmental monitoring program, and describe the intended use of the monitoring data.

7.2.1 *Monitoring Objectives*—Basic objectives should include the following, as a minimum:

7.2.1.1 Assess the actual or potential doses to man from contaminants released to the environment as a result of decontamination efforts,

7.2.1.2 Demonstrate compliance with applicable environmental regulations during decommissioning and with established release criteria. Chapter 4 of The Decommissioning Handbook[7] provides an excellent summary of the various environmental regulations that apply to decommissioning work,

7.2.1.3 Evaluate the adequacy and effectiveness of the containment and effluent control system during decontamination.

7.2.2 *Calibration and Measurement System Performance*:

7.2.2.1 Provisions must be made when planning environmental monitoring activities at decommissioning sites to ensure that all data are obtained using instruments and instrumentation systems capable of producing accurate and valid data. This requires the use of instruments and equipment having valid and current calibration certificates. It also means that careful consideration should be given to the appropriate use of spiked samples, blanks, and split samples as quality assurance principles are incorporated into the environmental monitoring program.

7.2.3 *Data Quality Objectives*—The DQOs impact statistical sampling design, sampling techniques, analytical procedures, and documentation procedures. The elements for a decommissioning monitoring plan will be prepared with concern for the DQO process. Technical monitoring objectives will be established to support the data quality objectives in the monitoring plan. The objectives will be specified in terms of precision, accuracy, representativeness, completeness, comparability, and detection limit. For further information on DQOs, see Ref **(1)**.[8]

7.3 *Background Information*:

7.3.1 *Location*—The plan should specify the location and describe the site and surrounding area.

7.3.2 *Source of Contaminants and Transport Pathways*—The source term from the site characterization data should be complete enough to identify the types of radionuclides and hazardous materials on site, their quantities, and the physical conditions in which they are found. The plan should specify the chemical composition and condition of the material, extent of contamination, and whether the material is in soil or groundwater, or on buildings and equipment surfaces.

7.3.3 *Information Sources*—Sources of information on the site should be identified, searched for pertinent information, and summarized, including previous sampling, facility waste plans, environmental characterizations, radiation surveys, and local sampling problems.

7.3.4 *Impact Data*—Available environmental impact data should be summarized.

7.3.5 *Background Evaluation Requirements*:

7.3.5.1 Requirements governing the decommissioning activities and release of the site may be based on levels above background; therefore, careful evaluation of background conditions at the decommissioning site should be considered when planning the environmental monitoring program.

[7] Taboas, A. L., Moghissi, A. A., and LaGuardia, T. S., Eds., The Decommissioning Handbook, Chapter 4, Environmental and Related Requirements, ASME, Three Park Ave., New York, NY, 2004.

[8] The boldface numbers in parentheses refer to a list of references at the end of this guide.

7.4 *Evaluation of Existing Data*:

7.4.1 *Source Term Examination*—Once all contaminants present at the site are identified, those contaminants that potentially could be released to the environment during decommissioning should be identified specifically and included in the transport model, as discussed in 7.4.2.

7.4.2 *Pathways Modeling for Monitoring System Design*—The decommissioning activities specified in the decommissioning plan should be reviewed to identify activities that could release hazardous materials to the off-site environment. The environmental transport pathways will then be identified, including critical environmental components and receptors. Using the strength of the source and the model, the most significant pathways and receptors will be identified for each contaminant.

7.4.2.1 The pathways model (conceptual or mathematical) for transport of material to the environment should comply with Guide E1278 and should establish the critical population and the most probable locations for accumulation of radioactivity or hazardous material. Pathways with potentially high accumulation rates should be selected for sampling to provide a means of detecting releases at the earliest opportunity. Likewise, exposure pathways to humans defined in the site release criteria (that is, milk, fish, and groundwater consumption, and dust ingestion and inhalation) should be specifically considered for sampling. These pathways to humans provide a means of comparing site releases and resultant environmental levels with calculated doses to individuals. The model must consider the transport of each contaminant separately, since their sources and environmental fates may be different.

7.5 *Sampling and Analytical Design*:

7.5.1 *Statistical Design*—A variety of statistical monitoring designs are available to meet monitoring objectives, including stratified, systematic, and random with grab or composite sampling. The statistical design chosen must account for the source of statistical variability in the samples, such as space, time, sampling procedures, sample handling, sample processing including subsampling, sample extraction, and analytical measurements. The parameters include several sources of statistical error. The development of data quality objectives requires consideration of these sources of error, an estimate of their magnitude, and, if necessary, a review of methods to reduce the overall variability in a cost-effective manner. For further information on statistical sampling design and data interpretation, see Refs **(2)** and **(3)**. In addition, the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) provides excellent guidance on sampling design for these projects.) provides excellent guidance on sampling design for these projects. See NUREG CR-2082 for additional guidance.

7.5.2 *Initial Baseline Conditions* —The site description and operating history should be reviewed to identify any previous environmental sampling plans and the resultant data. All licensed sites and sites operated by the government should have a documented baseline prior to the initial start of operations. These data should be reviewed, and those sample points used to establish the previous background should be trended through subsequent environmental reports to update the background value of these locations before decommissioning operations begin. This documentation should be supported by new samples taken from the original baseline sampling locations and new locations for pathways resulting from decommissioning activities. The long-term sampling data should depict the status of the environment at the start of decommissioning operations.

7.5.2.1 If the existing documentation or current sampling indicates that contamination has been deposited off-site, the quantity and location of this material must be characterized. Contaminants existing in the environment before decommissioning may be transported as a plume or slug and could result in increasing environmental levels. Without adequate data, the increase could be attributed incorrectly to decommissioning activities.

7.5.2.2 Sites with no previous environmental monitoring program should establish a baseline. Many state environmental or radiation protection programs maintain environmental sampling locations that can provide baseline information for normal air activity, radon levels, external beta/gamma radiation values, or trace element levels in ambient air. The baseline sampling activity should account for fluctuations in data taken by other programs, such as radon emanation rates and air activity levels.

7.5.3 *Sampling Rationale*—Select the media to sample according to the results of pathways modeling (see 7.3.2). Those pathways deemed significant for their possible dose to the public or release to the environment (both accidental and planned) should be monitored. For decontamination activities, the most important pathways to the off-site environment are typically atmospheric and surface water transport of contaminants. The sources may be point (such as a stack or discharge pipe) or non-point (fugitive dust or erosion of soil by surface water). The releases may be planned, unplanned, continuous, or episodic.

7.5.3.1 The most common environmental media to monitor for decommissioning operations are air, water (surface, ground, and drinking), soil, sediments, and biota. Paragraphs 7.5.3.2-7.5.3.8 discuss basic considerations. Corley et al. **(2)** provides further guidance on monitoring system design, sample type, sampling locations, and frequency.

7.5.3.2 *Air*—Air is an important transport pathway to off-site areas and an exposure pathway to man from contaminants released to the atmosphere. Therefore, environmental air sampling should be conducted to determine whether contaminants are migrating off-site and to evaluate potential doses to environmental populations from inhaled or ingested contaminants or from external exposure.

(*1*) The sampling method depends upon the contaminants of interest, such as particulates, radioiodines, noble gases, tritium, or volatile organic compounds. Particulate sampling techniques include filtration, electrostatic precipitation, impingement (into or onto a collection medium), and impaction. For particulates, proper particle sizes and sampling equipment must be selected to comply with current clean air regulations.[9] Factors to consider in filter selection are pressure drop, flow reduction due to particle collection efficiency (filter loading), particle-size selectivity, retention of alpha-emitting particles on the filter surface, and the ease of radiochemical analysis. Gases may be sampled either actively or passively using sorbent traps of Tenax, activated charcoal, or silica gel for example. For additional information on TDLs, see Practices E666 and E668 ~~and Guide E1707, as well as ANSI N545.~~ and ISO/ASTM Guide ISO/ASTM 51707, as well as ANSI N 545.

(*2*) Deposition sampling is an alternative to active air sampling for particulate contaminants. Deposition collectors include pails, dustfall jars, coated surfaces, and precipitation collectors. These methods are inexpensive, provide time integrated samples, are easy to maintain, and do not require power. However, the resultant data cannot easily be incorporated into dose assessment models. In addition, vegetation and surface soil may be sampled to evaluate atmospheric deposition.

(*3*) Thermoluminescent dosimeters (TLDs) may be used to determine an integrated exposure at site boundaries and population centers. TLDs are a relatively inexpensive means of determining external doses of radionuclides. It should be noted, however, that the correct use of TLDs outside of a controlled laboratory environment requires a certain amount of care.

(*4*) When selecting air sampling locations, consider the characteristics of the potential source and local meteorology. To monitor continuous releases from stacks, use a mathematical model to predict the area of maximum impact. The model should account for hours of operation, exhaust gas temperature and velocity, stack height, expected meteorological conditions, and form of the contaminant (particulate, gas). Then, select exposed population. To monitor episodic or accidental releases from stacks, use an isokinetic stack monitoring program coupled with reliable meteorological data to calculate off-site doses to the exposed population because the exact area of maximum impact cannot be predicted *a priori*. Monitoring at selected population centers may also be considered to evaluate exposure at specific locations in the event of an episodic release.

(*5*) For contaminants released at ground level, the maximum expected off-site concentration frequently is detected at or near the downwind site boundary. Position a series of air samplers along the boundary of the facility calculated to be downwind of the stack the greatest percentage of time, within the nearest exposed community, and upwind of the source for control samples.

(*6*) Recommended guides for air sampling include ANSI N13.1 ~~and Refs~~ **and Ref (4)** ~~**and (5)**~~**.**

7.5.3.3 *Surface Water*—Contamination of surface water during decommissioning may result from direct discharge or surface runoff. Both routes may be routinely monitored. In addition, the receiving water body or drinking water supply may be sampled as part of the D&D monitoring program. Exposure from the surface water pathway results primarily from ingesting drinking water, but may also result from ingesting fish, shellfish, and other foodstuffs from potentially contaminated surface water used for fishing, irrigation, or watering livestock.

(*1*) The selection of sampling locations depends on the type of water body (lake, stream, estuary), form of the contaminant (sorbed to particulate or soluble), monitoring objectives, and potential for collecting a representative sample. To determine actual doses to humans, use drinking water samples obtained from the water treatment plant or taps in the distribution system. To evaluate off-site transport, collect samples where the discharge has mixed with the receiving water. Complete mixing of the discharge and the water body may not occur for many miles and could require dye tracing studies or modeling. Similar problems exist in sampling lakes and estuaries where mixing may never be complete and collection of representative samples is difficult or impossible. To minimize these complications, sampling near the point of discharge is recommended. The effluent should also be sampled, but that may be an operational monitoring activity.

(*2*) Standardized sampling procedures and approaches are discussed in Ref **(~~6~~5)**.

7.5.3.4 *Soil*—Collection of soils in off-site areas to assess the impact of decommissioning operations is not recommended. The small amount of material deposited from atmospheric transport is greatly diluted when a soil sample is collected. Thus, soil is not a sensitive short-term indicator, but may be used for long-term monitoring. In addition, a statistically sound sampling scheme is difficult to design and expensive to implement because of spatial heterogeneity. Soils are a complicated medium, which presents a variety of problems to laboratory analysis that can adversely affect data quality. Special circumstances may require off-site monitoring of soils for a particular activity, but routine monitoring is not recommended. Air samplers, deposition collectors, and vegetation monitoring are much more sensitive techniques to assess atmospheric deposition of contaminants.

~~(*1*)Some specialized soil sampling procedures for detecting atmospheric deposition are reviewed by Fleischhauer **(7)**.~~

7.5.3.5 *Sediment*—Sediment is an excellent accumulator of certain contaminants and should be considered in pathways modeling. Sediment, like sessile aquatic biota, integrates exposure and can be used to determine whether contaminants with high partitioning or sorption coefficients have been released. Both upstream and downstream samples should be collected before decommissioning activities begin. Sediments should be collected in areas of low water velocity, such as the inside radius of stream bends, at the entrance to lakes and rivers, and above dams.

(*1*) Sediment may be sampled with dredges, hand or weighted corers, or by divers, depending on the depth and velocity of the water, type of sediment, and objectives. For further information on sediment sampling, see Refs **(~~6~~5)**, **(~~8~~6)**, and **(~~9~~7)**.

7.5.3.6 *Aquatic Biota*—Aquatic biota may indicate off-site contaminant transport and may represent a significant pathway of human exposure (via ingestion). Wastes released to a water body may partition to biota and result in relatively high concentrations of contaminants compared to the receiving water. The pathways model may have identified specific species or classes of organisms that could be ingested by man or could indicate off-site transport. For dose assessment, monitor the organisms directly ingested

[9] Consult current ICRP recommendations and EPA regulations.

by man, although some surrogate organisms may be used in modeling. Fish, shellfish, and waterfowl may be collected through direct field sampling, or they may be acquired from sportsmen or commercial fishermen if the point of collection can be determined. While aquatic vegetation is not usually a direct pathway to man, rooted aquatic plants and algae are concentrators and, therefore, indicators of release for some radionuclides, metals, and organic compounds.

(*1*) Consider using exposed sessile organisms as integrators of exposure. These organisms should be sampled upstream and downstream of the discharge, as described under sediment. Locations for the collection of mobile species depend on the habits of the organism, while drift species should be collected from the potential plume areas. For more information, see Refs **(65)**, **(86)**, and **(97)**.

7.5.3.7 *Terrestrial Biota and Food*—Terrestrial biota sampling may be used instead of, or along with, surface soil sampling, deposition samplers, and active air monitoring. Leaves, brush, litter, and new growth act as collectors for some contaminants and may be used to detect trends. The main attribute is simplicity and cost. Vegetative media should be selected for availability in the areas of interest, adequacy of analytical methods, and capacity of the media to collect the contaminant of interest.

(*1*) Food stuffs are monitored because they are a direct route of human exposure through ingestion. Milk, meat, and produce can become contaminated via atmospheric transport, irrigation using contaminated water, and direct ingestion of contaminated water or feed. Pathways modeling identifies critical foods for particular contaminants. For further information, see Corley et al. **(2)**.

7.5.3.8 *Groundwater*—Ingestion of contaminated groundwater is a significant human exposure pathway for some contaminants (usually soluble metals and volatile organics). Because groundwater moves slowly, it is unlikely that groundwater contamination from decommissioning activities would be detected during the project, or that it would be distinguishable from existing contamination. However, groundwater should be sampled as part of the environmental monitoring program in conjunction with a knowledgeable and independent organization (not the operational monitoring team).

(*1*) Volatile organic compounds pose the greatest threat to groundwater because of their mobility in vapor and liquid phases. Semivolatile organics, pesticides/PCBs, metals, and most radionuclides are less of a problem. One exception is tritium, which is highly mobile.

(*2*) The sampling technique and monitoring well design depend on the analytes of interest. Positive displacement submersible pumps and bailers are suitable for sampling volatiles, while pumps that draw a vacuum or create excessive turbulence are discouraged. In all cases, wells should be purged to obtain a representative sample of the aquifer. Generally, several well bore volumes must be removed until groundwater parameters stabilize, such as pH, temperature, and conductivity. However, purge water may have to be controlled as hazardous or mixed waste, depending on the contaminants.

(*3*) Wells must be constructed from stainless steel or Teflon wells to meet applicable EPA specifications[10] concerning polyvinylchloride (PVC) and carbon steel. The techniques for well drilling, grouting, and development are critical to obtain accurate and valid monitoring data.

(*4*) Recommended references for groundwater monitoring are U.S. EPA OSWER-9950.1 "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document" and Ref **(108)**.

7.5.4 *Analytes to be Determined*—The monitoring plan should specify the samples to be analyzed and the analytes, which should have been identified during site characterization and selected for analysis through the pathway analysis.

7.5.5 *Field Analytical Procedures* —The equipment and techniques should be described in the monitoring plan. When screen samples in the field are used to reduce the number of analyses required, the screening procedure must meet the DQOs and be clearly recorded in the plan, including quality control checks.

7.5.6 *Decontamination of Equipment and Supplies*—Environmental sampling may result in the contamination of personnel, sampling equipment, and supplies. Most decommissioning environments are relatively clean. However, any decontamination of personnel, if required, should be covered in a site safety or radiation protection plan, or both (Guide E1167). Contamination of sampling equipment and supplies should be avoided because decontamination is time consuming, costly, and generates waste that may require special disposal. Decontamination procedures for sampling equipment must be developed in conjunction with analytical personnel to ensure that no analytical interferences could be caused by any wash or rinse solutions.

7.5.6.1 Disposable sampling equipment should be used when applicable, available, and acceptable. Disposable equipment saves time and money and ensures that no cross contamination occurs.

7.5.6.2 Special consideration is required when both radioactive and chemical contaminants are present. At times, the presence of contamination (significantly above ambient) on equipment can be ascertained in the field using organic vapor analyzers for chemical contaminants and radiation monitoring equipment for radioactive contaminants. For many contaminants, no immediate methods are available to determine the effectiveness of decontamination. Collect decontamination or rinsate blanks to determine decontamination efficiency.

7.5.6.3 Prevent contamination of field measurement instrumentation by using them cautiously. If contamination does occur, it is difficult to clean most measurement instruments without damaging them. Any instruments that cannot be decontaminated easily should be protected while being used.

[10] Consult the current specifications for well construction and groundwater sampling under the Resource Conservation and Recovery Act/Comprehensive Environmental Response, Compensation, and Liability Act.