



Standard Guide for Post-Deactivation Surveillance and Maintenance of Radiologically Contaminated Facilities¹

This standard is issued under the fixed designation E2420; 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 guide outlines a method for developing a Surveillance and Maintenance (S&M) plan for inactive nuclear facilities. It describes the steps and activities necessary to prevent loss or release of radioactive or hazardous materials, and to minimize physical risks between the deactivation phase and the start of facility decontamination and decommissioning (D&D).

1.2 The primary concerns for S&M are related to (1) animal intrusion, (2) structural integrity degradation, (3) water leakage, (4) contamination migration, (5) unauthorized personnel entry, and (6) theft/intrusion. This document is intended to serve as a guide only, and is not intended to modify existing regulations.

2. Referenced Documents

2.1 ASTM Standards:²

[E1167 Guide for Radiation Protection Program for Decommissioning Operations](#)

[E1819 Guide for Environmental Monitoring Plans for Decommissioning of Nuclear Facilities](#)

[E1892 Guide for Preparing Characterization Plans for Decommissioning Nuclear Facilities](#)

[E1893 Guide for Selection and Use of Portable Radiological Survey Instruments for Performing In Situ Radiological Assessments to Support Unrestricted Release from Further Regulatory Controls](#)

2.2 Nuclear Regulatory Commission Documents:³

[NUREG-1576 Multi-Agency Radiological Laboratory Analytical Protocols \(MARLAP\)](#)

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.

Current edition approved June 1, 2015. Published July 2015. Originally approved in 2005. Last previous edition approved in 2010 as E2420-10. DOI: 10.1520/E2420-15.

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 U. S. Nuclear Regulatory Commission (NRC), One White Flint North, 11555 Rockville Pk., Rockville, MD 20852-2738, <http://www.nrc.gov>.

[NUREG-1575 Multi-Agency Radiation Survey and Site Investigation Manual \(MARSSIM\), Revision 1, August 2000](#)

[NUREG-1575-Supplement 1 Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual \(MARSAME\)](#)

3. Terminology

3.1 Definitions:

3.1.1 *deactivation*—to remove a facility from service. Deactivation means the facility is placed in a safe and stable condition.

3.1.2 *decommission*—to remove a nuclear facility safely from service and reduce residual radioactivity and other hazardous materials to levels that permit release of the property or facility for unrestricted use and termination of any applicable license(s).

3.1.3 *decontamination*—those activities employed to reduce the levels of radioactive and hazardous contamination in or on structures, equipment, and materials.

3.1.4 *nuclear facility*—a facility whose operations involve (or involved) radioactive materials in such form or quantity that radiological controls are (or were) required to protect employees, the environment, or the general public.

3.1.4.1 *Discussion*—Included are facilities that are (or were) used to produce, process, use, or store radioactive materials. Some examples are nuclear reactors (power, test, or research), fuel fabrication plants, fuel reprocessing plants, uranium/thorium mills, Uranium Hexafluoride (UF-6) production and enrichment plants, research laboratories using radioactive materials, chemical processing facilities, and radioactive waste disposal sites.

3.1.5 *standby*—a condition in which a nuclear facility has been deactivated, but in such a way that it could be restarted for its original purpose.

3.1.5.1 *Discussion*—Critical systems are maintained in working order with regularly scheduled maintenance activities performed. Surveillance and Maintenance (S&M) requirements for facilities placed in standby are much more demanding than for those which are deactivated for planned decommissioning. Operations procedures are usually maintained for facilities placed in standby.

3.1.6 *S&M*—the act of performing periodic inspections, and related maintenance activities on facilities which have been deactivated and are awaiting the start of decommissioning.

4. Significance and Use

4.1 The purpose of this guide is to provide the user information and guidance for preparation of a plan for the surveillance and maintenance of nuclear facilities that have been deactivated and are awaiting D&D.

4.1.1 This document provides guidance for performing S&M in a way that will ensure worker and public safety, while also addressing stakeholder requirements.

4.1.2 Use of this guide helps standardize the basic requirements for S&M of nuclear facilities.

4.2 Use of this guide helps ensure that the S&M plan addresses the significant activities and actions necessary to maintain these facilities in a safe and stable condition until they can be decommissioned.

5. Key Elements in S&M Planning

5.1 One of the key elements of post-deactivation S&M planning is determining the end point condition of the facility so that S&M activities can be established to support those conditions. While performing end point planning, a review of all possible endpoints for the facility should be made. Decisions made at the initial determination of the deactivated facility may, at a much later date, be changed. Thus a review and analysis of various re-determinations of the facility end point, and the accompanying actions and data needs could prove very useful at some time in the future of the facility. The S&M plan specifies the surveillance, inspection, and maintenance of the facility in the deactivated state and should specify the locations, frequency, and manner in which they will be conducted.

5.2 Part of S&M planning is deciding which spaces must remain accessible and which equipment must be maintained operable during post deactivation and D&D activities. This may be necessary to meet commitments to stakeholders and should be agreed upon by the organization that will perform S&M activities. The post-deactivation condition of the facility will determine S&M requirements.

5.3 To avoid incompatibilities between end-point requirements and S&M costs, it is important that the S&M plan be written early in deactivation planning of the facility.

5.4 Another important reason for early preparation of the S&M plan is that people who have operated and maintained the facility have considerable knowledge in the past facility history and can assist in recommending activities to ready the facility for S&M. Thus, developing the plan should be a cooperative effort between the deactivation organization and the owner, or organization responsible for the facility.

5.5 An attempt should be made to include all identified stakeholders in the decision-making process for the facility. This should include not only S&M actions while the facility is shut down, but end point decisions with respect to the long term status and final state of the facility.

6. Prerequisites

6.1 The S&M plan covers that portion of the life of a facility between deactivation and decommissioning. Prerequisites are those activities which must be performed during deactivation.

6.2 Prior to preparing the S&M plan, the facility must be deactivated and a detailed characterization performed to identify the actual physical, radiological, chemical, and hazardous material hazards. Guidance for planning and executing characterization operations are provided in Guide E1892 for developing the plan and Guide E1893 and the NRC NUREGS for the MARSSIM, MARLAP, and MARSAME documents for measurement protocols.

6.3 All radiation safety and Occupational Safety and Health Administration (OSHA) requirements applicable to performing S&M work in the facility must be identified and hazards mitigated as necessary.

6.4 Prior to implementation of the S&M plan, any facility modifications necessary to support the plan must be completed. This may include initial decontamination for hazard mitigation.

6.5 Identify all applicable regulations and regulatory authorities associated with the facilities. Discussions with appropriate regulators should be conducted early in the development of the plan.

6.6 Performance criteria associated with S&M activities should be identified and established prior to preparing the plan. Examples of performance criteria include: length of the S&M period, estimated contaminant stability, intrusion areas, etc. The condition of the facility during the S&M phase should be specified and described.

7. Typical S&M Plan Contents

NOTE 1—The contents of an S&M plan will vary in scope and content from project to project. It should be tailored to fit the requirements of the individual project or facility and be commensurate with the hazards present. The following are brief descriptions of the contents or sections of a typical S&M plan.

7.1 *Introduction*—Describe the deactivated condition of the facility and list the buildings that are the subject of the S&M plan. Provide a sketch or photograph to indicate the scope of the facility. Indicate any unusual situations, such as portions of a building that may remain operational. State the overall objectives of the intended S&M. Indicate proximity to neighboring businesses, structures, transportation (trains, roadways, airports) and waterways.

7.2 *Purpose*—State the specific objectives of the facility surveillance and maintenance phase. Objectives can relate to contamination control, physical security, hazard isolation, preservation of economic assets, and others. The planned level of effort to conduct S&M should also be stated.

7.3 *Background*—A background section is appropriate if this information might affect the S&M plan, that is, the safety classification of the facility. It is acceptable to reference other documents to provide background information.

7.4 *Regulatory Compliance*—Describe how regulations applicable to the specific facility configuration and conditions as well as any special agreements with the State or other

regulatory bodies are to be addressed during S&M. All applicable rules, regulations, permit, or licenses should be noted in the S&M plan.

7.5 Description of Surveillance and Maintenance Activities—This section should address eight key areas of surveillance and maintenance necessary to maintain deactivated facilities. This is the main part of the S&M plan and is likely to be the most extensive.

7.5.1 Facility Operations—This section should address all equipment or systems that must remain operational during S&M, such as heating and ventilation, fire suppression, and alarm systems. It must comply with Conduct of Operations procedures at the site if applicable.

7.5.2 Facility Maintenance—All activities necessary to maintain the facility in a safe and stable condition should be identified and the required maintenance tasks documented in the plan. Particular attention should be given to items such as roof repairs, window and door condition, HVAC operation, freeze and fire protection, animal and water intrusion, etc.

7.5.3 Quality Assurance (QA)—The S&M plan should define the level of QA involvement during the project. This may range from nonexistent up to the level required during facility operations. A QA plan is normally applied in situations where parts of the facility must be maintained in operating condition. The level and type of hazard associated with the S&M activities should be considered and a risk-based, graded approach to the quality requirements used as applicable. Document control requirements should be included. As part of the quality assurance program radiological sample data quality should be addressed. This should be done so that surveillance and maintenance samples can be integrated into D&D activities such that the data are defensible and can be used as part of the decommissioning program for the facility. Thus, these data will have a predetermined confidence limit and can be integrated into the final MARSSIM (Multi-Agency Radiation Survey and Site Investigation Manual) survey as well as the initial decontamination survey data. This will greatly reduce costs and shorten schedules.

7.5.4 Radiological Controls—A major activity will be the control of radioactive materials and subsequent radiation exposure of personnel during the S&M phase. A health and safety program that is based in radiation safety, hazardous material contents, and industrial safety conditions must be developed separately to cover the S&M phase. Guidance to support this effort may be found in Guide [E1167](#). The S&M plan should specify radiological monitoring, and work control requirements to be used. Survey procedures should be consistent with good health physics practices such as those outlined in Guide [E1893](#). While addressing facility radiological controls it is important to document the level of decontamination that was performed during facility shutdown, and any requirements upon which the decon levels were based.

7.5.5 Hazardous Material Protection—In addition to radioactivity, many nuclear facilities also contain other types of hazardous materials. These include a broad spectrum of chemicals, organic solvents, heavy metals, asbestos, PCBs, and other materials. These hazardous materials should be identified and provisions for dealing with them included in the S&M

plan, and the S&M or existing Health and Safety Plan (HASP). Many of these hazardous materials are regulated by government laws such as RCRA (Resource Conservation and Recovery Act) and TSCA (Toxic Substances Control Act), and as such require special provisions for their handling, storage, or disposal. This section of the S&M plan should carefully address implementing all applicable hazardous materials rules, regulations, permits, and licenses.

7.5.6 Health and Safety and Emergency Response—Health and Safety and Emergency response issues should be addressed in the S&M plan. This can be done by either preparing a section covering these topics in the S&M plan itself, or, by preparing a stand alone Health and Safety and Emergency Response plan which supplements and supports the S&M plan. The goal is to provide guidance on avoiding accidents or incidents associated with S&M activities. The physical integrity of the buildings, all safety concerns, and existing radiological conditions should be addressed in the S&M plan. An inspection and hazard assessment of the facility should be made and updated periodically, or as determined by conditions at the facility. This should address fire, industrial, criticality, chemical, toxicological, and biological safety as appropriate. If an Emergency Response plan does not exist for the facility, one should be developed. These plans are required by regulation and should address personnel response to emergencies at the facility.

7.5.7 Environmental Protection Plan—A goal of S&M at a shutdown nuclear facility should be to protect the environment. Guide [E1819](#) provides guidance for developing the appropriate environmental plan for the S&M phase. Radiological control procedures must be implemented to help prevent the spread of radioactivity to the environment. Since hazardous materials often coexist in nuclear facilities, these too should be identified and actions taken to prevent their release to the environment. Actions necessary to prevent spread of these materials to the environment should be clearly presented in the plan.

7.5.8 Safeguards and Security—Unapproved personnel entry into a shutdown nuclear facility could result in injury and exposure to radioactive and hazardous materials. In addition, valuable items or equipment may be removed without permission. For these reasons it is important to maintain physical security of sites or facilities which are shut down and in a surveillance and maintenance mode. Intruders may not be familiar with, or recognize, unsafe conditions in the facility and thereby intentionally or unintentionally cause accidents or incidents. Thus, if an adequate Safeguards and Security plan does not exist for the facility, one should be written. The intent of such a plan should be to prevent unauthorized entry into the facility, monitor or control the flow of materials and equipment into and out of the facility. These plans should be written to fit the complexity of the facility and can range from simple access control procedures to complex procedures that protect fissile and special nuclear materials.

7.5.9 Organizational Responsibilities—Organizational responsibilities should be clearly identified in the S&M plan. Where possible, individuals should be identified and their area of responsibility specified. In general, individuals responsible for the overall management of the project, QA, radiological

controls, health and safety, environmental monitoring and protection, and safeguards and security should be identified.

7.5.10 *Cost and Schedule*—Annual cost requirements for performing the required S&M, and other required activities should be presented in the plan. Costs should be broken down into the major elements or activities of the S&M work. The plan should require reporting of cost variances with adequate explanations. Likewise, major scheduled activities should be documented and reported regularly. Explanation of schedule variances should also be documented. Baseline costs and schedule should be provided such that cost and schedule performance can be evaluated and tracked. Likewise, a variance or trend program should be established to help predict events, which may require additional or future actions.

7.5.11 *Approvals*—Written approval of the S&M Plan should be obtained. This should include not only the facility owner, but any regulatory agency involved, and all Stakeholders. This ensures buy-in from all Stakeholders for the deter-

mined outcome and will help prevent being forced to readdress decisions at a later date.

8. Progress Reporting

8.1 Activities, including cost and schedule status, should be reported regularly as part of monthly reports, mid-year, and year-end reviews. For larger, more complex projects, annual reports may be considered. As a minimum, the reports should address routine completion of scheduled S&M activities, deviations from routine activities, special inspections, or activities conducted infrequently. Unusual situations or unsatisfactory conditions should also be reported along with corrective actions taken.

9. Keywords

9.1 decontamination and decommissioning; facility deactivation; nuclear facility; radioactive and hazardous materials; surveillance and maintenance

APPENDIX

(Nonmandatory Information)

X1. Related Documents

X1.1 ASTM Standards: ²
 E1034 Specification for Nuclear Facility Transient Worker Records
 E1168 Guide for Radiological Protection Training for Nuclear Workers
 E1281 Guide for Nuclear Facility Decommissioning Plans
 E1760 Guide for Unrestricted Disposition of Bulk Materials Containing Residual Amounts of Radioactivity

X1.2 U.S. Government Regulations: ⁴
 10 CFR 20 Standards for Protection Against Radiation
 10 CFR 830 Nuclear Safety Rules (QA, SARs, etc.)
 10 CFR 835 Occupational Radiation Protection
 29 CFR 1910.120 Hazardous Waste Operations and Emergency Response
 29 CFR 1910.1096 Ionizing Radiation
 International Atomic Energy Agency (IAEA) Documents
 Safety Report Series No. 26, Safe Enclosure of Nuclear Facilities During Deferred Dismantling

⁴ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401.

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