Designation: E 1167 – 87 (Reapproved 1996)ε1

Standard Guide for Radiation Protection Program for Decommissioning Operations[1]

This standard is issued under the fixed designation E 1167; 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.

ε[1] NOTE—Keywords were added and editorial changes were made throughout in January 1996.

1. Scope

1.1 This guide provides instruction to the individual charged with the responsibility for developing and implementing the radiation protection program for decommissioning operations.

1.2 This guide provides a basis for the user to develop radiation protection program documentation that will support both the radiological engineering and radiation safety aspects of the decommissioning project.

1.3 This guide presents a description of those elements that should be addressed in a specific radiation protection plan for each decommissioning project. The plan would, in turn, form the basis for development of the implementation procedures that execute the intent of the plan.

1.4 This guide applies to the development of radiation protection programs established to control exposures to radiation and radioactive materials associated with the decommissioning of nuclear facilities. The intent of this guide is to supplement existing radiation protection programs as they may pertain to decommissioning workers, members of the general public and the environment by describing the basic elements of a radiation protection program for decommissioning operations.

1.5 This guide defines the elements of a radiation protection program that will ensure that the goals and objectives of a decommissioning activity are attained within the radiological limits and restrictions imposed by applicable governing and regulating agencies. The implementation of such a program will provide radiological protection to personnel and the environment. This guide should be used for developing the documentation that defines the intent and implementation of the radiation protection program for a specific decommissioning project.

1.6 The Radiation Protection Program should address the following elements (see Note 1). This program shall be developed and maintained such that it satisfies all applicable Quality Assurance requirements developed for the decommissioning project.

NOTE 1—If the site to be decommissioned is adjacent to an operating site, the radiological impact of the operating site must be considered in the development of the Radiation Protection Program for the decommissioning site.

1.7 This guide does not address the subjects of emergency preparedness, safeguards, accountability, waste handling, storage, and transportation. Each of these issues has a direct interface with the radiation protection program. However, each constitutes a program in and of itself from program definition through implementation.

1.8 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*

C 986 Guide for Developing Training Programs in the Nuclear Fuel Cycle[2]

E 181 Test Methods for Detector Calibration and Analysis of Radionuclides[3]

E 1034 Specification for Nuclear Facility Transient Worker Records[3]

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

2.2 *ANSI Standards:*

N13.6 Practice for Occupational Radiation Exposure Records System[4]

N323 Radiation Protection Instrumentation Test and Calibration[4]

2.3 *NRC Document:*

USNRC Regulatory Guide 8.8 Information Relevant to Insuring that Occupational Radiation Exposure at Nuclear Power Stations will be as Low as is Reasonably Achievable[5]

[1] This guide is under the jurisdiction of ASTM Committee E-10 on Nuclear Technology and Applicationsand is the direct responsibility of Subcommittee E10.03on Radiological Protection for Decontamination and Decommissioning of Nuclear Facilities and Components.Current edition approved July 9, 1987. Published September 1987.

[2] *Annual Book of ASTM Standards*, Vol 12.01.

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

[4] Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

[5] Available from Nuclear Regulatory Commission, Public Document Room, 1717 H St. NW, Washington, DC 20555.

USNRC Regulatory Guide 8.10 Operating Philosophy for Maintaining Occupational Radiation Exposures as Low as Reasonably Achievable[5]

USNRC Regulatory Guide 8.13 Instruction Concerning Prenatal Radiation Exposure[5]

USNRC Regulatory Guide 8.15 Acceptable Programs for Respiratory Protection[5]

USNRC Regulatory Guide 8.29 Instruction Concerning Risk from Occupational Radiation Exposure[5]

2.4 *DOE Document:*

DOE/EV/1830-T5 Guide to Reducing Radiation Exposure to as Low as Reasonably Achievable (ALARA)[6]

2.5 *INPO Document:*

INPO 82-004 General Employee Training[7]

2.6 *ORP Document:*

ORP/SID 72-2 Environmental Radioactivity Surveillance Guide[8]

2.7 *ICRP Document:*

ICRP-43 Principles of Monitoring for the Radiation Protection of the Public[9]

3. Terminology

3.1 *Descriptions of Terms Specific to This Standard:*

3.1.1 *audit*, *n*—formal systematic examination to verify adequate implementation.

3.1.2 *certified radioactivity standard source*, *n*—calibrated radioactive source, with stated accuracy, whose calibration is certified by the source supplier, as traceable to the National Radioactivity Measurements System (see Test Methods E 181).

3.1.3 *decommission*, *vt*—to remove nuclear facilities 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.

3.1.4 *decontamination*, *n*—those activities employed to reduce the levels of (radioactive) contamination in or on structures, equipment, materials and personnel. Five levels of decontamination are defined as follows:

3.1.5 *decontamination for decommissioning*, *n*—at facilities such as nuclear reactors or accelerators, where high radiation fluxes have been present, structural materials may have become radioactive through activation. Removal of such radioactive material (such as a reactor vessel or internals) constitutes "decontamination." Removal of intact equipment or structures containing radioactive material (such as internally contaminated pipes, valves, pumps, tanks, etc.) also constitutes" decontamination."

3.1.6 *decontamination to reduce radiation levels*, *n*—examples of this type of decontamination would be the use of chemicals to dissolve radioactive corrosion product deposits from the inside of a piping system or the removal of the top layer of a concrete floor into which contaminants had been embedded and had become a part of the concrete matrix.

3.1.7 *decontamination supporting radiological protection*, *n*—this category includes the" housekeeping" type of decontamination intended to reduce the spread of contamination, to reduce the amount of protective clothing required, or to reduce the probability or amount of airborne contamination.

3.1.8 *decontamination for unrestricted release*, *n*—involves reducing radioactive contamination from material, tools, or equipment to levels that satisfy "Radiological Release Criteria" (see section 3.1.18).

3.1.9 *personnel decontamination*, *n*—removal of radioactive material from workers.

3.1.10 *nuclear facility*, *n*—facility whose operations involve (or involved) radioactive materials in such form and quantity that a radiological hazard potentially exists (or existed) to the employees and the general public.

3.1.10.1 *Discussion*—Included are facilities that are (or were) used to produce, process, or store radioactive materials. Some examples are as follows:

(*1*) Nuclear reactor (power or research),
(*2*) Fuel fabrication plant,
(*3*) Fuel reprocessing plant,
(*4*) Uranium or thorium mill,
(*5*) UF_6 production plant,
(*6*) Radiochemical laboratory, and
(*7*) Radioactive waste processing or disposal site, or both.

3.1.11 *review*, *n*—critical evaluation to ensure inclusion of appropriate principles.

3.1.12 *survey plan*, *n*—document that describes the techniques and procedures to be used to provide sufficient radiation measurements to describe the radiation source present within a predefined area.

3.1.13 *radiation protection plan*, *n*—document developed for a specific decommissioning project that describes the goals and intent of the radiation protection program.

3.1.13.1 *Discussion*—The radiation protection plan is an element of the radiation protection program and shall become an integral part of the decommissioning plan.

3.1.14 *radiation protection procedures*, *n*—documents used to implement the radiation protection plan.

3.1.15 *Radiation Protection Program*, *n*—actions applied to a decommissioning project whose intent is to limit the exposure of workers, members of the general public, and the environment from radiation or radioactive materials, or both, and the written documentation supporting these actions.

3.1.16 *radiation work procedure*, *n*—documentation used to specify protective measures and to specify personnel access requirements to radiation or radioactive materials, or both.

3.1.16.1 *Discussion*—Control may be achieved through use of a single document such as a Radiation Work Permit, which specifies the protective measures for particular work tasks, or it may be achieved through application of generic procedures and instructions.

3.1.17 *radiological control areas (RCA)*, *n*—area of a nuclear facility or area being decommissioned where access is controlled for purposes of radiological protection.

3.1.18 *radiological release criteria*, *n*—levels of residual radioactivity at the completion of a decommissioning activity below which the object of the decommissioning may be

[6] Available from Department of Energy, National Technical Information Service, U.S. Dept. of Commerce, Springfield, VA 22161.

[7] Available from Institute of Nuclear Power Operations, 1100 Circle, 75 Parkway, Atlanta, GA 30339-3064.

[8] Available from Office of Radiation Programs, 401 M St., SW, Washington, DC 20460.

[9] Available from Comitato Nazionale Per L'Energia Nucleare, Rome, Italy.

released for unrestricted use to the general public.

4. Significance and Use

4.1 A program based on this guide will provide assurance to all concerned that the appropriate elements of radiation safety have been included to protect workers, the general public, and the environment in proximity to the decommissioning activities.

4.2 Implementation of such a program will provide assurance to those agencies responsible for review or audit of the decommissioning project that the requirements for radiation protection have been addressed.

RADIATION PROTECTION PROGRAM

5. Radiation Safety Organization and Responsibilities

5.1 The radiation protection plan should include a description of the radiological protection organization and the radiation safety responsibilities of each level of the decommissioning project organization from the individual worker to the project manager. This description should show the radiation safety organization interfaces and reporting responsibilities at all levels of the project (see Note 2).

6. Radiological Control Areas (RCA)

6.1 The Radiation Protection Program should define the conditions for designation of an RCA, the physical barriers and administrative methods to control the spread of radioactive material, and the requirements to restrict personnel access for purposes of radiation exposure control. Access to these areas shall require a radiation work procedure. The Radiation Protection Program should include procedures to determine the radiological conditions within the area, that identify the anti-contamination clothing, dosimetry, and respiratory protection required for RCA entry and that define the limitations for working within the RCA. These procedures should include any restrictions for workers whose physical condition may limit entry into or ability to operate within an RCA. The procedures should describe the requirements for egress and checkout from the RCA.

NOTE 2—USNRC Regulatory Guides 8.8 and 8.10 provide guidance on describing the relationships that should exist between radiation safety and the operating function and the importance of high level management support of the radiation safety program.

7. Sources and Types of Radiation

7.1 The radiation sources, to be encountered during decommissioning activities, shall be defined. Reviews of the operating history of the facility (including interviews with past and present employees), coupled with nuclear analysis and detailed radiological characterization surveys (see Section 9), should be used to provide this information. This description of radiation sources should include the type of radiation such as alpha, beta, gamma, or neutron; the isotopic composition, the physical and chemical form of the radioactive material, and the magnitude and location of the radiation sources. This information is necessary for developing the instructions relating to radiation instrumentation selection, radiation measurement techniques, shielding requirements, selection of decontamination methods, contamination control methods, and personnel dosimetry systems.

8. Radiological Release Criteria

8.1 The radiation protection plan should include a discussion of the radiological criteria that will be used as the basis for determining the completion of decommissioning. These criteria should be based upon applicable limits for unrestricted release. Decontamination for unrestricted release, if needed, should consider the specific radionuclides present, the material contaminated such as soil or facility, and the potential end uses of the item or area being decontaminated. The development of the criteria should consider the type of measurement to be performed, such as surface versus volume, and the medium to be measured, such as air or water.

9. Radiological Survey Plans

9.1 There are many phases of a decommissioning project that require a radiological survey plan. Surveys generally fall into three categories: planning surveys, operational surveys, and release surveys. The survey plan for each should include the description of where the measurements are made, how they are made (direct measurement or samples), and what is to be measured (examples include soil samples, vegetation samples, air samples, surfaces, and bore hole logging). The survey plans should emphasize any unique features requiring special procedures.

9.2 An environmental monitoring plan should also be prepared to support the decommissioning project. This plan should be an independent document covering the environmental protection program from predecommissioning through unrestricted release of the facility or conclusion of the decommissioning project. The environmental monitoring plan should become an integral part of the radiation protection plan.

9.3 Since there are many factors that may influence the method and procedures to be used in support of an environmental monitoring plan, a detailed description of the environmental monitoring plan content is outside the scope of this guide (see Note 3).

9.3.1 *Planning Surveys*:

9.3.1.1 The primary objective of the planning surveys is to define the radiation source terms with respect to isotopic identification, location, physical and chemical configuration, and radiation level.

9.3.1.2 The results of this survey must also be in sufficient detail to permit an engineering evaluation for selecting an appropriate decommissioning option. These results then form the basis for input into the engineering plan for decommissioning and for defining elements of the radiation protection plan necessary to ensure that adequate environmental monitoring and radiation exposure management procedures are implemented for the isotopic and physical forms present. Elements of the engineering plan that have a direct bearing on the radiation protection plan include selection of the methods and extent of decontamination to reduce radiation and contamination levels, analysis and design of temporary and semi-permanent radiation shielding, selection and evaluation of remote tooling techniques, and the performance of tradeoff studies among various radiation exposure reduction alternatives.

9.3.1.3 The survey plan must be developed to identify the