



Standard Guide for Radiological Protection Training for Nuclear Facility Workers¹

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1. Scope

1.1 This guide covers general recommendations with respect to standard work practices, procedures, and measurement methods for the radiological protection portion of health and safety training for radiation workers at nuclear facilities. This guide defines the elements of a training program for radiation workers consistent with the philosophy that occupational radiation exposure be kept as low as is reasonably achievable (ALARA). Regulatory agencies have statutory responsibilities to promulgate regulations applying to the training of workers exposed to radiation hazards. This guide shall not take precedence over any such regulations.

1.2 This guide is intended to help ensure that the employer provides the radiation worker with radiological protection training that the worker needs to work safely in a radiologically controlled area and to maintain radiation exposure ALARA.

1.3 The scope of radiological protection training shall be related to the duties and responsibilities of each radiation worker and shall be commensurate with potential radiological protection problems in the radiologically controlled area.

1.4 This guide is also intended to provide guidance that will enable an evaluation of the effectiveness of the radiological protection training program toward achieving the purpose stated in Section 4.

1.5 This guide does not cover the more detailed training requirements for radiation protection professionals or technicians.

1.6 This guide provides reference to the type of radiological protecting training records that should be created, and recommends retention periods for radiological protection training records.

1.7 *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 appro-*

priate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 *NCRP Document:*

NCRP Report No. 134 Operational Radiation Safety Training, October 2000²

2.2 *ANSI Standard:*

ANSI/ANS 3.1 American National Standard for Selection, Qualification, and Training of Personnel for Nuclear Power Plants³

2.3 *ANI/MAELU Documents:*

Information Bulletin 80-1A, Nuclear Liability Insurance Records Retention⁴

Training and Qualification Criteria for Nuclear Liability Insurance (Section 2.2.1 of “General Employee Training”)⁴

2.3 *DOE Document:*

DOE Handbook 1078-04 Training Program Handbook: A Systematic Approach to Training⁵

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *nuclear facility, n*—facility whose operations involve or involved radiation or radioactive materials in such form and quantity that a radiological hazard potentially exists to the employees or the general public. Included are facilities used to produce, process, or store radioactive materials. Some examples are as follows (also see **Note 1**):

3.1.1.1 Fuel reprocessing plant,

3.1.1.2 Fusion research facility,

3.1.1.3 Nuclear reactor (power, test, or research),

3.1.1.4 Particle accelerator,

3.1.1.5 Radioactive waste disposal site,

3.1.1.6 Radiochemical laboratory,

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² Available online at <https://www.ncrppublications.org>.

³ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

⁴ Available from American Nuclear Insurers, 29 South Main, (Suite 300S), West Hartford, CT 06107-2445.

⁵ Available from Department of Energy, National Technical Information Services, U.S. Dept. of Commerce, 5285 Port Royal Rd., Springfield, VA 22161.

- 3.1.1.7 UF₆ production plant, and
- 3.1.1.8 Uranium or thorium mill.

NOTE 1—This guide is intended to apply to nuclear facilities licensed by the U.S. Nuclear Regulatory Commission and the individual agreement states, to nuclear facilities operated by the U.S. Department of Energy, and to those nuclear facilities that are under the control of the U.S. Department of Defense.

3.1.2 *radiation worker, n*—any person who enters a radiologically controlled area to perform work. Radiation workers are sometimes referred to as occupationally exposed workers.

3.1.3 *radiologically controlled area, n*— area where access is controlled for purposes of radiological protection.

4. Significance and Use

4.1 The purpose of this guide is to define the elements of a radiological protection training program that will enable a radiation worker, upon completion of training, to achieve the following:

4.1.1 Understand the relative health and safety risks associated with the types and levels of radiation that may be encountered during the work assignment in radiologically controlled areas,

4.1.2 Complete the forms and records necessary to be permitted to function as a radiation worker,

4.1.3 Practice the necessary monitoring and contamination control techniques to minimize exposure to radiation or radioactive materials, or both, and

4.1.4 Practice work habits that will minimize the impact of radiation or radioactive materials, or both, upon the workplace and surrounding environments.

4.2 The standardization of radiation worker radiological protection training provides the individual radiation worker with a greater assurance that the training received is adequate to minimize radiation exposure, to enable the worker to work safely in a radiologically controlled area, and to meet applicable regulations.

4.3 The standardization of radiation worker radiological protection training prevents unnecessary retraining of radiation workers.

4.4 This guide should be used as the basis for establishing a radiological protection training program for radiation workers at nuclear facilities.

5. Training Administration

5.1 *Training Program Objectives*—The objectives of the radiological protection training program shall be to accomplish the following:

5.1.1 Provide guidance and training to enable each radiation worker to ensure ALARA.

5.1.2 Ensure that radiation workers are instructed in and physically can demonstrate the proper use of commonly used radiological protection instrumentation, personal protective equipment, respirators, and personal exposure monitoring devices necessary to that individual's work assignment.

5.1.3 Train every radiation worker to enable compliance with appropriate safety and health postings and procedures and the proper reaction to warnings, alarms, and emergency situations.

5.1.4 Inform every radiation worker about the immediate and the long-term health risks associated with the acceptance of radiation exposure, and about the basis for health risk estimates.

5.1.5 Provide the information needed to enable each radiation worker to comply with applicable regulations.

5.1.6 Ensure that the program can be reviewed and revised as needed to meet changing conditions, and that the instruction is sufficiently understood to permit its practical application.

5.1.7 Ensure that radiation workers receive adequate radiological protection training for each job to which they are assigned.

5.1.8 Ensure that training is not repeated needlessly on site or at other facilities where the trained radiation worker may be employed.

5.1.9 Conduct training in such a way that the radiation worker knows the specific objectives of the training and can determine whether or not the training has been completed satisfactorily.

5.2 *Training Program Content:*

5.2.1 The content of the radiological protection training program shall be commensurate with potential radiological protection problems in the radiologically controlled area. The content of the program also shall reflect the type of nuclear facility (see 3.1) for which the training is being provided. The inclusion of topics in Section 6 and the emphasis of each topic within the training program shall be based on the needs of each individual or group requiring training. Hands-on or practical training shall be included in addition to classroom training where appropriate.

5.2.2 Credit may be given for prior applicable training received off site. Documentation of that training shall be in accordance with 5.6. It is appropriate to determine the applicability of an individual's prior training and experience, with respect to the present job requirements, by means of a test. If the prior applicable training was received before the period specified for requalification (see 5.5), then refresher training as described in 5.5 shall be given prior to the administration of the test. This refresher training may be combined with site-specific training.

5.2.3 Site-specific training shall be provided. Site-specific training shall include those topics in Section 6, the details of which may vary from one nuclear facility to another. Some examples are identification of and response to various alarms, evacuation routes, administrative limits and procedures, and radiological hazards unique to the facility.

5.3 *Scheduling:*

5.3.1 The radiological protection training program shall be scheduled so that each individual is trained in radiological protection to the degree necessary to perform his/her tasks safely before entering a radiologically controlled area.

5.3.2 For special cases in which an individual must enter a radiologically controlled area before completion of his training, the individual shall be escorted by a fully trained and qualified person. Such entries may be necessary for on-the-job training, for example. A brief radiological protection orientation should be provided to escorted individuals prior to entry into a radiologically controlled area.

5.4 Testing:

5.4.1 A radiation worker's knowledge of, competency in, and understanding of the basic principles and methods of radiological protection shall be evaluated through a written or computer-based objective test. Oral tests shall not be substituted for written or computer-based tests unless the impracticality of administering a written test is established and documented on an individual basis. The worker shall be reinstructed and retested on any subject of which he has insufficient knowledge. The testing shall be designed to establish whether or not the worker has the knowledge, understanding, and skill to work safely.

5.4.2 All radiation workers whose radiological protection depends on their effective use of equipment, facilities, or specialized procedures shall be observed by a qualified trainer while using such equipment or facilities or performing such procedures, and shall be individually graded on a pass-fail basis, that is, the worker performs the task satisfactorily or is given additional training until satisfactory performance is achieved or until the worker is found unsuitable for the job.

5.4.3 All written, computer-based, oral, and practical tests shall have carefully developed bases in order to ensure that appropriate areas of knowledge and skill are covered. Tests should cover information presented to the radiation worker and shall emphasize knowledge and practices directly related to day-to-day radiological protection.

5.5 Requalification:

5.5.1 The training program shall include periodic refresher training as required by the appropriate regulatory authority, or at least every two years, for any work description. High-risk work, for example, glove box operation, high-radiation entry, or radiography sources shall require at least annual requalification (see **Note 2**).

5.5.2 Requalification testing shall be carried out in conjunction with refresher training.

5.5.3 Those radiation workers requiring new or refreshed knowledge because of reassignment shall be given appropriate training and testing.

5.5.4 Supervisors and radiological protection personnel should be alert to radiation worker performance that indicates the need for further instruction, and shall design or revise training programs to meet those needs.

NOTE 2—Refresher training is generally less detailed than initial training, because refresher training usually highlights and reviews the material that was covered in initial training.

5.6 *Records*—Adequate training records help to avoid unnecessary repetition of an individual's training and may be used to determine the adequacy of an individual's training before each new work assignment. Training records shall be required for initial training and refresher training. These records, which are used to document compliance with training requirements for health and safety, shall be maintained by the organization providing the training or by the organization to which the radiation worker belongs. Records referenced throughout this guide could be beneficial in future defense litigation. Legal counsel of the training organization should be consulted for determination of retention requirements and retention periods.

5.6.1 An individual's training records shall include the following information:

5.6.1.1 The radiation worker's name and a unique identification code (such as a social security number or passport number),

5.6.1.2 Inclusive dates and instructor's name for each segment of training or for each different training program,

5.6.1.3 The type of nuclear facility (see **3.1**) for which the training program was developed,

5.6.1.4 A specific description of all training completed satisfactorily, such as references to pertinent lesson plans, course outlines, syllabuses, and other subject-specific descriptive information. Specific reference usually is made to such materials by date, edition, or issue,

5.6.1.5 A performance rating for each segment of training or each different training program satisfactorily completed by the radiation worker. This rating normally consists of a numerical or letter grade or a written evaluation,

5.6.1.6 Checklists that document the radiation worker's performance on an on-the-job training segment, where applicable, and

5.6.1.7 The name and location of the training facility.

5.6.2 On completion of training, each radiation worker shall receive a certificate of satisfactory completion, signed by the training department manager (or equivalent), that shall include the training dates and locations, the type of nuclear facility for which the training program content was developed, the name and location of the facility at which the training records are maintained, and a statement that the training is in accordance with this guide. This certificate allows the worker's previous training to be taken into account when determining training needs at another site.

5.6.3 In order for there to be an adequate basis for periodic evaluation of the training program, the following training program records shall be required:

5.6.3.1 Training materials such as outlines, syllabuses, brochures, videotapes, texts, tests (including test questions and oral and on-the-job checklists), or specific descriptions of these items to serve as a basis for determining the depth and scope of training given in each subject area. Specific reference usually is made to such materials by date, edition, or issue, and

5.6.3.2 The name and qualifications of each instructor and examiner involved in each training segment or each training program.

5.7 *Program Evaluations*—The training program shall be evaluated periodically by an assessor independent of the training program. The extent of such evaluations should determine the following:

5.7.1 Program objectives are being achieved,

5.7.2 Each radiation worker is receiving training related to his/her work,

5.7.3 Initial training and refresher training are timely,

5.7.4 Adequate training records are being created and maintained to ensure accessibility, completeness, and usefulness,

5.7.5 The program is supported by management with adequate facilities, number and quality of instructors, and training aids,

5.7.6 The program is responsive to the radiation worker's need for knowledge and skills, and

5.7.7 Each radiation worker's on-the-job performance confirms training effectiveness (see **Note 3**).

NOTE 3—Appropriate methods for examining on-the-job performance that confirms training effectiveness include conducting random worker interviews at the work site, direct observation of worker performance, and an examination of those nuclear facility records that may indicate deficiencies in specific training areas.

5.8 *Training Program Development*—NCRP Report No. 134 and DOE Handbook 1078-04 provide systematic processes for the development of training programs and provides a description of the activities that should be considered in developing effective training programs (see **Note 4**).

NOTE 4—NRC Regulatory Guide 8.27 **(1)**⁶ and INPO/NANT computer-based training **(2)** provide additional information on radiological protection training program development and implementation.

5.9 *Qualification of Training Personnel*—ANSI/ANS 3.1 provides guidance on the qualification of training department personnel (that is, managers, coordinators, and instructors).

6. Course Content

6.1 This section identifies the topics that should be addressed in a radiological protection training program to ensure that the program objectives as described in 5.1 are achieved. The inclusion of a given topic and the emphasis placed on that topic shall be consistent with 5.2. Additional guidance on radiological protection training is provided in ANI/MAELU Training and Qualification Criteria for Nuclear Liability Insurance (Section 2.2.1 of "General Employee Training").

6.2 *General Requirements* (see **Note 5**):

6.2.1 *Completion of Radiation Dose History Forms with Assistance*:

6.2.1.1 State the reasons for maintaining individual radiation dose records.

6.2.1.2 State the location of the repository, and explain how to obtain radiation dose records.

6.2.2 *Description of Workers' Rights Protected by Applicable Requirements*:

6.2.2.1 State the location of notices to workers, instructions for workers, reports to individuals, and regulatory agency site inspection information.

6.2.2.2 State the facility's responsibility to instruct workers in radiological protection.

6.2.3 *Permissible Radiation Dose Limits*:

6.2.3.1 Define radiation measurement and dose units.

6.2.3.2 State the applicable regulatory radiation dose limits for whole body, extremity, and skin dose, and the applicability of the limits.

6.2.3.3 Explain the basis for the dose limits.

6.2.3.4 Discuss the relationship of occupational dose limits to those for the general population.

6.2.3.5 State the dose limitations for planned special exposures and guidance for exposure during emergency conditions.

6.2.3.6 Explain the potential consequences and probability of consequences for exceeding dose limits given the best available risk estimates.

6.2.3.7 Relate the ALARA principle to dose limits and dose control.

6.2.4 *Determination of Internal Exposure*:

6.2.4.1 Define derived air concentration (DAC) and annual limit on intake (ALI).

6.2.4.2 State the basis of the DAC and ALI. Discuss the internal dosimetry models that relate DAC and ALI to internal exposure.

6.2.4.3 Explain how DACs and ALIs are used for internal dosimetry. Discuss various bioassay monitoring techniques used to verify the presence (or absence) of internal contamination derived from a DAC analysis.

6.2.5 *Posted Radiological Warning Signs and Labels*:

6.2.5.1 Explain the purpose and appropriate response to all prescribed warning signs and labels.

6.2.5.2 State the requirements that must be met before entering areas posted with prescribed warning signs.

6.2.5.3 Explain the consequences of disregarding warning signs and labels.

6.2.5.4 Explain the consequences of unauthorized movement of posted warning signs and labels.

6.2.6 *Possible Health Effects of Exposure to Ionizing Radiation*:

6.2.6.1 Explain the mechanisms of biological injury to cells and organ systems and how these mechanisms are related to radiation type and source of dose (internal versus external).

6.2.6.2 Define stochastic effects versus deterministic effects of radiation exposure and how this is related to dose limits for the various organs and tissues of the body.

6.2.6.3 Explain the risk basis for occupational dose limits and how this relates to other types of occupational and societal risks.

6.2.7 *Recommended Practices Concerning Prenatal Radiation Exposure*:

6.2.7.1 Explain the possible risks of radiation exposure to the developing embryo and fetus.

6.2.7.2 State the recommendations with respect to the radiation exposure of a woman who might be pregnant.

6.2.7.3 State the importance of informing supervisors of pregnancy.

6.2.7.4 Describe the options for a pregnant employee with respect to radiation exposure.

NOTE 5—U.S. NRC Regulatory Guides 8.8 **(3)**, 8.10 **(4)**, 8.13 **(5)**, and 8.29 **(6)**, 10 CFR Part 19 **(7)** Part 20 **(8)**, and Part 835 **(9)**, ICRP Publications 60 **(10)**, NCRP Report Number 116 **(11)**, and BEIR VII **(12)** all provide additional background information for some of the general requirements topics.

6.3 *Administrative Requirements*:

6.3.1 *Emergency Alarms and Conditions*:

6.3.1.1 State the pertinent requirements of the site's emergency plan.

6.3.1.2 State the role of the worker during an emergency.

6.3.1.3 Identify the emergency alarms, discuss the meaning of each alarm type, and state the appropriate response to each alarm type.

⁶ The boldface numbers in parentheses refer to the list of references at the end of this guide.

6.3.1.4 State the location of the predetermined emergency assembly areas for the individual's work group.

6.3.1.5 Explain the emergency situations that might require evacuation.

6.3.1.6 Explain the evacuation routes including identification of route markings and location of monitoring points.

6.3.1.7 Explain the special precautions and limitations to follow during an emergency, including those related to eating, drinking, smoking, chewing, and wearing anti-contamination clothing outside of areas controlled for radiological protection purposes.

6.3.2 *Response to Radiological Alarms:*

6.3.2.1 Identify the types of radiological alarms (area radiation monitors, continuous air monitors, etc.).

6.3.2.2 Explain the appropriate response to radiological alarms.

6.3.2.3 Explain the consequences of ignoring radiological alarms.

6.3.3 *Radiological Incidents and Emergencies:*

6.3.3.1 Explain the indicators of unusual radiological conditions and emergencies.

6.3.3.2 Identify whom to inform, how to inform them, and what information should be reported in the case of a radiological incident or emergency.

6.3.3.3 Explain the immediate responses to be taken by a worker in the case of a radiological incident or emergency.

6.3.4 *Rules Relating to Eating, Drinking, Smoking, and Chewing in Radiologically Controlled Areas:*

6.3.4.1 Identify the pathways through which radioactive materials can enter the body.

6.3.4.2 State the precautions (procedures for washing and monitoring) to be followed prior to eating, drinking, smoking, or chewing.

6.3.5 *Site-Specific Administrative Guidelines for Exposure Control:*

6.3.5.1 Explain and distinguish between government limits and specific facility administrative guideline limits for exposure control.

6.3.5.2 State the actions to be taken if government limits or administrative guideline limits are being approached or exceeded for an individual radiation worker.

6.3.5.3 Explain how administrative guidelines are changed or extended.

6.3.6 *Radiological Work Permit (RWP) Requirements:*

6.3.6.1 Explain the purpose of an RWP (or equivalent) including the information contained, the requirements imposed, and the consequences of violating those requirements (see **Note 6**).

6.3.6.2 Explain when an RWP is required.

6.3.6.3 Explain the individual's responsibility for obtaining information from an RWP.

6.3.6.4 State the requirements for entry into all types of high radiation areas and how to comply with requirements including RWPs posting and dosimetry.

6.3.6.5 Explain how an RWP is terminated.

NOTE 6—As applied as a work control document, the RWP or equivalent may include provisions for hazardous (nonradiological) protection.

6.4 *Radiological Exposure Control:*

6.4.1 *Compliance with the ALARA Program:*

6.4.1.1 Explain the principles of ALARA.

6.4.1.2 Explain the worker's responsibility to control radiation exposure at ALARA levels.

6.4.1.3 Explain management's policy for ALARA.

6.4.2 *Sources of Radiation at the Work Site:*

6.4.2.1 Explain each type of radiation and its characteristics.

6.4.2.2 Explain the nature and locations of the major sources of radiation and the types of radioactive material at the work site.

6.4.2.3 Explain how changing work processes can affect radiological conditions.

6.4.2.4 Explain how altering established physical exposure controls can affect radiological conditions.

6.4.3 *Use of Time, Distance, and Shielding to Minimize Radiation Exposure:*

6.4.3.1 Define the terms "dose," "dose rate," and "collective dose" (person-rem).

6.4.3.2 Explain how to minimize time spent working in radiologically controlled areas in accordance with the ALARA concept.

6.4.3.3 Explain how to maximize distance from sources of radiation exposure (recognizing the importance of the inverse square law, which defines the relationship of radiation intensity to distance) in accordance with the ALARA concept.

6.4.3.4 Explain how to use shielding materials wherever practical and describe different shielding materials for different types of radiation.

6.4.4 *Personnel Dosimetry Devices:*

6.4.4.1 Explain the purpose, basic operation, and use of personnel dosimetry devices used at the facility.

6.4.4.2 Demonstrate how to wear personnel dosimetry devices properly under normal radiological conditions.

6.4.4.3 State the ranges of secondary monitoring devices used at the facility.

6.4.4.4 Demonstrate how to read all types of secondary monitoring devices used at the work site.

6.4.4.5 Explain how to record secondary monitoring device results.

6.4.4.6 Explain the actions to be taken if a dosimeter is off scale or lost.

6.4.5 *Measurement of Radiation Fields with Appropriate Portable Instruments:*

6.4.5.1 Identify and describe portable radiation protection instruments by type, range, and usage.

6.4.5.2 Demonstrate the proper way to handle, use, and maintain portable radiation protection instruments.

6.4.5.3 Explain the importance of using instruments of the proper type and range.

6.4.6 *Bioassay Requirements:*

6.4.6.1 Describe the various techniques used to determine internal doses for the specific facility.

6.4.6.2 State the requirements for the baseline bioassay prior to starting work at the facility.

6.4.6.3 Describe the periodic bioassay monitoring methods and frequencies used during the conduct of work at the facility.

6.5 *Contamination Control:*

6.5.1 *Recognize Sources of Contamination at the Work Site:*

6.5.1.1 Define the term “contamination.”

6.5.1.2 Define contamination measurement units.

6.5.1.3 Describe sources of contamination, such as leaks, and maintenance that requires the opening of contaminated systems.

6.5.2 *Recognize Contamination-Control Areas:*

6.5.2.1 Describe the identifying features of contamination-control areas such as signs, ropes, and step-off pads.

6.5.2.2 Explain how and why to avoid contamination-control areas when possible.

6.5.3 *Protective Clothing:*

6.5.3.1 State the reasons for wearing protective clothing.

6.5.3.2 Locate where protective clothing requirements are found on an RWP.

6.5.3.3 State where clean protective clothing is stored and how it is issued for use.

6.5.3.4 Demonstrate the proper sequence for donning protective clothing.

6.5.3.5 Demonstrate the proper sequence for removing protective clothing.

6.5.3.6 Identify routes between dressing areas and work areas.

6.5.4 *Entering and Exiting Contaminated Areas:*

6.5.4.1 Describe the documentation requirements for entering and exiting contaminated areas.

6.5.4.2 Demonstrate the proper use of step-off pads.

6.5.4.3 Demonstrate the proper technique for entering and exiting a contaminated area in a manner that will minimize the spread of contamination between areas, to the body, and to the air.

6.5.4.4 Identify unusual incidents that require immediate exit from a contaminated area.

6.5.5 *Techniques for Preparing Work Areas to Minimize the Spread of Contamination:*

6.5.5.1 Explain the use of barriers such as floor coverings and ropes to minimize the spread of contamination.

6.5.5.2 Explain the use of contamination control equipment such as brooms, buckets, mops, vacuum cleaners, and other appropriate tools.

6.5.6 *Control of Dispersion of Radioactive Material While Working:*

6.5.6.1 Explain the difference between fixed and loose contamination.

6.5.6.2 State the effects of air movement on loose contamination.

6.5.6.3 Identify contamination indicators such as spills, leaks, and continuous air monitor alarms.

6.5.7 *Preventing External Contamination:*

6.5.7.1 State the reasons for avoiding areas with standing water on the floor.

6.5.7.2 State the reasons for avoiding contact with potentially contaminated surfaces and equipment.

6.5.7.3 State the reasons for avoiding contact of skin surfaces with potentially contaminated protective clothing.

6.5.8 *Airborne Contamination Controls:*

6.5.8.1 Describe equipment commonly used to control airborne contaminants (such as glove bags, tent enclosures, and ventilation systems) and demonstrate proper use if needed.

6.5.8.2 Explain how altering established airborne controls can affect radiological conditions.

6.5.9 *Control of Radioactive Waste Generation:*

6.5.9.1 Define “radioactive waste.”

6.5.9.2 Explain why it is important to limit the entry of tools, equipment, and packing containers into potentially contaminated areas.

6.5.9.3 Identify the methods available to decontaminate tools and equipment.

6.5.9.4 State the circumstances for reuse of tools and equipment with fixed contamination.

6.5.9.5 Explain why clean materials should be kept separate from contaminated or potentially contaminated materials.

6.5.10 *Control of Material Moved Into and Out of Radiologically Controlled Areas* (see **Note 7**):

6.5.10.1 Demonstrate how to bag, label, and transfer material into and between radiologically controlled areas.

6.5.10.2 Demonstrate how to properly survey material, tools, and equipment for contamination.

6.5.10.3 State the material release and documentation requirements.

6.5.10.4 State the labeling and tagging requirements.

6.5.11 *Methods for Personal Contamination Monitoring:*

6.5.11.1 State the self-monitoring requirements.

6.5.11.2 Demonstrate proper techniques for personal monitoring.

6.5.11.3 State the actions to be taken in case of an instrument alarm.

6.5.11.4 Identify the indicators of possible internal contamination.

6.5.11.5 Explain the purpose of applicable bioassays.

6.5.12 *Personnel Decontamination Techniques:*

6.5.12.1 State the location of the decontamination facilities.

6.5.12.2 Describe personnel decontamination methods.

NOTE 7—The Nuclear Facility Radiological Control Protection Organization would monitor and approve transfers from radiologically controlled areas to non-radiologically controlled areas.

6.6 *Respiratory Protection* (see **Note 8**):

6.6.1 *Respiratory Protection Characteristics:*

6.6.1.1 State the conditions required for classification of an area as an airborne radioactivity area.

6.6.1.2 Identify the pathways through which airborne radioactivity can enter the body.

6.6.1.3 Discuss possible indicators of airborne radioactivity in the absence of posted signs such as spills, leaks, vapor and cloudiness, or work in progress.

6.6.1.4 Identify the types of respiratory protection equipment, and specific limitations.

6.6.1.5 Define the term “protection factor” and specify the protection factor for each type of respirator.

6.6.2 *Qualification Requirements for Wearing Respiratory Protection Equipment:*

6.6.2.1 State the qualification policies for respirator use.

6.6.2.2 State the prerequisites for respirator use including physical examination, mask fitting, and training.

6.6.3 Requirements for Wearing Respiratory Protection Equipment:

6.6.3.1 Discuss the use of respiratory protection equipment for minimizing internal exposures. Explain considerations for use of respiratory equipment for particular tasks to balance internal exposure against external exposure and other hazards in order to maintain total exposure as low as reasonably achievable.

6.6.3.2 Locate where the respiratory protection equipment requirements are found on an RWP.

6.6.3.3 Locate where the stay-time requirements are found on an RWP.

6.6.3.4 Demonstrate how to properly don, remove, and use required respiratory protection equipment.

NOTE 8—29 CFR 1910 (13) and Z88.6 (14) provide additional requirements and background information for respiratory protection topics.

7. Keywords

7.1 radiation protection; radiation workers; training

REFERENCES

- (1) Regulatory Guide 8.27, “Radiation Protection Training for Personnel at Light-Water-Cooled Nuclear Power Plants,” U.S. Nuclear Regulatory Commission.
- (2) Institute of Nuclear Power Operators (INPO)/National Academy for Nuclear Training (NANT, Guidelines for General Employee Training (available to subscribers at <https://www.nanteI.org>).
- (3) Regulatory Guide 8.8, “Information Relevant to Ensuring That Occupational Radiation Exposures At Nuclear Power Stations Will Be As Low As is Reasonably Achievable,” U.S. Nuclear Regulatory Commission.
- (4) Regulatory Guide 8.10, “Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As is Reasonably Achievable,” U.S. Nuclear Regulatory Commission.
- (5) Regulatory Guide 8.13, “Instruction Concerning Prenatal Radiation Exposure,” U.S. Nuclear Regulatory Commission.
- (6) Regulatory Guide 8.29, “Instruction Concerning Risk from Occupational Radiation Exposure,” U.S. Nuclear Regulatory Commission.
- (7) Code of Federal Regulations, “Notices, Instructions, and Reports to Workers; Inspections,” 10 CFR Part 19.
- (8) Code of Federal Regulations, “Standards for Protection Against Radiation,” 10 CFR Part 20.
- (9) Code of Federal Regulations, “Occupational Radiation Protection,” 10 CFR 835.
- (10) ICRP Publication No. 60, “1990 Recommendations of the International Commission on Radiological Protection, Annals of the ICRP,” Vol 21/1-30.
- (11) NCRP Report No. 116, “Limitation of Exposure to Ionizing Radiation,” March 1993.
- (12) National Academy of Sciences, Health Risks from Exposure to Low Levels of Ionizing Radiation, BEIR VII-Phase 2, 2006.
- (13) Code of Federal Regulations, Occupational Safety and Health Standards, 29 CFR 1910.
- (14) ANSI Z88.6, American National Standard for Respiratory Protection—Respirator Use Physical Qualifications for Personnel.

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