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REGULATORY GUIDE

OFFICE OF STANDARDS DEVELOPMENT

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(Task OH 717-4)

RADIATION PROTECTION TRAINING FOR PERSONNEL AT LIGHT-WATER-COOLED NUCLEAR POWER PLANTS

A. INTRODUCTION

Section 19.12, "Instructions to Workers," of 10 CFR Part 19, "Notices, Instructions and Reports to Workers; Inspections," requires that individuals be given instruction in radiation protection that is commensurate with the potential radiation protection problems they may encounter in restricted areas as defined in paragraph 19.3(e) of 10 CFR Part 19. Paragraph 20.1(c) of 10 CFR Part 20, "Standards for Protection Against Radiation," states that occupational radiation exposure should be kept "as low as is reasonably achievable" (ALARA). Appropriate training is an essential aspect of an ALARA program. This guide describes a radiation protection training program consistent with the ALARA objective and acceptable to the NRC staff for meeting the training requirement of 10 CFR Part 19 with respect to individuals that enter restricted areas at nuclear power plants. Regulatory Guides 8.8, "Information Relevant to Ensuring That Occupational Radiation Exposures at Nuclear Power Stations Will Be As Low As Is Reasonably Achievable," and 8.10, "Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable," should be consulted with respect to other aspects of training within a complete ALARA program. Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants, LWR Edition," and Reference 1 should be consulted with respect to the license application review process.

This guide does not cover training necessary to qualify an individual as a radiation protection technician or professional. Regulatory Guide 1.8, "Personnel Selection and Training,"[1] should be consulted in this regard.

[1] In response to lessons learned from the Three Mile Island Accident, public comments, and additional staff review, a second proposed Revision 2 to Regulatory Guide 1.8 (Task RS 807-5) entitled "Personnel Qualification and Training" and its draft value/impact statement were issued in September 1980 for public comment.

B. DISCUSSION

Every job entails the acceptance of some risk. Many of these risks are obvious and easily recognized. Other hazards are more subtle and may not be recognized or appreciated without specific instruction. Radiation exposure is one of the subtle hazards. A person may be exposed to significant levels of radiation or to radioactive materials without knowing it since human senses will not detect ionizing radiation until exposure levels greatly exceed regulatory standards. For these reasons, instruction in radiation protection and an understanding of the occupational risks of work at nuclear power plants are essential.

Work at a nuclear power plant involves the potential for exposure to significant levels of ionizing radiation. The policy of the NRC is that radiation exposure should be kept "as low as is reasonably achievable" (ALARA). (ALARA programs at nuclear power plants are covered in Regulatory Guide 8.8.) Proper training in radiation protection is an essential part of an ALARA program.

It is not necessary for all plant personnel to become experts in radiation protection. However, it is important that every person receive training that is commensurate with his or her duties and responsibilities in restricted areas.

C. REGULATORY POSITION

1. GENERAL

Although training tailored to each individual's needs, is not necessary, each individual's primary and secondary duties and responsibilities as well as each individual's training and experience should be carefully considered in determining appropriate radiation protection training for that individual. It may be appropriate to determine the value of an individual's prior training and experience with respect to the present job requirements by means of a test. (See Regulatory Position 2.3.) The radiation protection

knowledge and experience of a worker's supervisor and the degree to which the supervisor's knowledge will be available to the worker in the performance of the worker's job may also be an important consideration.

Training should include classroom and on-the-job instruction and performance testing to document adequate understanding and skill. Such training should be provided by qualified personnel whose knowledge of the subject they are teaching exceeds that to be expected of workers completing the training. The radiation protection training should be conducted in such a way that the worker knows the specific objectives of the training and whether he or she has satisfactorily completed the training.

Although credit may be taken for applicable training received off site (its nature and applicability to onsite duties and responsibilities should be documented), plant-specific training should also be received with respect to appropriate aspects of those topics covered in Regulatory Position 3. Training may vary in length from a few minutes for some visitors, through a few hours for onsite orientation of a radiation protection professional, to a week (40 hours) or more for some workers without prior training in radiation protection and radiation work techniques. It is considered likely that most individuals working in areas where sources of radiation or radioactive materials (contamination) do not normally exist (e.g., clerical workers in restricted areas) may be trained as required by § 19.12 of 10 CFR Part 19 in 4 hours or less. Where more immediate potential hazards exist (e.g., in radiation or airborne radioactivity areas), it is considered likely that the most closely supervised workers with specific, narrow, well defined responsibilities may be trained in about 14 hours and that most workers operating independently under such conditions may be trained in 40 hours or less. As required in § 19.12 of 10 CFR Part 19, the extent of these instructions must be commensurate with potential radiation protection problems in the restricted area.

The use of trained workers as escorts for those who have not completed their radiation protection training or as a substitute for the training should be avoided (see Regulatory Position 2.2). Note that although providing a trained escort may reduce required training for those being escorted, it does not relieve the licensee from the requirement of § 19.12 of 10 CFR Part 19 for appropriate training of the persons being escorted. However, only those individuals "working in or frequenting...a restricted area" require training under § 19.12 of 10 CFR Part 19. If the individual being escorted is to be in a restricted area for long enough periods that training is required by § 19.12 of 10 CFR Part 19, such training should be completed in a timely manner in order to avoid the need for an escort and the unnecessary exposure of the escort to radiation or radioactive material.

The training program, including offsite, contractor-conducted, and prior training, should be approved by the nuclear power plant's radiation protection manager (see Regulatory Guide 1.8[1] for acceptable training and experience), conducted under the manager's continuing cognizance, reviewed[2] at least once every 3 years, and updated, as necessary, under the manager's direction. Changes to the program should be made promptly in response to changes in operations, technical specifications, regulations, etc.

The training described in this guide may be obtained in combination with other training when appropriate, e.g., an industrial safety training session could cover radiation protection as well as other occupational safety areas.

2. TRAINEES

2.1 Who Should Receive Radiation Protection Training

The training program should include all personnel, including supervisors, whose duties require them to work in or frequent restricted areas whether or not they are employees of the licensee. This includes visitors and transient workers.

Visitors are defined as people who enter the plant for purposes other than to work for the licensee and who are not expected to receive significant radiation doses although they may enter restricted areas incident to their activities (e.g., sales persons or students).

Transient workers are defined as people who enter the plant to work in restricted areas for a limited period of time and are directly involved in plant operations, maintenance or repair, or the direct support of these activities (whether or not they are employees of the licensee). Examples of transient workers are equipment manufacturers' representatives; individuals employed in maintenance work; nuclear steam supply system vendor personnel who assist with refueling, startup, or maintenance; vendor personnel employed to augment the radiation protection staff; transport workers; and licensee employees temporarily assigned to the nuclear power plant. Transient workers should receive onsite plant-specific training and should have a background of training in the more general (non-plant-specific) areas of radiation protection, as well as in the biological risks involved, of the same scope, depth, and quality as is required under § 19.12 of 10 CFR Part 19 for full-time onsite radiation workers doing the same or similar work. (Full-time onsite radiation workers may have knowledge and skills, perhaps as a result of working at more than one job at the plant, far exceeding the knowledge and skills that would be necessary to meet the training requirement of § 19.12 of 10 CFR Part 19.)

2.2 When Training Should Occur

The radiation protection training program should be scheduled so that each individual is trained in radiation protection prior to entering a restricted area. Every reasonable effort should be made to complete all training in a timely manner. In special cases where a worker or visitor must enter a restricted area prior to completion of the training, the individual should be escorted by a fully trained

[2] The review should include an examination of program effectiveness as evidenced by training program records.

and qualified person (such entries may be necessary for on-the-job training, etc.). Those individuals who will routinely be required to do site-specific work in restricted areas should receive onsite "field instruction" concerning the radiation protection aspects of their jobs prior to working in such areas.

The training program should include periodic refresher training as necessary to maintain awareness of the need for, and each individual's responsibility for, maintaining exposures ALARA and to update and renew each individual's knowledge of appropriate subjects as listed in Table 1. Refresher training should occur annually, as a minimum. Such training should not consist of a simple repetition of previous training without consideration of a worker's needs. Adequate training program records will be helpful in this regard. Meetings should be held as necessary to inform workers of important new developments in procedures, equipment, and regulations that have an immediate impact on the radiation protection aspects of their work. Recent plant radiation protection problems and the solutions to such problems should also be discussed by the training staff with participation of the radiation protection staff at these meetings. Special meetings for this purpose will not be necessary if opportunities for such discussions arise at meetings held for other purposes.

Appropriate training and testing should also be provided to those workers requiring new or refreshed knowledge because of reassignment. Reassignment to a new work area or job may present hazards of a different nature or degree from those associated with their previous job or work area. Similarly, reassignment to an area or job from which the worker has been absent for a substantial period of time may also call for additional training because of a loss of knowledge or skill with respect to that job or work area or changes in the radiation protection problems associated with the job or work area. Although reinstruction may be justified after shorter periods, a worker reassigned to a job or area from which the worker has been absent for a year or more should be reinstructed and tested with respect to the radiation protection aspects of that job or work area.

2.3 How Trainees Should Be Evaluated

Each worker's knowledge, competency, and understanding should be evaluated with regard to the radiation protection aspects of specific jobs to be performed. The evaluation may consist of a written or oral test only but should, in many cases, consist of a written test, an oral test, and a "practical" or on-the-job performance test. The evaluation should include a written test whenever practicable.

Oral tests should not be substituted for written tests unless the impracticability of administering a written test is established and documented on an individual case-by-case basis. However, oral and practical tests are a valuable adjunct to written tests giving the examiner an additional measure of trainee skills and appraising skills not tested by a written test. Everyone whose radiation protection depends on his or her effective use of equipment, facilities, or specialized procedures should be observed while using such equipment or facilities or implementing such procedures.[3]

All tests, including oral and practical tests, should have carefully developed bases in order to ensure that appropriate areas of knowledge and skill are covered. In preparing a test, consideration should be given to the job responsibilities, training received, and radiation protection experience of the individual worker.

Written tests will, of course, consist of a series of written questions to be answered by the worker. Similarly, oral and practical tests should, as a minimum, be based on check sheets or outlines showing the areas to be covered by the examiner. Oral and practical tests should be documented with respect to the questions asked, responses, performance areas covered, and level of performance by the worker.

High grades (i.e., 80% or higher) should be required on written and oral tests since each person's training should cover only radiation protection information relevant to the person's needs. The worker should be reinstructed and retested in any subject in which the worker's performance is deficient. The combination of testing and reinstruction should establish that the worker has the knowledge, understanding, and skill to work in a safe manner. Practical or on-the-job tests should be graded on a pass-fail basis. That is, the worker performs the task satisfactorily or is given additional training until satisfactory performance is obtained or is found unsuited for the job with respect to the job's radiological safety aspects.

The form of individual questions is the prerogative of the licensee. However, it should be noted that although true-false and multiple-choice questions are easy to grade and preferred by those taking tests, they lend themselves to guessing. Therefore, written tests may be most effective if they include essay or calculational type questions. Test questions should be of the types included in training session exercises or homework. Situation-type questions are especially desirable. In this type of question, a hypothetical (but credible) situation is described about which the worker is asked questions based on actual case histories.

Practical or on-the-job tests should not only stress knowledge but also proper performance on the job. A person may know what to do but be unable to do it in a timely manner when faced with a situation demanding expeditious action without a trial-and-error procedure. Practical tests should also give the examiner the opportunity to determine a trainee's attitude toward radiation protection and the ALARA concept.

[3] Such aspects of training are commonly referred to as "practical factors." Examples of these include the individual's ability to read all types of dosimeters to be used; properly don, use, and remove a full set of anticontamination clothing; properly enter, perform self-monitoring while occupying, and leave a contaminated area; properly work in containment areas (e.g., glove bags, tents); properly don, use, and remove respiratory protection equipment; and take proper action following a spill of radioactive liquid.

Written and practical tests should be designed to do the following:

a. Measure the individual's ability to recognize and cope with radiation hazards that may be encountered on the job.

b. Stress the importance of being prepared for work in restricted areas.

c. Assess the individual's knowledge of and attitude toward his or her rights and obligations as a worker from the standpoint of radiation protection.

d. Reinforce the key points of the training.

Tests should cover all information presented to the worker but should emphasize knowledge and practices directly related to the day-to-day radiation protection practices for each worker's job. As plant operating experience is gained, test questions should reflect radiation protection problems actually experienced at the plant.

Requalification testing should be carried out in conjunction with refresher training (see Regulatory Position 2.2). Satisfactory performance by an individual on a requalification test when the test includes all topics treated in the refresher training may be substituted for refresher training for that individual.

Whenever a test is used to help evaluate the knowledge and ability of an individual whose training and experience are not well known by the evaluator (e.g., the training and experience was not provided by the group performing the evaluation), it is especially important to keep in mind the limitations of such a procedure. When taking a test, a worker will not respond to the questions on the test by revealing all of his or her knowledge and abilities since a test that can be completed and evaluated in a reasonable period is not that comprehensive. The test simply samples the worker's knowledge and abilities. Therefore, the evaluator should carefully consider the test content and worker responses in light of the requirements of § 19.12 of 10 CFR Part 19 and the demands on the worker on the job.

Although training is usually thought of and implemented in a highly structured way, it should be kept in mind that a worker's performance on the job, following training, is the best measure of training effectiveness. In view of this, supervisors and radiation safety personnel should always be on the alert for worker performance characteristics that indicate the need for further instruction. Such experiences should also be considered when determining the training needs (both initial and refresher) of the workers and designing or revising training programs.

2.4. What Records of Training Could Be Maintained

Although NRC regulations do not require that records of radiation protection training at nuclear power plants be kept,[4] many nuclear power plant licensees have committed to keeping records of such training. A description of such records is included in technical specifications required by § 50.36 of 10 CFR Part 50 in accordance with Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants, LWR Edition."[5] Adequate training records will help eliminate unnecessary repetition of training and may also be used in determining the adequacy of an individual's training prior to each new work assignment. Periodic refresher training is encouraged, but unnecessary repetition of training should be avoided. Some workers (especially transient workers) may work in and be trained at several different nuclear power plants. Therefore, in the interest of improving the effectiveness of training and eliminating redundancy, training programs should be structured so that site-specific training and non-site-specific training may be readily identified in training outlines, syllabuses, other training materials, and records.

Such trainee-specific training records normally include:

a. The worker's name.

b. Inclusive dates for each segment of training or for each different training program.

c. A specific description of all training completed satisfactorily, including references to pertinent lesson plans, course outlines, syllabuses, and other subject-specific descriptive information. Specific reference is usually made to such materials by date, edition, issue, etc., applicable to each worker.

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

e. The source of the training, i.e., the training facility and its location.

To help prevent needless retraining of personnel, a statement containing the information described in items a, b, c, d, and e above on training received that may be applicable to work at another nuclear power plant is usually given to the worker for use if the worker is employed at a different plant. This procedure allows the person responsible for training at the second nuclear power plant to take the worker's previous training into account and thereby avoid needless repetition. Such records may be most useful to the worker in the new position if they clearly and explicitly describe all training received and clearly identify non-plant-specific training segments that may be applicable to work in the new position.

In order that there may be an adequate basis for periodic evaluation of the training program, the following additional records may be considered:

[4] However, records of radiation safety training, included as part of operator requalification training, must be kept as required by Appendix A to 10 CFR Part 55.

[5] See, for example, subsection 6.10.2h of Section 6, "Administrative Controls," of NUREG-0123, "Standard Technical Specifications for General Electric Boiling Water Reactors."

a. Training materials such as outlines, syllabuses, brochures, video tapes, 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 may be made to such materials by date, edition, issue, etc.

b. The name of each instructor and examiner involved in each segment of training or each different training program.

3. RADIATION PROTECTION TRAINING PROGRAM

3.1 Objectives

The primary objectives of the radiation protection training program should be to accomplish the following:

a. Ensure that all involved personnel are instructed about the biological effects of radiation, including both immediate and latent radiation effects, the risks associated with the acceptance of radiation exposure, and the basis for biological risk estimates.

b. Provide the information needed to enable each person to comply with plant rules and respond properly to warnings and alarms under both normal and accident conditions.

c. Provide information that will enable individuals to keep their own radiation exposures ALARA and effectively apply ALARA considerations in making decisions that affect the radiation exposure of others.

d. Provide the information needed to enable each person to comply with NRC regulations and license conditions.

Secondary objectives of the radiation protection training program should be to accomplish the following:

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

b. Ensure that (1) the status and extent of training of each individual may be determined in order to ensure that workers are adequately trained for each job to which they are assigned and (2) training is not repeated needlessly on site or at other facilities where the trained person may be employed (see Regulatory Position 2.4).

3.2 Content

The radiation protection training program should, in general, include the subjects listed in Table 1 and discussed in Sections 3.2.1 through 3.2.6. The inclusion of topics and the emphasis on each topic should be varied to meet the needs of each individual or group requiring training (see Regulatory Position 2.1). Instructors should consistently and closely adhere to lesson plans and outlines in order that training records (see Regulatory Position 2.4) accurately reflect the training given each worker. Appropriate reference documents covering essential facts, requirements, regulations, procedures, and plant organization should be given to each trainee. In those cases where it is clearly impractical to provide each trainee with a reference document, each trainee should be informed in writing of the times and locations at which the document will be readily and conveniently available.

3.2.1 Measurement and Control of Exposure to Radiation and Radioactive Material

Each worker should be informed that radiation and radioactive materials can be measured at levels significantly below regulatory limits and controlled by means of suitable design and procedural techniques. Workers and their supervisors should understand the elements of radiation measurement and control well enough to participate in the measurement and control programs in an effective manner consistent with the ALARA principle. Emphasis in radiation protection training should be on (a) sources of radiation (including, where appropriate, plant systems), (b) contamination control, (c) use of time, distance, and shielding to reduce doses, (d) proper use of dosimeters for measurement of beta, gamma, and neutron radiations, (e) the need for and proper use of respiratory protection equipment, and (f) the need for and proper use of protective apparel. Special attention should be given to item (e). It is essential that personnel who are likely to require the use of respiratory protection devices be trained in the proper use of these devices prior to their use for respiratory protection purposes. (See Regulatory Guide 8.15, "Acceptable Programs for Respiratory Protection," and Reference 2.)

Personnel having essentially unlimited access to all plant areas (i.e., freedom to go anywhere in the plant without escort or special instruction (e.g., without a radiation work permit) and, therefore, responsible for their own radiological safety) should acquire a detailed knowledge of sources of radiation and radioactive materials associated with all plant systems. Those areas, systems, and components that have associated with them the potential for acute lethal exposures (e.g., the fuel transfer system during spent fuel transfer) should receive special attention.

3.2.2 Radiation Protection Program

Each individual should understand the nature, scope, and objectives of the program, including pertinent portions of Federal regulations and plant radiation protection rules, administrative controls, and operating procedures. Controlling and minimizing occupational radiation exposure at a nuclear power plant in accordance with the ALARA concept is highly dependent on the procedures, rules, and administrative controls that implement the facility radiation safety program. It is therefore important that each individual be instructed in the latest versions of these procedures, rules, and controls. The meaning and importance of posted instructions, including radiation warning signs and tags, and the importance of following instructions should also be understood.

Emphasis should be placed on ALARA objectives, philosophy, and implementation within the radiation

protection program (see Regulatory Guide 8.8). This emphasis should include management's commitment to ALARA, the manner in which the radiation protection staff will implement ALARA, and the responsibilities of the individual worker within the ALARA program. The importance of controlling radiation doses to the worker and to others who may be exposed to radiation as a result of the worker's actions should be stressed.

The training should provide workers with an understanding of the relationship between the radiation protection program and their individual jobs and how and when they may or should request help from radiation protection personnel.

Pertinent license conditions, NRC regulations, and regulatory guides should be explained, not simply read or distributed, to those being trained.

3.2.3 Biological Effects of Radiation

Appropriate topics under this subject include the somatic and genetic risks to exposed individuals, their progeny, and exposed embryos/fetuses (see Regulatory Guide 8.13, "Instructions Concerning Prenatal Radiation Exposure"); the collective dose concept of risk;[6] risks associated with very high doses such as might occur in an accident; and the basis for biological risk estimates. To the extent practicable, the magnitudes of radiation risks relative to other more familiar risks encountered in life should be explained. References 3 through 9 are some relevant sources of information.

Persons who work in restricted areas or who make decisions affecting such work should be taught enough about radiation effects to permit appreciation of the importance and the implications of ALARA programs and requirements. Such persons should also be informed about the levels of radiation doses that persons working in restricted areas may normally receive (within the constraints of 10 CFR Part 20 and an appropriate ALARA program) and the risks associated with such doses.

3.2.4 Preparations for Emergencies and Incidents

Workers should know the appropriate response to alarms and other signals and should be sufficiently familiar with emergency procedures and preparations so as to know what is expected of them and from whom they can expect guidance with respect to emergencies and incidents. Preparations for emergencies and incidents that may be anticipated should be emphasized. Such emergencies and incidents include accidents involving severe personal contamination, spills of radioactive material, unexpected high levels of radiation or airborne radioactive materials, contaminated wounds, and fires that could result in unusual exposure to radioactive material or radiation.

The radiation protection training program should emphasize the emergency facilities and equipment as well as emergency exits, escape routes, and safe assembly points. Onsite instruction associated with appropriate plant areas is especially important to this phase of training.

3.2.5 Special or Nonroutine Work

Short-term training will be required from time to time in association with special or nonroutine work. The work may be considered special because of the equipment to be used, the procedures to be followed, or the radiation protection problems involved. Such training would normally be very limited in scope and should be considered as a supplement to, rather than a substitute for, the training described above.

3.2.6 Training with Mockups

Experience has established that training effectiveness is greatly enhanced when equipment or facility mockups are used, allowing workers to practice repair and maintenance procedures in a realistic context prior to entering areas in which a potential exists for exposure to high levels of radiation or radioactive contamination. This type of training is especially valuable in the case of repair and maintenance work involving tasks[7] that could result in high radiation doses to personnel in relatively short periods of time. When practicable, the mockups should be made to full scale and should incorporate components similar to those to be encountered in work on the equipment to be serviced.

A mockup of each piece of equipment and facility on which or in which high-man-rem tasks are anticipated should be used in plant-specific training for those workers who are to perform maintenance or repair work on the equipment or in the facility. Facility mockups are valuable in those cases in which work on a piece of equipment (e.g., a valve) requires the worker to gain access to or work in confined areas or areas containing complex equipment and strong sources of radiation. A facility mockup will allow the worker to practice entry, egress, and positioning within the facility so as to perform the necessary work in accordance with the ALARA principle.

Justification for the use of mockups in training should be established on an ALARA basis. An onsite evaluation is essential to such a determination. However, mockup training should be carefully considered by management for those tasks where the collective dose may exceed one man-rem. This should not be taken as a recommendation to ignore the feasibility of mockup training for lower-man-rem tasks. In the case of some lower-man-rem tasks, mockup training may be justified by the ready availability of uncomplicated mockups and the small amount of additional

[6] The collective dose concept applies to doses received collectively by all members of an exposed group. These doses, as well as individual doses, must be given due consideration in any radiation control plan and especially in a plan such as the plant ALARA program.

[7] For the purposes of this guide, a task is any work activity in a restricted area that may be defined by readily identifiable points of initiation and completion. Tasks may be simple or complex and may extend over long or short time periods. For example, refueling may be considered a long, complex task involving several smaller tasks such as head removal, internals removal, and fuel transfer, each one of which could be defined and associated with an estimated collective (man-rem) dose, i.e., the doses received collectively by all members of an exposed group.

effort required to integrate them into training. The desirability of mockup training should also be considered in light of the repetitiveness of a task. For example, the use of mockup training for a low-man-rem task may have the potential for a small one-time man-rem saving, but a significantly larger potential dose saving may be anticipated if the task is to be repeated many times.

4. RADIATION PROTECTION STAFF

The radiation protection staff should be thoroughly conversant with the materials discussed in Regulatory Position 3. Their knowledge should be of sufficient depth to qualify them to provide technical support to the training staff in the development and conduct of the radiation protection training. Further, they must be prepared to develop, modify, and implement the radiation protection program competently. Professional members of the staff will normally bring to the job the knowledge specified in Regulatory Guide 1.8, "Personnel Selection and Training."[1]

Many members of the radiation protection staff will have essentially unlimited access to all areas of the nuclear power plant (i.e., freedom to go anywhere in the plant without escort or special instruction (e.g., without a radiation work permit) and, therefore, responsible for their own radiological safety). Such individuals should have a detailed knowledge of and be thoroughly familiar with the type and magnitude of radiation protection problems associated with each and every plant system.

D. IMPLEMENTATION

The purpose of this section is to provide information to applicants and licensees regarding the NRC staff's plan for using this regulatory guide. This guide reflects practices currently acceptable to the NRC staff. Except in those cases in which the applicant or licensee proposes acceptable alternative practices or methods for complying with specified portions of the Commission's regulations, the practices or methods described herein will be used as a basis for evaluating applications for construction permits and operating licenses and (in conjunction with inspection of performance) for evaluating training programs established by licensees.

In the case of training programs at operating reactors, appropriate modifications to such programs should be made consistent with this guide as soon as practicable and no later than one year after publication of this guide.

Table 1*

APPROPRIATE SUBJECTS FOR A RADIATION PROTECTION TRAINING PROGRAM

1. Radiation Fundamentals

    a. The Nature of Radioactivity
    b. Sources of Radioactivity
        (1) Natural Background Sources
        (2) Manmade Sources

2. Measurement and Control of Exposure to Radiation and Radioactive Material (Contamination)

    a. Types of Radiation and Their Characteristics
    b. External Dosimetry**
    c. Controlling Exposure
        (1) Exposure Time Limitation
        (2) Distance Between People and Radiation Sources
        (3) Shielding
        (4) Source Strength Reduction (e.g., decontamination)
        (5) Use of Protective Apparel**
        (6) Respiratory Protection Devices and their Use**
    d. Sources (Origins) of Radioactive Materials (Contamination) and Radiations at the Plant
    e. Source Identification and Control
    f. Types and Forms of Radioactive Materials (Contamination)
    g. Detection and Control of Contamination**
    h. Radiation Measurement and Survey Instruments**
    i. Radioactive Wastes, Their Origins, Storage, Handling, and Disposal

3. Radiation Protection Program

    a. Purpose--Relationship to Individual
    b. ALARA Program
    c. Radiation Areas
    d. Airborne Radioactivity Areas
    e. Controlled Surface Contamination Areas
    f. Signs and Labels
    g. High Radiation Area Control
    h. Personnel Monitoring and Exposure Control
    i. Bioassay
        (1) Whole Body Counting
        (2) Urinalysis
        (3) Fecal Analysis
        (4) Avoiding Sample Contamination
    j. Investigation and Reporting of Abnormal Exposures
    k. Air and Area Monitoring
    l. Radiation Surveys--Purpose and Methods
    m. Rules and Procedures, Including Radiation Work Permits
    n. Pertinent NRC Regulations

*This table is not a course outline or order of presentation. Basic subjects (for example, vocabulary and basic math) necessary to an understanding of the listed subjects are not included. Also, subjects appropriate to a specific plant obviously are not included.

**See Section 2.3 with respect to the importance of "practical factors."

Table 1 (Continued)

(1) Dose Limits
(2) Concentration Values
(3) Reporting Requirements (10 CFR Part 20)
(4) Reporting Responsibility (§ 19.12 of 10 CFR Part 19)

o. Professional Guidance and Assistance
p. Detection and Control of Radioactively Contaminated Equipment and Detection, Control, and Removal of Radioactive Contamination from Personnel and Equipment

4. Biological Effects of Radiation

a. Carcinogenesis
b. Genetic Effects
c. Acute Effects
d. Latent Effects
e. Collective Dose Concept
(1) Group Total Man-Rem Risk
(2) Individual Dose Risk
f. Dose-Effect Relationship
(1) External Radiation
(2) Internal Radiation

5. Preparations for Emergencies and Incidents

a. Plant Safety and Accident Control Features
b. Signals and Alarms
c. Evacuation Routes and Procedures
d. Assembly Points
e. Communications
f. Guidance and Direction
g. Emergency Equipment
h. First Aid and Contaminated Wounds
i. Spills**

**See Section 2.3 with respect to the importance of "practical factors."

REFERENCES

1. U.S. Nuclear Regulatory Commission, NUREG-75/087, LWR Edition, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants."*

2. U.S. Nuclear Regulatory Commission, NUREG-0041, "Manual of Respiratory Protection Against Airborne Radioactive Materials," October 1976.*

3. National Academy of Sciences, National Research Council, "The Effects on Populations of Exposure to Low Levels of Ionizing Radiation," Washington, D.C. 20418, July 1980.

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5. National Safety Council, "Accident Facts," published annually, 444 N. Michigan Avenue, Chicago, Illinois 60611.

6. International Commission on Radiological Protection, ICRP-27, "Problems Involved in Developing an Index of Harm," Pergamon Press, Maxwell House, Fairview Park, Elmsford, New York 10523, May 1977.

7. United Nations Scientific Committee on the Effects of Atomic Radiation, United Nations Publication Sales No. E.77.IX.1, "Sources and Effects of Ionizing Radiation," New York, New York 10001, 1977.

8. U.S. Department of Health, Education and Welfare (currently the Department of Health and Human Services), "Report of the Interagency Task Force on the Health Effects of Ionizing Radiation," Washington, D.C. 20201, June 1979.

9. U.S. Nuclear Regulatory Commission, Draft Regulatory Guide OH 902-1, "Instruction Concerning Risk from Occupational Radiation Exposure," under development, issued May 1980.*

*NUREG-series documents are available at current rates and draft regulatory guides are free upon request through the Distribution Services Section, Division of Technical Information and Document Control, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555.

VALUE/IMPACT STATEMENT

1. THE ACTION

1.1 Description

Nuclear power plant personnel, in accordance with 10 CFR Part 19, must receive training in radiation protection to ensure that they are aware of and prepared to cope with radiological hazards. The training must be commensurate with the individual's duties and responsibilities. Paragraph 20.1(c) of 10 CFR Part 20 states that occupational radiation exposure should be kept "as low as is reasonably achievable" (ALARA). Appropriate training is an essential aspect of an ALARA program. Regulatory Guide 8.27, "Radiation Protection Training for Personnel at Light-Water-Cooled Nuclear Power Plants," discussed in this statement, will furnish guidance on the extent of training necessary in radiation protection training programs.

1.2 Need

Available information indicates that radiation protection training programs exist at all nuclear power plants but that there are wide variations in program scope and depth among plants. In some instances, programs include requirements that are needlessly expensive and time consuming. In other cases, the need for guidance with respect to program content is indicated by deficiencies in applicants' program descriptions. This regulatory guide establishes the NRC staff position regarding acceptable training programs and provides a basis for the evaluation of such programs.

Training is a major factor in controlling exposure. In the action plan (SECY-77-54)* prepared by the NRC Task Group on Occupational ALARA, guidance on training was given top priority. This regulatory guide will meet the relevant recommendation of the task group.

1.3 Value/Impact

1.3.1 NRC

Value - This guide provides a basis for staff review of applicants' commitments to radiation protection training and licensees' radiation protection training programs and provides a basis for NRC inspection of the programs to ensure that they are conducted as approved.

Availability of the guide should result in more effective and efficient evaluation of training programs and acceptably small time and manpower requirements for evaluating the training programs. Without the guidance, program evaluation is ineffective or highly time consuming.

The principal value to the staff of providing the guidance is that it seems the most cost-effective way of ensuring adequate training programs.

Impact - No impact is foreseen.

1.3.2 Other Government Agencies

Not applicable, unless the government agency is an applicant or licensee.

1.3.3 Industry

Value - The guidance is expected to benefit applicants by reducing occupational radiation exposures. Experience shows that exposure reduction is truly cost reduction. Secondary benefits expected include improved labor relations and, possibly, improved relations with the public. Also, the preparation and maintenance of suggested training records** may result in the elimination of redundant training and, consequently, in reduced costs.

Impact - It will be necessary for applicants (or their contractors) to spend additional time describing their programs in their safety analysis reports (SARs) if they choose alternatives other than those provided in the guide. Because of training program variability, improvements in licensee training programs may be necessary in some instances. However, the added cost from this action is not expected to be great since (1) program descriptions are necessary for internal purposes (e.g., to ensure uniform and adequate training), (2) existing training programs are normally revised periodically, (3) the guidance is based on a regulatory requirement that has been in effect for several years, (4) the guidance represents current staff practices, and (5) nothing in the guide is intended to increase current recordkeeping requirements.

1.3.4 Workers

The guide should result in improved worker protection by helping to ensure that the individual worker has enough knowledge to work safely, use available protective measures, and obtain appropriate guidance in accordance with ALARA concepts.

1.3.5 Public

Value - The general public should benefit to some extent from a reduction in occupational exposure and heightened awareness of radiological hazards.

*This Commission paper, dated February 4, 1977, is available for public inspection or copying for a fee at the NRC Public Document Room, 1717 H Street NW., Washington, D.C.

**Training records are covered in standard technical specifications referenced in Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants, LWR Edition," which is based on §50.36 of 10 CFR Part 50.

Impact - No direct impact on the public is foreseen.

2. TECHNICAL APPROACH

Although there will be technical alternatives in the development and conduct of training programs based on the guide, only procedural alternatives were available in preparing the guide.

3. PROCEDURAL APPROACH

3.1 Procedural Alternatives

Several methods of issuing the proposed guidance were considered, including an NRC regulation, an ANSI standard endorsed by a regulatory guide, a NUREG-series report, a branch position, and a regulatory guide. These are discussed in Section 3.2.

3.2 Value/Impact of Alternatives

An NRC regulation requires a complex and time-consuming legal procedure that is more suitable for general requirements than specific guidance. Regulations do not generally contain the detail included in the guide. The difficulty involved in revising the guidance would be greater for this alternative than for the others. An advantage would be that the regulation would legally require conformance, whereas the other alternatives would not. In general, however, the relatively narrow subject matter does not warrant use of this alternative.

No ANSI standard on the subject is known to be under preparation. This procedure could be logically undertaken by the Health Physics Society as an addition to the ongoing ANSI N13 Committee activities. However, past history of these working groups indicates that standards developed by them cover a much broader base and usually require more than 2 years for development. Issuance of an endorsing regulatory guide would take an additional year or more. As with the regulation alternative, it is believed that the narrow subject matter and the time involved work against use of this alternative.

NUREG-series reports can be prepared and published more rapidly than can the other alternatives. By NRC practice, however, a NUREG-series report cannot contain regulatory positions. Since positions are an integral part of the guidance, use of a NUREG-series report is not suitable.

The Office of Nuclear Reactor Regulation has not yet prepared a branch position on this subject and has indicated that a regulatory guide on the subject would be appropriate. Also, branch positions have limited circulation and are considered to be temporary measures that are to be used only until a more permanent mode of guidance can be issued.

The issuance of a regulatory guide is the most appropriate alternative in terms of time, content, and application. Also, the development of a regulatory guide provides for comments by interested persons.

3.3 Decision on Procedural Approach

A regulatory guide based on discussions with and comments from the various interested parties was determined to be the best approach.

4. STATUTORY CONSIDERATIONS

4.1 NRC Authority

Section 19.12 of 10 CFR Part 19 requires that personnel be given instruction in radiation protection that is commensurate with the potential radiological health protection problems encountered by these personnel.

4.2 Need for NEPA Assessment

The issuance of the guide is not a major action. The guide merely explains and elaborates on an existing requirement (§ 19.12 of 10 CFR Part 19). There will be no effect on the environment. Therefore, there is no need for a NEPA assessment.

5. RELATIONSHIP TO OTHER EXISTING OR PROPOSED REGULATIONS OR POLICIES

When Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants, LWR Edition," is next revised, consideration should be given to including at least those portions of this guide that deal with information to be included in SARs.

This guide is consistent with and cross-references Regulatory Guides 8.8, "Information Relevant to Ensuring that Occupational Exposures at Nuclear Power Stations Will Be As Low As Is Reasonably Achievable," and 8.10, "Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable." When these two guides are revised, consideration should be given to referencing this guide.

6. SUMMARY AND CONCLUSION

The values and impacts of the action will vary widely from plant to plant. In some cases, impacts may outweigh values; in others, the reverse will be true. In general, however, it was the expert judgment of the ALARA task group that the value will be greater, in general, than the impact. Therefore, the regulatory guide has been issued.

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