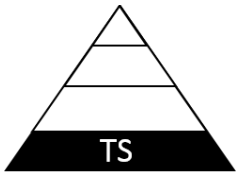

NOT MEASUREMENT SENSITIVE

DOE-HDBK-1130-2022

November 2022

DOE HANDBOOK

RADIOLOGICAL WORKER TRAINING

U.S. Department of Energy

Washington, DC 20585

AREA TRNG

Available to the public on the DOE Technical Standards Program Web Site at
https://www.standards.doe.gov

FOREWORD

DOE-HDBK-1130-2008, Radiological Worker Training (RWT) was initially developed to describe an implementation process for RWT and to assist those individuals within the Department of Energy (DOE), Managing and Operating contractors, and Managing and Integrating contractors in developing a RWT program. Since the last revision, training programs have matured, and this handbook has been revised to reflect current radiological training as well as the modality of the training. The revision contains a RWT course lesson plan template that meets the requirements specified in 10 CFR part 835, *Occupational Radiation Protection*, and restructures RWT by creating modules that address the variety of risks associated with DOE operations and is commensurate with the associated hazards. It also helps facilitate reciprocity for use across the DOE complex in support of DOE Policy 364.1, Health and Safety Training Reciprocity (DOE P 364.1), that establishes training reciprocity to improve efficient use of Departmental resources.

The handbook has been revised to:

- Develop a Radiological Worker Training course lesson plan that meets the requirements specified in 10 CFR § 835.901 and provides the worker with enough knowledge to identify potential radiological hazards and maintain exposure to radiation As Low As Reasonably Achievable (ALARA).
- Restructure RWT by creating modules that would address the variety of risks associated with DOE operations and be commensurate with the associated hazards.
- Promote reciprocity for use across DOE complex (does not include Site Specific information such as specific hazards, work control and radiation work permits).
- Achieve standardization of core material provided by the National Training Center (NTC) for use across DOE complex.
- Allow DOE NTC to provide a mechanism for distribution of training material across the DOE complex (not including site-specific training requirements such as specific hazards, work control, radiation work permits).
- Allow for the incorporation of lessons learned, policy updates, changes to regulations, and best practices through the existing NTC course maintenance process with technical support from the Office of Worker Safety and Health Policy, EHSS-11.

Table of Contents

1 INTRODUCTION

NOTE: The numbering and sequence of the information presented in the handbook and Appendix A do not imply a required sequence for the course as presented to the student.

1.1 PURPOSE

This document describes the radiation safety training recommended to comply with 10 CFR part 835, DOE policies, and standards. Occupational DOE radiation safety training consists of fundamental core curriculum provided through the DOE National Training Center (NTC). Appropriate facility and site-specific instruction should also be completed before qualification.

Fundamental radiation safety training applies to all individuals performing occupational radiological activities within the DOE enterprise. In accordance with 10 CFR §835.901, radiation safety training will be provided when there is a significant change to radiation protection policies and procedures that may affect the individual and at intervals not to exceed 24 months.

DOE Policy 364.1, Health and Safety Training Reciprocity (DOE P 364.1), establishes a policy for training reciprocity that allows efficient use of Departmental resources. DOE P 364.1 reduces the time employees spend accomplishing Departmental missions. The Fundamental Radiation Safety Training content presented in this Handbook was developed following DOE training guidance and has been approved for reciprocity certification according to DOE P 364.1. This Handbook was created to achieve maximum training content transportability between DOE organizations.

1.2 COMPLIANCE WITH 10 CFR PART 835

The DOE fundamental training materials for Radiation Worker Training (RWT) reflect the requirements identified in 10 CFR § 835-Subpart J, *Radiation Safety Training*. Training material was developed using a Systematic Approach to Training and the Analyze, Design, Develop, Implement and Evaluate (ADDIE) model principles.

When implemented in its entirety and supplemented with the appropriate site and facility-specific information, this handbook will meet the requirements of 10 CFR § 835-Subpart J for radiation safety training. Final worker qualifications should be conducted within the context of other contractually required programs such as Integrated Safety Management .

The training described in this handbook does not eliminate the need to consider additional training for site and facility-specific hazards as described in the DOE-approved Radiation Protection Program. Training should be appropriate for the work activity and commensurate with radiological hazards and the degree of exposure to potential radiological hazards.

1.3 TRAINING PROGRAM GOAL

The Fundamental Radiation Safety Training Program's goal is to provide knowledge of the DOE radiological program that applies to all DOE activities. Radiation Safety Training should be augmented by facility and site-specific information necessary to perform work safely while implementing appropriate As Low As Reasonably Achievable (ALARA) principles.

1.4 TRAINING PROGRAM DESCRIPTION

Radiation safety training, such as General Employee Radiological Training (GERT), is intended for workers whose job assignments require unescorted access to controlled areas, radiological buffer areas and, radioactive material areas. Radiological Worker Training (RWT) is intended for radiological workers whose job assignments require unescorted access to 10CFR835 defined Radiological Areas and for those workers who handle radioactive material or provide emergency response.

Unescorted entry to other areas containing potential radiological hazards requires additional training. Additional requirements for training may occur in the Contractor Radiation Protection Program or other training commitments. Appendix A, *Fundamental Radiological Worker Training Module Objective*s, provides the learning objectives for the elements applicable to all DOE activities.

Required Fundamental Radiation Safety Training knowledge can be achieved through eLearning, instructor-led delivery, or virtual delivery as determined by the facility. Training providers can change the delivery modality and add additional core training information and should maintain alignment with the DOE National Training Center reciprocity evaluation program. Providers cannot eliminate Appendix A course content. A minimum passing grade of 80 percent is required for final qualification.

The Fundamental Radiation Safety Training duration will vary and be commensurate with facility hazards, the amount of facility-specific information required, and the material presented. A challenge exam is not permitted for initial training.

If desired, organizations may offer a challenge exam for retraining, providing the passing grade is a minimum of 80 percent. The challenge examination should address the knowledge portion of the Fundamental Radiation Safety Training.

Retraining in accordance with 10 CFR §835.901 is also required when significant changes to radiation protection policies and procedures may affect the individual. Refresher training is further discussed in Sections 3 and 4 of this Handbook.

After satisfactory completion of the Fundamental Radiation Safety Training, but before final qualification, personnel should complete appropriate training for facility and site-specific activities, policies, procedures, hazards, and lessons learned. Responsible organizations

should establish performance evaluations or practical factors that individuals should complete before the final radiological worker qualification. Materials developed to support training should be documented in accordance with 10 CFR 835.704, Administrative Records.

2 RADIATION SAFETY TRAINING STRUCTURE

Individuals who enter controlled areas (as defined by 10 CFR §835.2(a)) and encounter radiological barriers, postings, radiation producing devices, or radioactive materials are required to receive radiation safety training such as General Employee Radiological Training (GERT) in accordance with 10 CFR §835.901(a).

Fundamental RWT consists of the content described in Appendix A. RWT is provided to individuals who are permitted unescorted access to radiological areas or perform unescorted assignments as a radiological worker. RWT consists of a fundamental module, facility and site-specific training, a performance demonstration, and additional modules commensurate with the hazards of the work being performed.

2.1 RADIOLOGICAL WORKER TRAINING MODULES

RWT consists of two modules: 1) supports fundamental training, and 2) reflects facility activities and site-specific topics required for the hazards of the work being performed. The individual modules cover a variety of radiological topics and specialty areas. All radiological workers should complete the Fundamental Radiation Safety Training topics described in Appendix A.

Additional radiation safety training should be completed depending on the hazards of the work being performed. This additional training addresses topics not covered in the Fundamental Radiation Safety Training, such as contamination control, high and very high radiation areas, airborne radioactive material areas, and their respective controls and hazards. Table 1 summarizes a job assignment approach to define appropriate training.

2.2 IDENTIFYING ADDITIONAL TRAINING REQUIREMENTS

Additional radiation safety training modules should be identified by an appropriate task analysis and commensurate with the hazards present at the facility, site, or area and the work being performed. As required by 10 CFR 835.501(d), written authorization is required to control entry into and complete work within radiological areas. These authorizations identify the radiation protection measures and training required for existing and potential hazards.

Table 1: RADIATION SAFETY TRAINING SUMMARY

Activity	Training
Unescorted access to a Controlled Area	GERT
Entry into a Radioactive Material Area where an individual has the potential to receive occupational radiation exposure	GERT
Unescorted entry into radiological areas as defined in 10 CFR 835.2(a).	Complete Fundamental RWT plus organization-specific training based on actual and anticipated radiological hazards. Complete an examination and performance demonstration that verifies critical knowledge, skills and abilities.
Specific radiological assignments such as containment installation and removal, job-specific radiological support, maintenance and repair of radiological support equipment, additional supervisory training, and emergency or off-normal response actions	Appropriate training as described above and additional radiological training as determined by an appropriate task analysis.

3 GENERAL EMPLOYEE RADIOLOGICAL TRAINING

3.1 OVERVIEW

General Employee Radiological Training (GERT) is provided to all individuals with the potential to receive occupational exposure during access to controlled areas (as defined in 10 CFR 835.2(a)) or who are permitted unescorted access to controlled areas. These individuals may routinely enter controlled areas and encounter radiological barriers, postings, radiation-producing devices, or radioactive material. Employee responsibilities for observing and obeying radiological postings and procedures should be emphasized during the GERT course. GERT does not provide training for unescorted individuals who enter radiological areas or perform duties as radiological workers.

3.2 LESSON PLAN

GERT is intended to fulfill the training required by 10 CFR 835.901 for workers who require

unescorted access to controlled areas and radioactive material areas as summarized in Table 1 of this handbook and who will not perform unescorted assignments as a radiological worker

The DOE National Training Center maintains an eLearning delivery of a GERT course that is certified for reciprocity in accordance with DOE P 364.1. Organizations should accept verification of completion as adequate for entry to controlled areas. Training organizations are encouraged to seek reciprocity certification for locally maintained GERT training.

Fundamental GERT material is approximately 1 hour in length but will vary depending on the amount of facility-specific material added. Topics will include Sources of Radiation, Non-ionizing and Ionizing Radiation, Risks in Perspective, Radiological Controls, Monitoring (Dosimetry), Emergency Procedures, ALARA Program, Employee Responsibilities, and Exposure Reports.

3.3 GERT PROFICIENCY REQUIREMENTS

In accordance with 10 CFR 835-Subpart J, each individual must complete training on the topics established in 10 CFR 835-Subpart J, commensurate with the hazards in the area and required controls, before being permitted unescorted access to controlled areas. Training is also required when the potential to receive occupational radiation exposure exists during access to controlled areas.

3.4 GERT RETRAINING

In accordance with 10 CFR 835-Subpart J, training will be provided when there is a significant change to radiation protection policies and procedures that may affect the individual and at intervals not to exceed 24 months.

Training should include selected fundamentals, recent DOE-wide lessons learned and seldom-used knowledge and skills. Training should be tailored to subjects that trainee evaluations and experience indicate are needed.

A self-study method may be used, when possible, for retraining. The self-study method allows workers to review the training material followed by a presentation of any updates, facility changes and lessons learned.

4 RADIOLOGICAL WORKER TRAINING

4.1 OVERVIEW

RWT is provided to individuals who are permitted unescorted access to radiological areas or perform unescorted work activities as a radiological worker. RWT consists of fundamental radiation safety, facility and site-specific training, and a performance demonstration. Training

should be commensurate with the hazards in the area and required controls.

4.2 FUNDAMENTAL RADIATION SAFETY TRAINING

Fundamental Radiation Safety Training varies in length depending on the amount of facility and site-specific material added. All newly qualifying radiological workers are required to complete the Fundamental Radiation Safety Training module. Workers will also be required to pass a final test with a minimum score of 80 percent.

4.3 PERFORMANCE EXAMINATION

10 CFR 835-Subpart J requires that individuals demonstrate knowledge of the radiation safety training topics established in 10 CFR 835, Subpart J, commensurate with the hazards in the area and required control by completing an examination and performance demonstrations before being permitted unescorted access to radiological areas and before performing unescorted work activities as a radiological worker. A written examination, with a minimum score of 80 percent, and a performance demonstration (practical factors evaluation) are used to demonstrate satisfactory completion of the Radiation Safety Training.

Computer-based and other electronic methods of examination are acceptable. NTC maintains an exam bank that satisfies the learning objectives identified in Appendix A. If computer-based training and examination are used, sites need to ensure that the testing process meets the requirement that individuals demonstrate an acceptable baseline knowledge of radiation protection fundamentals and practices. Programs that allow trainees to pass the examination based on trial and error or allow unlimited attempts without requiring retraining are inconsistent with the requirement and not allowed.

4.4 RWT RETRAINING

10 CFR 835-Subpart J requires that Radiation Safety retraining be provided when there is a significant change to radiation protection policies and procedures that may affect the individual and at intervals not to exceed 24 months. This includes the requirement of passing an examination.

Retraining is intended to maintain and enhance the proficiency of the worker. In addition to the requirements for retraining required by 10 CFR 835, retraining may be implemented in response to observations or indications of poor or degrading radiological performance. See Section 8 for additional information.

Retraining should include changes in requirements and lessons learned from operations and maintenance experience, and occurrence reporting for the site and across the DOE complex. The following topics may be included:

- New procedures and changes to existing procedures,

- New equipment and changes or modifications to existing equipment or facilities,
- Lessons learned from facility and site operating experiences,
- Lessons learned from industry operating experiences,
- Identified deficiencies from post-training evaluations.

Retraining should include selected fundamentals from the initial training, DOE-wide lessons learned, and seldom-used knowledge and skills. Retraining should present any updates or changes to the program and recent lessons learned. Retraining should be tailored to subjects that trainee evaluations and experience indicate are needed.

A self-study method may be used for retraining. An example of self-study is allowing workers to self-study the training material before completing the examination and applicable practical exercise.

4.5 TRAINING CONTENTS

The fundamental RWT will include the topics described in Appendix A. Additional training modules such as High Radiation, Very High Radiation, and Contamination Area are required if they are commensurate with the hazards present at the facility and in the area of the work being performed.

Training should be completed for non-routine operations, activities, and work in areas with changing radiological conditions. This training is in addition to the fundamental RWT described in Appendix A and is required for personnel planning, preparing, and performing jobs that have the potential for high radiological consequences. Such jobs may involve special containment devices, the use of mockups, and ALARA considerations.

5 FACILITY AND SITE-SPECIFIC TRAINING

Facility and site-specific training will consist of information directly related to the activities and hazards associated with the facility's mission. Training developed by the facility staff should be input into the DOE National Training Center Course and Related Data System (CARDS) for other DOE contractors. This action will support the development of standardized training materials that are common to more than one contractor. Contact the NTC for assistance accessing CARDS.

It is appropriate for facilities to supplement a visiting radiological worker’s training with facility and site-specific training sufficient to ensure an adequate level of training for the hazards present. Depending on radiological hazards, it may also be appropriate to confirm the adequacy of the worker’s training with an examination and practical evaluation.

Site-specific training aids may be developed at the facility to suit individual training styles. Each site may add information, activities, a glossary, and graphs to enhance the training. Topics for consideration to be included in facility and site-specific training may include the following:

- Identification of radiological areas and applicable materials needed to enter the area,
- Familiarity of Radiation Work Permits (RWP) and the information on the RWP (or equivalent work authorization document),
- Facility requirements to select and don protective clothing and dosimeter(s) as per RWP,
- Removal of protective clothing and dosimetry,
- Personnel monitoring for contamination,
- Response to abnormal radiological conditions and alarms,
- Work procedures and or task assignments,
- Radiological survey maps.

6 INSTRUCTION AND DELIVERY DESCRIPTION

Instructor-led training that uses multi-delivery modalities allows students to adjust their learning process based on abilities and defined outcomes. Instructor-led training also allows for practice and coaching to build confidence and critical skills proficiency. The peer training model enables the development of an emotional connection and improves overall adult learning. Evaluation of radiation worker proficiency skills should be done using in-person training.

6.1 INSTRUCTOR QUALIFICATIONS

Course instructors should complete either an organization-sponsored qualification program or achieve the NTC Instructor Certification. Instructors should have the technical qualifications, including theory, practical knowledge, and experience that is applicable to RWT.

NOTE: The National Institute of Environmental Health and Science Worker Training Program (WTP) grantees complete the instructor training and qualification described in the WTP Minimum Criterion Document. Contractors are encouraged to grant reciprocity or equivalency for the WTP grantee instructor qualification.

6.2 DELIVERY MODALITY AND USE OF TECHNOLIGY

Training should be conducted using a demonstration of theory and practical applications that

apply to the radiation worker. Technology integration is the blending of all delivery modalities, including computer-related learning activities, into the curriculum so students can acquire, organize, demonstrate, and communicate information.

Computer-Based Training (CBT) or eLearning can be used to deliver and access training programs. CBT can be web-based, mobile, or through other applicable formats. This form of training is beneficial for students who need general knowledge or skills for Radiation Worker Training. Trainers should ensure that this modality for initial RWT training is adequate to address possible additional learning needs for students who do not have science or physics backgrounds.

6.3 INSTRUCTOR RESPONSIBILITIES

Methods should be implemented to ensure that individual instructors meet and maintain instructional and technical position qualification requirements. Instructors' developmental and instructional qualifications should include theory, practical knowledge, and work experience in analyzing, designing, developing, conducting, and evaluating training appropriate to their job assignments. Adult learning methodologies show that adults learn best when the:

- learning is self-directed,
- learning is experiential and uses background knowledge,
- learning is relevant to current roles,
- instruction is activity-centered and,
- students are motivated to learn.

7 TESTING AND PRACTICAL FACTORS

Testing indicates when additional training is necessary based on mastery of approved learning objectives by documenting the learning status at the end of the training. Testing is typically performed for three purposes. A pre-training test or challenge exam demonstrates prerequisite knowledge for requalification. A post-training test verifies that the student understands the training materials and indicates training improvements. A third testing may be considered to aid in evaluating long-term retention of knowledge or identifying weaknesses contributing to field implementation problems.

7.1 MINIMUM PASSING GRADE

A good test reveals more than employee competence. It can also identify weaknesses in RWT and demonstrate areas where the program needs improvement. The minimum passing grade for the DOE radiation worker is 80 percent. A challenge exam is not appropriate for

initial qualification.

7.2 PRACTICAL FACTORS

Organizations should establish practical factors based on their hazards and task analysis. Practical factor training and testing are task-oriented and based on the radiological hazards that an individual may encounter as a qualified radiation worker.

Practical factor training and testing align job performance and behaviors to the organization's standards. It is recommended that a mentored practice session be performed before an evaluated practical exam. The practice session identifies weaknesses and reinforces proper performance and techniques.

Students should be trained in an environment that replicates the work environment to the maximum extent possible. The practical factor training should include the use of protective clothing, personnel monitoring equipment and devices, ALARA techniques and, proper response to unplanned radiological hazards or emergencies.

Final qualification requires verification of job performance for the known or potential radiological hazards. Practical factors should be performed such that the trainee is evaluated using pre-approved performance criteria without mentoring or coaching during the practical exam. Identified unsatisfactory performance weaknesses should be upgraded and reevaluated in the realistic exam setting before final qualification. Reperformance must be documented.

Organizations should establish minimum passing criteria based on the training and job hazard analysis supporting final radiation worker qualification. The evaluation should measure critical skills as pass-or-fail and include verification of the organization's desired best practices.

7.3 DEVELOPMENT OF PERFORMANCE EVALUATIONS

Performance demonstration evaluations are intended for students to demonstrate to the evaluator that they are competent to perform the necessary actions and responses to the relative radiological conditions. The evaluation should accomplish verification of general radiological activity knowledge applicable to the organization and the hazard. One on one evaluations are most desirable but there may be some applications for a group evaluation.

The information below provides the minimum expectations for the development of the student performance evaluation. Some items may be considered facility and site-specific.

- Understanding the radiological conditions and hazards associated with work activities based on the content of the work package and radiological survey,
- Reading and understanding the content of the RWP or equivalent work

authorization document,

- Expected dose rates and dosimetry requirements for the work activities,
- Expected removable contamination levels,
- Established stop work limits,
- Requirements for Radiological Control Technician (RCT) monitoring support,
- Actions to take when encountering unplanned work or radiological conditions,
- Who to contact for radiological questions or concerns,
- Satisfactorily complete established procedures for donning and doffing protective clothing without spreading contamination,
- Demonstrating the proper response actions for unplanned radiological conditions or emergencies,
- Understanding the requirements to remove materials from a radiological area,
- The worker's right to voluntarily declare pregnancy and the process to implement ALARA for the individual,
- Organization occupational radiological emergency responses applicable to the radiological worker,
- Completing other performance evaluations determined by the organization as needed to verify the worker's ability to perform safe occupational radiological activities.

8 TRAINING PROGRAM EFFECTIVENESS

8.1 MEASURING EFFECTIVENESS

Verification of the effectiveness of DOE Radiological Control training should be accomplished through the implementation of a continuing performance-based evaluation program. Feedback, tracking, and trending of radiological training helps evaluate the occupational radiological program performance and measure effectiveness. The program should include elements that monitor student feedback, exams, and practical performance.

The program should also monitor workers' performance during radiological activities. In addition to the required 10 CFR 835 assessment program that evaluates radiological training every 36 months, additional training assessments should be conducted at least annually or more frequently. Organizations should have measures in their quality programs (such as the Contractor Assurance System) that establish leading and lagging indicators of radiological performance.

Training and qualification programs require a significant investment in equipment, materials, and personnel resources. Evaluations of a training program's effectiveness in producing competent employees are conducted to ensure that training is conducted consistently, cost-effectively, and efficiently. Performance based training goes beyond minimum compliance.

Ideally, minor weaknesses should be identified, and corrective actions should be implemented that eliminate or prevent significant issues during work. The entire life cycle of work should have monitoring tools in place to aid in achieving continuous radiological improvement. Post-training evaluations should be used to identify opportunities for improving course materials, upgrading instruction methods and techniques, and the need for additional training. Retention testing should indicate when individual performance or knowledge fails to meet expectations. Corrective actions for deficiencies identified during assessments should be incorporated into the site's training program on an appropriate schedule. The training assessments should identify:

- program strengths and weaknesses,
- whether worker performance has improved or deteriorated,
- if the program content matches current job needs and,
- what corrective actions are needed to improve program effectiveness.

8.2 FEEDBACK

Solicit and monitor student feedback immediately following exams and practical performances. Student feedback provides the training program with how effective and useful the training and information presented is to their work in the field.

Periodically interview workers to determine if the workers think that the previously received training is applicable and helpful in their routine radiological work. Use this feedback to make applicable changes and improvements to the training, both methodology of training delivery and training content.

Perform assessments of the training as outlined in Section 8.1. Evaluating the training and identifying deficiencies will help improve the training and help justify the need for resources for the training and the relative improvements. Trainers should provide training revision recommendations to the NTC to aid in improving course materials. Recommendations may be submitted to the NTC through the NTC website Contact Form. Training providers should provide copies of locally developed training materials to the NTC Course and Related Data System (CARDS) for other DOE training providers. Contact the NTC for assistance in accessing CARDS.

The DOE NTC maintains the fundamental radiation worker course curriculum. The NTC periodically performs reviews of training materials and upgrades the course materials when

improvements are identified. The NTC processes include seeking input from training providers and students. However, recommended changes can be submitted at any time. Technical changes are approved by the DOE Headquarters' subject matter expert. Significant changes or lessons learned will be incorporated into course materials by NTC in coordination with the DOE Headquarters' subject matter expert. Notice of revised training materials will be provided to the DOE community using NTC processes and procedures.

8.3 TRACKING and TRENDING

Tracking and trending can provide valuable information on the effectiveness of training. It can also provide information regarding areas of improvement. Identify and develop measurable key performance indicators (KPIs), or equivalent, to help track and trend training effectiveness and worker performance. KPIs help measure workers' achievement of the training objective. KPIs could include:

- Exam scores
- Exam questions that have a pattern of being frequently answered correctly or incorrectly
- Radiological posting violations
- Reviewing radiological mishaps to determine if there is an identifiable trend that can strengthen the training program.
- Observing and noting workers' behavior and adherence to radiological work planning requirements and how they relate to the applicable portions of RWT.

The detail and frequency of evaluation activities depend on the hazard, risk, and complexity associated with the facility's operation. Evaluations should include activities such as:

- monitoring classroom and on-the-job training sessions,
- performing proficiency reviews during actual work,
- capturing worker feedback and recommendations,
- reviewing work post-job and work events for improvements,
- spot-checking training materials and individual training and qualification records,
- monitoring practical examinations and,
- reviewing examination results.

APPENDIX A

RADIOLOGICAL WORKER FUNDAMENTAL RADIATION SAFETY TRAINING REQUIREMENTS

1. **Introduction and Purpose of Course**
The student will understand that this course will provide the transportable basic knowledge necessary to perform radiological activities governed by 10 CFR 835, *Occupational Radiation Protection.*

1.1. Describe the requirement that occupational radiological activities require training before work. Training should be commensurate with the radiological hazards, equipment and tool processes, and job and site safety and health policies and procedures. Explain that the content of this course satisfies the fundamental radiation safety training requirements for DOE radiological activities.

1.2. State the expectation to receive additional facility-specific procedure and process training, tool and equipment-specific training, and occupational radiological hazard training associated with the planned work before final qualification.

2. Radiological Fundamentals and Radiation Protection Concepts

The student will understand fundamental radiological concepts.

a. Describe the components of atoms.

b. Describe the concept of nuclear instability.

c. Define basic radiological terms.

d. Identify the units used to measure radioactivity and contamination.

e. Explain the difference between radiation and contamination.

f. Convert various radiation measurements.

g. Explain ionizing and non-ionizing radiation and their effects.

h. Explain background radiation and its effects.

3. **Radiation Dose Limits and Administrative Control Levels**
The student will understand occupational dose limits, what those limits are for DOE, and the implementation of Administrative Controls Levels (ACL).

a. Explain the basis and purpose of DOE Federal dose limits.

b. Define terms related to radiation dose limits.

c. Explain the use of ACLs.

4. **As Low as Reasonably Achievable (ALARA)**
The student will understand the ALARA concept and identify techniques for minimizing exposure to radiation and radioactive materials.

a. State the purpose of the ALARA concept as it applies to occupational radiation exposure.

b. Identify the responsibilities of the radiological worker, management, and the radiation protection organization as it applies to the ALARA concept.

c. Identify methods for reducing external radiation dose.

d. Identify methods for reducing internal radiation dose.

5. **Personnel Monitoring Programs**
The student will understand the purpose, types, and worker responsibilities for personnel radiation monitoring.

a. State the purpose and requirements for personnel monitoring.

b. Describe the types of personnel monitoring methods.

c. Identify the worker responsibilities for participation in personnel monitoring programs.

d. Identify how to obtain radiation dose records and the annual dose summary.

e. Explain the worker responsibilities for monitoring exposure.

f. Explain the consequence of failing to comply with radiological requirements.

g. Describe dose recording methods and reporting requirements.

h. Describe reporting procedures for radiation dose received from medical or other employment.

6. **Radiological Access Controls and Postings**
The student will understand the requirements for working in an area controlled for radiological purposes regarding work authorizations and radiological postings, signs, and labels.

a. State the purpose of and information found in radiological work permits or other applicable forms of work authorization documents.

b. Describe the minimum appearance requirements for radiological postings and signs.

c. State the purpose of and information found in radiological postings, signs, and labels,

including the types of areas controlled for radiological purposes.

d. Describe the consequence of not complying with radiological direction, postings, or labels.

e. Describe the worker's responsibilities for complying with a radiological work permit (RWP); access control system or process; and radiological postings, signs, and labels.

7. **Radiological Emergencies**

The student will understand the use of basic occupation monitoring systems that warn personnel of unanticipated radiological conditions and emergencies.

a. Explain the use of occupational monitoring systems as they relate to unanticipated radiological conditions.

b. Describe the appropriate response to unanticipated radiological conditions.