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DOE-HDBK-1130-98
October 1998

Reaffirmation with Errata
May 2004

Change Notice No. 1
February 2005

DOE HANDBOOK

Radiological Worker Training

U.S. Department of Energy
Washington, D.C. 20585

AREA TRNG

Change Notice No. 1 to DOE-HDBK-1130-98, Radiological Worker Training

Section/page/para	Change
Part 1	Header to read “Program Management Guide” instead of “Instructor Guide”

Foreword

This Handbook describes an implementation process for core training as recommended in Implementation Guide G441.12, *Radiation Safety Training*, and as outlined in the *DOE Radiological Control Standard* (RCS). The Handbook is meant to assist those individuals within the Department of Energy, Managing and Operating contractors, and Managing and Integrating contractors identified as having responsibility for implementing core training recommended by the RCS. This training is intended for radiological workers to assist in meeting their job-specific training requirements of 10 CFR 835. While this Handbook addresses many requirements of 10 CFR 835 Subpart J, it must be supplemented with facility-specific information to achieve full compliance.

This Handbook contains recommended training materials consistent with other DOE core radiological training materials. The training material consists of the following documents:

Program Management Guide - This document contains detailed information on how to use the Handbook material.

Instructor's Guide - This document contains a lesson plan for instructor use, including notation of key points for inclusion of facility-specific information.

Student's Guide - This document contains student handout material and also should be augmented by facility-specific information.

This Handbook was produced in Word 2002 and has been formatted for printing on an HP 4M (or higher) LaserJet printer. Copies of this Handbook may be obtained from either the DOE Radiation Safety Training Home Page Internet site (http://www.eh.doe.gov/whs/rhmwp/RST/rstmater.htm) or the DOE Technical Standards Program Internet site (http://tis.eh.doe.gov/techstds/). Documents downloaded from the DOE Radiation Safety Training Home Page Internet site may be manipulated using the software noted above.

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Part 1 of 3

Radiological Worker Training

Program Management Guide

Coordinated and Conducted
for
Office of Environment, Safety & Health
U.S. Department of Energy

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We would also like to take this opportunity to recognize several individuals who provided significant contributions in developing previous revisions to DOE Radiological Worker Training material.

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Introduction

Purpose and Scope

This guide describes the DOE Radiological Worker I and II (RW I and II) training programs. It includes standards and policies as well as recommendations for material development and program administration. It is intended for use by DOE contractors for the development of facility-specific radiological worker training.

Compliance with 10 CFR 835-Subpart J

The DOE core training materials for RW Training reflect the requirements identified in 10 CFR 835-Subpart J, "Radiation Safety Training" and recommendations identified in the DOE Implementation Guide G441.12, *Radiation Safety Training,* and in the *DOE Radiological Control Technical Standard.* When implemented in its entirety and supplemented as noted with appropriate facility-specific information, this handbook will generally meet the requirements of 10 CFR 835-Subpart J for radiological worker training. However, it is incumbent on management of each facility to review the content of this course against the radiological hazards present to ensure that the training content is appropriate to each individual's prior training, anticipated and actual assignments, and degree of exposure to potential radiological hazards.

Training described in this guide does not eliminate the need for additional training for facility-specific hazards. Notations throughout the program documents indicate the need for facility-specific information. If the noted section is not applicable to the facility, no information is required to be presented. The site Radiological Control Manager or designee should concur in facility-generated radiological training material.

Goal of Training Program

The goal of the core training program is to provide a high level of knowledge and skills in radiological fundamentals for the radiological worker at all DOE facilities.

Organizational Relationships and Reporting Structure

DOE Office of Worker Protection Policy and Programs (DOE EH-52) is responsible for approving and maintaining the core training materials associated with the RW I and II training programs.

The establishment of a comprehensive and effective contractor site radiological control training program is the responsibility of line management and their subordinates. The training function may be performed by a separate training organization, but the responsibility for quality and effectiveness rests with line management.

Training Program Descriptions

Overview of Training Program

Radiological Worker I Training is intended for radiological workers whose job assignments require unescorted access to Radiological Buffer Areas, Radiation Areas, or Radioactive Materials Areas. The RW I program consists of the core academic material plus the appropriate practical factors evaluation and lessons learned.

The High/Very High Radiation (HR/VHR) Area module may be added to the Radiological Worker I course to give personnel unescorted entry into High Radiation Areas where contamination is not present.

Radiological Worker II Training is intended for radiological workers whose job assignments involve unescorted entry to High Radiation Areas, Contamination Areas, High Contamination Areas and Airborne Radioactivity Areas. Further, workers who have potential contact with hot particles or use of gloveboxes with high contamination levels should complete Radiological Worker II training.

The RW II program consists of the RW core academic material, the HR/VHR Area module (this may be deleted for certain sites, such as uranium mill tailings remediation projects, which do not have HR/VHR Areas), the Contamination Control module, the applicable practical factors evaluation, and lessons learned.

Description of Programs

Core Academic Material is approximately 8 hours in length but will vary dependent upon the amount of facility-specific material. RW Core Academic Training includes the following modules (1-7):

Radiological Fundamentals (Module 1)

- Atomic Structure
- Definitions and Units of Measure
- The Four Basic Types of Ionizing Radiation
- Units of Measure for Radiation

Biological Effects (Module 2)

- Sources of Radiation
- Effects of Radiation on Cells
- Acute and Chronic Radiation Dose
- Prenatal Radiation Exposure
- Risks in Perspective

Radiation Limits (Module 3)

- Basis for and Purpose of Radiation Dose Limits and
- Administrative Control Levels
- Dose Limits and Administrative Control Levels
- Worker Responsibilities Regarding Dose Limits

ALARA Program (Module 4)

- ALARA Program
- Responsibilities for the ALARA Program
- External and Internal Dose Reduction
- Radioactive Waste Minimization

Personnel Monitoring Programs (Module 5)

- External Dosimetry
- Internal Monitoring
- Methods for Obtaining Radiation Dose Records

Radiological Access Controls and Postings (Module 6)

- External Dosimetry
- Internal Monitoring
- Methods for Obtaining Radiation Dose Records

Radiological Emergencies (Module 7)

- Emergency Alarms and Responses
- Radiological Emergency Situations
- Considerations in Rescue and Recovery Operations

Radiological Worker I

Radiological Worker I training consists of the RW core academic material (Modules 1-7) plus the applicable practical factors (Module 10.1).

Practical Factors for RW I (Module 10.1)

The recommended evaluation for RW I consists of the following topics:

- Review an Appropriate Radiological Work Permit (RWP)
- Record the Appropriate Information on the RWP
- Select and Wear Required Dosimeter(s)
- Enter Simulated Area and Demonstrate ALARA Techniques
- Monitor for Contamination (e.g., hand and foot monitoring on exiting RBA)
- Respond to Emergency Situations or Abnormal Radiological Situations

It may be necessary for an RW I qualified individual to enter an HR Area. If this becomes necessary, then the HR/VHR training should be presented, along with the applicable practical factors (Modules 10.1 and/or 10.2).

High/Very High Radiation Area Training (Module 8)

The materials for the HR/VHR Area Module include the following:

- High and Very High Radiation Area Definitions
- Signs and Postings
- Entry, Work In, and Exit from High Radiation Areas
- Access Controls for High and Very High Radiation Areas

Practical Factors for High Radiation Areas (Module 10.2)

The recommended evaluation for RW I (High Radiation Area) consists of entry, work, and exit requirements:

- Identify High Radiation Area signs
- State special controls on RWP
- State area radiation levels (with appropriate units)
- State facility-specific administrative control levels
- Select dosimetry in accordance with RWP
- Wear dosimetry in accordance with procedures
- Perform pre-operational checks (as appropriate) on survey meter and/or dose rate indicating device
- Record appropriate information on RWP prior to entry
- Verify current radiation survey prior to first entry
- Enter only areas designated on RWP
- Maximize distance from higher radiation areas
- Do not loiter
- State appropriate actions to take when a radiation area monitor alarms
- Record appropriate information on RWP upon exit

Radiological Worker II

RW II Core Training is approximately 16 hours in length but will vary dependent on the amount of facility-specific material. RW II includes the core academic material modules (1 - 7), HR/VHR Area module (8), Contamination Control module (9), and RW II Practical Exercise module (10.3).

Radioactive Contamination Control (Module 9)

The radioactive contamination control module includes the following topics:

- Comparison of Ionizing Radiation and Radioactive Contamination
- Types of Contamination
- Sources of Radioactive Contamination
- Contamination Control Methods
- Contamination Monitoring Equipment
- Decontamination
- Types of Contamination Areas
- Lessons Learned

Practical Factors for RW II (Module 10.3)

The recommended evaluation for RW II consists of the following topics:

- Review an Appropriate Radiological Work Permit (RWP)
- Record the Appropriate Information on the RWP
- Select Required Dosimeter(s) and Protective Clothing
- Don Protective Clothing and Dosimeter(s)
- Enter Simulated Area and Demonstrate Contamination Control Practices
- Remove Protective Clothing and Dosimeter(s)
- Monitor for Contamination
- Respond to emergency situations or abnormal radiological situations

Specialized Radiological Worker Training

Specialized Radiological Worker Training should be completed for non-routine operations or work in areas with changing radiological conditions. This training is in addition to Radiological Worker II training 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. In some cases, depending on facility-specific criteria, pre-job briefings provide an acceptable alternative to Specialized Radiological Worker Training.

Individuals who install, inspect, or work in radiological containments shall be trained commensurate with their duties. Individuals that wear respiratory protection need to be medically qualified and wear the equipment as trained in accordance with OSHA standards and DOE requirements. This training is in addition to Radiological Worker II training.

Refresher Training

Refresher training programs for RW I and II training may be implemented in the alternate year when full retraining is not completed or in response to observations or indications of poor radiological performance. Refresher training is intended to maintain and enhance the proficiency of the worker. The refresher training for RW I and II training should be documented.

RW I and II refresher training may be accomplished through any available media. This may include video, handout, computer- based training or classroom training.

RW I and II refresher training 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 operating experiences
- Lessons learned from industry operating experiences
- Identified deficiencies from post training evaluations

Proficiency Requirements

In accordance with 10 CFR 835-Subpart J, each individual shall demonstrate knowledge of the radiation safety training topics established in § 835-Subpart J, commensurate with the hazards in the area and required controls, by successful completion of an examination and performance demonstrations prior to being permitted unescorted access to radiological areas and prior to performing unescorted assignments as a radiological worker.

A written examination and a practical factors evaluation shall be used to demonstrate satisfactory completion of RW I, HR/VHR Area, and RW II training (10 CFR 835 - Subpart J). These exams may be combined into one exam if the training is presented as one training class.

- The minimum passing score for any written examination should be 80%.
- A minimum passing score on the practical evaluation should be 80%.
- Computer-based and other electronic methods of examination are acceptable.

Retraining

In accordance with 10 CFR 835-Subpart J, RW retraining shall be provided to individuals 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. The requirements of 10 CFR 835-Subpart J for examination apply.

Retraining should include selected fundamentals of the initial training with emphasis on seldom-used knowledge and skills. Retraining should be tailored to subjects for which trainee evaluations and experience indicate that special emphasis and depth of coverage is needed.

A self-study method may be used, when possible, for retraining. A suggestion for a self-study method is to allow the workers to self study the training material; present any updates or changes, lessons learned, etc.; then allow the workers to take the examination and applicable practical exercise.

Minimum requirements for RW I and RW II retraining should be successful completion of the written examination, practical exercise, and training on lessons learned/new procedures.

Materials developed in support of retraining should be documented in accordance with 10 CFR 835.704 “Administrative Records.”

Instructor Training and Qualifications

All classroom instruction should be provided by instructors qualified in accordance with the contractor’s site instructor qualification program. Training staff (contractor and subcontractor, if used) should possess both technical knowledge and experience, and the developmental and instructional skills required to fulfill their assigned duties.

1. Training staff responsible for program management, supervision, and development should have and maintain the education, experience, and technical qualifications required for their jobs.

2. Instructors should have the technical qualifications, which include adequate theory, practical knowledge, and experience for the subject matter that they are assigned to teach.

3. Methods should be in place at each contractor site to ensure that individual instructors meet and maintain position qualification requirements.

4. Subject matter experts, without instructor qualification, may provide training in their area of expertise. However, if these subject matter experts are to be permanent instructors, they should be trained as instructors in the next practical training cycle. Qualifications for trainers at nuclear facilities can be found in DOE Order 5480.20A, "Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities."

Training Program Material Development

Training Material Presentation

Training materials for the core programs consist of lesson plans and study guides. To ensure compliance with 10 CFR 835-Subpart J, facility-specific materials must be added to the core materials when necessary to adequately train individuals for facility-specific radiological hazards.

Training Certificates

A training certificate that identifies current training status of core training may be provided to qualified personnel. Each facility is responsible to administer and track the certificates. Facilities have the option of utilizing the certificates as proof of training.

However, it should be noted that 10 CFR 835-Subpart J requires each facility to ensure radiological workers have adequate training for the hazards present. The training certificate from another DOE site does not, in itself, relieve the facility from ensuring the worker has had adequate training.

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

Training Aids

Facility-specific training aids may be developed at the facility to suit individual training styles. Each facility may add information, activities, a glossary, and/or view graphs to enhance their program.

Training Program Standards and Policies

Training Examinations

Written examinations and/or computer-based training (CBT) examinations shall be used to demonstrate satisfactory completion of theoretical and classroom material for RW I and RW II. The examinations should:

- Be completed with a minimum passing grade of 80%,
- Cover material representative of the learning objectives from both core material and facility-specific material,
- Be varied from class to class and within classes when the class size is large,

- Not use true/false questions, and
- Be acknowledged by trainee signature participation in a post-examination review.

An example core examination question bank is available from DOE EH-52. Each question in the examination bank should be numbered in accordance with the corresponding learning objective. All questions should consist of the multiple choice type question.

The facility should develop an appropriate exam bank, and the DOE example questions may be used as a basis. Example questions may be used verbatim, but the order of answers should be changed. The DOE example exam bank is not held confidential. The facility exam bank should be held confidential in accordance with facility practices for exam confidentiality. The practice should ensure students do not have knowledge of specific answer keys.

Rad Worker I Written Examination: The Rad Worker I exam is the responsibility of each facility and should consist of a minimum of thirty (30) questions.

The remedial action for failure of this examination is the responsibility of each facility.

HR/VHR Area Written Examinations: The HR/VHR Area exam is the responsibility of each facility and should consist of a minimum of five (5) questions.

The remedial action for failure of this examination is the responsibility of each facility.

Rad Worker Written II Examinations: The Rad Worker II exam is the responsibility of each facility and should consist of a minimum of fifty (50) questions. The remedial action for failure of this examination is the responsibility of each facility.

Initial challenge examinations may be appropriate for experienced radiological workers and those with current qualifications at another DOE facility. They should be designed to cover the core RW training core learning objectives only. Challenges should not apply to facility-specific topics. Each learning objective should be represented on the challenge examination. Failure of a challenge examination should result in the attendance of a scheduled initial training session. Successful completion of the initial challenge examination does not exempt the employee from the facility-specific examination, practical factors evaluation, and training in lessons learned/new procedures.

Practical Factors Evaluation: A practical factors evaluation should be used to demonstrate satisfactory completion skills for RW I, RW I HR/VHR Area, and RW II training. A minimum score of 80% should be attained for each practical factor evaluation. The criteria for a satisfactory score is outlined in the attachments to the Instructor's Guide. Successful completion of the written examination should be a prerequisite for the practical evaluation.

Lectures, Seminars, Training Exercises, etc.

RW I and II core training programs are designed to be delivered in a classroom setting. An alternate delivery method may be implemented with CBT equipment. The presentation of RWT should include core materials and facility-specific information. In all cases, regardless of the setting or delivery method, examination requirements of 10 CFR 835-Subpart J shall be followed.

Delinquent Training/Failure Procedures and Policies

Radiological workers who are delinquent on retraining shall lose their Radiological Worker access status until successful completion of the delinquent training requirement. These workers shall not be allowed unescorted entry into associated radiological areas.

Currently trained radiological workers who fail a challenge or retraining exam shall lose their training status until successful completion of the examination and practical factors evaluation. These workers should not be allowed unescorted entry into associated controlled/radiological areas.

Exceptions and Waivers

Successful completion of the core courses for RW I, RW I HR/VHR Area, and RW II training at one DOE site may be recognized by other DOE sites. However, the determination as to the adequacy of training as required by 10 CFR 835-Subpart J is the responsibility of the facility. It may be appropriate to accept this training as the basis for a challenge exam covering generic topics. However, this training may not adequately cover facility-specific topics.

Administration

Training Records

Training records and course documentation shall meet the requirements of 10 CFR 835.704 “Administration Records” and be in accordance with local DOE Records Disposition Schedules.

Training Program Development/Change Requests

All requests for program changes and revisions should be submitted to EH-52 using the DOE Technical Standard Program form "Document Improvement Proposal" F 1300.3. This form is available from the DOE Technical Standards Home Page - Maintenance of DOE Technical Standards TSPP-09). (See the Foreword of this document for website address).

Audits (internal and external)

Internal verification of training effectiveness may be accomplished through senior instructor or supervisor observation of practical applications and discussions of course material. Results should be documented and maintained by the organization responsible for Radiological Control Training.

The RW I, RW I HR/VHR Area, and RW II core training program materials and processes will be evaluated on a periodic basis by DOE-HQ. The evaluation should include a comparison of program elements with applicable industry standards and requirements.

Evaluating Training Program Effectiveness

Verification of the effectiveness of Radiological Control training should be accomplished by surveying a limited subset of former students in the workplace. This evaluation should include observation of practical applications, discussion of the course material, and may include an associated written examination. DOE/EH has issued guidelines for evaluating the effectiveness of radiological training through the DOE Operations Offices and DOE Field Offices.

These guidelines are included as an attachment to the Program Management Guide to DOE-HDBK-1131-98, General Employee Radiological Training.

For additional guidance, refer to DOE STD 1070-94, "Guide for Evaluation of Nuclear Facility Training Programs." The guidelines contained in these documents are relevant for the establishment and implementation of post-training evaluation and retention testing programs.

In response to the Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 91-6, DOE committed to develop an implementation plan to upgrade radiation protection programs at DOE defense nuclear facilities.

The implementation plan detailed DOE's plans to develop and implement radiation protection post-training evaluation and retention testing programs. Post-training evaluations will be used to identify opportunities for improving course materials, upgrading instruction methods and techniques, and the need for additional training. Retention testing will indicate when individual performance or testing fails to meet expectations. Corrective actions for deficiencies identified in retention testing will be incorporated in the individual's development plan and the site's training program on an appropriate schedule.

In addition, Article 613.7 of the DOE Radiological Control Standard states that sites should implement a training effectiveness verification program. This program, which is in addition to performance evaluations routinely performed by the site's training department, is to verify the effectiveness of radiological control training by surveying a limited subset of former students in the workplace. This recommendation applies to both

DOE defense nuclear facilities and DOE facilities not classified as defense nuclear facilities.

Per DOE's commitment to DNFSB, it is expected that all defense nuclear facilities will implement these or equivalent programs. DOE facilities not classified as defense nuclear facilities should also strive to implement such programs. Line management should monitor progress of program implementation.

The guidance contained in DOE STD-1070-94 is not meant to be prescriptive. Training organizations should review this guidance and determine its applicability, taking into consideration the existence of similar programs already in place at their facility.

Forward evaluation results indicating a possible need to revise core training programs to EH-52 using the "Request for Change to DOE Core Training Materials" form.

References

1. Cohen, Bernard L., "Catalog of Risks Extended and Updated," Health Physics, the Radiation Protection Journal, Vol. 61, 1991.

2. "Investigation Report C-337-A, Contamination Incident at the Paducah Gaseous Diffusion Plant on August 23, 1991," September 1991.

3. NCRP, "Ionizing Radiation Exposure of the Population of the United States," Report No. 93.

4. ORAU 88/H-99, "Guide to Good Practice in Radiation Protection Training."

5. Travis, E. L., "Primer of Medical Radiobiology," 1989.

6. U.S. Department of Energy, "Implementation Guidance for Use with 10 CFR 835, Occupational Radiation Protection," 1998.

7. U.S. Department of Energy, DOE Radiological Control Standard, 1998.

8. U.S. Department of Energy, "Occupational Radiation Protection," 10 CFR 835, 1998.

9. U.S. Department of Energy, "Reproductive Health: Effects of Chemical and Radiation on Fertility and the Unborn Child," Lawrence Livermore National Laboratory, February 1, 1984.

10. U.S. Department of Energy, Order 5480.20A, Ch. 1, "Personnel Selection, Qualification, and Training Requirements For DOE Nuclear Facilities," November, 2001.

11. U.S. Department of Health, Education and Welfare, Radiological Health Handbook, January 1970.

12. U.S. Nuclear Regulatory Commission, "Instruction Concerning Prenatal Radiation Exposure," U.S. NRC Regulatory Guide 8.13, December 1987.

13. U.S. Nuclear Regulatory Commission, "Instruction Concerning Risks From Occupational Radiation Exposure," U.S. NRC Regulatory Guide 8.29, Version I, February 1997.

14. Wallace, Susan S., and Robert B. Painter, Editors., "Ionizing Radiation Damage to DNA: Molecular Aspects," UCLA Symposia on Molecular and Cellular Biology, New Series, Vol. 136, Wiley-Liss, N.Y. 1990.

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