

FRCM CHAPTER 6

RADIOLOGICAL TRAINING AND QUALIFICATION

Revision History

Author	Description of Change	Revision Date
J. D. Cossairt	1. Editorial change to correct typographical error in Article 621.2.	October 2017
J. D. Cossairt	1. Reformulated in light of Fermilab-wide ESH&Q consolidation and reorganization 2. Modified title to more accurately express the scope. 3. Change discussion of specific course content relegating the details of the content to the Radiological Control Organization consistent with requirements of other FRCM Chapters. 4. Removed material duplicative of or in potential conflict with FESHM Chapter 2070.	June 2017
J. D. Cossairt	Removed the special provisions for experimenters to make controlled access without having the requisite training that formerly appeared at Article 653.3. Henceforth, no such accesses will be permitted	March 2016
J.D.Cossairt	Changes to reflect evolution of Fermilab's ESH&Q organization.	July 2015
J. D. Cossairt	Revision of Article 613 to add in a provision allowing the use of job-specific radiological worker training constrained by special conditions.	September 2014
J. D. Cossairt	1. Revision of Article 622 to improve clarity and better reflect actual practice. 2. Revision of Article 653 to institute corrective actions applied to ORPS SC—FSO-FNAL-FERMILAB-2014-0002.	April 2014
J. D. Cossairt	Most recent version issued prior to the institution of revision history tracking.	February 2010

CHAPTER 6 RADIOLOGICAL TRAINING AND QUALIFICATION

TABLE OF CONTENTS

<u>Article</u>	<u>Page</u>
PART 1 GENERAL REQUIREMENTS.....	3
611 Purpose and Introduction.....	3
612 Procedures	4
613 Requirements.....	5
PART 2 TRAINING IN GENERAL RADIOLOGICAL SAFETY	10
621 General Employee Radiation Training (GERT)	10
622 Radiological Worker Training (RW)	10
623 Other Fermilab-Specific Radiological Worker Training	11
Table 6-1 Radiological Worker Training Requirements	12
PART 3 RADIOLOGICAL CONTROL TECHNICIAN QUALIFICATION	13
631 Requirements	13
632 Radiological Control Technician	13
633 Continuing Radiological Control Technician Training.....	14
PART 4 RADIOLOGICAL TRAINING FOR PERSONNEL WITH SELECTED ROLES	16
641 Management Training.....	16
642 Support Personnel.....	16
643 Radiological Control Organization Personnel	16
644 Radiographers.....	17
645 Emergency Response Personnel	17
PART 5 RADIOLOGICAL TRAINING FOR SPECIAL APPLICATIONS	18
651 Uranium Facilities—provided in the event that work with depleted uranium is to be done.....	18
652 Accelerator Operators Radiological Training	18
653 Controlled Access Training	19

PART 1 GENERAL REQUIREMENTS

611 Purpose and Introduction

This chapter establishes the requirements to ensure that personnel have the training to work safely in and around radiological areas and to maintain their individual radiation exposure and the radiation exposures of others As-Low-As-Reasonably-Achievable (ALARA). Training requirements in this chapter apply to all individuals, except visitors and minors, entering areas at Fermilab controlled for radiological purposes as defined in Chapter 2 of this Manual. Included are Laboratory employees, subcontractor employees, and scientific users. The training requirements for minors and non-occupational- visitors are discussed further in Article 931 and 941, respectively. This chapter does not provide the details of course content. That information is embodied in the content of the courses themselves as developed by the Radiological Control Organization and, reflective of the requirements of this Manual in its entirety, including the provisions of [FESHM Chapter 2070](#)

1. The basic objective of radiological safety training is to enable those who work at the Laboratory to work safely, efficiently, and competently in areas controlled for radiological purposes and with radioactive materials. To accomplish this objective, it is necessary to instruct individuals on procedures, practices and regulations designed to minimize exposures and to inform them of the potential risks involved in radiation exposure.
2. Responsibilities
 - a. Division/Section Heads- It is the responsibility of division/section heads to implement the Laboratory's environment, safety and health training programs, including radiological training, for their personnel. For purposes of this article, contractors and individuals from other institutions who use Fermilab research facilities (i.e., "users") are treated as equivalent to Fermilab personnel who work in the same type of radiological areas. It is the responsibility of the supervisors to ensure that employees under their supervision maintain training that complies with the requirements of this Manual.
 - b. Environment, Safety, Health, and Quality (ESH&Q) Section - The ESH&Q Section provides the labwide radiological training specified in other Articles of this Chapter and elsewhere in this Manual in accordance with policies stated in the Fermilab ES&H Manual (FESHM), specifically in FESHM Chapter 2070. The ESH&Q Section assures lab wide implementation of standardized radiological training. The ESH&Q Section also routinely provides specialized radiological training in the following areas:

- (1) Controlled Access training for personnel who are otherwise authorized to perform such access to accelerator/beamline enclosures (see Chapter 3, Article 337).
- (2) Material Move Request survey training for personnel who are approved to conduct such surveys (see Chapter 4, Part 2),
- (3) Radioactive source training to personnel who are approved to utilize radioactive sources (see Chapter 4 Part 3),
- (4) Special emergency exposure training, as needed (see Article 922).

612 Procedures

1. ESH&Q Training Database- Training status shall be entered and tracked in accordance with current procedures developed by the ESH&Q Section for utilizing the Fermilab Environment, Safety, and Health (ES&H) Training Records, and Information Network Database (TRAIN) in accordance with FESHM 2070. This database comprises the permanent repository at Fermilab of training status, including that required by this Manual and administered under the auspices of the Radiological Control Organization.
2. Transfer of Training from other Department of Energy (DOE) Sites- Successful completion of the courses for General Employee Radiological Training (GERT), Radiological Worker (RW), and Radiological Control Technician (RCT) within the past two years at another DOE site may be recognized by Fermilab upon review by the Radiological Control Organization, provided sections a through d below are satisfied. This does not exempt the individual from other training determined to be required by the Radiological Control Organization.
 - a. The individual must provide documentation of successful completion of the course. Documentation of the previous training shall include the individual's name, date of training, topics covered, and the name of the certifying official. A copy of this certification shall be sent to the ESH&Q Section.
 - b. Fermilab-specific aspects of the academic portions of radiological training shall be completed. For GERT and RW training, the online training content satisfies this requirement except for the specific hands-on training provided in Radiological Worker Practical Factors. The individual should sign that he/she has read and understands the site-specific information presented. This document ([RP Form 89](#)) shall also be sent to the ESH&Q Section.
 - c. To be fully qualified as a radiological worker at Fermilab, in addition to the site-specific component of Fermilab Radiological Worker Training, the

individual shall also successfully complete the Fermilab Radiological Worker Practical Factors training class.

- d. Fermilab-specific aspects of RCT Training will be provided on an individual basis.
3. Transfer of Training to other DOE Sites- The non-site specific part of the radiological training received at Fermilab is acceptable by other DOE facilities. A completed [RP Form #90](#), signed by an authorized instructor should be used as proof of this training.

613 Requirements

1. All radiological safety training should encompass at least the following topics, to the extent appropriate based on the degree of exposure to potential radiological hazards and the level of training being implemented commensurate with the work to be done by the individuals being trained:
 - a. Risks of exposure to radiation and radioactive materials, including prenatal radiation exposure;
 - b. Basic radiological fundamentals and radiation protection concepts;
 - c. Physical design features, administrative controls, limits, policies, procedures, alarms, and other measures implemented at the facility to manage doses and maintain doses ALARA, including both routine and emergency actions;
 - d. Individual rights and responsibilities as related to implementation of the facility radiation protection program;
 - e. Individual responsibilities for implementing ALARA measures required by Part 5, Chapter 3 of this manual; and
 - f. Individual exposure reports that may be issued in accordance with Article 781.
2. Each individual shall complete, at a minimum, GERT, (See Part 2 of this Chapter):
 - a. Before being permitted unescorted access to controlled areas; and
 - b. Before receiving occupational dose during access to controlled areas at a DOE site or facility.

3. For radiological workers and those who will be granted unescorted access into radiological areas and who will work with radioactive materials, examinations shall be used to verify the appropriate level of knowledge of radiological safety. This requirement applies to Radiological Worker, Radiological Control Technician, Controlled Access, and Sealed Source training (Chapters 3 and 4 of this Manual). Examinations should be conducted online or in writing. However, alternative methods with the approval of the Senior Radiation Safety Officer (SRSO) may be used to accommodate special needs. The examination process requires:
 - a. A minimum acceptable score be established;
 - b. True/false questions not be included;
 - c. The use of questions selected from a question bank;
 - d. Remedial actions for failure to meet the minimum score. A fully qualified and authorized individual must directly supervise the individual until remedial actions have been completed.
4. In addition to the examination required in paragraph 3, practical factors are required for qualification as a Radiological Worker and may be specified for other classes by the Radiological Control Organization.
 - a. Being permitted unescorted access to radiological areas,
 - b. Performing unescorted assignments as a radiological worker.
5. The retraining intervals are stated below for each training course. The specified interval may be extended by a period not to exceed 30 days to accommodate scheduling needs. In such a case, the written approval of the assigned Radiation Safety officer (RSO) shall be obtained. Significant changes to the program should be incorporated as they are identified and a decision made by the SRSO if retraining or a suitable alternative method of communicating the changes shall be employed.
6. Workers entering a radiological area or working with radioactive material and/or radioactive sources should take the full Radiological Worker training provided by Fermilab. However, at the discretion of the assigned RSO, job-specific Radiological Worker training may be given for special circumstances involving radiological work activities of limited scope, time duration, and estimated doses to be received. Under such conditions the estimated doses shall be 100 mrem in a year or less due to work at Fermilab. This provision may also be used for workers who have already received significant radiological training at their home institution or from their employer. This provision is not to be used to circumvent training

requirements or to avoid dose limitations through multiple uses in a year. To use this provision the following steps shall be completed:

- a. A Work Evaluation for Job Specific Radiological Worker Training (R.P. Form #87) shall be filled out when giving job-specific Radiological Worker training. This form for the tasks covered is considered to be the documentation of the radiological work controls specified in Part 4 of Chapter 3 of this manual and shall include information regarding:
 - 1) The worker's name and FNAL ID or other ID;
 - 2) The area to be entered and the posting;
 - 3) The estimated time required to complete the work;
 - 4) A description of the work to be performed;
 - 5) If deemed necessary, details of the worker's history regarding radiological work. (i.e., past radiation training, past dosimetry use at Fermilab or elsewhere, and estimated dose at Fermilab or elsewhere);
 - 6) The training requirements for work at Fermilab;
 - 7) The radiological conditions at the specified work location; and
 - 8) Any additional requirements and/or limitations on the worker as determined by the assigned RSO.
- b. Industrial radiographers who are certified may be given a training waiver since their radiographer training is sufficient for them to use their sources. A job-specific briefing is usually not necessary unless the assigned RSO deems it required due to work area conditions. This does not modify the requirements of other provision of the FRCM, notably Article 362.
- c. The Job Specific Topics Covered list on R.P. Form #87 shall be filled out to document the training topics given to the worker. Additional training topics may be added as necessary.
- d. R.P. Form #87 shall be signed by the escort, the worker, and the assigned RSO.

- e. After completing the job-specific Radiological Worker training and filling out and signing R.P. Form #87, this training [FN000342] shall be added to the worker's ITNA in TRAIN. Under these circumstances, the worker is considered a trained Radiological Worker (for only the work in the area specified on R.P. Form #87) and is no longer considered to be a member of the public.
 - f. This provision does not automatically apply to other ES&H training requirements pertaining to the work such as ODH, Controlled Access, Underground access, etc. Exceptions to other training/entry requirements shall follow requirements of this Manual and of FESHM.
7. When an escort is used in lieu of training, the escort shall:
- a. Be fully qualified for entry to the area and performance of the work; and
 - b. Ensure that all escorted individuals comply with the documented radiation protection program.
 - c. Advise the individual to attend the appropriate radiation safety training, if appropriate.
 - d. Arrange for the individual to receive an orientation commensurate with the areas to be entered addressing the topics contained in paragraph 1 of this Article. Records of this orientation should be retained.
 - e. If the work will be in a radiological area or involve radioactive materials, coordinate a review of the work by the assigned RSO for the purpose of estimating the potential exposure to the individual. Issuance of dosimetry should be in accordance with the requirements of Chapter 5, Part 1 of this manual.
8. Verification of the effectiveness of radiological control training should be accomplished as a part of audits conducted as a part of the Fermilab ES&H appraisal program discussed in the [Fermilab Quality Assurance Manual Chapter 12080](#) "Self-Assessments".
9. Reading and comprehension skills in the English language are generally necessary for radiological training. Orientation provided by the assigned RSO and the use of trained escorts/translator can be determined to provide an alternative to the completion of training with the concurrence of the SRSO. The assigned RSO should inform the worker of the exposure limits, risk associated with the radiation exposure, the anticipated exposure for the job. Other ESH&Q staff members should

inform such workers of general safety hazards and associated risks that may be involved (e.g. ODH, Lock Out Tag Out).

10. Training records and course documentation shall meet the requirements of Article 723.
11. The SRSO has approval authority over Fermilab-generated radiological training material.

PART 2 TRAINING IN GENERAL RADIOLOGICAL SAFETY

621 General Employee Radiation Training (GERT)

Due to the presence of numerous postings for radiological purposes, individuals who enter, without an escort, areas controlled for radiological purposes, or may encounter radiological postings (see Chapter 2) shall receive GERT unless they are required to receive RW Training.

1. GERT (Fermilab Course [FN000241/CR](#) GERT – “General Employee Radiation Training”) shall include the topics outlined in Article 613.1 at a level of detail commensurate with the radiological hazards that may be encountered in Controlled Areas and Radioactive Material Areas.
2. Additional training beyond GERT is necessary for unescorted entry into Controlled Areas where a dose of 100 millirem (mrem)/year or more is possible, Radiation Areas, Contamination Areas, Airborne Radioactivity Areas, and to work with radioactive materials and in Radioactive Materials Areas.
3. Personnel receiving RW Training are not required to receive GERT.
4. Classroom lecture, or online training may be used to deliver this training..
5. The retraining interval for GERT is 24 months.

622 Radiological Worker Training (RW)

Workers whose job assignments require unescorted access to radiological areas, require the handling of radioactive materials, or may receive a dose of 100 mrem or more in a year shall complete RW Training. Training shall either precede assignment as a radiological worker or be concurrent with assignment as a radiological worker if the worker is accompanied by and under the direct supervision of a trained radiological worker (see Article 613).

1. Radiological Worker training is accomplished in two steps:
2. Step 1: The individual successfully completes using an online class and passes an associated online examination. This is called Radiological Worker Classroom Training (Fermilab Course FN000470/CR “Radiological Worker – Classroom”) In person training in a classroom may be provided to meet special needs. Passage of a written examination is required.

Step 2: Upon successful completion, and only upon completion of the online class, the individual participates in Radiological Worker Practical Factors (Fermilab Course FN000471/OJ “Radiological Worker – Practical Factors”), a class consisting of demonstrations and hands-on activities.

Both Steps are required to be complete before the individual does the work of a radiological worker.

3. The retraining interval for Radiological Worker training is 24 months.

623 Other Fermilab-Specific Radiological Worker Training

1. Specialized radiological worker training should be completed for nonroutine operations or work in areas with changing radiological conditions. This training is in addition to RW Training and is required for personnel planning, preparing and performing specific jobs that have the potential for high radiological consequences. Such jobs may involve special containment devices, the use of mockups and ALARA considerations (see Article 356). Such training should be documented.
2. Material Move Survey Training (Fermilab Course [FN000125/CR](#) - “Material Move Survey”) is required for individuals performing the radiation surveys required by the Material Move Request Form (MMR), when there is a need to determine if some item is radioactive or not (see Article 423). MMR Training is not required to sign the MMR form if a survey is not required, i.e., the initiator knows from process knowledge that the item in question cannot be radioactive. This course has RW as a prerequisite as it uses concepts presented in that class concerning how to deal with radioactive materials, should they be identified.
 - a. The retraining interval for Material Move Survey training is 24 months.
3. Work with radioactive sources at Fermilab requires the completion of RW Training followed by specialized radioactive source training (see Article 432) (Fermilab Course [FN000048/CR](#) – “Radioactive Source Training”). This training is required to assure that the source users have a full understanding of their responsibilities regarding sources. The course builds upon the general information about ionizing radiation provided in Radiological Worker Training.
 - a. The retraining interval for Radioactive Source Training is 24 months.
4. Personnel called upon to receive emergency exposures in accordance with Article 922 shall receive special training in accordance with the provisions of 10 CFR 835.1302. Based on decades of practical experience, this training is extremely rare at Fermilab.

Table 6-1 Radiological Worker Training Requirements

AREAS	TRAINING REQUIREMENT	
	Entry Only	Working with Radioactive-Material
Controlled Area	GERT or RW	RW
Radioactive Material Areas	GERT or RW	RW
Radiation Areas (<100 mrem/hr)	RW	RW
High or Very High Radiation Areas (≥ 100 mrem/hr) ¹	RW	RW
Contamination Areas and High Contamination Areas	RW	RW
Airborne Radioactivity Areas ²	RW	RW

¹Entry requirements further restricted by Article 333, 234.7-9.

²If there is a potential for contamination or internal exposure due to the airborne radioactivity, respiratory protection may be required (see Chapter 3 Part 5 of this Manual).

PART 3 RADIOLOGICAL CONTROL TECHNICIAN QUALIFICATION

631 Requirements

Training and qualification of RCTs shall address routine operations. It should also focus on recognizing and handling situations in both normal and changing radiological conditions. Newly qualified technicians and those in training should be given the opportunity to work with qualified, experienced technicians to foster development. The level of training shall be commensurate with the technician's assignment. Normally, all Fermilab RCTs are employees of the ESH&Q Section.

632 Radiological Control Technician

1. Fermilab's Radiological Control Technician Training Implementation Plan documents RCT DOE core academic, site specific, continuing requalification, and on-the-job training requirements.
2. RCT Training shall include information based on job task analysis and essential job functions.
3. RCT candidates who have prerequisite knowledge, such as college credit, operational experience, National Registry of Radiation Protection Technologists (NRRPT) registration, or related qualifications, may satisfy the academics portion of the standardized training requirements by passing a comprehensive challenge exam. If the comprehensive challenge exam is not successfully passed in one attempt, the entire academic phase should be completed. The challenge exam does not exempt the candidate from the site-specific academics, practical factors, and on-the-job training.
4. Entry-level prerequisites should be established to ensure that RCTs meet standards for physical condition and education. At a minimum, these standards should include the following:
 - a. High school education or equivalency.
 - b. Fundamentals of mathematics and science.
 - c. Reading, comprehension, and writing skills sufficient to follow procedures, write radiological work permits, prepare survey maps, write reports and prepare shipping and transfer permits.
 - d. Ability to work in a support role, including communicating verbal instructions to others.

- e. Physical requirements to handle Personal Protective Equipment, other equipment and assist others in work locations, commensurate with assignment.
5. RCTs are encouraged to pursue registration by the NRRPT.

633 Continuing Radiological Control Technician Training

1. RCT continuing requalification training is conducted on a two-year training cycle and is managed by the Radiological Control Organization. RCTs complete a total of 24 hours of continuing training over a two-year interval. Successful completion of examinations with passing scores of 80% are required for RCT requalification.
2. RCT continuing requalification training consists of selected topics from the DOE core academic training and/or site-specific training as outlined in Fermilab's RCT Training Implementation Plan. In addition, requalification includes on-the-job training conducted during the two year cycle.
3. Successful completion of an examination on the topics listed above and any specified practical demonstration of required tasks as determined by the assigned RSO is required for requalification.
4. Personnel who maintain qualifications as RCTs are considered to have satisfied the requirements of Radiological Worker training.
5. As appropriate and in consultation with their supervision, RCTs are highly encouraged to participate in the following activities:
 - a. Continuing education seminars.
 - b. Review of established RCT Training materials.
 - c. Review of relevant health physics/radiation protection documents, i.e., Radiation Safety Subcommittee Meeting Minutes, regulatory guidance, applicable Radiation Protection and Environmental Protection Notes, Health Physics Newsletter, Health Physics Journal, Operation Radiation Safety Journal and the NRRPT Newsletter.
 - d. RSO Training Sessions.

- e. Miscellaneous activities, i.e. tours of other radiological facilities, investigation of an aspect of radiological protection, off-site training, and evening/weekend courses.

PART 4 RADIOLOGICAL TRAINING FOR PERSONNEL WITH SELECTED ROLES

641 Management Training

Line Managers (Fermilab supervisors) who manage, supervise or provide oversight of individuals performing radiological work should be trained in the principles of this FRCM. This is usually accomplished by completion of Radiological Worker Training by such personnel.

642 Support Personnel

Appropriate support personnel (engineers, schedulers, procedure writers) should be trained in the principles of ALARA, basic ALARA techniques and dose reduction techniques commensurate with their job function and the radiological hazards potentially to be encountered by the individuals using the work plans. This is generally accomplished by participation in GERT or RW training. They should also participate in selected portions of job-specific and specialized training, particularly in situations using mock-ups. Some training of this type is commonly and effectively done informally.

643 Radiological Control Organization Personnel

1. Radiological control technical staff and management should, as promoted by their supervisors, have:
 - a. A combination of education and experience commensurate with their job responsibilities as determined by the SRSO.
 - b. Continuing training based on an assessment of job responsibilities to maintain and enhance proficiency.
 - c. Continuing training to remain cognizant of changes to the facility, operating experience, procedures, regulations and quality assurance requirements.
 - d. Otherwise comply with the training requirements of this Manual.
2. Certification and involvement with professional industry organizations such as the American Board of Health Physics and the National Registry of Radiation Protection Technologists is encouraged.

644 Radiographers

As part of the subcontract with the companies that are commissioned to conduct radiographic surveys at Fermilab, it is required that radiographers shall have training in accordance with the requirements of 10 CFR 34.43 or equivalent state regulations.

645 Emergency Response Personnel

Provisions should be in place to accommodate rapid access to the radiological area by on site and off site emergency workers such as firefighters, medical personnel, and security personnel.

1. Emergency response personnel may be required to work in radiological areas.
2. Emergency response personnel should receive special radiological worker training commensurate with the situations they are likely to encounter.
3. Such training should be based on the Radiological Worker course materials.
4. If such workers are not trained, trained escorts should be assigned.
5. Training should make it clear that medical surveillance and lifesaving have priority over radiological controls.
6. The specific provisions of 10 CFR 835.1301 shall be implemented on an as-needed basis.
7. This training should be documented in accord with requirements for ESH&Q training documentation.

PART 5 RADIOLOGICAL TRAINING FOR SPECIAL APPLICATIONS

651 Uranium Facilities—provided in the event that work with depleted uranium is to be done

The following topics should be considered in addition to standardized training requirements at uranium facilities in the event that work involving the extensive handling of depleted uranium is conducted:

1. Properties of depleted uranium.
2. Special radiological surveys and techniques.
3. External and internal exposure control.
4. Toxicological properties and behavior of uranium.
5. Release of uranium-contaminated materials.
6. Instruments and measurement techniques.
7. Personnel protection.
8. Inventory control and accountability.
9. Biological effects.
10. Emergency response considerations.
11. These and other details as defined at a later date in the event in the planning of a specific project of this type.

652 Accelerator Operators Radiological Training

This training program will consist of current Radiological Worker Training augmented by a series of training modules including topics such as the following. The division/section responsible for the operation will develop this training program and define its scope. Participation in this training program shall be documented.

1. Interlock systems, radiation detectors, and associated electronics.
2. Search and secure procedures.

3. Emergency response.
4. Radioactive water cooling systems.
5. Residual activity.
6. Prompt radiation fields.
7. Beam operation procedures intended to minimize the generation of radiation and consequent exposures.

653 Controlled Access Training

A controlled access is an entry into a beam area under conditions such that the integrity of the radiation safety interlock system is maintained, and/or an Opening Up or Initial Entry survey has not been performed in the area. All personnel authorized for controlled accesses shall maintain current RW Training. Controlled access training (Fermilab Course [FN000311/CR](#) – “Fermilab Controlled Access”) addresses a broad spectrum of hazard including, but not limited to important topics in radiation protection.

1. The training for those who are to be authorized to make unescorted controlled accesses shall include the hazard control provisions covered in detail in Article 337.
 - a. The retraining interval for Controlled Access Training, because of its high level of importance, is 12 months.