

FRCM CHAPTER 9 SPECIAL CIRCUMSTANCES

Revision History

| Author | Description of Change | Revision Date |
|----------------|--|----------------------|
| J. D. Cossairt | <ol style="list-style-type: none">1. Restated portions of Article 962 to clarify that its provisions are applicable to all personnel at Fermilab.2. Verified that any references, if any, to Fermilab's central ES&H organization refer to it as the "ES&H Section" following the reorganization of February 1, 2019. | January 2020 |
| J. D. Cossairt | <ul style="list-style-type: none">• Restated portions of Article 941 to clarify requirements and to reflect actual practices. | January 2018 |
| J. D. Cossairt | <ul style="list-style-type: none">• Reformulated in light of Fermilab-wide ESH&Q consolidation and reorganization. | June 2017 |
| J. D. Cossairt | <ul style="list-style-type: none">• Editorial changes made to reflect evolution of the ESH&Q organization at Fermilab | July 2015 |
| K. J. Graden | <ol style="list-style-type: none">1. Implement recommendations of a self-assessment conducted in February 2015 (iTrack Review No. 41868).2. Correct references to FESHM chapters.3. Changed ES&H Section to the ESH&Q Section. | March 2015 |
| J. D. Cossairt | Most recent version issued prior to the institution of revision history tracking. | February 2010 |

CHAPTER 9 - SPECIAL CIRCUMSTANCES

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PART 1 CONTROL OF RADIOACTIVE MATERIALS IN WILSON HALL

911 General Requirement

Wilson Hall is an office building as well as a laboratory. Unlike many of the other buildings on the Fermilab site, it is open to the general public. Therefore, more restrictive procedures for the control of radioactive material are applied to this building than to most other buildings on the site to mitigate the potential for exposure of visitors to radiation and radioactive materials. It is the intent of the Fermilab Director to minimize the usage of radioactive material in this building to the extent possible.

1. Prior written approval from the SRSO is required before any radioactive material is brought into Wilson Hall, with the following exceptions:
 - a. Class 1 radioactive material (Refer to Table 4-2 and Article 413.1)
 - b. Check sources built into radiation survey meters
2. Long-term storage of radioactive materials in Wilson Hall is discouraged.

912 Radioactive Source Use in Wilson Hall

The design and construction details of all sealed radioactive sources used at Fermilab must be reviewed and approved by the ES&H Section. All requirements pertaining to the use of sealed radioactive sources apply to those used in Wilson Hall (see Chapter 4, Part 3). Because of the nature of activities conducted in this building, sealed source activities are required to be limited in scope and level of radioactivity. Table 9-1 specifies Wilson Hall limits for some common radionuclides used in sealed sources at Fermilab. The assigned RSO will specify limits for radionuclides not listed in Table 9-1.

Table 9-1 Wilson Hall Limits for Common Radionuclides

| Common Radionuclides | Wilson Hall Limit |
|--|--------------------------|
| ^{241}Am , ^{244}Cm , ^{210}Po , ^{226}Ra | 0.1 milliCurie |
| ^{207}Bi , ^{57}Co , ^{60}Co , ^{137}Cs , ^{54}Mn , ^{22}Na , ^{65}Zn | 1 milliCurie |
| ^{55}Fe , ^{106}Ru , ^{90}Sr , ^{109}Cd | 10 milliCuries |

913 Use of Other Radioactive Materials in Wilson Hall

1. Radioactivity Class 2 and 3 items (see Article 413), on the rare occasions when the SRSO approves their placement and use in Wilson Hall (see Article 911), shall be tagged to indicate their presence has been approved by the SRSO. Written records of the location of each object must be maintained by the responsible division/section and maintained by the Radiological Control Organization.
2. Class 4 and 5 items shall not be allowed in Wilson Hall.
3. Uranium, transuranic elements, radioactive gases, and radioactive liquids will generally not be approved unless packaged in a sealed, rugged container and prior written approval from the SRSO is obtained.

914 Contamination Limits in Wilson Hall

Because of the possibility of surface contamination, sample changer wipe test results must accompany all applications for approval to bring the following into Wilson Hall:

1. Class 2 or 3 items.
2. Items from any beam target station, beam absorber, etc.
3. Any items from an area known or suspected of having contamination levels exceeding those specified in Table 2-2.

Upper limits on the removable contamination levels for the item to be allowed entry in Wilson Hall are one/tenth of those stated in Table 2-2.

915 Storage and Handling of Radioactive Material in Wilson Hall

1. All radioactive material must be stored in designated storage areas and used in a manner such that the maximum dose rate in areas occupied by non-radiological workers or in areas frequented by the public does not exceed 0.05 mrem/hr.
2. The exposure rate at any location which is open to non-radiological workers or to the general public shall not exceed 0.05 mrem/hr. During movement of radioactive materials or other temporary situations, this level may be exceeded if surveillance by members of the Radiological Control Organization is exercised to avoid excessive exposures to non-radiological workers.
3. No machining, cutting, grinding, or welding on radioactive material is permitted in Wilson Hall without prior written approval of the SRSO.
4. All radioactive items not in use must be stored in a designated area approved by the assigned Radiation Safety Officer (RSO). These storage areas must be posted in accordance with

Articles 232 and 233. Radiation Areas in Wilson Hall require SRSO or designee approval. For sealed radioactive sources and small items, this storage area can be a locked storage cabinet. For large or heavy items, it may be the working area itself.

PART 2 SPECIAL OCCUPATIONAL EXPOSURES

921 Planned Special Exposures

1. A planned special exposure may be authorized for a radiological worker to receive doses in addition to and accounted for separately from the doses received under the limits specified in Table 2-1, provided each of the following conditions is satisfied:
 - a. The planned special exposure is considered only in an exceptional situation when alternatives that might prevent a radiological worker from exceeding the established limits are unavailable or impractical. Such planned special exposures are highly discouraged at Fermilab and are anticipated to be extremely rare. Since such exposures are, prudently, rare or nonexistent at Fermilab, in event that they do occur, 10 CFR 835.204 should be consulted for detailed requirements.
 - b. Fermilab management and the employee's management (for non-Fermilab employees) have specifically requested, in writing, the planned special exposure.
 - c. The request has been reviewed by the SRSO and submitted by the Fermilab Laboratory Director or designee to the DOE for approval.
 - d. Written approval from the Secretarial Official responsible for environment, safety and health matters and the appropriate DOE Headquarters program office has been obtained.
2. Prior to requesting an individual to participate in an authorized planned special exposure, the individual's dose from all previous planned special exposures and all doses in excess of the occupational dose limits shall be determined. An individual shall not participate if the sum of all previous planned special exposures, exposures in excess of the occupational dose limits and the estimate for this planned special exposure would result in:
 - a. Exceeding any of the numeric values for limits established in Table 2-1; and/or
 - b. For the individual's lifetime, exceeding 5 times the numeric values for limits established in Table 2-1.
3. Prior to a planned special exposure, written consent shall be obtained from each individual involved and the following documented:
 - a. The purpose of the planned operations and procedures to be used;
 - b. The estimated doses and associated potential risks and specific radiological conditions and other hazards which might be involved; and
 - c. The measures to be taken to keep the dose ALARA considering other risks that may be present.

4. Records of the written request for a planned special exposure and the appropriate consent and approvals shall be maintained by the ES&H Section. A written report shall be submitted within 30 days after the exposure to the SRSO, the Laboratory Director, the Secretarial Official responsible for environment, safety and health matters and the appropriate DOE Headquarters program office.
5. The dose from planned special exposures is not to be considered in controlling future occupational dose of the individual, but must be included in the individual's exposure history and reported under the requirements of Article 781.

922 Emergency Exposures

In extremely rare cases, emergency exposure to radiation may be necessary to rescue personnel or to protect major property. Emergency exposures may be authorized in accordance with the provisions contained in 10 CFR 835. These doses are in addition to and accounted for separately from the doses received under the limits in Table 2-1. Emergency exposures are not classified as Planned Special Exposures. Prior to incurring any emergency exposure:

1. The risk of injury to those individuals involved in rescue and recovery operations shall be minimized.
2. Operating management shall weigh actual and potential risks to rescue and recovery individuals against the benefits to be gained.
3. Each individual selected shall be trained at a minimum as a Radiological Worker (Article 622) and briefed beforehand of the known or anticipated hazards to which the individual will be subjected. Rescue operations that involve substantial personal risk shall be performed by volunteers.
4. No individual shall be required to perform rescue action that might involve substantial personal risk.

The dose guidelines for personnel performing these operations are provided in Table 9-2.

Table 9-2 Guidelines for Control of Emergency Exposures

| DOSE LIMIT^{1,2} (Whole Body) | ACTIVITY PERFORMED | CONDITIONS |
|--|---|--|
| 5 rem | All | As determined by Emergency Official in charge |
| 10 rem | Protecting major property | Where lower dose limit not practicable |
| 25 rem | Lifesaving or protection of large populations | Where lower dose limit not practicable |
| >25 rem | Lifesaving or protection of large populations | Only on a voluntary basis to personnel fully aware of the risks involved |

Notes to Table 9-2:

1. The dose limit to the lens of the eye should be three times the listed values.
2. The dose limit to the skin of the whole body and the extremities is ten times the listed values.

PART 3 CONTROLLING DOSES TO MINORS

931 Exposure Control Procedures for Minors

Although the receipt of occupational exposures by minor persons under the age of 18 years is highly discouraged at Fermilab, it is conceivable that a minor may be exposed to radiation and radioactive materials while working at Fermilab. The occupational dose limit to minors, individuals under the age of 18, is established in Article 212. NOTE: Non-occupational exposures of minors are addressed in Article 941. To ensure that the occupational dose limit for minors is not exceeded, Fermilab has implemented the following procedure for the entry of persons under the age of 18 into posted radiological areas:

1. The prior approval of the SRSO is needed before persons under 18 years of age are allowed to enter any radiological area.
2. Persons under 18 years of age are not permitted to enter any radiation areas where the dose rate exceeds 10 mrem in an hour, nor are they allowed to enter any area where contamination is known to be present.
3. At the discretion of the assigned RSO and/or the ES&H Section Dosimetry Program Manager, a personnel monitoring dosimetry badge, which is the dosimeter of record at Fermilab, may be issued to minors. The assigned RSO may also deem it prudent to issue the individual a pocket dosimeter or other supplemental dosimetry. The temporary badge card associated with the dosimetry badge shall indicate the areas visited.
4. The dose limits specified in Article 212 are applicable here.

PART 4 POLICIES FOR ON SITE VISITORS

941 General

This Part only addresses issues pertaining to radiological hazards. In addition to radiation and radioactive materials, there are many other hazards (see the Fermilab ES&H Manual) that a visitor may encounter. As such, it is highly recommended that all visitors be escorted in experimental and/or operational areas.

1. Visitors shall be escorted by an individual who satisfies all entry requirements into the area and is cognizant of any unsafe or unusual conditions in the area. Consistent with this requirement, visitors entering Controlled Areas or Radioactive Materials Areas shall be escorted by personnel having current General Employee Radiological Training (GERT).
 - a. Visitors who have service contracts for facility and/or office maintenance (e.g., water bottle delivery, printer paper delivery, copier and/or printer maintenance, vending machine services, laundry services, etc.) who only enter areas with Controlled Area and/or Radioactive Material Area postings do not require such escort.
2. Prior approval of the assigned RSO is required before entry by visitors or untrained personnel into any Radiological Areas. If the visitor is a minor or if the visitor has the potential to receive a dose in excess of 10 mrem, prior approval of the SRSO is also required. Visitors are prohibited from entering Very High Radiation Areas, Contamination Areas, High Contamination Areas and Airborne Radioactivity Areas. This requirement for prior approval does not apply to officially sanctioned public tours (see [Fermilab public tour website](#))
3. Visitors entering Radiological Areas should receive a radiological orientation commensurate with the areas to be visited addressing the topics listed below:
 - a. Basic radiation protection concepts
 - b. Risk of low-level radiation exposure, including cancer and genetic effects
 - c. Risk of prenatal radiation exposure
 - d. Relevant radiological protection policies and procedures for the areas they will visit
 - e. Visitor and management responsibilities for radiation safety
 - f. Radiological posting and labeling
 - g. Applicable emergency procedures

- h. Training in the use of the personnel monitoring dosimetry badge and/or pocket dosimeters, if required.
- i. Information about the potential dose rates and/or potential contamination levels present.

This information may be communicated by handout, preferably the pamphlet entitled RADIATION SAFETY INFORMATION FOR VISITORS ([R.P. Form No. 31](#)), to individuals expected to enter such locations. Records of such orientation should be maintained by the division/section sponsoring the visit.

- 4. At the discretion of the assigned RSO and/or the Dosimetry Program Manager, a personnel monitoring dosimetry badge, which is the dosimeter of record at Fermilab, may be issued to visitors. The assigned RSO may also deem it prudent to issue individuals a pocket dosimeter or other supplemental dosimetry. The temporary dosimetry badge card associated with the dosimetry badge shall indicate the areas visited.

PART 5 PRENATAL POLICY/PROCEDURES

951 Prenatal Policy and Procedures

Members of the Radiological Control Organization, typically division/section RSOs, are available to answer questions and concerns regarding prenatal radiation exposure raised by any radiological worker. In addition, they will provide assistance in implementing prudent measures to minimize exposure of the unborn child. The requirements of this Article pertain only to Fermilab employees. To learn of options available to them, female employees of subcontractors or other institutions should contact their own employer. As appropriate, the following may be used as guidelines in outlining a course of action for employees of subcontractors or other institutions.

Fermilab has established a policy and appropriate procedures to allow a radiological worker to make a knowledgeable decision regarding the risk to her unborn child. Once a woman declares her pregnancy in writing, the dose limit of 500 mrem to the embryo/fetus for the gestation period established in Article 213 applies.

If a woman knows or suspects that she is pregnant, she must choose one of the following options:

1. Choose not to notify the Occupational Medicine Office in writing of her pregnancy. In this case, the usual occupational exposure limits will continue to apply. Women who choose this option should only do so with full awareness that the fetus is more sensitive to radiation than are adults.
2. Voluntarily notify the Occupational Medicine Office, the assigned RSO, or the Dosimetry Program Manager in writing as soon as possible. The declared pregnant radiological worker may request that her pregnancy be kept private to the extent possible during her first trimester. The documentation of declarations of pregnancy should be made on the Declared Pregnant Worker Evaluation Form ([R.P. Form No. 86](#)) and distributed as stated on the form.
 - a. After a radiological worker voluntarily notifies Fermilab in writing that she is pregnant, she is considered a declared pregnant worker for the purpose of fetal/embryo dose protection. At this time, a radiation safety staff member will measure radiation levels in her work area(s) and estimate the exposure to the unborn child for the term.
 - b. After this evaluation is conducted, the declared pregnant worker who is a Fermilab employee has the following options:
 - 1) Request a temporary reassignment to work in areas involving a lower potential for radiation exposure. If a transfer is recommended by the Occupational Medicine Office and radiation safety, Fermilab shall make a reasonable attempt to find an assignment of equal pay and status for the employee.
 - 2) Ask for a leave of absence. Leaves of absence under such circumstances are subject to the requirements of the Personnel Policy Guide.

- 3) Continue working at the same job assignment and reducing her dose to less than 500 mrem throughout the duration of the pregnancy, where practical, by using shielding, increasing distances from radiation sources and decreasing the amount of time spent in radiation areas. Fermilab radiation safety personnel shall make recommendations to the woman's supervisor such that reasonable steps can be taken to minimize her radiation exposure.
- 4) Terminate employment at the Laboratory.

The option selected shall be documented and dated in writing and retained by the Dosimetry Program Manager.

- c. To learn options available to them, female users should contact the administrator of their sponsoring institution and female subcontractor employees should contact their own employer.
3. If the dose to the embryo/fetus is determined to have already exceeded 500 mrem when a worker notifies her employer of her pregnancy, the worker shall not be assigned to tasks where additional occupational exposure is likely for the duration of her pregnancy.
 4. Efforts shall be made to avoid exceeding 50 mrem per month to the declared pregnant worker. The worker shall be assigned a pocket dosimeter and wear it while working in controlled areas in order to monitor her dose on a monthly basis.
 5. The Fermilab dosimetry vendor offers the option of an additional badge for fetal monitoring. Declared pregnant workers who frequently work in non-uniform fields or in close proximity to radioactive materials such that the fetal dose might differ significantly from the pregnant worker's whole-body dose are encouraged to use this option.
 6. In the event that a declared pregnant radiological worker needs to revoke this declaration, she should contact the Dosimetry Program Manager or her assigned RSO. It is recommended that the declared worker sign the Declared Pregnant Worker Evaluation Form ([R.P. Form No. 86](#)) to document the revocation.

PART 6 OTHER CONSIDERATIONS TO PERFORM RADIOLOGICAL WORK

961 Temporary Disabilities

Temporary disabilities such as a fracture, sprain, or cut may impair a radiological worker's ability to conduct his/her work in a manner that is ALARA or may require additional protective measures to be taken. Each situation should be evaluated separately by the radiological worker and his/her supervisor. Often the work can be postponed, or it can be reassigned to another individual. The assigned RSO or designee should be consulted when the decision is made to continue with the work to ensure the protective measures employed are commensurate with the hazard.

962 Medical Exposures

On occasion, an individual such as a Fermilab employee, scientific user, or subcontractor with an assigned Fermilab identification badge may undergo a medical procedure involving the administration of radioactive materials. In the hours and days after a nuclear medicine procedure, a person is a low-level radiation source. For this reason, Fermilab highly encourages such individuals to inform the Fermilab Occupational Medicine Office or the assigned RSO. Although such individuals are not required to inform the Fermilab Occupational Medicine Office or the assigned RSO, it is highly recommended that they do so. If the individual is a radiological worker, they will be instructed to not wear their dosimetry badge, to minimize exposures to co-workers, and to provide Fermilab instructions for handling radioactive bodily fluids. Doses from such procedures are not to be included in one's occupational exposure history record. In addition, the radioactivity within the body may interfere with the conduct of radiation surveys of equipment and persons. For these reasons, reporting such a procedure is strongly encouraged. R.P. Form No. 88 and R.P. Form No. 91 (<https://eshq.fnal.gov/manuals/frcm/#radforms>) should be used to document such exposures.

1. Such an individual who has received a nuclear medicine procedure should inform the Fermilab Occupational Medicine Office, the assigned RSO, or the Dosimetry Program Manager. The RSO will evaluate the situation and provide relevant instructions to the individual
2. Waste materials (paper products and chewing gum in particular) from an individual who has received a nuclear medicine procedure may be contaminated after use. Care must be taken to isolate these materials by placing them in temporary storage or having the employee take the materials home for disposal. The assigned RSO or designee should make the appropriate arrangements.
3. For radiological workers the assigned RSO should assist the individual in completing R.P. Form No. 88, Medical Procedures Involving Radioactive Material.
4. The completed R.P. Form No. 88 should be forwarded to the ES&H Section Dosimetry Program Manager. The Dosimetry Program Manager shall inform the assigned RSO if they have not already been notified.

5. The assigned RSO should complete R.P. Form No. 91, “RSO Checklist for Radiological Workers Who Have Undergone a Nuclear Medicine Procedure”.
6. Upon receipt of R.P. Form No. 88, the assigned RSO should take appropriate steps to ensure that the issued personnel monitoring dosimetry badge was not worn during or immediately after the procedure. If the badge was worn, the badge should be sent to the vendor for processing and an exposure investigation should be initiated (Articles 572 and 573). The completed R.P. Form No. 88 should be retained in the individual’s exposure history file.
7. The affected individual should be instructed to contact his/her assigned RSO upon returning to work.
8. The assigned RSO or designee should supervise a personnel frisk using an approved instrument.
 - a. If no radioactivity above background can be detected, the assigned RSO may release the individual to perform radiological work.
 - b. If levels exceed background, the assigned RSO may restrict the radiological worker from radiological work until levels return to background. Depending upon the isotope and activity administered, this could be from one day to four or more weeks. The individual’s immediate supervisor should be notified of this restriction to allow temporary accommodations to be implemented.
9. The assigned RSO should visit the individual’s workbench/desk area to ensure the prevailing dose rates to other personnel in the area are below 0.05 mrem/hour the majority of the workday, and re-check dose rates if necessary.