Department of Energy
Fermi Site Office
Post Office Box 2000
Batavia, Illinois 60510

December 3, 2018

Ms. Martha Michels
Chief Safety Officer
Fermilab
P.O. Box 500
Batavia, IL 60510

Dear Ms. Michels:

SUBJECT: FERMI NATIONAL ACCELERATOR LABORATORY (FERMILAB) RADIATION PROTECTION PROGRAM

Reference: Letter, from M. Michels to M. Weis, dated October 22, 2018, Subject: Same As Above

The Fermi Site Office (FSO) approves the Fermilab Radiation Protection Program (RPP) and its equivalency determination. The RPP is the implementation plan for the requirements contained in 10 C.F.R. 835, *Occupational Radiation Protection* (Part 835). The recent revision of the RPP updates the scope of Fermilab radiological operations.

FSO agrees that the Laboratory has addressed the suggested DOE changes in the final RPP and thereby is approving the attached RPP for your use.

Please contact Rachel Zeman, of my staff, at (630) 840-2449, if you need further assistance.

Sincerely,

Michael J. Weis
Site Manager

cc: N. Lockyer, Fermilab, w/o encl.
T. Meyer, Fermilab, w/o encl.
D. Cossairt, Fermilab, w/o encl.
M. Quinn, Fermilab, w/o encl.

ESH&Q Docdb No. 88

FERMILAB RADIATION PROTECTION PROGRAM
October 2018

INTRODUCTION

This Radiation Protection Program (RPP) applies to the activities described in the Scope of Radiological Operations (see below) of the Fermi National Accelerator Laboratory (Fermilab), operated by Fermi Research Alliance, LLC under contract with the Department of Energy (DOE). It constitutes Fermilab's implementation plan for the requirements of 10 CFR Part 835, *Occupational Radiation Protection.* It contains a detailed description of Fermilab's current compliance status with respect to all applicable requirements of 10 CFR Part 835 as amended most recently on August 11, 2017. Implementation of the RPP does not significantly impact upon any programs or activities not included in the plan. The most recent previous version of this RPP was dated September 2013 and approved by the Department of Energy Fermi Site Office on October 21, 2013

The principal purpose of this revision of the Fermilab Radiation Protection Program is to update the description of Fermilab radiological operations. Each requirement of 10 CFR Part 835 is explicitly addressed in this document. Justification is given for all instances where a determination has been made that a requirement of the Regulation is not applicable to Fermilab. Fermilab is believed to be in full compliance with the requirements of 10 CFR Part 835. At this time, Fermilab does not plan to submit any requests for exemption from any of the requirements of 10 CFR 835.

SCOPE OF RADIOLOGICAL OPERATIONS

The Fermi National Accelerator Laboratory (Fermilab), located in DuPage and Kane Counties, Illinois, is a single program laboratory dedicated to basic research in high-energy physics, related support activities and associated scientific research programs. Under contract with DOE, Fermi Research Alliance, LLC (FRA) has operated Fermilab since January 1, 2007. High energy physics research involves the creation of new states of matter and the study of these states on a microscopic (atomic, nuclear, and sub-nuclear) scale. These states are created in the interaction of accelerated particle beams with other targets fixed in space or with other particle beams. As of October 2011, upon completion of the operation of the proton-antiproton colliding beam experimental physics program based upon the Tevatron collider, there is presently no operational colliding beam experimental program operational on the Fermilab site although operations with colliding beams remains consistent with scope of this RPP. A major portion of the research activities conducted at Fermilab involves the acceleration and delivery of particle beams to particle and nuclear physics experiments built and operated by collaborations of scientists assembled from many nations. These experiments and their constituent apparatus may also be calibrated by and used to study cosmogenic radiation. Also, Fermilab is a principal collaborator in the experimental program of the Large Hadron Collider at the European Organization for Nuclear Research (CERN) and a

participant in other accelerator-related endeavors at other laboratories both in the U. S. and elsewhere. New accelerator-related projects are being developed for the near, and intermediate, term futures. In addition, Fermilab is the base of support of several non-accelerator experiments in particle physics and particle astrophysics, endeavors that utilize much of the same technology base as does the accelerator-based research program. Some of these activities may be managed by Fermilab at locations that are not part of the government-owned Illinois site. This recent evolution of the Fermilab program does not, in itself, require modification of this RPP.

Fermilab also participates in applied physics and engineering activities designed to support the physics research program and to provide for transfer of technology developed at Fermilab to society at large. A major emphasis at the present time is accelerator development, materials science, and detector technology directed toward future use both in the United States and in international collaborations. Important examples of transfer of technology include the research and development toward the advancement of use of particle accelerators for routine medical treatments, and for radiobiological and medical research. Industrial applications of accelerators are also being pursued. Some of these involve partnerships with private enterprise and other institutions, notably at the Illinois Accelerator Research Center (IARC), being developed on the Fermilab site. Other practical applications are being investigated. These practical applications as they develop are not envisioned to, by themselves, require modification of this RPP.

Finally, education is an important part of Fermilab's mission. Educational activities range from elementary school and high school level activities at Fermilab to the sponsorship of graduate students working toward advanced degrees.

To accomplish its mission, Fermilab engages in the design, construction, commissioning, operating and, as necessary, decommissioning of a large particle accelerator and related apparatus used for physics experiments. Components developed at Fermilab are used both on the Fermilab site and at other research facilities worldwide. Fermilab also operates related support facilities that provide equipment components for the physics experiments. The operation of the physical plant of Fermilab is included within the scope of this RPP.

Radiological work is conducted in the radiation fields produced by the accelerator as well as with manufactured sources and materials radio-activated by the accelerated beams. The dominant component of radiological work, in terms of the radiation dose received by occupation workers at Fermilab involves maintenance on radio-activated equipment. Radioactive sources are utilized for calibration purposes and as important components of the particle detectors. Radioactive materials

are sometimes incorporated as part of the experimental apparatus and beamline components. Work with all of these sources of radiation is a part of routine operations at Fermilab. Radioactive waste is generated in the course of these operations. Collection and preparation of such waste for its transport to DOE-approved disposal sites is also conducted at Fermilab. Other shipments of radioactive materials are made to and from the Fermilab site in accordance with applicable transportation regulations.

A large number of researchers at Fermilab are from universities and other research institutions from all over the world. In addition, subcontractors perform many support, maintenance and construction activities. Although these individuals are not employees of Fermilab, FRA, or DOE the Laboratory nonetheless includes them in all aspects of its safety programs, including those related to occupational radiological safety.

A comprehensive environmental monitoring program including environmental monitoring, managed in accordance with DOE requirements, notably DOE Order 458.1, *Radiation Protection of the Public and the Environment*, and accepted national standards in the context of an Environmental Management System, is an important part of Fermilab environment, safety, and health program. Fermilab also participates in a program of environmental restoration that addresses environmental concerns related to past practices in compliance with regulatory agency requirements. The occupational radiological activities associated with the management of the ionizing radiation components of Fermilab's Environmental Management System (EMS) are conducted with the Scope of this RPP.

At Fermilab developing and operating the accelerators in a safe manner is a high priority. Accordingly, Fermilab maintains an accelerator safety program compliant with DOE Order 420.2C, *Safety of Accelerator Facilities.* The accelerator safety program is developed in harmony with the radiological safety program discussed in this RPP. The safety of radiation generating devices not subject to the requirements of DOE Order 420.2C are managed within the Scope of this RPP.

Fermi Research Alliance (FRA) is assigned the leadership role in the development of the Long Baseline Neutrino Facility (LBNF) that will build and operate a target facility on the Fermilab site that will use a high intensity proton beam to produce a high intensity neutrino beam to be sent through the earth to Sanford Underground Research Facility (SURF) in Lead, South Dakota. Large neutrino detectors, both on the Fermilab Site and at SURF will comprise the Deep Underground Neutrino Experiment (DUNE). The acronym for the entire project is LBNF/DUNE. While the

"far" detector in South Dakota will be placed in space owned by SURF, DOE has leased the physical space for this detector and its support facilities and has contracted with FRA/Fermilab to operate this experimental facility with corresponding responsibilities for environment, safety, health, and quality within this "FRA Leased Space". Thus, this RPP applies to radiological activities conducted by FRA/Fermilab in this space. This statement does not preclude applicability of this RPP to other work spaces managed on behalf of FRA for the Department of Energy in locations other than the physical site in Illinois designated as the Fermilab site.

It is appropriate to review the magnitude of radiological hazards at Fermilab that were taken into account in developing this RPP. These radiological conditions are continually monitored by the radiological control organization to promptly detect deviations from normal conditions. Conditions are evaluated through review of surveys, dosimetry reports and special radiological measurements. Fermilab's integrated safety management system (ISMS) also provides a useful tool for the periodic evaluation of radiological protection and radiological condition, commonly in coordination with associated reviews with other environment, safety, and health disciplines. New projects, programs and experiments are reviewed for radiation safety concerns throughout their development. Occupational exposures at Fermilab are maintained considerably lower than the limits set forth in 10 CFR Part 835. It is improbable that occupational workers, visitors, minors, or pregnant workers could exceed the limits prescribed in the regulation, based on exposure histories at Fermilab and the nature of the activities of such individuals at Fermilab. Within the present scope of Fermilab's radiological operations, it is difficult to formulate any plausible scenario in which Fermilab would authorize a planned special exposure as defined by 10 CFR Part 835. It is equally difficult to conceive of any credible emergency scenario in which rescue and recovery operations would result in a significant exposure to radiation. There have never been any nuclear facilities on the Fermilab site. Furthermore, there are no plans for such facilities at Fermilab and thus occupational radiation protection provisions for nuclear facilities are not included in this RPP.

Fermilab does not have any identified routine tasks that necessitate periodic monitoring for internal exposures. It may, however, be possible for an individual to receive an uptake of radioactivity under infrequent circumstances, examples of which include the machining of radioactive materials, work with potentially contaminated fluids, and exposure to airborne radioactivity; or certain types of accidents, such as a broken sealed source encapsulation. There are no identified circumstances under which a minor, a member of the public, or a declared pregnant worker would be receiving an internal exposure under ordinary operating conditions. There are no occupied areas at Fermilab in which, under typical conditions, airborne radioactivity presents a hazard requiring specific control measures. Hence, neither real-time air monitoring nor air sampling are generally

performed, except as needed for particular conditions well identified in advance by radiation protection and operational staff members. In general, there are few internal exposures which need to be incorporated into the total effective dose of any worker. The established vigorous survey and monitoring continues to assure that surface contamination levels remain small, consistent with conditions present throughout the life of the Laboratory.

Fermilab has limited beta-gamma contamination and essentially no alpha contamination. The probability of having both forms of contamination simultaneously is extremely small. When contamination is found, decontamination is the preferred course of action and the buildup of contamination in the workplace is thus rendered unlikely. The control of removable radioactivity is achieved by containing contamination at the source or eliminating it entirely. Fermilab has no areas with fixed contamination. Given the nature of Fermilab activities and past experience, Contamination Areas are somewhat rare and it is much more unlikely that contamination would exist in such quantity as to create a High Contamination Area. Only in rare circumstances does an individual receive skin contamination at Fermilab.

Should the program of Fermilab be modified in the future in a way that encompasses significant decontamination and decommissioning activities, the need for additional monitoring of contamination levels and internal exposures will be evaluated and implemented proactively to assure compliance with requirements.

Fermilab ALARA Statement

ALARA is an approach to radiological protection to manage and control exposures (individual and collective) to the work force and the general public to be As Low As Reasonably Achievable. ALARA is not a dose limit, but is a philosophy for devising processes, procedures and operations so as to maintain doses within applicable limits and as far below them as can be reasonably achieved.

It is the policy of Fermilab to conduct its activities in such a manner that worker and public safety, as well as protection of the environment, is given high priority. Fermilab management is committed to maintaining risks to safety, health, or the environment that are associated with ionizing radiation or radioactivity at levels that are ALARA in all laboratory activities. Both individual and collective exposures, be they to laboratory workers, visitors, or members of the public, shall be maintained within appropriate regulatory limits and as far below them as social, technical, economic, practical and public policy considerations permit. Participation in the

ALARA Program is required of all Fermilab divisions, sections, and centers that perform radiological work.

The ALARA Program addresses such areas as (1) establishment of goals, (2) training, (3) plans and procedures, (4) assessments, (5) optimization methodology, (6) design review, (7) conduct of radiological work, and (8) records. Details regarding each of these general areas are provided as the requirements of 10 CFR Part 835 are addressed.

10 CFR 835 Citation	Requirement Text	Implementation
Subpart A - General Provisions		
835.1 Scope		
835.1 (a)	General. The rules in this part establish radiation protection standards, limits, and program requirements for protecting individuals from ionizing radiation resulting from the conduct of DOE activities.	This statement summarizes the contents of the rules in this Part and does not require any specific action on the part of Fermilab.
835.1 (b)	Exclusion. Except as provided in paragraph (c) of this section, the requirements in this part do not apply to: (1) Activities that are regulated through a license by the Nuclear Regulatory Commission or a State under an Agreement with the Nuclear Regulatory Commission, including activities certified by the Nuclear Regulatory Commission under section 1701 of the Atomic Energy Act; (2) Activities conducted under the authority of the Deputy Administrator for Naval Reactors, as described in Pub. L. 98-525 and 106-65; (3) Activities conducted under the Nuclear Explosives and Weapons Surety Program relating to the prevention of accidental or unauthorized nuclear detonations. (4) DOE activities conducted outside the United States on territory under the jurisdiction of a foreign government to the extent governed by occupational radiation protection requirements agreed to between the United States and the cognizant government; (5) Background radiation, radiation doses received as a patient for the purposes of medical diagnosis or therapy, or radiation doses received from participation as a subject in medical research programs; or	Fermilab acknowledges that the activities mentioned in Part 835.1(b) are specifically excluded from the requirements of Part 835. Fermilab policies and procedures include specific provisions to ensure that background radiation, radiation doses received as a patient for the purposes of medical diagnosis or therapy, or radiation doses received from participation as a subject in medical research programs are not included as part of our occupational radiation protection program. Activities conducted on behalf of Fermilab under licenses issued by the Nuclear Regulatory Commission or Agreement States are not subject to Fermilab radiation protection plan policies.

10 CFR 835 Citation	Requirement Text	Implementation
	(6) Radioactive material on or within material, equipment, and real property which is approved for release when the radiological conditions of the material, equipment, and real property have been documented to comply with the criteria for release set forth in a DOE authorized limit which has been approved by a Secretarial Officer in consultation with the Chief Health, Safety and Security Officer. (7) Radioactive material transportation not performed by DOE or a DOE contractor.	DOE activities conducted outside of US territory under the jurisdiction of a foreign government conducted by Fermilab employees are governed by the occupational radiation protection requirements of the host government. Radioactive material on or within material, equipment, or real property that have been documented to comply with DOE authorized limits, if approved, are excluded from the requirements of Part 835. Fermilab has no participation in DOE or other programs concerning naval reactors or nuclear weapons.
835.1 (c)	Occupational doses received as a result of excluded activities and radioactive material transportation, listed in paragraphs (b)(1) through (b)(4) and (b)(7) of this section, shall be included to the extent practicable when determining compliance with the occupational dose limits at §§ 835.202 and 835.207, and with the limits for the embryo/fetus at § 835.206. Occupational doses resulting from authorized emergency exposures and planned special exposures shall not be considered when determining compliance with the dose limits at	Fermilab policies and procedures specify that occupational doses received as a result of excluded activities and radioactive material transportation specified by Part 835 in paragraphs (b)(1) through (b)(4) and (b)(7) shall be included to the extent practicable when determining compliance with the

10 CFR 835 Citation	Requirement Text	Implementation
	§§835.202 and 835.207.	occupational dose limits at Parts 835.202 and 835.207 and with the limits for embryo/fetus at Part 835.206. Occupational doses resulting from authorized emergency exposures and planned special exposures shall not be considered when determining compliance with the dose limits of Parts 835.202 and 835.207.
835.1 (d)	The requirements in subparts F and G of this part do not apply to radioactive material transportation by DOE or a DOE contractor conducted: (1) Under the continuous observation and control of an individual who is knowledgeable of and implements required exposure control measures, or (2) In accordance with Department of Transportation regulations or DOE orders that govern such movements.	Fermilab policies are consistent with this provision.
835.2 Definitions		
835.2 (a)	As used in this part: Accountable sealed radioactive source means a sealed radioactive source having a half-life equal to or greater than 30 days and an isotopic activity equal to or greater than the corresponding value provided in appendix E of this part. Activity Median Aerodynamic Diameter (AMAD) means a particle size in an aerosol where fifty percent of the activity in the aerosol is associated with particles of aerodynamic diameter greater than the AMAD.	As of May 1, 2010, Fermilab policies and procedures related to the definitions of Part 835.2(a) have been modified to be consistent with the changes to the DOE-prescribed system of radiation dosimetry promulgated in the Federal Register, Vol. 72, No. 110, Docket No. EH-RM-02-835, pp. 31904-31941, June 8, 2007

10 CFR 835 Citation	Requirement Text	Implementation
	Airborne radioactive material or airborne radioactivity means radioactive material dispersed in the air in the form of dusts, fumes, particulates, mists, vapors, or gases. Airborne radioactivity area means any area, accessible to individuals, where: (1) The concentration of airborne radioactivity, above natural background, exceeds or is likely to exceed the derived air concentration (DAC) values listed in appendix A or appendix C of this part; or (2) An individual present in the area without respiratory protection could receive an intake exceeding 12 DAC-hours in a week. ALARA means "As Low As is Reasonably Achievable," which is the approach to radiation protection to manage and control exposures (both individual and collective) to the work force and to the general public to as low as is reasonable, taking into account social, technical, economic, practical, and public policy considerations. As used in this part, ALARA is not a dose limit but a process which has the objective of attaining doses as far below the applicable limits of this part as is reasonably achievable. Annual limit on intake (ALI) means the derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the reference man (ICRP Publication 23) that would result in a committed effective dose of 5 rems (0.05 sieverts (Sv)) (1 rem = 0.01 Sv) or a committed equivalent dose of 50 rems (0.5 Sv) to any individual organ or	based on ICRP Reports 60 and 68 as updated by the subsequent clarifications issued by ICRP in ICRP Report 103.

10 CFR 835 Citation	Requirement Text	Implementation
	tissue. ALI values for intake by ingestion and inhalation of selected radionuclides are based on International Commission on Radiological Protection Publication 68, Dose Coefficients for Intakes of Radionuclides by Workers, published July, 1994 (ISBN 0 08 042651 4). This document is available from Elsevier Science Inc., Tarrytown, NY. Authorized limit means a limit on the concentration of residual radioactive material on the surfaces or within the property that has been derived consistent with DOE directives including the as low as is reasonably achievable (ALARA) process requirements, given the anticipated use of the property and has been authorized by DOE to permit the release of the property from DOE radiological control. Background means radiation from: (1) Naturally occurring radioactive materials which have not been technologically enhanced; (2) Cosmic sources; (3) Global fallout as it exists in the environment (such as from the testing of nuclear explosive devices); (4) Radon and its progeny in concentrations or levels existing in buildings or the environment which have not been elevated as a result of current or prior activities; and (5) Consumer products containing nominal amounts of radioactive material or producing nominal amounts of radiation. Bioassay means the determination of kinds, quantities, or concentrations, and, in some cases, locations of radioactive material in the human body, whether by	

10 CFR 835 Citation	Requirement Text	Implementation
	direct measurement or by analysis and evaluation of radioactive materials excreted or removed from the human body. Calibration means to adjust and/or determine either: (1) The response or reading of an instrument relative to a standard (e.g., primary, secondary, or tertiary) or to a series of conventionally true values; or (2) The strength of a radiation source relative to a standard (e.g., primary, secondary, or tertiary) or conventionally true value. Contamination area means any area, accessible to individuals, where removable surface contamination levels exceed or are likely to exceed the removable surface contamination values specified in appendix D of this part, but do not exceed 100 times those values. Controlled area means any area to which access is managed by or for DOE to protect individuals from exposure to radiation and/or radioactive material. Declared pregnant worker means a woman who has voluntarily declared to her employer, in writing, her pregnancy for the purpose of being subject to the occupational dose limits to the embryo/fetus as provided in § 835.206. This declaration may be revoked, in writing, at any time by the declared pregnant worker. Derived air concentration (DAC) means, for the radionuclides listed in appendix A of this part, the airborne concentration that equals the ALI divided by the volume of air breathed by an average worker for a working year of 2000 hours (assuming a breathing volume of 2400 m^3). For the radionuclides listed in appendix C of this part, the	

10 CFR 835 Citation	Requirement Text	Implementation
	air immersion DACs were calculated for a continuous, non-shielded exposure via immersion in a semi-infinite cloud of radioactive material. Except as noted in the footnotes to appendix A of this part, the values are based on dose coefficients from International Commission on Radiological Protection Publication 68, Dose Coefficients for Intakes of Radionuclides by Workers, published July, 1994 (ISBN 0 08 042651 4) and the associated ICRP computer program, The ICRP Database of Dose Coefficients: Workers and Members of the Public, (ISBN 0 08 043 8768). These materials are available from Elsevier Science Inc., Tarrytown, NY. Derived air concentration-hour (DAC-hour) means the product of the concentration of radioactive material in air (expressed as a fraction or multiple of the DAC for each radionuclide) and the time of exposure to that radionuclide, in hours. Deterministic effects means effects due to radiation exposure for which the severity varies with the dose and for which a threshold normally exists (e.g., radiation-induced opacities within the lens of the eye). DOE means the United States Department of Energy. DOE activity means an activity taken for or by DOE in a DOE operation or facility that has the potential to result in the occupational exposure of an individual to radiation or radioactive material. The activity may be, but is not limited to, design, construction, operation, or decommissioning. To the extent appropriate, the activity may involve a single DOE facility or operation or a combination of facilities	

10 CFR 835 Citation	Requirement Text	Implementation
	and operations, possibly including an entire site or multiple DOE sites. Entrance or access point means any location through which an individual could gain access to areas controlled for the purpose of radiation protection. This includes entry or exit portals of sufficient size to permit human entry, irrespective of their intended use. General employee means an individual who is either a DOE or DOE contractor employee; an employee of a subcontractor to a DOE contractor; or an individual who performs work for or in conjunction with DOE or utilizes DOE facilities. High contamination area means any area, accessible to individuals, where removable surface contamination levels exceed or are likely to exceed 100 times the removable surface contamination values specified in appendix D of this part. High radiation area means any area, accessible to individuals, in which radiation levels could result in an individual receiving an equivalent dose to the whole body in excess of 0.1 rems (0.001 Sv) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates. Individual means any human being. Member of the public means an individual who is not a general employee. An individual is not a "member of the public" during any period in which the individual receives an occupational dose. Minor means an individual less than 18 years of age. Monitoring means the measurement of radiation levels, airborne radioactivity concentrations, radioactive contamination levels, quantities of radioactive	

10 CFR 835 Citation	Requirement Text	Implementation
	material, or individual doses and the use of the results of these measurements to evaluate radiological hazards or potential and actual doses resulting from exposures to ionizing radiation. Occupational dose means an individual's ionizing radiation dose (external and internal) as a result of that individual's work assignment. Occupational dose does not include doses received as a medical patient or doses resulting from background radiation or participation as a subject in medical research programs. Person means any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, Government agency, any State or political subdivision of, or any political entity within a State, any foreign government or nation or other entity, and any legal successor, representative, agent or agency of the foregoing; provided that person does not include DOE or the United States Nuclear Regulatory Commission. Radiation means ionizing radiation: alpha particles, beta particles, gamma rays, X-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions. Radiation, as used in this part, does not include non-ionizing radiation, such as radio waves or microwaves, or visible, infrared, or ultraviolet light. Radiation area means any area, accessible to individuals, in which radiation levels could result in an individual receiving an equivalent dose to the whole body in excess of 0.005 rem (0.05 mSv) in 1 hour at 30 centimeters from the source or from any surface that the radiation penetrates.	

10 CFR 835 Citation	Requirement Text	Implementation
	Radioactive material area means any area within a controlled area, accessible to individuals, in which items or containers of radioactive material exist and the total activity of radioactive material exceeds the applicable values provided in appendix E of this part. Radioactive material transportation means the movement of radioactive material by aircraft, rail, vessel, or highway vehicle. Radioactive material transportation does not include preparation of material or packagings for transportation, storage of material awaiting transportation, or application of markings and labels required for transportation. Radiological area means any area within a controlled area defined in this section as a "radiation area," "high radiation area," "very high radiation area," "contamination area," "high contamination area," or "airborne radioactivity area." Radiological worker means a general employee whose job assignment involves operation of radiation producing devices or working with radioactive materials, or who is likely to be routinely occupationally exposed above 0.1 rem (0.001 Sv) per year total effective dose. Real property means land and anything permanently affixed to the land such as buildings, fences and those things attached to the buildings, such as light fixtures, plumbing and heating fixtures. Real-time air monitoring means measurement of the concentrations or quantities of airborne radioactive materials on a continuous basis. Respiratory protective device means an apparatus, such as a respirator, worn by an individual for the	

10 CFR 835 Citation	Requirement Text	Implementation
	purpose of reducing the individual's intake of airborne radioactive materials. Sealed radioactive source means a radioactive source manufactured, obtained, or retained for the purpose of utilizing the emitted radiation. The sealed radioactive source consists of a known or estimated quantity of radioactive material contained within a sealed capsule, sealed between layer(s) of non-radioactive material, or firmly fixed to a non-radioactive surface by electroplating or other means intended to prevent leakage or escape of the radioactive material. Sealed radioactive sources do not include reactor fuel elements, nuclear explosive devices, and radioisotope thermoelectric generators. Source leak test means a test to determine if a sealed radioactive source is leaking radioactive material. Special tritium compound means any compound, except for H_2O, that contains tritium, either intentionally (e.g., by synthesis) or inadvertently (e.g., by contamination mechanisms). Stochastic effects means malignant and hereditary diseases for which the probability of an effect occurring, rather than its severity, is regarded as a function of dose without a threshold, for radiation protection purposes. Very high radiation area means any area accessible to individuals in which radiation levels could result in an individual receiving an absorbed dose in excess of 500 rads (5 grays) in one hour at 1 meter from a radiation source or from any surface that the radiation penetrates. Week means a period of seven consecutive days.	

10 CFR 835 Citation	Requirement Text	Implementation
	Year means the period of time beginning on or near January 1 and ending on or near December 31 of that same year used to determine compliance with the provisions of this part. The starting and ending date of the year used to determine compliance may be changed, provided that the change is made at the beginning of the year and that no day is omitted or duplicated in consecutive years.	
835.2 (b)	As used in this part to describe various aspects of radiation dose: Absorbed dose (D) means the average energy imparted by ionizing radiation to the matter in a volume element divided by the mass of the matter in the volume. The absorbed dose is expressed in units of rad (or gray) (1 rad = 0.01 gray). Committed effective dose (E_{50}) means the sum of the committed equivalent doses to various tissues or organs in the body ($H_{T,50}$), each multiplied by the appropriate tissue weighting factor (w_T)--that is, $E_{50} = \Sigma w_T H_{T,50} + w_{Remainder} H_{Remainder,50}$. Where $w_{Remainder}$ is the tissue weighting factor assigned to the remainder organs and tissues and $H_{Remainder,50}$ is the committed equivalent dose to the remainder organs and tissues. Committed effective dose is expressed in units of rems (or Sv) . Committed equivalent dose ($H_{T,50}$) means the equivalent dose calculated to be received by a tissue or organ over a 50-year period after the intake of a radionuclide into the body. It does not include contributions from radiation sources external to the body. Committed equivalent dose is expressed in units of rems (or Sv).	As of May 1, 2010, Fermilab policies and procedures related to the definitions of Part 835.2(b) have been modified to be consistent with the changes to the DOE-prescribed system of radiation dosimetry promulgated in the Federal Register, Vol. 72, No. 110, Docket No. EH-RM-02-835, pp. 31904-31941, June 8, 2007 based on ICRP Reports 60 and 68 as amended by the subsequent clarifications issued by ICRP in ICRP Report 103.

10 CFR 835 Citation	Requirement Text	Implementation
	Cumulative total effective dose means the sum of all total effective dose values recorded for an individual plus, for occupational exposures received before the implementation date of this amendment, the cumulative total effective dose equivalent (as defined in the November 4, 1998 amendment to this rule) values recorded for an individual, where available, for each year occupational dose was received, beginning January 1, 1989. Dose is a general term for absorbed dose, equivalent dose, effective dose, committed equivalent dose , committed effective dose , or total effective dose as defined in this part. Effective dose (E) means the summation of the products of the equivalent dose received by specified tissues or organs of the body (H_T) and the appropriate tissue weighting factor (w_T)--that is, $E = \Sigma w_T H_T$. It includes the dose from radiation sources internal and/or external to the body. For purposes of compliance with this part, equivalent dose to the whole body may be used as effective dose for external exposures. The effective dose is expressed in units of rems (or Sv). Equivalent dose (H_T) means the product of average absorbed dose ($D_{T,R}$) in rad (or gray) in a tissue or organ (T) and a radiation (R) weighting factor (w_R). For external dose, the equivalent dose to the whole body is assessed at a depth of 1 cm in tissue; the equivalent dose to the lens of the eye is assessed at a depth of 0.3 cm in tissue, and the equivalent dose to the extremity and skin is assessed at a depth of 0.007 cm in tissue. Equivalent dose is expressed in units of rems (or Sv).	

10 CFR 835 Citation	Requirement Text	Implementation

External dose or exposure means that portion of the equivalent dose received from radiation sources outside the body (i.e., "external sources").

Extremity means hands and arms below the elbow or feet and legs below the knee.

Internal dose or exposure means that portion of the equivalent dose received from radioactive material taken into the body (i.e., "internal sources").

Radiation weighting factor (w_R) means the modifying factor used to calculate the equivalent dose from the average tissue or organ absorbed dose; the absorbed dose (expressed in rad or gray) is multiplied by the appropriate radiation weighting factor. The radiation weighting factors to be used for determining equivalent dose in rems are as follow:

RADIATION WEIGHTING FACTORS[1],

Type and energy range	w_R Radiation weighting factor
Photons, electrons and muons, all energies	1
Neutrons, energy < 10 keV[2, 3]	5
Neutrons, energy 10 keV to 100 keV[2, 3]	10
Neutrons, energy > 100 keV to 2 MeV[2, 3]	20
Neutrons, energy > 2 MeV to 20 MeV[2, 3]	10
Neutrons, energy > 20 MeV[2, 3]	5
Protons, other than recoil protons, energy > 2 MeV	5
Alpha particles, fission fragments, heavy nuclei	20

1. All values relate to the radiation incident on the body or, for internal sources, emitted from the source.
2. When spectral data are insufficient to identify the energy of the neutrons, a radiation weighting factor of 20 shall be used.

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[3] When spectral data are sufficient to identify the energy of the neutrons, the following equation may be used to determine a neutron radiation weighting factor value:

$$w_R = 5 + 17 \exp\left[\frac{-(\ln(2E_n))^2}{6}\right]$$

Where E_n is the neutron energy in MeV.

Tissue weighting factor (w_T) means the fraction of the overall health risk, resulting from uniform, whole body irradiation, attributable to specific tissue (T). The equivalent dose to tissue, (H_T), is multiplied by the appropriate tissue weighting factor to obtain the effective dose (E) contribution from that tissue. The tissue weighting factors are as follows:

TISSUE WEIGHTING FACTORS FOR VARIOUS ORGANS AND TISSUES

Organs or tissues, T	Tissue weighting factor, w_T
Gonads	0.20
Red bone marrow	0.12
Colon	0.12
Lungs	0.12
Stomach	0.12
Bladder	0.05
Breast	0.05
Liver	0.05
Esophagus	0.05
Thyroid	0.05
Skin	0.01
Bone surfaces	0.01
Remainder[1]	0.05
Whole body[2]	1.00

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	[1] "Remainder" means the following additional tissues and organs and their masses, in grams, following parenthetically: adrenals (14), brain (1400), extrathoracic airways (15), small intestine (640), kidneys (310), muscle (28,000), pancreas (100), spleen (180), thymus (20), and uterus (80). The equivalent dose to the remainder tissues ($H_{remainder}$), is normally calculated as the mass-weighted mean dose to the preceding ten organs and tissues. In those cases in which the most highly irradiated remainder tissue or organ receives the highest equivalent dose of all the organs, a weighting factor of 0.025 (half of remainder) is applied to that tissue or organ and 0.025 (half of remainder) to the mass-weighted equivalent dose in the rest of the remainder tissues and organs to give the remainder equivalent dose. [2] For the case of uniform external irradiation of the whole body, a tissue weighting factor (w_T) equal to 1 may be used in determination of the effective dose. Total effective dose (TED) means the sum of the effective dose (for external exposures) and the committed effective dose. Whole body means, for the purposes of external exposure, head, trunk (including male gonads), arms above and including the elbow, or legs above and including the knee.	
835.2 (c)	Terms defined in the Atomic Energy Act of 1954 or in 10 CFR part 820 and not defined in this part are used consistent with their meanings given in the Atomic Energy Act of 1954 or in 10 CFR part 820.	This provision is simply a clarification of definitions by DOE in Part 835 and does not require any action by Fermilab.
835.3 General Rule	(a) No person or DOE personnel shall take or cause to be taken any action inconsistent with the requirements of: (1) This part; or (2) Any program, plan, schedule, or other process established by this part.	Fermilab policies and procedures with respect to Fermilab employees and users and their actions are consistent with the provisions of Part 835.3. DOE is responsible for the actions of DOE personnel or activities managed directly by DOE.

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	(b) With respect to a particular DOE activity, contractor management shall be responsible for compliance with the requirements of this part. (c) Where there is no contractor for a DOE activity, DOE shall ensure implementation of and compliance with the requirements of this part. (d) Nothing in this part shall be construed as limiting actions that may be necessary to protect health and safety. (e) For those activities that are required by §§ 835.102, 835.901(e), 835.1202(a), and 835.1202(b), the time interval to conduct these activities may be extended by a period not to exceed 30 days to accommodate scheduling needs.	Provisions have been made for a grace period of up to 30 days to accommodate scheduling needs as provided for 835.3(e).
835.4 Radiological units	Unless otherwise specified, the quantities used in the records required by this part shall be clearly indicated in special units of curie, rad, roentgen, or rem, including multiples and subdivisions of these units, or other conventional units, such as, dpm, dpm/100 cm^2 or mass units. The SI units, becquerel (Bq), gray (Gy), and sievert (Sv), may be provided parenthetically for reference with scientific standards.	Fermilab policies and procedures are consistent with this requirement.
Subpart B- Management and Administrative Requirements		
835.101 Radiation protection programs	(a) A DOE activity shall be conducted in compliance with a documented radiation protection program (RPP) as approved by the DOE.	Fermilab policies and procedures are consistent with this requirement.

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	(b) The DOE may direct or make modifications to a RPP. (c) The content of each RPP shall be commensurate with the nature of the activities performed and shall include formal plans and measures for applying the as low as reasonably achievable (ALARA) process to occupational exposure. (d) The RPP shall specify the existing and/or anticipated operational tasks that are intended to be within the scope of the RPP. Except as provided in §835.101(h), any task outside the scope of a RPP shall not be initiated until an update of the RPP is approved by DOE. (e) The content of the RPP shall address, but shall not necessarily be limited to, each requirement in this part. (f) The RPP shall include plans, schedules, and other measures for achieving compliance with regulations of this part. Unless otherwise specified in this part, compliance with the amendments to this part published on June 8, 2007 shall be achieved no later than July 9, 2010. (g) An update of the RPP shall be submitted to DOE: (1) Whenever a change or an addition to the RPP is made; (2) Prior to the initiation of a task not within the scope of the RPP; or	

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	(3) Within 180 days of the effective date of any modifications to this part. (h) Changes, additions, or updates to the RPP may become effective without prior Department approval only if the changes do not decrease the effectiveness of the RPP and the RPP, as changed, continues to meet the requirements of this part. Proposed changes that decrease the effectiveness of the RPP shall not be implemented without submittal to and approval by the Department. (i) An initial RPP or an update shall be considered approved 180 days after its submission unless rejected by DOE at an earlier date.	
835.102 Internal audits	Internal audits of the radiation protection program, including examination of program content and implementation, shall be conducted through a process that ensures that all functional elements are reviewed no less frequently than every 36 months.	Fermilab policies and procedures are consistent with this requirement and have implemented it as part of its overall assessment program and implementation of Integrated Safety Management Systems. Internal audits of all functional elements of the radiation protection program are conducted every 36 months including program content and implementation. Provisions have been made for a grace period of up to 30 days to accommodate scheduling needs as specified in 835.3(e).

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835.103 Education, Training and Skills	Individuals responsible for developing and implementing measures necessary for ensuring compliance with the requirements of this part shall have the appropriate education, training, and skills to discharge these responsibilities.	Although all personnel at Fermilab are accountable for radiological protection, the members of the Radiological Control Organization housed in the Environment, Safety Health, and Quality (ESH&Q) Section, have primary responsibility for leading the implementation of and compliance with Part 835 and has demonstrated through academic degrees, experience, professional certifications, registrations, training completed, etc., that they have the appropriate qualifications to discharge these responsibilities. Additional training and/or education are required as roles changes and Fermilab activities evolve within the scope of this RPP.
835.104 Written Procedures	Written procedures shall be developed and implemented as necessary to ensure compliance with this part, commensurate with the radiological hazards created by the activity and consistent with the education, training, and skills of the individuals exposed to those hazards.	Written procedures have been developed and implemented to assure compliance with Fermilab's radiation protection program. The degree of formality of the procedures is commensurate with the radiological hazards created by the activity and is consistent with the education, training, and

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		skills of the individuals exposed to those hazards.
Subpart C-Standards for Internal and External Exposure		
835.201 [Reserved]		
835.202 Occupational dose limits for general employees.	(a) Except for planned special exposures conducted consistent with § 835.204 and emergency exposures authorized in accordance with § 835.1302, the occupational dose received by general employees shall be controlled such that the following limits are not exceeded in a year: (1) A total effective dose of 5 rems (0.05 Sv); (2) The sum of the equivalent dose to the whole body for external exposures and the committed equivalent dose to any organ or tissue other than the skin or the lens of the eye of 50 rems (0.5 Sv); (3) An equivalent dose to the lens of the eye of 15 rems (0.15 Sv); and (4) The sum of the equivalent dose to the skin or to any extremity for external exposures and the committed equivalent dose to the skin or to any extremity of 50 rems (0.5 Sv). (b) All occupational doses received during the current year, except doses resulting from planned special exposures conducted in compliance with § 835.204 and emergency exposures authorized in accordance with § 835.1302, shall be included when demonstrating compliance with §§ 835.202(a) and 835.207.	As of May 1, 2010, Fermilab policies and procedures related to the definitions of Part 835.2 were modified to be consistent with the changes to the DOE-prescribed system of radiation dosimetry promulgated in the Federal Register, Vol. 72, No. 110, Docket No. EH-RM-02-835, pp. 31904-31941, June 8, 2007 based on ICRP Reports 60 and 68 as amended by the subsequent clarifications issued by ICRP in ICRP Report 103. Fermilab has implemented Part 835.202. The changes promulgated by the above-cited FR Notice implemented in the Fermilab external dosimetry program are implemented on a schedule determined by DOE's administration of the DOELAP program.

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	(c) Doses from background, therapeutic and diagnostic medical radiation, and participation as a subject in medical research programs shall not be included in dose records or in the assessment of compliance with the occupational dose limits.	Fermilab policies and procedures are consistent with the provisions of Part 835.202(b). Fermilab policies and procedures are consistent with the provisions of Part 835.202(c).
835.203 Combining internal and external equivalent doses .	(a) The total effective dose during a year shall be determined by summing the effective dose from external exposures and the committed effective dose from intakes during the year. (b) Determinations of the effective dose shall be made using the radiation and tissue weighting factor values provided in § 835.2.	As of May 1, 2010, Fermilab policies and procedures related to the definitions of Part 835.2 have been modified to be consistent with the changes to the DOE-prescribed system of radiation dosimetry promulgated in the Federal Register, Vol. 72, No. 110, Docket No. EH-RM-02-835, pp. 31904-31941, June 8, 2007 based on ICRP Reports 60 and 68 as amended by the subsequent clarification issued by ICRP in ICRP Report 103. Fermilab has implemented Parts 835.203(a) and 835.203(b). The changes promulgated by the above-cited FR Notice implemented in the Fermilab external dosimetry program are implemented on a schedule determined by DOE's

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		administration of the DOELAP program.
835.204 Planned special exposures	(a) 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 § 835.202(a), provided that each of the following conditions is satisfied: (1) The planned special exposure is considered only in an exceptional situation when alternatives that might prevent a radiological worker from exceeding the limits in § 835.202(a) are unavailable or impractical; (2) The contractor management (and employer, if the employer is not the contractor) specifically requests the planned special exposure, in writing; and (3) Joint written approval is received from the appropriate DOE Headquarters program office and the Secretarial Officer responsible for environment, safety and health matters. (b) 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. (c) An individual shall not receive a planned special exposure that, in addition to the doses determined in § 835.204(b), would result in a dose exceeding the following: (1) In a year, the numerical values of the dose limits established at § 835.202(a); and	Fermilab policies and procedures implemented the provisions of Part 835.204 for planned special exposures. Such planned special exposures have never conducted at Fermilab and none are currently anticipated. Such exposures are anticipated to either be extremely rare if conducted at all. See comments at 835.203 concerning implementation status of personal dosimetry records and Fermilab's dosimetry program.

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	(2) Over the individual's lifetime, five times the numerical values of the dose limits established at §835.202(a). (d) Prior to a planned special exposure, written consent shall be obtained from each individual involved. Each such written consent shall include: (1) The purpose of the planned operations and procedures to be used; (2) The estimated doses and associated potential risks and specific radiological conditions and other hazards which might be involved in performing the task; and (3) Instructions on the measures to be taken to keep the dose ALARA considering other risks that may be present. (e) Records of the conduct of a planned special exposure shall be maintained and a written report submitted within 30 days after the planned special exposure to the approving organizations identified in § 835.204(a)(3). (f) The dose from planned special exposures is not to be considered in controlling future occupational dose of the individual under § 835.202(a), but is to be included in records and reports required under this part.	
835.205 Determination of compliance for non-uniform exposure of the skin	(a) Non-uniform exposures of the skin from X-rays, beta radiation, and/or radioactive material on the skin are to be assessed as specified in this section.	As of May 1, 2010, Fermilab policies and procedures related to the definitions of Part 835.2 have been modified to be

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	(b) For purposes of demonstrating compliance with §835.202(a)(4), assessments shall be conducted as follows: (1) Area of skin irradiated is 100 cm^2 or more. The non-uniform equivalent dose received during the year shall be averaged over the 100 cm^2 of the skin receiving the maximum dose, added to any uniform equivalent dose also received by the skin, and recorded as the equivalent dose to any extremity or skin for the year. (2) Area of skin irradiated is 10 cm^2 or more, but is less than 100 cm^2. The non-uniform equivalent dose (H) to the irradiated area received during the year shall be added to any uniform equivalent dose also received by the skin and recorded as the equivalent dose to any extremity or skin for the year. H is the equivalent dose averaged over the 1 cm^2 of skin receiving the maximum absorbed dose, D, reduced by the fraction f, which is the irradiated area in cm^2 divided by 100 cm^2 (i.e., H = fD). In no case shall a value of f less than 0.1 be used. (3) Area of skin irradiated is less than 10 cm^2. The non-uniform equivalent dose shall be averaged over the 1 cm^2 of skin receiving the maximum dose. This equivalent dose shall: (i) Be recorded in the individual's occupational exposure history as a special entry; and (ii) Not be added to any other equivalent dose to any extremity or skin for the year.	consistent with the changes to the DOE-prescribed system of radiation dosimetry promulgated in the Federal Register, Vol. 72, No. 110, Docket No. EH-RM-02-835, pp. 31904-31941, June 8, 2007 based on ICRP Reports 60 and 68 as amended by the subsequent clarifications issued by ICRP in ICRP Report 103. Fermilab has implemented Part 835.205. The changes promulgated by the above-cited FR Notice implemented in the Fermilab external dosimetry program are implemented on a schedule determined by DOE's administration of the DOELAP program.
835.206 Limits for the embryo/fetus	a) The equivalent dose limit for the embryo/fetus from the period of conception to birth, as a result of	As of May 1, 2010, Fermilab policies and procedures related to the definitions of Part 835.2

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	occupational exposure of a declared pregnant worker, is 0.5 rem (0.005 Sv). (b) Substantial variation above a uniform exposure rate that would satisfy the limits provided in §835.206(a) shall be avoided. (c) If the equivalent dose to the embryo/fetus is determined to have already exceeded 0.5 rem (0.005 Sv) by the time a worker declares her pregnancy, the declared pregnant worker shall not be assigned to tasks where additional occupational exposure is likely during the remaining gestation period.	have been modified to be consistent with the changes to the DOE-prescribed system of radiation dosimetry promulgated in the Federal Register, Vol. 72, No. 110, Docket No. EH-RM-02-835, pp. 31904-31941, June 8, 2007 based on ICRP Reports 60 and 68 as amended by the subsequent clarifications issued by ICRP in ICRP Report 103. Fermilab has implemented Part 835.206. The changes promulgated by the above-cited FR Notice implemented in the Fermilab external dosimetry program are implemented on a schedule determined by DOE's administration of the DOELAP program.
835.207 Occupational dose limits for minors	The dose limits for minors occupationally exposed to radiation and/or radioactive materials at a DOE activity are 0.1 rem (0.001 Sv) total effective dose in a year and 10 percent of the occupational dose limits specified at § 835.202(a)(3) and (a)(4).	As of May 1, 2010, Fermilab policies and procedures related to the definitions of Part 835.2 have been modified to be consistent with the changes to the DOE-prescribed system of radiation dosimetry promulgated in the Federal Register, Vol. 72, No. 110, Docket No. EH-RM-02-835, pp. 31904-31941, June 8, 2007 based on ICRP Reports 60 and 68 as amended by the

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		subsequent clarifications issued by ICRP in ICRP Report 103. Fermilab is in compliance with Part 835.207.
835.208 Limits for members of the public entering a controlled area	The total effective dose limit for members of the public exposed to radiation and/or radioactive material during access to a controlled area is 0.1 rem (0.001 Sv) in a year.	As of May 1, 2010, Fermilab policies and procedures related to the definitions of Part 835.2 have been modified to be consistent with the changes to the DOE-prescribed system of radiation dosimetry promulgated in the Federal Register, Vol. 72, No. 110, Docket No. EH-RM-02-835, pp. 31904-31941, June 8, 2007 based on ICRP Reports 60 and 68 as amended by the subsequent clarification issued by ICRP in ICRP Report 103. Fermilab is in compliance with Part 835.208.
835.209 Concentrations of radioactive material in air	(a) The derived air concentration (DAC) values given in appendices A and C of this part shall be used in the control of occupational exposures to airborne radioactive material. (b) The estimation of internal dose shall be based on bioassay data rather than air concentration values unless bioassay data are: (1) unavailable; (2) inadequate; or (3) internal dose estimates based on air concentration values are demonstrated to be as or more accurate.	Fermilab is in compliance with Part 835.209.

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Subpart D-- [Reserved]		
Subpart E-- Monitoring of Individuals and Areas		
835.401 General requirements	(a) Monitoring of individuals and areas shall be performed to: (1) Demonstrate compliance with the regulations in this part; (2) Document radiological conditions; (3) Detect changes in radiological conditions; (4) Detect the gradual buildup of radioactive material; (5) Verify the effectiveness of engineered and administrative controls in containing radioactive material and reducing radiation exposure; and (6) Identify and control potential sources of individual exposure to radiation and/or radioactive material. (b) Instruments and equipment used for monitoring shall be: (1) Periodically maintained and calibrated on an established frequency; (2) Appropriate for the type(s), levels, and energies of the radiation(s) encountered; (3) Appropriate for existing environmental conditions; and (4) Routinely tested for operability.	Fermilab policies and procedures fully implement the provisions of Part 835.401. Monitoring results are used to demonstrate compliance with all other requirements of Part 835. Fermilab radiation safety instrument maintenance and calibration records are in compliance with the provisions of Part 835.401. Those used for surveying areas or personnel are routinely checked for operability with a check source.

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§ 835.402 Individual monitoring	(a) For the purpose of monitoring individual exposures to external radiation, personnel dosimeters shall be provided to and used by: (1) Radiological workers who, under typical conditions, are likely to receive one or more of the following: (i) An effective dose of 0.1 rem (0.001 Sv) or more in a year; (ii) An equivalent dose to the skin or to any extremity of 5 rems (0.05 Sv) or more in a year; (iii) An equivalent dose to the lens of the eye of 1.5 rems (0.015 Sv) or more in a year; (2) Declared pregnant workers who are likely to receive from external sources an equivalent dose to the embryo/fetus in excess of 10 percent of the applicable limit at § 835.206(a); (3) Occupationally exposed minors likely to receive a dose in excess of 50 percent of the applicable limits at § 835.207 in a year from external sources; (4) Members of the public entering a controlled area likely to receive a dose in excess of 50 percent of the limit at § 835.208 in a year from external sources; and (5) Individuals entering a high or very high radiation area. (b) External dose monitoring programs implemented to demonstrate compliance with § 835.402(a) shall be adequate to demonstrate compliance with the dose limits established in subpart C of this part and shall be:	As of May 1, 2010, Fermilab policies and procedures related to the definitions of Part 835.2 have been modified to be consistent with the changes to the DOE-prescribed system of radiation dosimetry promulgated in the Federal Register, Vol. 72, No. 110, Docket No. EH-RM-02-835, pp. 31904-31941, June 8, 2007 based on ICRP Reports 60 and 68 as amended by the subsequent clarifications issued by ICRP in ICRP Report 103. Fermilab has implemented Part 835.402. The changes promulgated by the above-cited FR Notice implemented in the Fermilab external dosimetry program are implemented on a schedule determined by DOE's administration of the DOELAP program. Internal radiation exposures are rare at Fermilab. When needed, DOELAP accredited services shall be used. Internal radiation exposures are not anticipated to be received by

10 CFR 835 Citation	Requirement Text	Implementation
	(1) Accredited, or excepted from accreditation, in accordance with the DOE Laboratory Accreditation Program for Personnel Dosimetry; or (2) Determined by the Secretarial Officer responsible for environment, safety and health matters to have performance substantially equivalent to that of programs accredited under the DOE Laboratory Accreditation Program for Personnel Dosimetry. (c) For the purpose of monitoring individual exposures to internal radiation, internal dosimetry programs (including routine bioassay programs) shall be conducted for: (1) Radiological workers who, under typical conditions, are likely to receive a committed effective dose of 0.1 rem (0.001 Sv) or more from all occupational radionuclide intakes in a year; (2) Declared pregnant workers likely to receive an intake or intakes resulting in an equivalent dose to the embryo/fetus in excess of 10 percent of the limit stated at § 835.206(a); (3) Occupationally exposed minors who are likely to receive a dose in excess of 50 percent of the applicable limit stated at § 835.207 from all radionuclide intakes in a year; or (4) Members of the public entering a controlled area likely to receive a dose in excess of 50 percent of the limit stated at § 835.208 from all radionuclide intakes in a year. (d) Internal dose monitoring programs implemented to demonstrate compliance with § 835.402(c) shall be adequate to demonstrate compliance with the dose	occupational exposed minors or members of the public. Nevertheless, the requirements of Part 835.402 (c) are implemented at Fermilab.

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	limits established in subpart C of this part and shall be: (1) Accredited, or excepted from accreditation, in accordance with the DOE Laboratory Accreditation Program for Radiobioassay; or (2) Determined by the Secretarial Officer responsible for environment, safety and health matters to have performance substantially equivalent to that of programs accredited under the DOE Laboratory Accreditation Program for Radiobioassay.	
835.403 Air monitoring	(a) Monitoring of airborne radioactivity shall be performed: (1) Where an individual is likely to receive an exposure of 40 or more DAC-hours in a year; or (2) As necessary to characterize the airborne radioactivity hazard where respiratory protective devices for protection against airborne radionuclides have been prescribed. (b) Real-time air monitoring shall be performed as necessary to detect and provide warning of airborne radioactivity concentrations that warrant immediate action to terminate inhalation of airborne radioactive material.	Because of the relatively short half-lives of air activation products produced during normal operations at Fermilab, it is highly unlikely to have an area where an individual could receive an exposure of 40 or more DAC-hours in a year or one for which respiratory protective devices have been prescribed to protect the individual from airborne radionuclides. Exposure to airborne radioactivity at Fermilab is minimized by controlling facility ventilation and imposing administrative procedures prohibiting access to the areas to allow for decay where appropriate. Samples are taken as necessary to detect and evaluate the level or

10 CFR 835 Citation	Requirement Text	Implementation
		concentration airborne radionuclides at work locations to ensure that the individuals do not receive internal exposures. Real-time air monitors are used where required by radiological conditions at Fermilab. Should the scope of activities be modified such that air monitoring is required to comply with Part 835.403, Fermilab will revise its procedures accordingly.
835.404 [Reserved]		
835.405 Receipt of packages containing radioactive material.	(a) If packages containing quantities of radioactive material in excess of a Type A quantity (as defined at 10 CFR 71.4) are expected to be received from radioactive material transportation, arrangements shall be made to either: (1) Take possession of the package when the carrier offers it for delivery; or (2) Receive notification as soon as practicable after arrival of the package at the carrier's terminal and to take possession of the package expeditiously after receiving such notification. (b) Upon receipt from radioactive material transportation, external surfaces of packages known to contain radioactive material shall be monitored if the package: (1) Is labeled with a Radioactive White I, Yellow II, or Yellow III label (as specified at 49 CFR 172.403 and 172.436-440); or	Fermilab has established and implemented policies and procedures to comply with the requirements of Part 835.405.

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	(2) Has been transported as low specific activity material (as defined at 10 CFR 71.4) on an exclusive use vehicle (as defined at 10 CFR 71.4); or (3) Has evidence of degradation, such as packages that are crushed, wet, or damaged. (c) The monitoring required by paragraph (b) of this section shall include: (1) Measurements of removable contamination levels, unless the package contains only special form (as defined at 10 CFR 71.4) or gaseous radioactive material; and (2) Measurements of the radiation levels, if the package contains a Type B quantity (as defined at 10 CFR 71.4) of radioactive material. (d) The monitoring required by paragraph (b) of this section shall be completed as soon as practicable following receipt of the package, but not later than 8 hours after the beginning of the working day following receipt of the package. (e) Monitoring pursuant to § 835.405(b) is not required for packages transported on a DOE site which have remained under the continuous observation and control of a DOE employee or DOE contractor employee who is knowledgeable of and implements required exposure control measures.	

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Subpart F--Entry Control Program		
835.501 Radiological areas	(a) Personnel entry control shall be maintained for each radiological area. (b) The degree of control shall be commensurate with existing and potential radiological hazards within the area. (c) One or more of the following methods shall be used to ensure control: (1) Signs and barricades; (2) Control devices on entrances; (3) Conspicuous visual and/or audible alarms; (4) Locked entrance ways; or (5) Administrative controls. (d) Written authorizations shall be required to control entry into and perform work within radiological areas. These authorizations shall specify radiation protection measures commensurate with the existing and potential hazards. (e) No control(s) shall be installed at any radiological area exit that would prevent rapid evacuation of personnel under emergency conditions.	Fermilab policies and procedures fully implement the personnel entry control provisions of Part 835.501 (a), (b), and (c). This is a done in a manner that applies a graduated system of controls and postings commensurate with the existing and potential radiological hazards present in a given area. As specified in Part 835.501 (d), written authorizations are required prior to the performance of work within radiological areas or with radioactive materials with contents commensurate with the existing and potential hazards. In accordance with Fermilab's implementation of Integrated Safety Management systems and with Part 835.501(e), no controls are installed at any radiological area exit that would prevent, or even impede rapid evacuation of personnel under emergency conditions.

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835.502 High and very high radiation areas	(a) The following measures shall be implemented for each entry into a high radiation area: (1) The area shall be monitored as necessary during access to determine the exposure rates to which the individuals are exposed; and (2) Each individual shall be monitored by a supplemental dosimetry device or other means capable of providing an immediate estimate of the individual's integrated equivalent dose to the whole body during the entry. (b) Physical controls. One or more of the following controls shall be used for each entrance or access point to a high radiation area where radiation levels exist such that an individual could exceed an equivalent dose to the whole body of 1 rem (0.01 Sv) in any one hour at 30 centimeters from the source or from any surface that the radiation penetrates: (1) A control device that prevents entry to the area when high radiation levels exist or that, upon entry, causes the radiation level to be reduced below the level that defines a high radiation area; (2) A device that functions automatically to prevent use or operation of the radiation source or field while individuals are in the area; (3) A control device that energizes a conspicuous visible or audible alarm signal so that the individual entering the high radiation area and the supervisor of the activity are made aware of the entry; (4) Entryways that are locked. During periods when access to the area is required, positive control over each entry is maintained;	The doses to which individuals are exposed have been determined prior to access or if an initial access, assessed during the initial entry. Each individual entering a high radiation area is monitored by a supplemental dosimetry device that is capable of providing an immediate estimate of the individual's whole body dose during the particular task in question. Part 835.502(a) is thus completely implemented. The provisions of Part 835.502(b) are implemented by utilizing one or more of the types of control devices specified in the Regulation where radiation levels exist such that an individual could exceed a dose to the whole body of 1 rem (0.01 Sv) in any hour at 30 centimeters from the source or from any surface that the radiation penetrates. Concerning Part 835.502 (c), Fermilab has instituted additional measures to prevent access to areas where dose rates are in excess of 25 rads/hr.

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	(5) Continuous direct or electronic surveillance that is capable of preventing unauthorized entry; (6) A control device that will automatically generate audible and visual alarm signals to alert personnel in the area before use or operation of the radiation source and in sufficient time to permit evacuation of the area or activation of a secondary control device that will prevent use or operation of the source. (c) Very high radiation areas. In addition to the above requirements, additional measures shall be implemented to ensure individuals are not able to gain unauthorized or inadvertent access to very high radiation areas. (d) No control(s) shall be established in a high or very high radiation area that would prevent rapid evacuation of personnel.	Access to these areas must have at least two of the features listed in Part 835.502(a) in place. In practices such accesses are exceptionally rare at Fermilab. In accordance with Fermilab's implementation of Integrated Safety Management systems and with Part 835.502(d), no controls are installed at any high or very high area exit that would prevent, or even impede rapid evacuation of personnel under emergency conditions.
Subpart G--Posting and Labeling		
835.601 General requirements	(a) Except as otherwise provided in this subpart, postings and labels required by this subpart shall include the standard radiation warning trefoil in black or magenta imposed upon a yellow background. (b) Signs required by this subpart shall be clearly and conspicuously posted and may include radiological protection instructions.	Fermilab has instituted policies and procedures to fully implement the requirements of Part 835.601. All postings are to be done clearly and conspicuously and commonly include radiological protection instructions. Fermilab activities that have the potential of an individual receiving a dose of

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	(c) The posting and labeling requirements in this subpart may be modified to reflect the special considerations of DOE activities conducted at private residences or businesses. Such modifications shall provide the same level of protection to individuals as the existing provisions in this subpart.	100 millirem in a year are not sponsored or conducted at private residences or businesses. If such an activity were to be conducted in the future, measures would be taken to assure an equivalent level of protection.
835.602 Controlled areas	(a) Each access point to a controlled area (as defined in § 835.2) shall be posted whenever radiological areas or radioactive material areas exist in the area. Individuals who enter only controlled areas without entering radiological areas or radioactive material areas are not expected to receive a total effective dose of more than 0.1 rem (0.001 sievert) in a year. (b) Signs used for this purpose may be selected by the contractor to avoid conflict with local security requirements.	Fermilab has instituted policies and procedures to fully implement the requirements of Part 835.602 pertaining to entry into controlled areas as defined in Part 835.2. Individuals who only enter controlled areas are not expected to receive a total dose of more than 0.1 rem (0.001 Sv) in a year. There are no security requirements at Fermilab that conflict with the choice of signage and wording thereof that is used to post the controlled areas defined in Part 835.2 so Part 835.602(b) has no implementation implications at Fermilab.
835.603 Radiological areas and radioactive material areas	Each access point to radiological areas and radioactive material areas (as defined at § 835.2) shall be posted with conspicuous signs bearing the wording provided in this section.	Fermilab has fully implemented the requirements of Part 835.603 pertaining to access to radiological areas and radioactive material areas as defined in Part 835.2. The

10 CFR 835 Citation	Requirement Text	Implementation
	(a) Radiation Area. The words "Caution, Radiation Area" shall be posted at each radiation area. (b) High Radiation Area. The words "Caution, High Radiation Area" or "Danger, High Radiation Area" shall be posted at each high radiation area. (c) Very High Radiation Area. The words "Grave Danger, Very High Radiation Area" shall be posted at each very high radiation area. (d) Airborne Radioactivity Area. The words "Caution, Airborne Radioactivity Area" or "Danger, Airborne Radioactivity Area" shall be posted at each airborne radioactivity area. (e) Contamination Area. The words "Caution, Contamination Area" shall be posted at each contamination area. (f) High Contamination Area. The words "Caution, High Contamination Area" or "Danger, High Contamination Area" shall be posted at each high contamination area. (g) Radioactive Material Area. The words "Caution, Radioactive Material(s)" shall be posted at each radioactive material area.	wording of the signage or labeling (e.g. of radioactive materials) is consistent with the requirements set forth in Part 835.603. Because radiation levels can vary significantly with the operation of the accelerators and the impracticability of reposting every time the beam is turned on or off, accelerator/beamline enclosures are posted for the radiological conditions present when beam enclosures are rendered accessible to personnel. Physical controls, which render access impossible during operation, are imposed for those areas in which radiation levels could pose a significant danger to personnel. Compliance with the posting requirements of Part 835.603 has been confirmed by an assessment conducted by the DOE Office of Science on June 17, 2014.
835.604 Exceptions to posting requirements	(a) Areas may be excepted from the posting requirements of § 835.603 for periods of less than 8 continuous hours when placed under continuous observation and control of an individual	Fermilab has instituted policies and procedures implementing the exception from posting expressed in Part 835.604(a)

10 CFR 835 Citation	Requirement Text	Implementation
	knowledgeable of, and empowered to implement, required access and exposure control measures. (b) Areas may be excepted from the radioactive material area posting requirements of § 835.603(g) when: (1) Posted in accordance with § 835.603(a) through (f); or (2) Each item or container of radioactive material is labeled in accordance with this subpart such that individuals entering the area are made aware of the hazard; or (3) The radioactive material of concern consists solely of structures or installed components which have been activated (i.e. such as by being exposed to neutron radiation or particles produced in an accelerator). (c) Areas containing only packages received from radioactive material transportation labeled and in non-degraded condition need not be posted in accordance with § 835.603 until the packages are monitored in accordance with § 835.405.	Fermilab has instituted policies and procedures implementing the exception from posting expressed in Part 835.604(b). Specifically, the "Caution, Radioactive Material (s)" posting may be omitted if it is determined that the posting does not convey additional information useful to the worker as described by the circumstances expressed in Part 835.604(b). Fermilab has instituted policies and procedures implementing the exception from posting expressed in Part 835.604(c). Items received from radioactive material transportation are isolated pending successful completion of monitoring activities otherwise required. Those found to be in a degraded or compromised condition are monitored prior to receipt from the carrier.
835.605 Labeling items and containers	Except as provided in § 835.606, each item or container of radioactive material shall bear a durable, clearly visible label bearing the standard radiation warning trefoil and the words "Caution, Radioactive	Fermilab has adopted policies and procedures to fully implement Part 835.605 except as provided in Part 835.606. In addition,

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	Material" or "Danger, Radioactive Material." The label shall also provide sufficient information to permit individuals handling, using, or working in the vicinity of the items or containers, to take precautions to avoid or control exposures.	Fermilab has instituted and internal classification scheme, consistent with Part 835, that provided additional information to the workers concerning radiation levels present.
835.606 Exceptions to labeling requirements	(a) Items and containers may be excepted from the radioactive material labeling requirements of § 835.605 when: (1) Used, handled, or stored in areas posted and controlled in accordance with this subpart and sufficient information is provided to permit individuals to take precautions to avoid or control exposures; or (2) The quantity of radioactive material is less than one tenth of the values specified in appendix E of this part and less than 0.1 Ci; or (3) Packaged, labeled, and marked in accordance with the regulations of the Department of Transportation or DOE Orders governing radioactive material transportation; or (4) Inaccessible, or accessible only to individuals authorized to handle or use them, or to work in the vicinity; or (5) Installed in manufacturing, process, or other equipment, such as reactor components, piping, and tanks; or (6) The radioactive material consists solely of nuclear weapons or their components. (b) Radioactive material labels applied to sealed radioactive sources may be excepted from the color specifications of § 835.601(a).	Fermilab policies and procedures have implemented the exceptions from the labeling requirements of Part 835.605 as specified in Part 835.606. Part 835.606(a)(6) is not applicable to Fermilab as there are no nuclear weapons or nuclear weapons components present on the Fermilab site.

10 CFR 835 Citation	Requirement Text	Implementation
Subpart H--Records		
835.701 General provisions	(a) Records shall be maintained to document compliance with this part and with radiation protection programs required by § 835.101. (b) Unless otherwise specified in this subpart, records shall be retained until final disposition is authorized by DOE.	Fermilab maintains records to document compliance with Part 835 and with this Radiation Protection Program submitted in compliance with Part 835.101. All such records shall be retained until final dispositions specified and authorized by DOE.
835.702 Individual monitoring records.	(a) Except as authorized by § 835.702(b), records shall be maintained to document doses received by all individuals for whom monitoring was conducted and to document doses received during planned special exposures, unplanned doses exceeding the monitoring thresholds of § 835.402, and authorized emergency exposures. (b) Recording of the non-uniform equivalent dose to the skin is not required if the dose is less than 2 percent of the limit specified for the skin at § 835.202(a)(4). Recording of internal dose (committed effective dose or committed equivalent dose) is not required for any monitoring result estimated to correspond to an individual receiving less than 0.01 rem (0.1 mSv) committed effective dose. The bioassay or air monitoring result used to make the estimate shall be maintained in accordance with § 835.703(b) and the unrecorded internal dose estimated for any individual in a year shall not exceed the applicable monitoring threshold at § 835.402(c).	Fermilab maintains records for all personnel for whom monitoring is conducted and documents doses received during planned special exposures, unplanned doses exceeding the monitoring thresholds of Part 835.402, and authorized emergency exposures. Fermilab has incorporated the exclusions from mandatory recording of non-uniform doses and internal doses specified in Part 835.702(b). However, data supporting such a determination shall be retained in conformance with the Part 835. Fermilab also retains certain data in order to support design efforts and the radiation protection dosimetry program.

10 CFR 835 Citation	Requirement Text	Implementation
	(c) The records required by this section shall: (1) Be sufficient to evaluate compliance with subpart C of this part; (2) Be sufficient to provide dose information necessary to complete reports required by subpart I of this part; (3) Include the results of monitoring used to assess the following quantities for external dose received during the year: (i) The effective dose from external sources of radiation (equivalent dose to the whole body may be used as effective dose for external exposure); (ii) The equivalent dose to the lens of the eye; (iii)The equivalent dose to the skin; and (iv)The equivalent dose to the extremities. (4) Include the following information for internal dose resulting from intakes received during the year: (i) Committed effective dose; (ii) Committed equivalent dose to any organ or tissue of concern; and (iii)Identity of radionuclides. (5) Include the following quantities for the summation of the external and internal dose: (i) Total effective dose in a year; (ii) For any organ or tissue assigned an internal dose during the year, the sum of the equivalent dose to the whole body from external exposures and the committed equivalent dose to that organ or tissue; and (iii)Cumulative total effective dose. (6) Include the equivalent dose to the embryo/fetus of a declared pregnant worker.	As of May 1, 2010, Fermilab policies and procedures related to the definitions of Part 835.2(a) have been modified to be consistent with the changes to the DOE-prescribed system of radiation dosimetry promulgated in the Federal Register, Vol. 72, No. 110, Docket No. EH-RM-02-835, pp. 31904-31941, June 8, 2007 based on ICRP Reports 60 and 68 as amended by the subsequent clarifications issued by ICRP in ICRP Report 103. Fermilab has implemented Part 835.702. The changes promulgated by the above-cited FR Notice implemented in the Fermilab external dosimetry program are implemented on a schedule determined by DOE's administration of the DOELAP program. In accordance with the referenced Federal Register Notice, page 31908, historical doses recorded and reported to individuals and dosimetry results acquired from other institutions (both DOE and

10 CFR 835 Citation	Requirement Text	Implementation
	(d) Documentation of all occupational doses received during the current year, except for doses resulting from planned special exposures conducted in compliance with § 835.204 and emergency exposures authorized in accordance with § 835.1302(d), shall be obtained to demonstrate compliance with § 835.202(a). If complete records documenting previous occupational dose during the year cannot be obtained, a written estimate signed by the individual may be accepted to demonstrate compliance. (e) For radiological workers whose occupational dose is monitored in accordance with § 835.402, reasonable efforts shall be made to obtain complete records of prior years occupational internal and external doses. (f) The records specified in this section that are identified with a specific individual shall be readily available to that individual. (g) Data necessary for future verification or reassessment of the recorded doses shall be recorded. (h) All records required by this section shall be transferred to the DOE upon cessation of activities at the site that could cause exposure to individuals.	non-DOE) prior to complete implementation of the new system of radiation dosimetry shall still be considered to be the official doses of record. Fermilab policies and procedures will continue to implement the requirements of Part 835.702(d). Fermilab policies and procedures continue to implement the provisions of Parts 835.702(e),(f), and (g). Fermilab policies and procedures both in the general area of recordkeeping and specific to environment, safety, and health, the integrated safety management system, and radiation protection implement the requirements of Part 835.702(h).
835.703 Other monitoring records	The following information shall be documented and maintained:	Fermilab has instituted policies and procedures to continue to implement Part 835.703.

10 CFR 835 Citation	Requirement Text	Implementation
	(a) Results of monitoring for radiation and radioactive material as required by subparts E and L of this part, except for monitoring required by §835.1102(d); (b) Results of monitoring used to determine individual occupational dose from external and internal sources; (c) Results of monitoring for the release and control of material and equipment as required by § 835.1101; and (d) Results of maintenance and calibration performed on instruments and equipment as required by § 835.401(b).	Part 835.703(a) is implemented by means of radiation surveys, measurements, and calculations associated with the activities covered by subparts E and L of Part 835 except for the monitoring required by Part 835.1102(d) Fermilab utilizes radiation surveys, dosimetry results, calculations, specific measurements, and where needed special analyses and measurements to implement Part 835.703(b) Fermilab has implemented procedures to document and maintain surveys for the release and control of material and equipment as required by Part 835.1101 in order to implement Part 835.703(c). Fermilab has implemented procedures to document maintenance and calibration on instruments and equipment as required by Part 835.401(b) in order to implement Part 835.703(d).

10 CFR 835 Citation	Requirement Text	Implementation
835.704 Administrative records	(a) Training records shall be maintained, as necessary, to demonstrate compliance with § 835.901. (b) Actions taken to maintain occupational exposures as low as reasonably achievable, including the actions required for this purpose by § 835.101, as well as facility design and control actions required by §§835.1001, 835.1002 and 835.1003, shall be documented. (c) Records shall be maintained to document the results of internal audits and other reviews of program content and implementation. (d) Written declarations of pregnancy, including the estimated date of conception, and revocations of declarations of pregnancy shall be maintained. (e) Changes in equipment, techniques, and procedures used for monitoring shall be documented. (f) Records shall be maintained as necessary to demonstrate compliance with the requirements of §§ 835.1201 and 835.1202 for sealed radioactive source control, inventory, and source leak tests.	Fermilab continues to implement policies and procedures as required by Part 835.704. Training records are maintained as necessary to assure compliance with Part 835. 901 and implement Part 835.704(a). Efforts to document actions taken to maintain occupational radiation exposures ALARA, inclusive of those required by Parts 835.101, 835.1001, 835.1002 and 835.1003 are documented and retained in order to implement Part 835.704(b) Internal audits and other reviews of program content and implementation required by Part 835.704(c) are documented and retained to implement Part 835.704 (c). Written declarations of pregnancy including the estimated date of conception, and revocations of declarations of pregnancy are maintained to implement Part 835.704(d).

10 CFR 835 Citation	Requirement Text	Implementation
		Fermilab takes care to evaluate and document and evaluate changes in equipment and monitoring techniques used in order to continue to implement Part 835.704(e). Fermilab's program for the control of sealed sources in accordance with Parts 835.1201 and 835.1202 are maintained to implement Part 835.704(f).
Subpart I--Reports to Individuals		
835.801 Reports to individuals	(a) Radiation exposure data for individuals monitored in accordance with § 835.402 shall be reported as specified in this section. The information shall include the data required under § 835.702(c). Each notification and report shall be in writing and include: the DOE site or facility name, the name of the individual, and the individual's social security number, employee number, or other unique identification number. (b) Upon the request from an individual terminating employment, records of exposure shall be provided to that individual as soon as the data are available, but not later than 90 days after termination. A written estimate of the radiation dose received by	Fermilab policies and procedures continue to implement the detailed provisions of Part 835.801. Full implementation of the changes promulgated by the above-cited FR notice will be complete upon DOELAP accreditation of Fermilab's dosimetry program, a schedule to be determined by DOE's administration of the DOELAP program.

10 CFR 835 Citation	Requirement Text	Implementation
	that employee based on available information shall be provided at the time of termination, if requested. (c) Each DOE- or DOE-contractor-operated site or facility shall, on an annual basis, provide a radiation dose report to each individual monitored during the year at that site or facility in accordance with § 835.402. (d) Detailed information concerning any individual's exposure shall be made available to the individual upon request of that individual, consistent with the provisions of the Privacy Act (5 U.S.C. 552a). (e) When a DOE contractor is required to report to the Department, pursuant to Departmental requirements for occurrence reporting and processing, any exposure of an individual to radiation and/or radioactive material, or planned special exposure in accordance with § 835.204(e), the contractor shall also provide that individual with a report on his or her exposure data included therein. Such report shall be transmitted at a time not later than the transmittal to the Department.	
Subpart J--Radiation Safety Training		
835.901 Radiation safety training	(a) Each individual shall complete radiation safety training on the topics established at § 835.901(c commensurate with the hazards in the area and the required controls:	Under Fermilab Integrated Safety Management Systems (ISMS) program, Fermilab has implemented a comprehensive radiation safety training

10 CFR 835 Citation	Requirement Text	Implementation
	(1) Before being permitted unescorted access to controlled areas; and (2) Before receiving occupational dose during access to controlled areas at a DOE site or facility. (b) Each individual shall demonstrate knowledge of the radiation safety training topics established in § 835.901(c), commensurate with the hazards in the area and required controls, by successful completion of an examination and performance demonstrations: (1) Before being permitted unescorted access to radiological areas; and (2) Before performing unescorted assignments as a radiological worker. (c) Radiation safety training shall include the following topics, to the extent appropriate to each individual's prior training, work assignments, and degree of exposure to potential radiological hazards: (1) Risks of exposure to radiation and radioactive materials, including prenatal radiation exposure; (2) Basic radiological fundamentals and radiation protection concepts; (3) 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; (4) Individual rights and responsibilities as related to implementation of the facility radiation protection program;	program commensurate with the radiological hazards encountered and congruent with the applied controls in order to implement the individual provisions of Part 835.901. Provisions have been made for a grace period of up to 30 days to accommodate scheduling needs as specified in 835.3(e).

10 CFR 835 Citation	Requirement Text	Implementation
	(5) Individual responsibilities for implementing ALARA measures required by § 835.101; and (6) Individual exposure reports that may be requested in accordance with § 835.801. (d) When an escort is used in lieu of training in accordance with paragraph (a) or (b) of this section, the escort shall: (1) Have completed radiation safety training, examinations, and performance demonstrations required for entry to the area and performance of the work; and (2) Ensure that all escorted individuals comply with the documented radiation protection program. (e) Radiation safety training 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. Such training provided for individuals subject to the requirements of § 835.901(b)(1) and (b)(2) shall include successful completion of an examination.	
835.902 [Removed and Reserved]		
835.903 [Removed and Reserved]		
Subpart K--Design and Control		

10 CFR 835 Citation	Requirement Text	Implementation
835.1001 Design and control	(a) Measures shall be taken to maintain radiation exposure in controlled areas ALARA through engineered and administrative controls. The primary methods used shall be engineered controls (e.g., confinement, ventilation, remote handling, and shielding). Administrative controls shall be employed only as supplemental methods to control radiation exposure. (b) For specific activities where use of engineered controls is demonstrated to be impractical, administrative controls shall be used to maintain radiation exposures ALARA.	Fermilab continues to implement measures to maintain radiation exposures in controlled areas ALARA through engineered and administrative controls. Engineered controls are recognizes as the primary methods of controlling exposures with administrative controls regarded as secondary methods to control radiation exposure in order to implement the provisions of Part 835.1001.
835.1002 Facility design and modifications	During the design of new facilities or modification of existing facilities, the following objectives shall be adopted: (a) Optimization methods shall be used to assure that occupational exposure is maintained ALARA in developing and justifying facility design and physical controls. (b) The design objective for controlling personnel exposure from external sources of radiation in areas of continuous occupational occupancy (2000 hours per year) shall be to maintain exposure levels below an average of 0.5 millirem (5 μSv) per hour and as far below this average as is reasonably achievable. The design objectives for exposure rates for potential exposure to a radiological worker where occupancy differs from the above shall be ALARA	Fermilab continues to implement measures to maintain radiation exposures in controlled areas ALARA through engineered and administrative controls. Engineered controls are recognizes as the primary methods of controlling exposures with administrative controls regarded as secondary methods to control radiation exposure in order to implement the provisions of Part 835.1002.

10 CFR 835 Citation	Requirement Text	Implementation
	and shall not exceed 20 percent of the applicable standards in § 835.202. (c) Regarding the control of airborne radioactive material, the design objective shall be, under normal conditions, to avoid releases to the workplace atmosphere and in any situation, to control the inhalation of such material by workers to levels that are ALARA; confinement and ventilation shall normally be used. (d) The design or modification of a facility and the selection of materials shall include features that facilitate operations, maintenance, decontamination, and decommissioning.	
§ 835.1003 Workplace Controls	During routine operations, the combination of engineered and administrative controls shall provide that: (a) The anticipated occupational dose to general employees shall not exceed the limits established at § 835.202; and (b) The ALARA process is utilized for personnel exposures to ionizing radiation.	Fermilab facilities are designed such that during routine operations the combination of engineered and administrative controls achieve the requirements expressed in Part 835.1003 pertaining to Part 835.202 with the ALARA process utilized as required elsewhere in Part 835.
Subpart L - Radioactive Contamination Control		

10 CFR 835 Citation	Requirement Text	Implementation
835.1101 Control of material and equipment	(a) Except as provided in paragraphs (b) and (c) of this section, material and equipment in contamination areas, high contamination areas, and airborne radioactivity areas shall not be released to a controlled area if: (1) Removable surface contamination levels on accessible surfaces exceed the removable surface contamination values specified in appendix D of this part; or (2) Prior use suggests that the removable surface contamination levels on inaccessible surfaces are likely to exceed the removable surface contamination values specified in appendix D of this part. (b) Material and equipment exceeding the removable surface contamination values specified in appendix D of this part may be conditionally released for movement on-site from one radiological area for immediate placement in another radiological area only if appropriate monitoring is performed and appropriate controls for the movement are established and exercised. (c) Material and equipment with fixed contamination levels that exceed the total surface contamination values specified in appendix D of this part may be released for use in controlled areas outside of radiological areas only under the following conditions: (1) Removable surface contamination levels are below the removable surface contamination values specified in appendix D of this part; and	Fermilab policies and procedures implement the provisions of Part 835.1101. Material and equipment in contamination areas, high contamination areas, and airborne radioactivity areas are not released to a controlled area if the surface contamination levels exceed the values specified in appendix D of Part 835 or prior use suggests that this is likely in order to implement Part 835.1101 (a). Materials and equipment exceeding the surface contamination values of Appendix D of Part 835 may be conditionally released for movement on-site from one radiological areas for immediate placement in another radiological areas only if appropriate monitoring is performed in accordance with the provisions of Part 835.1101(b). Material and equipment with fixed contamination levels that exceed the surface contamination values

10 CFR 835 Citation	Requirement Text	Implementation
	(2) The material or equipment is routinely monitored and clearly marked or labeled to alert personnel of the contaminated status.	specified in Appendix D of Part 835 may be released according to the provisions of Part 835.1101(c). Fixed contamination of material and equipment is rarely encountered at particle accelerators and at Fermilab. More common at Fermilab is volume activation. Volume activation is not considered to be fixed contamination as used in Part 835.
835.1102 Control of areas	(a) Appropriate controls shall be maintained and verified which prevent the inadvertent transfer of removable contamination to locations outside of radiological areas under normal operating conditions. (b) Any area in which contamination levels exceed the values specified in appendix D of this part shall be controlled in a manner commensurate with the physical and chemical characteristics of the contaminant, the radionuclides present, and the fixed and removable surface contamination levels. (c) Areas accessible to individuals where the measured total surface contamination levels exceed, but the removable surface contamination levels are less than, corresponding surface contamination values specified in appendix D of this part, shall be	Fermilab policies and procedures implement the provisions of Part 835.1102. Fermilab has implemented a multi-faceted program to control contamination in order to implement the requirements of Part 835.1102(a) and Part 835.1102(b). These are tailored to the physical and chemical characteristics of the contaminant, the radionuclides present including consideration of their half-lives, and the levels of removable surface contamination encountered.

10 CFR 835 Citation	Requirement Text	Implementation
	controlled as follows when located outside of radiological areas: (1) The area shall be routinely monitored to ensure the removable surface contamination level remains below the removable surface contamination values specified in appendix D of this part; and (2) The area shall be conspicuously marked to warn individuals of the contaminated status. (d) Individuals exiting contamination, high contamination, or airborne radioactivity areas shall be monitored, as appropriate, for the presence of surface contamination. (e) Protective clothing shall be required for entry to areas in which removable contamination exists at levels exceeding the removable surface contamination values specified in appendix D of this part.	While, as discussed above, fixed contamination is rare at particle accelerators and at Fermilab, Fermilab has instituted measures to implement the provisions of Part 835.1102 (c). Fermilab has instituted policies and procedures to require the personnel monitoring upon exiting contamination, high contamination, or airborne radioactivity areas for surface contamination as specified by Part 835.1102(d). Fermilab requires protective clothing to be worn in areas where removable contamination levels exceed the removable surface contamination values specified in appendix D of Part 835 in accordance with Part 835.1102(e). In practice, protective clothing is commonly used as a precautionary measure in situations so that the contamination values specified in Part 835 Appendix D may not be exceeded.

10 CFR 835 Citation	Requirement Text	Implementation
Subpart M--Sealed Radioactive Source Control		
835.1201 Sealed radioactive source control	Sealed radioactive sources shall be used, handled, and stored in a manner commensurate with the hazards associated with operations involving the sources.	Sealed radioactive sources on the Fermilab site are used, handled, and stored in a manner commensurate with the hazards associated with the source and its operations.
835.1202 Accountable sealed radioactive sources	(a) Each accountable sealed radioactive source shall be inventoried at intervals not to exceed six months. This inventory shall: (1) Establish the physical location of each accountable sealed radioactive source; (2) Verify the presence and adequacy of associated postings and labels; and (3) Establish the adequacy of storage locations, containers, and devices. (b) Except for sealed radioactive sources consisting solely of gaseous radioactive material or tritium, each accountable sealed radioactive source shall be subject to a source leak test upon receipt, when damage is suspected, and at intervals not to exceed six months. Source leak tests shall be capable of detecting radioactive material leakage equal to or exceeding 0.005 μCi. (c) Notwithstanding the requirements of paragraph (b) of this section, an accountable sealed radioactive source is not subject to periodic source leak testing if that source has been removed from service. Such sources shall be stored in a controlled location,	The accountable sealed radioactive sources at Fermilab are inventoried and leak-checked in accordance with the provisions of Part 835.1202. Provisions have been made for a grace period of up to 30 days to accommodate scheduling needs as specified in 835.3(e). For purposes of implementation of this part, Fermilab does not include sealed sources used in commercial fire protection devices such as smoke detectors in its Radioactive Sealed Source Control and Accountability Program.

10 CFR 835 Citation	Requirement Text	Implementation
	subject to periodic inventory as required by paragraph (a) of this section, and subject to source leak testing prior to being returned to service. (d) Notwithstanding the requirements of paragraphs (a) and (b) of this section, an accountable sealed radioactive source is not subject to periodic inventory and source leak testing if that source is located in an area that is unsafe for human entry or otherwise inaccessible. (e) An accountable sealed radioactive source found to be leaking radioactive material shall be controlled in a manner that minimizes the spread of radioactive contamination.	
Subpart N--Emergency Exposure Situations		
835.1301 General provisions	(a) A general employee whose occupational dose has exceeded the numerical value of any of the limits specified in § 835.202 as a result of an authorized emergency exposure may be permitted to return to work in radiological areas during the current year providing that all of the following conditions are met: (1) Approval is first obtained from the contractor management and the Head of the responsible DOE field organization; (2) The individual receives counseling from radiological protection and medical personnel	Fermilab policies and procedures are in place to implement the provisions of Part 835.1301. Such exposures have, to-date, been non-existent.

10 CFR 835 Citation	Requirement Text	Implementation
	regarding the consequences of receiving additional occupational exposure during the year; and (3) The affected employee agrees to return to radiological work. (b) All doses exceeding the limits specified in § 835.202 shall be recorded in the affected individual's occupational dose record. (c) When the conditions under which a dose was received in excess of the limits specified in § 835.202, except those doses received in accordance with § 835.204, have been eliminated, operating management shall notify the Head of the responsible DOE field organization. (d) Operations which have been suspended as a result of a dose in excess of the limits specified in §835.202, except those received in accordance with § 835.204, may be resumed only with the approval of DOE.	
835.1302 Emergency exposure situations	(a) The risk of injury to those individuals involved in rescue and recovery operations shall be minimized. (b) Operating management shall weigh actual and potential risks against the benefits to be gained. (c) No individual shall be required to perform rescue action that might involve substantial personal risk. (d) Each individual authorized to perform emergency actions likely to result in occupational doses	Fermilab policies and procedures in radiation protection are designed in their entirety to prevent emergency exposures situations. Fermilab policies and procedures have been established to implement the provisions of Part 835.1302.

10 CFR 835 Citation	Requirement Text	Implementation
	exceeding the values of the limits provided at §835.202(a) shall be trained in accordance with §835.901(b) and briefed beforehand on the known or anticipated hazards to which the individual will be subjected.	
835.1303 [Reserved]		
835.1304 Nuclear accident dosimetry	(a) Installations possessing sufficient quantities of fissile material to potentially constitute a critical mass, such that the excessive exposure of individuals to radiation from a nuclear accident is possible, shall provide nuclear accident dosimetry for those individuals. (b) Nuclear accident dosimetry shall include the following: (1) A method to conduct initial screening of individuals involved in a nuclear accident to determine whether significant exposures to radiation occurred; (2) Methods and equipment for analysis of biological materials; (3) A system of fixed nuclear accident dosimeter units; and (4) Personal nuclear accident dosimeters.	There are no such quantities of fissile material present on the Fermilab site nor are any acquisitions of such quantities of fissile material within the scope of present or planned Fermilab operations. Thus criticality events creating a nuclear accident on the Fermilab are precluded and Part 835.1304 is not applicable.
Appendix A to Part 835--DERIVED AIR CONCENTRA-TIONS (DAC) FOR CONTROLLING RADIATION	The data presented in appendix A are to be used for controlling individual internal doses in accordance with § 835.209, identifying the need for air monitoring in accordance with § 835.403, and identifying and posting airborne radioactivity areas in accordance with § 835.603(d).	As of May 1, 2010, Fermilab policies and procedures related to the definitions of Part 835.2(a) have been modified to be consistent with the changes to the DOE-prescribed system of radiation dosimetry promulgated in the Federal

10 CFR 835 Citation	Requirement Text	Implementation
EXPOSURE TO WORKERS AT DOE FACILITIES	The DAC values are given for individual radionuclides. For known mixtures of radionuclides, determine the sum of the ratio of the observed concentration of a particular radionuclide and its corresponding DAC for all radionuclides in the mixture. If this sum exceeds unity (1), then the DAC has been exceeded. For unknown radionuclides, the most restrictive DAC (lowest value) for those isotopes not known to be absent shall be used. For any single radionuclide not listed in appendix A with decay mode other than alpha emission or spontaneous fission and with radioactive half-life greater than two hours, the DAC value shall be 4 E−11 μCi/mL (1 Bq/m^3). For any single radionuclide not listed in appendix A that decays by alpha emission or spontaneous fission the DAC value shall be 2 E−13 μCi/mL (8 E−03 Bq/m^3). The DACs for limiting radiation exposures through inhalation of radionuclides by workers are listed in this appendix. The values are based on either a stochastic (committed effective dose) dose limit of 5 rems (0.05 Sv) or a deterministic (organ or tissue) dose limit of 50 rems (0.5 Sv) per year, whichever is more limiting. Note: the 15 rems (0.15 Sv) dose limit for the lens of the eye does not appear as a critical organ dose limit. The columns in this appendix contain the following information: (1) Radionuclide; (2) inhaled air DAC for type F (fast), type M (moderate), and type S (slow) materials in units of μCi/mL; (3) inhaled air	Register, Vol. 72, No. 110, Docket No. EH-RM-02-835, pp. 31904-31941, June 8, 2007. This includes the values and footnotes pertaining to Derived Air Concentrations (DAC) as specified by Appendix A to Part 835.

10 CFR 835 Citation	Requirement Text	Implementation
	DAC for type F (fast), type M (moderate), and type S (slow) materials in units of Bq/m^3; (4) an indication of whether or not the DAC for each class is controlled by the stochastic (effective dose) or deterministic (organ or tissue) dose. The absorption types (F, M, and S) have been established to describe the absorption type of the materials from the respiratory tract into the blood. The range of half-times for the absorption types correspond to: Type F, 100% at 10 minutes; Type M, 10% at 10 minutes and 90% at 140 days; and Type S 0.1% at 10 minutes and 99.9% at 7000 days. The DACs are listed by radionuclide, in order of increasing atomic mass, and are based on the assumption that the particle size distribution of 5 micrometers AMAD is used. For situations where the particle size distribution is known to differ significantly from 5 micrometers AMAD, appropriate corrections may be made to both the estimated dose to workers and the DACs. Footnotes for Appendix A: [1] A determination of whether the DACs are controlled by stochastic (St) or deterministic (organ or tissue) dose, or if they both give the same result (E), for each absorption type, is given in this column. The key to the organ notation for deterministic dose is: BS = Bone surface, ET = Extra thoracic, K = Kidney, L = Liver, and T = Thyroid. A blank indicates that no calculations were performed for the absorption type shown. [2] The ICRP identifies these materials as soluble or reactive gases and vapors or highly soluble or reactive gases and vapors. For tritiated water, the inhalation DAC values allow for an additional 50% absorption through the skin, as described in ICRP Publication No. 68, Dose Coefficients for Intakes of Radionuclides by Workers. For elemental tritium, the DAC values include a factor	

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	that irradiation from gas within the lungs might increase the dose by 20%. [3] A dash indicates no values given for this data category. [4] DAC values derived using hafnium tritide particle and are based on "observed activity" (i.e., only radiation emitted from the particle is considered). DAC values derived using methodology found in Radiological Control Programs for Special Tritium Compounds, DOE-HDBK-1184-2004. [5] These values are appropriate for protection from radon combined with its short-lived decay products and are based on information given in ICRP Publication 65: Protection Against Radon-222 at Home and at Work and in DOE-STD-1121-98: Internal Dosimetry. The values given are for 100% equilibrium concentration conditions of the short-lived radon decay products with the parent. To allow for an actual measured equilibrium concentration or a demonstrated equilibrium concentration, the values given in this table should be multiplied by the ratio (100%/actual %) or (100%/demonstrated %), respectively. Alternatively, the DAC values for Rn-220 and Rn-222 may be replaced by 2.5 working level (WL) and 0.83 WL, respectively, for appropriate limiting of decay product concentrations. A WL is any combination of short-lived radon decay products, in one liter of air without regard to the degree of equilibrium, that will result in the ultimate emission of 1.3 E+05 MeV of alpha energy.	
Appendix B to Part 835--[Reserved]		
Appendix C to Part 835--DERIVED AIR CONCENTRATION (DAC) FOR WORKERS FROM EXTERNAL EXPOSURE DURING IMMERSION IN A CLOUD OF AIRBORNE	a. The data presented in appendix C are to be used for controlling occupational exposures in accordance with § 835.209, identifying the need for air monitoring in accordance with § 835.403 and identifying the need for posting of airborne radioactivity areas in accordance with § 835.603(d). b. The air immersion DAC values shown in this appendix are based on a stochastic dose limit of 5 rems (0.05 Sv) per year. Four columns of information are presented: (1) radionuclide; (2) half-life in units of	As of May 1, 2010, Fermilab policies and procedures related to the definitions of Part 835.2(a) have been modified to be consistent with the changes to the DOE-prescribed system of radiation dosimetry promulgated in the Federal Register, Vol. 72, No. 110, Docket No. EH-RM-02-835, pp. 31904-31941, June 8, 2007.

10 CFR 835 Citation	Requirement Text	Implementation
RADIOACTIVE MATERIAL	seconds (s), minutes (min), hours (h), days (d), or years (yr); (3) air immersion DAC in units of μCi/mL; and (4) air immersion DAC in units of Bq/m^3. The data are listed by radionuclide in order of increasing atomic mass. The air immersion DACs were calculated for a continuous, nonshielded exposure via immersion in a semi-infinite cloud of airborne radioactive material. The DACs listed in this appendix may be modified to allow for submersion in a cloud of finite dimensions. c. The DAC values are given for individual radionuclides. For known mixtures of radionuclides, determine the sum of the ratio of the observed concentration of a particular radionuclide and its corresponding DAC for all radionuclides in the mixture. If this sum exceeds unity (1), then the DAC has been exceeded. For unknown radionuclides, the most restrictive DAC (lowest value) for those isotopes not known to be absent shall be used. <u>Footnote for Appendix C:</u> For any single radionuclide not listed above with decay mode other than alpha emission or spontaneous fission and with radioactive half-life less than two hours, the DAC value shall be 1 E−06 μCi/mL (7 E+04 Bq/m^3).	This includes the values and footnotes pertaining to Derived Air Concentrations (DAC) as specified by Appendix A to Part 835. For other radionuclides not listed in Appendix C, should they be encountered, the "default" values set forth in the footnotes to Appendix C as modified by the Notice posted in the Federal Register, Vol. 82, No. 154, pp. 37512-37514, August 11, 2017.
Appendix D to Part 835--SURFACE CONTAMINATION VALUES	The data presented in appendix D are to be used in identifying and posting contamination and high contamination areas in accordance with § 835.603(e) and (f) and identifying the need for surface contamination monitoring and control in accordance with § 835.1101 and 1102. <u>Footnotes for Appendix D:</u>	Fermilab policies and procedures implement the values and footnotes of Appendix D of Part 835 with respect to the identification and posting of contamination and high contamination and identifying

10 CFR 835 Citation	Requirement Text	Implementation
	[1] The values in this appendix, with the exception noted in footnote 6 below, apply to radioactive contamination deposited on, but not incorporated into the interior or matrix of, the contaminated item. Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides apply independently. [2] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation. [3] The levels may be averaged over one square meter provided the maximum surface activity in any area of 100 cm^2 is less than three times the value specified. For purposes of averaging, any square meter of surface shall be considered to be above the surface contamination value if: (1) from measurements of a representative number of sections it is determined that the average contamination level exceeds the applicable value; or (2) it is determined that the sum of the activity of all isolated spots or particles in any 100 cm^2 area exceeds three times the applicable value. [4] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by swiping the area with dry filter or soft absorbent paper, applying moderate pressure, and then assessing the amount of radioactive material on the swipe with an appropriate instrument of known efficiency. (Note - The use of dry material may not be appropriate for tritium.) When removable contamination on objects of surface area less than 100 cm^2 is determined, the activity per unit area shall be based on the actual area and the entire surface shall be wiped. It is not necessary to use swiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual surface contamination levels are within the limits for removable contamination. [5] This category of radionuclides includes mixed fission products, including the Sr-90 which is present in them. It does not apply to Sr-90 which has been separated from the other fission products or mixtures where the Sr-90 has been enriched.	the need for contamination monitoring and control.

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	[6] Tritium contamination may diffuse into the volume or matrix of materials. Evaluation of surface contamination shall consider the extent to which such contamination may migrate to the surface in order to ensure the surface contamination value provided in this appendix is not exceeded. Once this contamination migrates to the surface, it may be removable, not fixed; therefore, a "Total" value does not apply. In certain cases, a "Total" value of 10,000 dpm/100 cm^2 may be applicable either to metals of the types from which insoluble special tritium compounds are formed, that have been exposed to tritium, or to bulk materials to which insoluble special tritium compound particles are fixed to a surface. [7] These limits apply only to the alpha emitters within the respective decay series.	
Appendix E to Part 835--VALUES FOR ESTABLISHING SEALED RADIOACTIVE SOURCE ACCOUNTABILITY AND RADIOACTIVE MATERIAL POSTING AND LABELING REQUIREMENTS	The data presented in appendix E are to be used for identifying accountable sealed radioactive sources and radioactive material areas as those terms are defined at § 835.2(a), establishing the need for radioactive material area posting in accordance with § 835.603(g), and establishing the need for radioactive material labeling in accordance with § 835.605. Footnotes for Appendix E: Any alpha emitting radionuclide not listed in appendix E and mixtures of alpha emitters of unknown composition have a value of 10 μCi. With the exception that any type of STC has a value of 10 Ci, any radionuclide other than alpha emitting radionuclides not listed in appendix E and mixtures of beta emitters of unknown composition have a value of 100 μCi. Note: Where there is involved a combination of radionuclides in known amounts, derive the value for the combination as follows: determine, for each radionuclide in the combination, the ratio between the quantity present in the combination and the value otherwise established for the specific radionuclide when not in	Fermilab continues to implement the requirements of this Appendix. While the isotopes Rh-102 and Rh-102m are rarely encountered at accelerators, Fermilab acknowledges the amendment to Appendix E set forth in the Notice posted in the Federal Register, Vol. 82, No. 154, pp. 37512-37514, August 11, 2017.

10 CFR 835 Citation	Requirement Text	Implementation
	combination. If the sum of such ratios for all radionuclides in the combination exceeds unity (1), then the accountability criterion has been exceeded.	