


 All DOL OSHA Advanced Search

 SEARCH

[A to Z Index](#) | [En Español](#) | [Contact Us](#) | [About OSHA](#)

OSHA

[QuickTakes](#) Biweekly Newsletter [RSS Feeds](#) [Print This Page](#) [Text Size](#)

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[What's New](#) | [Offices](#)
[Home](#)
[Workers](#)
[Regulations](#)
[Enforcement](#)
[Data & Statistics](#)
[Training](#)
[Publications](#)
[Newsroom](#)
[Small Business](#)


SAFETY AND HEALTH TOPICS

Ionizing Radiation



Introduction

Ionizing radiation sources may be found in a wide range of occupational settings, including health care facilities, research institutions, nuclear reactors and their support facilities, nuclear weapon production facilities, and other various manufacturing settings, just to name a few. These radiation sources can pose a considerable health risk to affected workers if not properly controlled. This page provides a starting point for technical and regulatory information regarding the recognition, evaluation, and control of occupational health hazards associated with ionizing radiation.

This page is maintained as a product of OSHA's Alliance with the American Biological Safety Association ([ABSA](#)).

Ionizing radiation is addressed in specific standards for the general industry, shipyard employment, and the construction industry.

Standards

This section highlights OSHA standards, directives (instructions for compliance officers), standard interpretations (official letters of interpretation of the standards), and other federal standards related to ionizing radiation.

OSHA

Note: Twenty-five states, Puerto Rico and the Virgin Islands, have [OSHA-approved State Plans](#) and have adopted their own standards and enforcement policies. For the most part, these States adopt standards that are identical to Federal OSHA. However, some States have adopted different standards applicable to this topic or may have different enforcement policies.

General Industry ([29 CFR 1910](#))

- [1910.120](#), Hazardous waste operations and emergency response [\[related topic page\]](#)
- [1910.1096](#), Ionizing radiation (general industry)

Shipyard Employment ([29 CFR 1915](#))

- [1915.57](#), Uses of fissionable material in ship repairing and shipbuilding

Construction Industry ([29 CFR 1926](#))

- [1926.53](#), Ionizing radiation (construction)
- [1926.65](#), Hazardous waste operations and emergency response

Federal Register

- [Occupational Exposure to Ionizing Radiation](#), Proposed Rules 70:44074-44075, (2005, August 1).
- [Occupational Exposure to Ionizing Radiation](#), Proposed Rules 70:22828-22835, (2005, May 3).
- [Ionizing Radiation Standard; Extension of the OMB's Approval of the information-Collection \(Paperwork\) Requirements](#), Notice 66:22014-22015, (2001, May 2).
- Search all available [Federal Registers](#).

Directives

- [Memorandum of Understanding Between the OSHA and the U.S. Nuclear Regulatory Commission](#), CPL 02-00-086 [CPL 2.86], (1989, December 22). Delineates the authorities, responsibilities, and other activities between OSHA and NRC for occupational health and safety at radiation sites.
- [OSHA Coverage of Ionizing Radiation Sources Not Covered by Atomic Energy Act of 1954](#), STD 01-04-001 [STD 1-4.1], (1978, October 30).
- Search all available [directives](#).

Standard Interpretations

- [Workplace exposure limits for ultra-violet radiation](#), (2003, February 26).
- [Occupational exposure limits, access restrictions, and posting requirements for airborne radioactive materials](#), (2002, December 23).
- [Correct method for calculating whole body dose for ionizing radiation](#), (1999, August 4).
- [Bloodborne Pathogens Standard applicability to radiopharmaceutical use](#), (1998, May 18).
- [Maintenance of radiation exposure records NRC licensee contractors](#), (1998, February 23).

Contents

- [Standards](#)
- [Health Effects](#)
- [Pregnant Workers](#)
- [Hazards and Solutions](#)
- [Measuring Exposure](#)
- [Safety and Health Programs](#)
- [Additional Information](#)
- [Credits](#)



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Highlights

- [Radiation Dispersal from Japan and the Effect on U.S. Workers](#), OSHA, (2011, March).
- [Radiation Dispersal from Japan](#), National Institute for Occupational Safety and Health (NIOSH) Workplace Safety and Health Topic, (2011).
 - [Worker Information](#)

- [Clarification of OSHA's Bloodborne Pathogens Standard as it relates to syringes and needles contaminated with both a bloodborne pathogen and radioactive nuclear medicine](#). (1996, October 29).
- [Suggested state regulations for control of radiation](#). (1995, September 19).
- [Male infertility and welding engineers](#). (1992, October 27). This interpretation includes a discussion of ionizing radiation sources from various welding operations.
- [Definition of an airborne radioactivity area](#). (1992, October 6).
- [Definition of Reasonable Diligence as stated in 1910.1096\(d\)\(1\)](#). (1991, April 17).
- [Application of 1910.120 to emergency Responders at a nuclear power plants](#). (1991, January 28).
- [Applicability of 1910.120 to the Uranium Mill Tailings Remedial Action Project](#). (1990, December 28).
- [Ionizing radiation hazards in the workplace](#). (1990, September 27).
- [Application of 1910.120 to cleanup of nuclear and hazardous waste](#). (1990, April 4).
- [Clarification of the jurisdiction's of OSHA and the NRC in nuclear power plants](#). (1987, January 8).
- [OSHA/NRC Interface Activities and Related Information](#). (1985, January 15).
- [Review of permissible radiation exposure levels](#). (1984, November 5).
- [Respirator air quality standards do not apply where the NRC has jurisdiction](#). (1979, March 6).
- Search all available [standard interpretations](#).

Other Federal

Note: These are NOT OSHA regulations. However, they do provide guidance from their originating organizations related to worker protection.

Nuclear Regulatory Commission (NRC)

- [10 CFR 20](#), Standards for Protection Against Radiation
- [10 CFR 20, Appendices A-C \(1971 version\)](#) [1 MB PDF[†], 9 pages]. These appendices are referenced by OSHA standards [29 CFR 1910.1096](#), [29 CFR 1926.53](#), and [29 CFR 1915.57](#). **The 1971 version is the actual version enforceable by OSHA, not the most current version.**

US Department of Energy (DOE)

- [10 CFR 835](#), Occupational Radiation Protection

Health Effects

General

- [Physical Agents - Health Care Facilities](#). OSHA Directive TED 01-00-015 [TED 1-0.15A], (1999, January 20). Contains general exposure and health effect information for ionizing radiation sources in health care facilities.
- [Radiation Protection](#). Environmental Protection Agency (EPA), Radiation Protection Division.
 - [Health Effects](#)
 - [Ionizing Radiation Fact Book](#) [1 MB PDF, 22 pages]. (2007, March) Contains a general description of ionizing radiation types, sources, and health effects.
- For additional information on industries with potential ionizing radiation sources, see OSHA's Safety and Health Topics pages on:
 - [Healthcare Facilities](#)
 - [Hazardous Waste](#)
 - [Semiconductors](#)

Pregnant Workers

Note: These are NOT OSHA regulations. However, they do provide guidance from their originating organizations related to worker protection.

Nuclear Regulatory Commission (NRC)

- [10 CFR 20](#), Standards for Protection Against Radiation. The NRC requires licensees to maintain exposure to the fetus of an occupationally exposed individual to 500 mrem (5 mSv) or less during the gestation period.

International Commission on Radiological Protection (ICRP)

- *1990 Recommendations of the International Commission on Radiological Protection*. Report 60. Recommends a limit of radiation exposure to a member of the general public as 100 mrem/y (1 mSv/y) and the limit for the fetus of an occupationally exposed individual to 200 mrem (2 mSv) during the gestation period.

National Council on Radiation Protection (NCRP)

- *Limitation of Exposure to Ionizing Radiation*. Report 116. Recommends a limit of radiation exposure to a member of the general public as 100 mrem/y (1 mSv/y) and the limit for the fetus of an occupationally exposed individual to 50 mrem (0.5 mSv) per month during the gestation period.

Conference of Radiation Control Program Directors (CRCPD)

- *Radiation Protection*. Suggests state regulations for radiation protection. In Subpart D, the suggested regulations state that the limit on exposure to the fetus of an occupationally exposed worker be kept below 500 mrem (5 mSv) during the gestation period.

US Department of Energy (DOE)

- [Office of Worker Safety and Health - Radiation Protection Policy](#). (2011, February 7). Develops and issues the Department of Energy's occupational radiation protection policy, requirements and guidance.

Medical Doses

- [UNSCLEAR 2000 Report Vol. 1: Sources and Effects of Ionizing Radiation](#). United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). Contains medical radiation doses in Annex D.
- [Exposure of the US population from diagnostic medical radiation](#). National Council on Radiation Protection (NCRP) Report 100. Contains information on various sources of radiation exposure for the public and the associated radiation doses.
- [Sources and magnitude of occupational and public exposures from nuclear medicine procedures](#). National Council on Radiation Protection (NCRP) Report 124. Contains information on sources of radiation exposure and associated doses from medical nuclear medicine procedures.
- [Doses to the embryo and fetus from intakes of radionuclides by the mother](#). International Commission on Radiological Protection (ICRP) Report 88. Contains information on radiation doses from maternal intake of radioactive materials and potential biological effects.
- [Patient Information](#). Royal College of Radiologists. A variety of patient information leaflets on Diagnostic Radiology, Intervention Radiology, and Oncology.

Health Effects of Radiation Exposure during Pregnancy

- [Physical Agents](#). OSHA Directive TED 01-00-015 [TED 1-0.15A], (1999, January 20). Contains general exposure and health effect information for ionizing radiation sources in health care facilities.
- [Instruction Concerning Prenatal Radiation Exposure](#) [48 KB PDF, 12 pages]. Nuclear Regulatory Commission (NRC) Regulatory Guide 8.13. (1999, June). Provides information to pregnant women, and other personnel, to help them make decisions regarding radiation exposure during pregnancy. Supplements Regulatory Guide 8.29, *Instruction Concerning Risks from Occupational Radiation Exposure*, which contains a broad discussion of the risks from exposure to ionizing radiation.
- [Radiation Protection](#). Environmental Protection Agency (EPA), Radiation Protection Division.
 - [Health Effects](#).
 - [Ionizing Radiation Fact Book](#) [1 MB PDF, 22 pages]. (2007, March). Contains a general description of ionizing radiation types, sources, and health effects.
- [Possible Health Effects of Radiation Exposure on Unborn Babies](#). Centers for Disease Control and Prevention (CDC). Discusses possible health effects to unborn babies from exposure to radiation.
- [Pregnancy and medical radiation](#). International Commission on Radiological Protection (ICRP) Report 84. Contains information regarding the potential biological effects of medical procedures involving radiation for the pregnant patient.
- [Biological effects after prenatal irradiation \(embryo and fetus\)](#). International Commission on Radiological Protection (ICRP) Report 90. Discusses pregnancy, radiation during pregnancy, health effects and radiation protection.
- [Radionuclide exposure of the embryo/fetus: Recommendations of the National Council on Radiation Protection and Measurements](#). International Commission on Radiological Protection (ICRP) Report 128. Contains information on the effects of radiation exposure during pregnancy.

Examples Programs for Pregnant Radiation Workers

- [Policy on Declared Pregnant Radiation Workers](#). University of Minnesota.
- [Radiation Safety Manual for Laboratory Users](#). Princeton University.
- [Pregnant Worker in Radiation Environment](#). University of Maryland.

Hazards and Solutions

- [Ionizing Radiation Presentations](#). OSHA Slide Presentations.
 - [Introduction to Ionizing Radiation](#) [5 MB PPT*, 54 slides]. (2001). This is an updated version of the original lecture outline.
 - [Introduction to Ionizing Radiation](#). (1999). Original lecture outline.
- [Evaluation of Radiation Exposure to TSA Baggage Screeners](#). National Institute for Occupational Safety and Health (NIOSH) Health Hazard Evaluation Summary Report HETA-2003-0206-3067.
- [Prussian Blue \(ferric hexacyanoferrate \(II\)\) for Treatment of Internal Contamination with Thallium or Radioactive Cesium](#). US Food and Drug Administration (FDA), Center for Drug Evaluation and Research, (2010, September 7). Provides references to FDA approval of a new drug application for Radiogardase, also known as Prussian blue, to treat people exposed to radiation contamination, due to harmful levels of cesium-137 or thallium.
- [Office of Worker Safety and Health - Radiation Protection Policy](#). US Department of Energy (DOE), (2011, February 7). Develops and issues the Department of Energy's occupational radiation protection policy, requirements and guidance.
- [Guide for Safe Handling of Radioactive Sources and A Primer on the Effects of Exposure to Ionizing Radiation](#). CalTech Senior Physics Laboratory, (1999, September 17). Covers the recognition, evaluation, and control of radioactive sources used in laboratories.
- [Radiological Worker Training Guide](#). Thomas Jefferson National Accelerator Facility (JLab). Provides "self-study course" covering radiation fundamentals for workers who routinely enter radiologically controlled areas.

Measuring Exposure

- [OSHA Technical Manual](#). OSHA Directive TED 01-00-015 [TED 1-0.15A], (1999, January 20).
 - [Technical Equipment](#)
 - [Radiation Monitors and Meters](#). Contains sampling, measurement methods, and instrument information for ionizing radiation.
 - [Hospital Investigations: Health Hazards](#). Describes investigation methods for health and safety hazards in health care facilities, including X-Ray sources.

Safety and Health Programs

- [DOE Standard - Radiological Control](#) [788 KB PDF, 194 pages]. US Department of Energy (DOE) DOE-STD-1098-2008, (2008, October). Assists line managers in meeting their responsibilities for implementing occupational radiological control programs.
- Radiation Control Manuals from Department of Energy (DOE) Laboratories:
 - [Fermilab Radiological Control Manual \(FRCM\)](#). Fermi National Accelerator Laboratory (Fermilab), (2010).
 - [Radiological Safety](#). Stanford Linear Accelerator Center (SLAC), (2010). Describes the engineering and administrative controls required to maintain personal radiation doses ALARA, to prevent uncontrolled or accidental exposure to ionizing radiation, and to prevent release of radioactive material into the environment.
 - [SLAC Radiological Control Manual](#) [2 MB PDF, 232 pages]. (2010, July 2). Summarizes the elements of the Radiological Health and Safety Policy and is intended to guide the actions of every person involved in radiological work at SLAC.
 - [LBLN Radiation Safety](#). Lawrence Berkeley National Laboratory (LBLN) Health and Safety Manual, PUB-3000, Chapter 21, (2011, February).
 - [Jefferson Lab Radiation Control Manual](#) [5 MB PDF, 174 pages]. Thomas Jefferson National Accelerator Facility (JLab), (2004, January). Establishes the

requirements of Jefferson Lab's Radiation Protection Program (RPP) based on 10 CFR 835 and ensures that Radiation Control activities are conducted in accord with this RPP. Includes formal plans and measures for applying the ALARA process to occupational exposure.

- [Office of Worker Safety and Health - Radiation Protection Policy](#). US Department of Energy (DOE), (2011, February 7). Develops and issues the Department of Energy's occupational radiation protection policy, requirements and guidance. Key regulatory topics covered in [10 CFR 835](#) include:
 - monitoring individual internal and external radiation dose,
 - radiation safety training,
 - workplace monitoring,
 - As Low As Reasonably Achievable (ALARA) programs,
 - radiation detection instrumentation,
 - posting and control of radioactive material,
 - radiation dose reporting.
- For additional information on safety and health programs, see OSHA's [Safety and Health Programs Safety and Health Topics Page](#).

Additional Information

Related Safety and Health Topics Pages

- [Radiation](#)

Other Resources

- [American Biological Safety Association \(ABSA\)](#). OSHA Alliance Page.
- [American Industrial Hygiene Association](#). Serves the needs of occupational and environmental health professionals practicing industrial hygiene and has two standing committees on radiation:
 - [Ionizing Radiation Committee](#). Provides a forum for exchanging ideas and information about the impact of ionizing radiation on the workplace and in the community and to participate in the development and analysis of related technological and regulatory issues.
- [Radiation Protection Basics](#). Environmental Protection Agency (EPA), (2011, March 15). Provides EPA radiation protection programs and related information.
- [Occupational Radiation Exposure](#). US Department of Energy (DOE), (2011). Provides several DOE documents on ionizing radiation and related links.
- [Armed Forces Radiobiology Research Institute \(AFRRI\)](#). (2011, March 17). Provides information and radiation-related links.

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