

**RADIATION PROTECTION STANDARDS FOR
THE OCCUPATIONAL WORKERS AND THE PUBLIC**

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ABSTRACT

Federal Regulations concerning radiation protection standards have been undergoing significant changes within the last decade. In addition to these changes, a proliferation in the number of Federal radiation standards has also occurred. A tabulation of these regulations aids in the understanding of which current standards apply to the nuclear industry with respect to environmental contamination and exposure to workers, and the public.

Furthermore, most of the current regulations, proposed revisions, and proposed new rulings fall into several major categories. A tabulation of these categories illustrates common public, occupational, and environmental needs for which the DOE, NRC, and EPA have developed their specific radiation standards.

Finally, risk based systems for radiation protection have been proposed by the DOE, NRC, and EPA, although these agencies are not entirely consistent in the application of this methodology.

Attachments:

1. Table of "Radiation Protection Standards for Exposure of the Public"
2. Table of "Radiation Protection Standards for Occupational Exposures"

RADIATION PROTECTION STANDARDS FOR EXPOSURE OF THE PUBLIC

DOE Order 5480.1A Radiation Standards for Protection of the Public in the Vicinity of DOE Facilities, as revised by the Vaughn Memorandum of Aug. 5, 1986	Effective dose equivalents from all routine operations or releases: Occasional annual exposures 500 mrem/yr Prolonged period of exposure 100 mrem/yr Action Level for reporting 25 mrem/yr Annual dose equivalent to an individual organ. 5,000 mrem
	For airborne emissions: Whole body dose equivalent 25 mrem/yr Organ dose equivalent 75 mrem/yr (These limits are for the total dose commitment received by the individual. They also reflect DOE's implementation of the EPA regulations in 40 CFR 61.)
DOE Order 5820.2 Radioactive Waste Management "Lytle Memorandum" Proposed Revision (interim performance objective) (Feb. 19, 1986)	Dose rate to the off-site public near new LLW storage or disposal facilities 25 mrem/yr
NRC 10 CFR 20 Standards for Protection Against Radiation for Individuals Who Are Exposed Outside Normal Operations Licensed by the NRC	Whole body dose equivalent 500 mrem/yr (including blood-forming organs and gonads) Bone and thyroid 300 mrem/yr Other Organs 1,500 mrem/yr
Proposed Revision (January 9, 1986) to NRC 10 CFR 20	Effective dose equivalent 500 mrem/yr (Summation of external deep dose equivalent to the whole body and internal committed effective dose equivalent. Includes all known sources except natural background, medical diagnosis and therapy and radioactive material disposed into sanitary sewage.)

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<p>NRC 10 CFR 50, Appendix I</p> <p>Design objectives for levels of radioactive materials in light-water-cooled nuclear power effluents</p>	<p>The annual dose equivalent or dose commitment from radioactivity released in liquid effluents:</p> <table> <tr> <td>Whole body</td> <td>3 mrem/reactor year</td> </tr> <tr> <td>Other organs</td> <td>10 mrem/reactor year</td> </tr> </table> <p>The annual air dose from gaseous effluents at the point of maximum concentration in an unrestricted area:</p> <table> <tr> <td>Gamma radiation</td> <td>10 mrad/reactor year</td> </tr> <tr> <td>Beta radiation</td> <td>20 mrad/reactor year</td> </tr> </table> <p>The commission may further specify limits to the annual dose equivalent to an individual:</p> <table> <tr> <td>Whole body</td> <td>5 mrem/reactor year</td> </tr> <tr> <td>Skin</td> <td>15 mrem/reactor year</td> </tr> <tr> <td>Other organs</td> <td>10 mrem/reactor year</td> </tr> </table>	Whole body	3 mrem/reactor year	Other organs	10 mrem/reactor year	Gamma radiation	10 mrad/reactor year	Beta radiation	20 mrad/reactor year	Whole body	5 mrem/reactor year	Skin	15 mrem/reactor year	Other organs	10 mrem/reactor year
Whole body	3 mrem/reactor year														
Other organs	10 mrem/reactor year														
Gamma radiation	10 mrad/reactor year														
Beta radiation	20 mrad/reactor year														
Whole body	5 mrem/reactor year														
Skin	15 mrem/reactor year														
Other organs	10 mrem/reactor year														
<p>NRC 10 CFR 61 Licensing Requirements for Land Disposal of Radioactive Waste</p>	<p>The annual dose equivalent from radioactive material released to the general environment:</p> <table> <tr> <td>Whole body</td> <td>25 mrem</td> </tr> <tr> <td>Thyroid</td> <td>75 mrem</td> </tr> <tr> <td>Other organs</td> <td>25 mrem</td> </tr> </table>	Whole body	25 mrem	Thyroid	75 mrem	Other organs	25 mrem								
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Thyroid	75 mrem														
Other organs	25 mrem														
<p>EPA 40 CFR 61, Subpart H National Emission Standard for Radionuclide Emissions From DOE Facilities</p>	<p>Emissions of radionuclides to air shall not exceed those amounts that cause a dose equivalent of:</p> <table> <tr> <td>Whole body</td> <td>25 mrem/yr</td> </tr> <tr> <td>Critical organ</td> <td>75 mrem/yr</td> </tr> </table> <p>Doses due to Rn-220, Rn-222, and their respective decay products are excluded from these limits. Similar regulations exist for NRC Licensed Facilities and other Federal Facilities not covered by Subpart H.</p>	Whole body	25 mrem/yr	Critical organ	75 mrem/yr										
Whole body	25 mrem/yr														
Critical organ	75 mrem/yr														

<p>EPA 40 CFR 190 Environmental Radiation Protection Standards for Nuclear Power Operations</p>	<p>Annual dose equivalent for operations associated with the production of electrical power for public use through utilization of nuclear energy:</p> <table> <tr> <td>Whole body</td> <td>25 mrem</td> </tr> <tr> <td>Thyroid</td> <td>75 mrem</td> </tr> <tr> <td>Other organs</td> <td>25 mrem</td> </tr> </table>	Whole body	25 mrem	Thyroid	75 mrem	Other organs	25 mrem
Whole body	25 mrem						
Thyroid	75 mrem						
Other organs	25 mrem						
<p>EPA 40 CFR 191, Subpart A Environmental Standards Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes</p>	<p>Annual dose equivalent to any member of the public in the general environment resulting from discharges of radioactive material and direct radiation from management and storage of wastes and all operations covered by Part 190:</p> <table> <tr> <td>Whole body</td> <td>25 mrem/yr</td> </tr> <tr> <td>Thyroid</td> <td>75 mrem/yr</td> </tr> <tr> <td>Other organs*</td> <td>25 mrem/yr</td> </tr> </table> <p>*(For facilities regulated by NRC or by agreement states; 75 mrem for facilities operated by DOE and that are not regulated by NRC or by agreement states.)</p>	Whole body	25 mrem/yr	Thyroid	75 mrem/yr	Other organs*	25 mrem/yr
Whole body	25 mrem/yr						
Thyroid	75 mrem/yr						
Other organs*	25 mrem/yr						
<p>EPA 40 CFR 191, Subpart B</p>	<p>Annual dose equivalent for all potential pathways from the disposal system for wastes to any member of the general public for 1000 years after disposal:</p> <table> <tr> <td>Whole body</td> <td>25 mrem/yr</td> </tr> <tr> <td>Any organ</td> <td>75 mrem/yr</td> </tr> </table>	Whole body	25 mrem/yr	Any organ	75 mrem/yr		
Whole body	25 mrem/yr						
Any organ	75 mrem/yr						
<p>EPA 40 CFR 192 Environmental Protection Agency Standards for Protection Against Uranium Mill Tailings</p>	<p>Annual dose equivalent to any member of the general public during processing operations and prior to end of the closure period:</p> <table> <tr> <td>Whole body</td> <td>25 mrem/yr</td> </tr> <tr> <td>Thyroid</td> <td>75 mrem/yr</td> </tr> <tr> <td>Other organs</td> <td>25 mrem/yr</td> </tr> </table>	Whole body	25 mrem/yr	Thyroid	75 mrem/yr	Other organs	25 mrem/yr
Whole body	25 mrem/yr						
Thyroid	75 mrem/yr						
Other organs	25 mrem/yr						

EPA 40 CFR 141
National Interim
Primary Drinking
Water Regulations

Annual dose equivalent from beta particle or photon radioactivity:
in community drinking water systems:

Whole body and other organs 4 mrem

For Ra-226 and R-228 combined, 5 pCi/l. For gross Alpha activity
(including Ra-226 but excluding radon and uranium, 15 pCi/l).

RADIATION PROTECTION STANDARDS FOR OCCUPATIONAL EXPOSURES

ATTACHMENT 2

	Dose Equivalent (mrem)		
	<u>Quarterly</u>	<u>Annual</u>	
DOE Order 5480.1 Environmental Protection Safety and Health Protection Standards for DOE Facilities	Whole body, head and trunk, lens of eye, red marrow, active blood-forming organs or gonads	3,000	5,000
	Skin, other organs and tissues (except bone)	5,000	15,000
	Bone, forearms	10,000	30,000
	Hands and feet	25,000	75,000
Proposed Revision (Nov. 1, 1985) to DOE Order 5480.1	Annual effective dose equivalent		5,000
	Annual dose equivalent to the lens of eye		15,000
	Annual dose equivalent for individual organs or tissue		50,000
	Lifetime occupational dose objective		100,000
	Unborn child of female worker declared pregnant		500
	Planned special exposure-annual effective dose equivalent		10,000
NRC 10 CFR 20 Standards for Protection Against Radiation for Individuals Exposed Within Normal Operations Licensed by the NRC		<u>Quarterly Dose Equivalent (mrem)</u>	
	Whole body, head and trunk, lens of eye, active blood-forming organs, or gonads	1,250	
	Skin	18,750	
	Hands & forearms, feet & ankles	7,500	
Exposure to contaminated air or water		Exposure limited so that intake during any period of 7 consecutive days is less than what would occur from exposure to concentrations in Appendix B, Table I for forty hours	

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Proposed Revision to (Jan. 9, 1985) to 10 CFR 20	Sum of deep dose equivalent and Committed effective dose equivalent	5,000 mrem/yr
	Sum of deep dose equivalent and Committed dose equivalent	50,000 mrem/yr
	Deep dose equivalent during any calendar quarter	3,000 mrem/yr
	Dose equivalent to the lens of the eye	15,000 mrem/yr
	Dose equivalent to the skin and to each extremity	50,000 mrem/yr
	Planned special exposure (annual effective dose equivalent)	5,000 mrem
	Effective dose equivalent of declared pregnant woman during gestation.	500 mrem
NOTE: Special provisions apply for internal exposure to radionuclides with very long effective half-lives.		

Radiation Protection Standards for General Public and Occupational Workers

	General Nuclear Facilities (Public Exposure)				General Nuclear Facilities (Occupational Exposure)	Community Drinking Water Supply (Public Exposure)	Milling/ Mining Activities (Public Exposure)	Mixed Waste
	Nuclear Facility Operations ¹	Design	Reactor Operations	Waste Management				
DGE	Order 5480.1 August 5, Vaughn Memorandum (Attached)				Lytle Memorandum for DOE Order 5820.2 (Attached)	Order 5480.1		Memorandum of Under- standing between the US DOE and the US EPA for Hazardous Waste and Radioactive Waste Management 2/22/84 ⁴
NRC	10 CFR 20	10 CFR 50	10 CFR 20	10 CFR 61	10 CFR 20			NRC Policy Issue (Commission Meeting) 5/5/86
EPA			40 CFR 61 40 CFR 190	40 CFR 61 40 CFR 191 ² 40 CFR 193 ³		40 CFR 141	40 CFR 192	State Authorization to Regulate the Hazardous Components of Radio- active Mixed Waste Under RCRA Federal Register v. 51 No. 128 July 3, 1986

- 1 Includes Research, and Weapons Fabrication
- 2 For Spent Nuclear Fuel, High-Level and Transuranic Waste
- 3 Proposed Document
- 4 Also Applies to EPA