

7. REGULATIONS AND ADVISORIES

International and national regulations and guidelines pertinent to human exposure to radon are summarized in Table 7-1. Recommendations for radiation protection for people in the general population as a result of exposure to radiation in the environment are found in the Federal Radiation Guidance (FRC 1960) and ICRP No. 26 (ICRP 1977). National guidelines for occupational radiation protection are found in the "Federal Radiation Protection Guidance for Occupational Exposure" (EPA 1987b). This guidance for occupational exposure supersedes recommendations of the Federal Radiation Council for occupational exposure (FRC 1960). The new guidance presents general principles for the radiation protection of workers and specifies the numerical primary guides for limiting occupational exposure. These recommendations are consistent with the ICRP (ICRP 1977).

The basic philosophy of radiation protection is the concept of ALARA (As Low As Reasonably Achievable). As a rule, all exposure should be kept as low as reasonably achievable and the regulations and guidelines are meant to give an upper limit to exposure. Based on the primary guides, guides for Annual Limits on Intake (ALIs) have been calculated (EPA 1988a; ICRP 1979). The ALI is defined as "that activity of a radionuclide which, if inhaled or ingested by Reference Man (ICRP 1975), will result in a dose equal to the most limiting primary guide for committed dose" (EPA 1988a) (see Appendix B).

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TABLE 7-1. Regulations and Guidelines Applicable to Radon-222

Agency	Description	Value	Reference
<u>International</u>			
<u>Guidelines</u>			
WHO	Remedial action should be considered if exceeded in building	2,700 pCi/L (99,900 Bq/m ³) EER	Suess 1988
WHO	Remedial action should be considered without long delay if exceeded in building	10,800 pCi/L (399,600 Bq/m ³) EER	Suess 1988
WHO	Should not be exceeded before remedial action	5.4x10 ⁴ pCi yr/L (2.00x10 ⁶ Bq yr/m ³) EER	Suess 1988
ICRP	Maximum cumulative occupational exposure	4.8 WLM/yr	Bodansky et al. 1987
ICRP	Annual limit for intake by inhalation	0.02 Joules/yr	ICRP 1977
<u>National</u>			
<u>Regulations</u>			
a. Air			
Environmental and indoor			
EPA	Average annual atmospheric release rate from residual radioactive material from inactive uranium processing sites	20 pCi/m ² /sec (0.74 Bq/m ² / sec)	EPA 1988b (40 CFR 190 192.02)
EPA	Annual average concentration should not be increased by more than this due to inactive uranium processing sites	0.5 pCi/L (18.5 Bq/m ³)	EPA 1988b (40 CFR 190 192.02)

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TABLE 7-1 (Continued)

Agency	Description	Value	Reference
EPA	Maximum average annual radon decay product concentration (including background) as a result of inactive uranium processing sites, in any occupied or habitable building	0.02 WL	EPA 1988b (40 CFR 190 192.12)
EPA	Maximum radon decay product concentration (including background) as a result of inactive uranium processing sites, in any occupied or habitable building	0.03 WL	EPA 1988b (40 CFR 190 192.12)
NRC	Maximum permissible concentration in air released to unrestricted areas	3×10^{-9} $\mu\text{Ci}/\text{cm}^3$ (1.1×10^{-4} Bq/cm ³)	NRC 1988 ^a (10 CFR 20)
Mine and cave			
OSHA	Individual exposure limit	4.0 WLM/yr	OSHA 1988 (41 CFR 57.5038)
OSHA	Monitor workspace at least once yearly	0.1 WL	OSHA 1988 (41 CFR 57.5087)
OSHA	Monitor workspace quarterly	0.1 - 0.3 WL	OSHA 1988 (41 CFR 57.5037)
OSHA	Monitor workspace weekly and maintain exposure records on all exposed employees	> 3.0 WL	OSHA 1988 (41 CFR 57.5037)
OSHA	Immediate corrective action to lower the concentration	1.0 WL	OSHA 1988 (41 CFR 57.5041)
MSHA	Maximal cumulative dose	4.0 WLM/yr	MSHA 1989 (30 CFR 57)

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TABLE 7-1 (Continued)

Agency	Description	Value	Reference
MSHA	Instantaneous maximum	1.0 WL	MSHA 1989 (30 CFR 57)
b. Drinking water			
NRC	Maximum permissible concentration in water released to unrestricted areas	No data	
c. Food			
d. Nonspecific media			
EPA	Reportable quantity	<u>Ci (Bq)</u>	EPA 1989b
	Radon-220	0.1 (3.7x10 ⁹)	40 CFR 302
	Radon-222	0.1 (3.7x10 ⁹)	
<u>Guidelines</u>			
a. Air			
ANSI/ ASHRAE	Annual average concentration of indoor radon	0.01 WL	Natl. Res. Council 1981
EPA	Upper level of exposure in home	4 pCi radon-222/L of air (148 Bq/m ³)	Deluca and Castronovo 1988
EPA	Desired target concentration in the home	0.02 WL	Bodansky et al. 1987
EPA	Action within several months	0.1 WL	Bodansky et al. 1987
EPA	Remedial action must be undertaken	8 pCi radon-222/L of air (300 Bq/m ³)	Deluca and Castronovo 1988
EPA	Occupational ALI for inhalation ^b	4 WLM	EPA 1988a
NCRP	Remedial action level	2 WLM/yr	NCRP 1984b
NIOSH	Recommended exposure limit	1.0 WLM/yr	NIOSH 1987

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TABLE 7-1 (Continued)

Agency	Description	Value	Reference
NIOSH	Average work shift concentration limit	0.083 WL	NIOSH 1987
b.	Drinking water	No data	
c.	Food	No data	
	<u>State</u>		
	<u>Regulations and Guidelines</u>		
a.	Air		
Alaska	Regulated hazardous substance	No data	Alaska 1988
New Mexico	Immediate corrective action or withdraw workers	1.0 - 1.4 WL	New Mexico 1981 (NMMSC 11)
New Mexico	Withdraw workers until corrective action is taken or until reduced to 1.0 WL or less	> 1.4 WL	New Mexico 1981 (NMMSC 11)
New Mexico	Maximal cumulative exposure to workers	4.0 WLM/yr	New Mexico 1981 (SIM Rule 76-1)
New Mexico	Instantaneous maximum to workers	1.0 WL	New Mexico 1981 (SIM Rule 76-1)
New Mexico	Exposure records should be kept for employees entering areas with this concentration	0.3 WL	New Mexico 1981 (SIM Rule 71-2)
New Mexico	Respiratory devices to prevent inhalation of radon daughters should be worn by workers	1.0 WL	New Mexico 1981 (SIM Rule 78-1(2a))
New Mexico	Respiratory devices to prevent inhalation of radon gas and daughters should be worn by workers	10 WL	New Mexico 1981 (SIM Rule 78-1(2a))

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TABLE 7-1 (Continued)

Agency	Description	Value	Reference
b. Water/Drinking water			
Maine		10,000 pCi/L (3.7×10^5 Bq/m ³)	FSTRAC 1988
Rhode Island		10,000 pCi/L (3.7×10^5 Bq/m ³)	FSTRAC 1988

^aThe Nuclear Regulatory Commission limits in 10 CFR 20 are in the process of revision.

^bThe ALI recommended by the EPA is numerically identical to that recommended by the ICRP Publication 30 (ICRP 1979).

ALI = Annual Limit of Intake

ANSI/ASHRAE = American National Standards Institute/American Society of Heating, Refrigerating and Air Conditioning

EER = Equilibrium Equivalent Radon

EPA = Environmental Protection Agency

FSTRAC = Federal-State Toxicology and Regulatory Alliance Committee

ICRP = International Commission on Radiological Protection

MSHA = Mine Safety and Health Administration

NCRP = National Council for Radiation Protection and Measurements

NRC = Nuclear Regulatory Commission

NIOSH = National Institute for Occupational Safety and Health

NMMSA = New Mexico Mine Safety Code

OSHA = Occupational Safety and Health Administration

SIM = State Inspector of Mines, New Mexico

WHO = World Health Organization

WL = Working Level

WLM = Working Level Month