Performance Objectives and Public Dose Limits for Radioactive Waste Disposal Facilities

Summary

Any disposal of non-HLW at a disposal facility would have to meet existing dose limits and performance objectives for protecting the environment, workers, and the public. Performance objectives and public dose limits are factors that DOE must consider when assessing any waste stream for potential disposal under the HLW interpretation. The HLW Interpretation does not change or diminish these existing safety requirements. DOE and NRC have similar requirements ensuring that the public, workers, and the environment are protected from radioactive materials.

- NRC's performance objectives for commercial LLW disposal facilities are specified in 10 Code of Federal Regulations (CFR) Part 61, Subpart C, Performance Objectives.
- DOE's performance objectives and dose limits for LLW disposal facilities are specified in the DOE Manual 435.1-1, Radioactive Waste Management Manual.

The table below compares the DOE and NRC performance objectives (referred to in the table as the Safety Goal).

Table: Comparison of DOE and NRC Performance Objectives for LLW Disposal Facilities

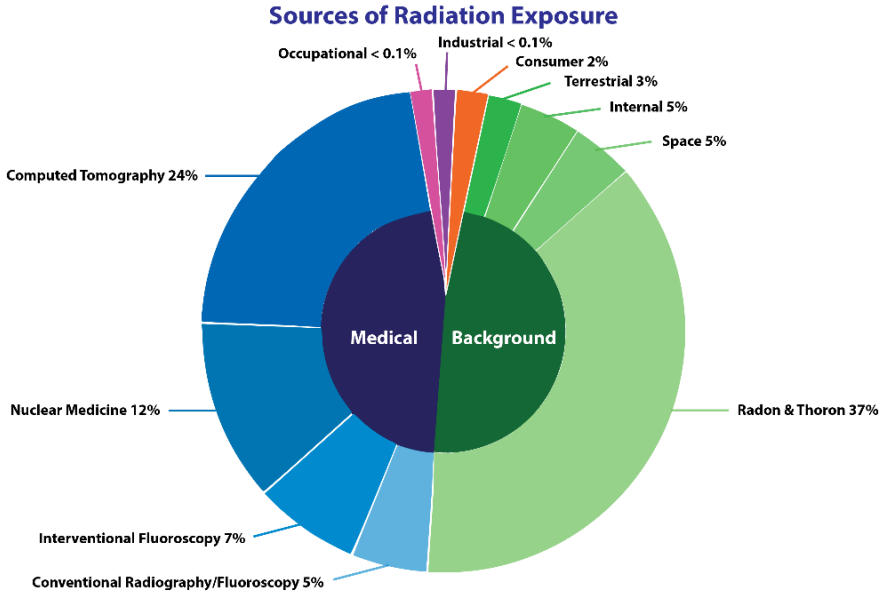
Safety Goal	NRC Performance Objective for Commercial Facilities	DOE Performance Objective/Measures for DOE Facilities
Protection of the General Population	Radioactive material released to the general environment in groundwater, surface water, air, soil, plants, or animals must not result in a dose to the whole body in excess of 25 millirem (mrem) annually. [10 CFR 61.41]	Dose to a representative member of the public shall not exceed 25 mrem annually from all exposure pathways excluding the dose from radon and its progeny in air. [DOE Manual 435.1-1 Ch. IV P(1)(a)]
	NRC adds organ-specific objectives: No dose to the thyroid in excess of 75 mrem/year and to any other organ of any member of the public in excess of 25 mrem/year. [10 CFR 61.41]	DOE adds air pathway objective: Dose to representative members of the public shall not exceed 10 mrem/year, excluding radon and its progeny. [DOE Manual 435.1-1 Ch. IV P(1)(b)]
	- This cell intentionally blank -	DOE adds an objective specifically for radon: Radon release shall not exceed an average flux of 20 pCi/m^2/second at the surface of the disposal facility. Alternatively a limit of 0.5 pCi/liter of air may be applied at the facility boundary. [DOE Manual 435.1-1 Ch. IV P(1)(c)]

Safety Goal	NRC Performance Objective for Commercial Facilities	DOE Performance Objective/Measures for DOE Facilities
Protection of Individuals from Inadvertent Intrusion	Design, operation, and closure of the land disposal facility must ensure protection of any individual inadvertently intruding into the disposal site and occupying the site or contacting the waste at any time after active institutional controls over the disposal site are removed. [10 CFR 61.42]	For purposes of establishing limits on concentration of radionuclides that may be disposed of near-surface, an analysis of inadvertent human intrusion shall use performance measures for chronic and acute exposure scenarios of 100 mrem in a year and 500 mrem total effective dose equivalent, excluding radon. [DOE Manual 435.1-1 Ch. IV P(2)(h)]
Protection of Individuals During Operations	Operations at the land disposal facility must be conducted in compliance with radiation protection standards set out in 10 CFR Part 20 except for releases of radioactivity in effluents from the land disposal facility, which shall be governed by 10 CFR 61.41. [10 CFR 61.43]	Facilities, operations, and activities shall meet the requirements of 10 CFR Part 835 and DOE Order 5400.5 (superseded by Order 458.1) for establishing acceptable dose rates to workers and the public. [DOE Manual 435.1-1 Ch. I 1.E(13)]
Stability of Disposal Facility	The disposal facility must be sited, designed, used, operated, and closed to achieve long-term stability of the disposal site and to eliminate to the extent practicable the need for ongoing active maintenance of the disposal site following closure so that only surveillance, monitoring, or minor custodial care are required. [10 CFR 61.44]	Disposal Facility Closure Plans, includes a description of how the disposal facility will be closed to achieve long-term stability and minimize the need for active maintenance following closure and to ensure compliance with the requirements of DOE Order 5400.5, *Radiation Protection of the Public and the Environment*. [DOE Manual 435.1-1 Ch. IV Q(1)(b)]
Composite Analysis of Impacts of All Sources of Radioactive Material at a DOE Site	- *This cell intentionally blank* -	Dose at point of compliance from all interacting sources does not exceed 30 mrem per year. [DOE Standard 5002-2017, Section 3.2.1.]

Perspective on Dose Objectives

100,000 mrem:	Dose leading to ~5% chance of Fatal Cancer (United Nations Scientific Committee on the Effects of Atomic Radiation [UNSCEAR])
10,000 mrem/yr:	International Atomic Energy Agency (IAEA) mandatory intervention
1,000 mrem/yr:	IAEA reference level for intervention for cleanup situations
620 mrem/yr:	US Average dose all sources (National Council on Radiation Protection and Measurements [NCRP])
100 mrem/yr:	All sources limit (IAEA practices, DOE)
25 mrem/yr:	**DOE and NRC LLW Disposal Facilities**
15 mrem/yr:	EPA Radiation Standards (40 CFR 191)
10 mrem/yr:	Air (atmospheric) (40 CFR 61)
4 mrem/yr:	Drinking Water (40 CFR 141)
1 mrem/yr:	IAEA Exemption/Clearance

Note: Air crew average (300 mrem/yr) From UNSCEAR (2000)



Average Annual Radiation Dose

Sources	Radon & Thoron	Computed Tomography	Nuclear Medicine	Interventional Fluoroscopy	Space	Conventional Radiography/ Fluoroscopy	Internal	Terrestrial	Consumer	Occupational	Industrial
Units											
mrem (United States)	228 mrem	147 mrem	77 mrem	43 mrem	33 mrem	33 mrem	29 mrem	21 mrem	13 mrem	0.5 mrem	0.3 mrem
mSv (International)	2.28 mSv	1.47 mSv	0.77 mSv	0.43 mSv	0.33 mSv	0.33mSv	0.29 mSv	0.21 mSv	0.13 mSv	0.005 mSv	0.003 mSv

(Source: National Council on Radiation Protection & Measurements, Report No. 160)