J. Executive Order 12898: Federal Actions To Address Environmental Justice in Minority Populations and Low-income Populations

Executive Order (EO) 12898 (59 FR 7629 (Feb. 16, 1994)) establishes federal executive policy on environmental justice. Its main provision directs federal agencies, to the greatest extent practicable and permitted by law, to make environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations in the United States.

EPA lacks the discretionary authority to address environmental justice in this final rulemaking. This final rule implements requirements specifically set forth by the Congress in section 801 of the EnPA and establishes radiological protection standards applicable solely and exclusively to the Department of Energy's potential storage and disposal facility at Yucca Mountain. Section 801(a)(1) of the EnPA directs EPA to "promulgate, by rule, public health and safety standards" that " prescribe the maximum annual effective dose equivalent to individual members of the public" from releases of radioactive material from the Yucca Mountain repository. This final rule fulfills this statutory direction.

K. Congressional Review Act

The Congressional Review Act, 5 U.S.C. 801 *et seq.*, as added by the Small Business Regulatory Enforcement Fairness Act of 1996, generally provides that before a rule may take effect, the agency promulgating the rule must submit a rule report, which includes a copy of the rule, to each House of the Congress and to the Comptroller General of the United States. Section 804 exempts from section 801 the following types of rules: (1) Rules of particular applicability; (2) rules relating to agency management or personnel; and (3) rules of agency organization, procedure, or practice that do not substantially affect the rights or obligations of non-agency parties. 5 U.S.C. 804(3). EPA is not required to submit a rule report regarding today's action under section 801 because this is a rule of particular applicability. This final rule will apply only to DOE, and is issued by EPA in response to direction from Congress in the EnPA.

List of Subjects in 40 CFR Part 197

Environmental protection, Nuclear energy, Radiation protection, Radionuclides, Uranium, Waste treatment and disposal, Spent nuclear fuel, High-level radioactive waste.

Dated: September 30, 2008.

Stephen L. Johnson,

Administrator.

■ 40 CFR part 197 is amended as follows:

PART 197—PUBLIC HEALTH AND ENVIRONMENTAL RADIATION PROTECTION STANDARDS FOR YUCCA MOUNTAIN, NEVADA

■ 1. The authority citation for part 197 continues to read as follows:

Authority: Sec. 801, Pub. L. 102–486, 106 Stat. 2921, 42 U.S.C. 10141n.

Subpart A—Public Health and Environmental Standards for Storage

■ 2. Section 197.2 is amended by revising the definition of "Effective dose equivalent" to read as follows:

§ 197.2 What definitions apply in Subpart A?

* * * * *

Effective dose equivalent means the sum of the products of the dose equivalent received by specified tissues following an exposure of, or an intake of radionuclides into, specified tissues of the body, multiplied by appropriate weighting factors. Annual committed effective dose equivalents shall be calculated using weighting factors in appendix A of this part, unless otherwise directed by NRC in accordance with the introduction to appendix A of this part.

* * * * *

Subpart B—Public Health and Environmental Standards for Disposal

■ 3. Section 197.12 is amended by revising paragraph (1) of the definition of "Performance assessment" and the definition of "Period of geologic stability" to read as follows:

§ 197.12 What definitions apply in Subpart B?

* * * * *

Performance assessment means an analysis that:

(1) Identifies the features, events, processes, (except human intrusion), and sequences of events and processes (except human intrusion) that might affect the Yucca Mountain disposal system and their probabilities of occurring;

* * * * *

Period of geologic stability means the time during which the variability of geologic characteristics and their future behavior in and around the Yucca Mountain site can be bounded, that is, they can be projected within a reasonable range of possibilities. This period is defined to end at 1 million years after disposal.

* * * * *

■ 4. Section 197.13 is revised to read as follows:

§ 197.13 How is Subpart B implemented?

The NRC implements this subpart B. The DOE must demonstrate to NRC that there is a reasonable expectation of compliance with this subpart before NRC may issue a license.

(a) The NRC will determine compliance, based upon the arithmetic mean of the projected doses from DOE's performance assessments for the period within 1 million years after disposal, with:

(1) Sections 197.20(a)(1) and 197.20(a)(2) of this subpart; and

(2) Sections 197.25(b)(1), 197.25(b)(2), and 197.30 of this subpart, if performance assessment is used to demonstrate compliance with either or both of these sections.

(b) [Reserved]

■ 5. Section 197.15 is revised to read as follows:

§ 197.15 How must DOE take into account the changes that will occur during the period of geologic stability?

The DOE should not project changes in society, the biosphere (other than climate), human biology, or increases or decreases of human knowledge or technology. In all analyses done to demonstrate compliance with this part, DOE must assume that all of those factors remain constant as they are at the time of license application submission to NRC. However, DOE must vary factors related to the geology, hydrology, and climate based upon cautious, but reasonable assumptions of the changes in these factors that could affect the Yucca Mountain disposal system during the period of geologic stability, consistent with the requirements for performance assessments specified at § 197.36.

■ 6. Section 197.20 is revised to read as follows:

§ 197.20 What standard must DOE meet?

(a) The DOE must demonstrate, using performance assessment, that there is a reasonable expectation that the reasonably maximally exposed individual receives no more than the following annual committed effective dose equivalent from releases from the undisturbed Yucca Mountain disposal system:

(1) 150 microsieverts (15 millirems) for 10,000 years following disposal; and

(2) 1 millisievert (100 millirems) after 10,000 years, but within the period of geologic stability.

(b) The DOE's performance assessment must include all potential pathways of radionuclide transport and exposure.

■ 7. Section 197.25 is revised to read as follows:

§ 197.25 What standard must DOE meet?

(a) The DOE must determine the earliest time after disposal that the waste package would degrade sufficiently that a human intrusion (see § 197.26) could occur without recognition by the drillers.

(b) The DOE must demonstrate that there is a reasonable expectation that the reasonably maximally exposed individual will receive an annual committed effective dose equivalent, as a result of the human intrusion, of no more than:

(1) 150 microsieverts (15 millirems) for 10,000 years following disposal; and

(2) 1 millisievert (100 millirems) after 10,000 years, but within the period of geologic stability.

(c) The analysis must include all potential environmental pathways of radionuclide transport and exposure.

■ 8. Section 197.35 is removed and reserved.

§ 197.35 [Removed and Reserved]

■ 9. Section 197.36 is revised to read as follows:

§ 197.36 Are there limits on what DOE must consider in the performance assessments?

(a) Yes, there are limits on what DOE must consider in the performance assessments.

(1) The DOE's performance assessments conducted to show compliance with §§ 197.20(a)(1), 197.25(b)(1), and 197.30 shall not include consideration of very unlikely features, events, or processes, i.e., those that are estimated to have less than one chance in 100,000,000 per year of occurring. Features, events, and processes with a higher chance of occurring shall be considered for use in performance assessments conducted to show compliance with §§ 197.20(a)(1), 197.25(b)(1), and 197.30, except as stipulated in paragraph (b) of this section. In addition, unless otherwise specified in these standards or NRC regulations, DOE's performance assessments need not evaluate the impacts resulting from features, events, and processes or sequences of events and processes with a higher chance of occurring if the results of the performance assessments would not be changed significantly in the initial 10,000-year period after disposal.

(2) The same features, events, and processes identified in paragraph (a)(1) of this section shall be used in performance assessments conducted to show compliance with §§ 197.20(a)(2) and 197.25(b)(2), with additional considerations as stipulated in paragraph (c) of this section.

(b) For performance assessments conducted to show compliance with §§ 197.25(b) and 197.30, DOE's performance assessments shall exclude unlikely features, events, or processes, or sequences of events and processes. The DOE should use the specific probability of the unlikely features, events, and processes as specified by NRC.

(c) For performance assessments conducted to show compliance with §§ 197.20(a)(2) and 197.25(b)(2), DOE's performance assessments shall project the continued effects of the features, events, and processes included in paragraph (a) of this section beyond the 10,000-year post-disposal period through the period of geologic stability. The DOE must evaluate all of the features, events, or processes included in paragraph (a) of this section, and also:

(1) The DOE must assess the effects of seismic and igneous scenarios, subject to the probability limits in paragraph (a) of this section for very unlikely features, events, and processes. Performance assessments conducted to show compliance with § 197.25(b)(2) are also subject to the probability limits for unlikely features, events, and processes as specified by NRC.

(i) The seismic analysis may be limited to the effects caused by damage to the drifts in the repository, failure of the waste packages, and changes in the elevation of the water table under Yucca Mountain. NRC may determine the magnitude of the water table rise and its significance on the results of the performance assessment, or NRC may require DOE to demonstrate the magnitude of the water table rise and its significance in the license application. If NRC determines that the increased elevation of the water table does not significantly affect the results of the performance assessment, NRC may choose to not require its consideration in the performance assessment.

(ii) The igneous analysis may be limited to the effects of a volcanic event directly intersecting the repository. The igneous event may be limited to that causing damage to the waste packages directly, causing releases of radionuclides to the biosphere, atmosphere, or ground water.

(2) The DOE must assess the effects of climate change. The climate change analysis may be limited to the effects of increased water flow through the repository as a result of climate change, and the resulting transport and release of radionuclides to the accessible environment. The nature and degree of climate change may be represented by constant climate conditions. The analysis may commence at 10,000 years after disposal and shall extend through the period of geologic stability. The NRC shall specify in regulation the values to be used to represent climate change, such as temperature, precipitation, or infiltration rate of water.

(3) The DOE must assess the effects of general corrosion on engineered barriers. The DOE may use a constant representative corrosion rate throughout the period of geologic stability or a distribution of corrosion rates correlated to other repository parameters.

■ 10. Appendix A to part 197 is added to read as follows:

Appendix A to Part 197—Calculation of Annual Committed Effective Dose Equivalent

Unless otherwise directed by NRC, DOE shall use the radiation weighting factors and tissue weighting factors in this Appendix to calculate the internal component of the annual committed effective dose equivalent for compliance with §§ 197.20 and 197.25 of this part. NRC may allow DOE to use updated factors issued after the effective date of this regulation. Any such factors shall have been issued by consensus scientific organizations and incorporated by EPA into Federal radiation guidance in order to be considered generally accepted and eligible for this use. Further, they must be compatible with the effective dose equivalent dose calculation methodology established in ICRP 26 and 30, and continued in ICRP 60 and 72, and incorporated in this appendix.

I. Equivalent Dose

The calculation of the committed effective dose equivalent (CEDE) begins with the determination of the equivalent dose, H_T, to a tissue or organ, T, listed in Table A.2 below by using the equation:

$$H_T = \sum_R D_{T,R} \cdot w_R$$

where $D_{T,R}$ is the absorbed dose in rads (one gray, an SI unit, equals 100 rads) averaged over the tissue or organ, T, due to radiation type, R, and w_R is the radiation weighting factor which is given in Table A.1 below. The unit of equivalent dose is the rem (sievert, in SI units).

TABLE A.1—RADIATION WEIGHTING FACTORS, w_R [1]

Radiation type and energy range [2]	w_R value
Photons, all energies	1
Electrons and muons, all energies	1
Neutrons, energy	
< 10 keV	5
10 keV to 100 keV	10
> 100 keV to 2 MeV	20
>2 MeV to 20 MeV	10
> 20 MeV	5
Protons, other than recoil protons, > 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] See paragraph A14 in ICRP Publication 60 for the choice of values for other radiation types and energies not in the table.

II. Effective Dose Equivalent

The next step is the calculation of the *effective dose equivalent,* E. The probability of occurrence of a stochastic effect in a tissue or organ is assumed to be proportional to the equivalent dose in the tissue or organ. The constant of proportionality differs for the various tissues of the body, but in assessing health detriment the total risk is required. This is taken into account using the tissue weighting factors, w_T in Table A.2, which represent the proportion of the stochastic risk resulting from irradiation of the tissue or organ to the total risk when the whole body is irradiated uniformly and H_T is the equivalent dose in the tissue or organ, T, in the equation:

$$E = \sum_T w_T \cdot H_T.$$

TABLE A.2—TISSUE WEIGHTING FACTORS, W_T

Tissue or organ	w_T value
Gonads	0.20
Bone marrow (red)	0.12
Colon	0.12
Lung	0.12
Stomach	0.12
Bladder	0.05
Breast	0.05
Liver	0.05
Esophagus	0.05
Thyroid	0.05
Skin	0.01
Bone surface	0.01
Remainder	[a] [b] 0.05

[a] Remainder is composed of the following tissues: adrenals, brain, extrathoracic airways, small intestine, kidneys, muscle, pancreas, spleen, thymus, and uterus.

[b] The value 0.05 is applied to the mass-weighted average dose to the Remainder tissues group, except when the following "splitting rule" applies: If a tissue of Remainder receives a dose in excess of that received by any of the 12 tissues for which weighting factors are specified, a weighting factor of 0.025 (half of Remainder) is applied to that tissue or organ and 0.025 to the mass-averaged committed equivalent dose equivalent in the rest of the Remainder tissues.

III. Annual Committed Tissue or Organ Equivalent Dose

For internal irradiation from incorporated radionuclides, the total absorbed dose will be spread out in time, being gradually delivered as the radionuclide decays. The time distribution of the absorbed dose rate will vary with the radionuclide, its form, the mode of intake and the tissue within which it is incorporated. To take account of this distribution the quantity *committed equivalent dose,* $H_T(\tau)$ where τ is the integration time in years following an intake over any particular year, is used and is the integral over time of the equivalent dose rate in a particular tissue or organ that will be received by an individual following an intake of radioactive material into the body:

$$H_T(\tau) = \int_{t_0}^{t_0+\tau} H_T(t)\, dt$$

for a single intake of activity at time t_0 where $H_T(\tau)$ is the relevant equivalent-dose rate in a tissue or organ at time t. For the purposes of this rule, the previously mentioned single intake may be considered to be an annual intake.

IV. Internal Component of the Annual Committed Effective Dose Equivalent

If the annual committed equivalent doses to the individual tissues or organs resulting from an annual intake are multiplied by the appropriate weighting factors, w_T, from table A.2, and then summed, the result will be the internal component of the *annual committed effective dose equivalent* $E(\tau)$:

$$E(\tau) = \sum_T w_T \cdot H_T(\tau).$$

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