

**§ 197.20**

Yucca Mountain disposal system over the next 10,000 years.

**INDIVIDUAL-PROTECTION STANDARD**

**§ 197.20 What standard must DOE meet?**

The DOE must demonstrate, using performance assessment, that there is a reasonable expectation that, for 10,000 years following disposal, the reasonably maximally exposed individual receives no more than an annual committed effective dose equivalent of 150 microsieverts (15 millirems) from releases from the undisturbed Yucca Mountain disposal system. The DOE's analysis must include all potential pathways of radionuclide transport and exposure.

**§ 197.21 Who is the reasonably maximally exposed individual?**

The reasonably maximally exposed individual is a hypothetical person who meets the following criteria:

- (a) Lives in the accessible environment above the highest concentration of radionuclides in the plume of contamination;
- (b) Has a diet and living style representative of the people who now reside in the Town of Amargosa Valley, Nevada. The DOE must use projections based upon surveys of the people residing in the Town of Amargosa Valley, Nevada, to determine their current diets and living styles and use the mean values of these factors in the assessments conducted for §§ 197.20 and 197.25; and
- (c) Drinks 2 liters of water per day from wells drilled into the ground water at the location specified in paragraph (a) of this section.

**HUMAN-INTRUSION STANDARD**

**§ 197.25 What standard must DOE meet?**

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. The DOE must:

- (a) If complete waste package penetration is projected to occur at or before 10,000 years after disposal:

- (1) Demonstrate that there is a reasonable expectation that the reasonably maximally exposed individual receives no more than an annual committed effective dose equivalent of 150 microsieverts (15 millirems) as a result of a human intrusion, at or before 10,000 years after disposal. The analysis must include all potential environmental pathways of radionuclide transport and exposure; and

- (2) If exposures to the reasonably maximally exposed individual occur more than 10,000 years after disposal, include the results of the analysis and its bases in the environmental impact statement for Yucca Mountain as an indicator of long-term disposal system performance; and

- (b) Include the results of the analysis and its bases in the environmental impact statement for Yucca Mountain as an indicator of long-term disposal system performance, if the intrusion is not projected to occur before 10,000 years after disposal.

**§ 197.26 What are the circumstances of the human intrusion?**

For the purposes of the analysis of human intrusion, DOE must make the following assumptions:

- (a) There is a single human intrusion as a result of exploratory drilling for ground water;
- (b) The intruders drill a borehole directly through a degraded waste package into the uppermost aquifer underlying the Yucca Mountain repository;
- (c) The drillers use the common techniques and practices that are currently employed in exploratory drilling for ground water in the region surrounding Yucca Mountain;
- (d) Careful sealing of the borehole does not occur, instead natural degradation processes gradually modify the borehole;
- (e) Only releases of radionuclides that occur as a result of the intrusion and that are transported through the resulting borehole to the saturated zone are projected; and
- (f) No releases are included which are caused by unlikely natural processes and events.

**Environmental Protection Agency**

**§ 197.31**

**GROUND WATER PROTECTION STANDARDS**

**§ 197.30 What standards must DOE meet?**

The DOE must demonstrate that there is a reasonable expectation that, for 10,000 years of undisturbed perform-

ance after disposal, releases of radionuclides from waste in the Yucca Mountain disposal system into the accessible environment will not cause the level of radioactivity in the representative volume of ground water to exceed the limits in the following Table 1:

TABLE 1—LIMITS ON RADIONUCLIDES IN THE REPRESENTATIVE VOLUME

| Radionuclide or type of radiation emitted                                    | Limit  | Is natural background included? |
|--|--|---------------------------------|
| Combined radium-226 and radium-228 .....                                     | 5 picocuries per liter .....   | Yes.                            |
| Gross alpha activity (including radium-226 but excluding radon and uranium). | 15 picocuries per liter .....  | Yes.                            |
| Combined beta and photon emitting radionuclides                              | 40 microsieverts (4 millirem) per year to the whole body or any organ, based on drinking 2 liters of water per day from the representative volume. | No.                             |

**§ 197.31 What is a representative volume?**

(a) It is the volume of ground water that would be withdrawn annually from an aquifer containing less than 10,000 milligrams of total dissolved solids per liter of water to supply a given water demand. The DOE must project the concentration of radionuclides released from the Yucca Mountain disposal system that will be in the representative volume. The DOE must then use the projected concentrations to demonstrate a reasonable expectation to NRC that the Yucca Mountain disposal system complies with § 197.30. The DOE must make the following assumptions concerning the representative volume:

- (1) It includes the highest concentration level in the plume of contamination in the accessible environment;
  - (2) Its position and dimensions in the aquifer are determined using average hydrologic characteristics which have cautious, but reasonable, values representative of the aquifers along the radionuclide migration path from the Yucca Mountain repository to the accessible environment as determined by site characterization; and
  - (3) It contains 3,000 acre-feet of water (about 3,714,450,000 liters or 977,486,000 gallons).
- (b) The DOE must use one of two alternative methods for determining the dimensions of the representative volume. The DOE must propose its chosen method, and any underlying assumptions, to NRC for approval.

(1) The DOE may calculate the dimensions as a well-capture zone. If DOE uses this approach, it must assume that the:

- (i) Water supply well(s) has (have) characteristics consistent with public water supply wells in the Town of Amargosa Valley, Nevada, for example, well-bore size and length of the screened intervals;
- (ii) Screened interval(s) include(s) the highest concentration in the plume of contamination in the accessible environment; and
- (iii) Pumping rates and the placement of the well(s) must be set to produce an annual withdrawal equal to the representative volume and to tap the highest concentration within the plume of contamination.

(2) The DOE may calculate the dimensions as a slice of the plume. If DOE uses this approach, it must:

- (i) Propose to NRC, for its approval, where the location of the edge of the plume of contamination occurs. For example, the place where the concentration of radionuclides reaches 0.1% of the level of the highest concentration in the accessible environment;
- (ii) Assume that the slice of the plume is perpendicular to the prevalent direction of flow of the aquifer; and
- (iii) Assume that the volume of ground water contained within the slice of the plume equals the representative volume.