

IMPLEMENTATION OF THE ENVIRONMENTAL PROTECTION AGENCY FINAL STANDARDS

1. INTRODUCTION

The U.S. Environmental Protection Agency (EPA) published Public Health and Environmental Radiation Protection Standards for Yucca Mountain, Nevada, at 40 CFR Part 197 on June 13, 2001 (66 FR 32073). The Energy Policy Act of 1992, Pub. L. 102-486 (EnPA) directs the Commission to modify its technical requirements and criteria to be consistent with these standards. The Commission has imported the EPA standards into its final 10 CFR Part 63 (hereafter referred to as Part 63) regulations in as transparent a manner as possible. Three categories of changes were necessary to accomplish this. First, the two subparts of the EPA standards -- Subpart A for storage and Subpart B for disposal -- have been added to Part 63 as subparts K and L, respectively. Second, in most cases, the Commission adopted wording precisely as it appears at 40 CFR Part 197. The Commission also made nonsubstantive changes that: conformed to the regulatory style of the proposed Part 63, and other U.S. Nuclear Regulatory Commission (NRC) regulations; removed unnecessary references to NRC; and adapted or removed redundant definitions. Lastly, as the implementing authority for the EPA standards, we have provided additional specifications and requirements in the areas where it is appropriate to do so, and based on the proposed Part 63 rule and public comments we received. Indeed, EPA has acknowledged NRC's authority to add implementing requirements. As part of its rulemaking process, the Commission proposed, and received comments on many aspects of radiation exposure scenarios including several matters relevant to implementation of the EPA standards. Although EPA publication of the standards postdated the formal comment period for proposed Part 63, the Commission has provided further specifications in Subpart L, where needed, for clarification. We believe these additions are consistent with EPA's intent and are responsive to public comments we received. A description of the Commission's implementation of EPA's Standards in the final Part 63 regulations appears below.

2. RADIATION STANDARDS FOR STORAGE

NRC has adopted the 0.15 mSv/year (15 mrem/year) dose limit for members of the public, during the storage period, and the associated requirements for determining compliance with the standards. The EPA standards identify the standards for storage as applicable at Yucca Mountain during the time period before closure of the proposed repository. In proposed Part 63, NRC characterized this phase as "pre-closure." Therefore, we are implementing EPA's standards for storage to apply to the pre-closure time period.

3. RADIATION STANDARDS FOR DISPOSAL

The NRC has adopted the 0.15 mSv/year (15 mrem/year) dose limit for the reasonably maximally exposed individual, during the disposal period, and the associated requirements for determining compliance with the standards.

4. GROUND-WATER PROTECTION STANDARDS

NRC has adopted the ground-water protection standards and the associated requirements for determining compliance with the standards.

5. RADIATION STANDARDS FOR HUMAN INTRUSION

NRC has adopted the 0.15 mSv/year (15 mrem/year) dose limit for the reasonably maximally exposed individual as a result of a human intrusion and the associated requirements for determining compliance with the standards. One aspect of EPA's final standards is the specification of the characteristics of a postulated scenario for evaluating the consequences of human intrusion. NRC fully supports and has adopted the characteristics of the human intrusion scenario as specified in 40 CFR Part 197 and has specified one additional requirement to further characterize the scenario. Specifically, Part 63 provides that no particulate waste material falls into the borehole, and that DOE should only consider soluble radionuclides, leached from the package and traveling with ground water, in the human intrusion scenario. This change responds to a public comment seeking clarification of this aspect of the human intrusion scenario in proposed Part 63. The Commission considers the additional requirement to be appropriate for addressing the comment and to be a matter of implementation of the EPA final standards. Further, the requirement is consistent with the human intrusion scenario as specified in 40 CFR Part 197.

6. REFERENCE BIOSPHERE

The EPA standards for Yucca Mountain specify criteria that pertain to the characteristics of a reference biosphere, for use in the performance assessments that are required to show compliance with the post-closure standards for disposal. NRC fully supports and has adopted, in Part 63, the characteristics of the reference biosphere as specified in 40 CFR Part 197 and has included an additional requirement on characteristics of the biosphere that are consistent with EPA's final standards and that were discussed in proposed Part 63 (64 FR 8640, February 22, 1999). Specifically, Part 63 provides a further requirement for biosphere pathways by stating these pathways ... "must be consistent with arid and semi-arid conditions." This addition, from proposed Part 63 (64 FR 8677), clarifies the bounds on what DOE needs to consider and is consistent with present knowledge of how the biosphere could change over the next 10,000 years.

7. REASONABLY MAXIMALLY EXPOSED INDIVIDUAL

The EPA standards specify characteristics of the reasonably maximally exposed individual for use in the performance assessments used to demonstrate compliance with standards for disposal. NRC fully supports and has adopted the characteristics of the reasonably maximally exposed individual from 40 CFR Part 197, and has included requirements specifying additional characteristics that are consistent with the EPA standards and were discussed in proposed Part 63 (64 FR 8640). First, Part 63 provides that the reasonably maximally exposed individual ... "is an adult with metabolic and physiological considerations consistent with present knowledge of adults." This addition, suggested for the average member of the critical group in proposed Part 63 (64 FR 8677), clarifies assumptions DOE must make in estimating the radiation exposure to the reasonably maximally exposed individual. This addition

is considered to be consistent with EPA's standards because: (1) the standards specify a consumption rate for water (i.e., 2 liters per day) that corresponds with that of an adult; and (2) a dose limit of 0.15 mSv (15 mrem) for an adult is protective of children as well as other age groups. The requirement that metabolic and physiological considerations are consistent with present knowledge of adults is consistent with EPA's final standards, which state that DOE should not project changes in human biology (66 FR 32133).

Second, although the EPA standards specify a representative volume approach for demonstrating compliance with the separate ground-water protection standards, they leave to NRC the approach for demonstrating compliance with the individual protection standard for disposal. EPA's approach for ground-water protection specifies a representative volume of 3,000 acre-feet for estimating the concentrations of radionuclides. The 3,000 acre-feet representative volume of groundwater is consistent with assumptions for the critical group described in proposed Part 63 (64 FR 8646). Specifically, in the proposed Part 63, we suggested consideration of a farming community of up to 100 individuals, living on 15 to 25 farms. Fifteen to 25 farms are consistent with current conditions in the town of Amargosa Valley, Nevada, and would be the number needed to produce the range of locally produced food that is currently consumed in this area. The purpose of identifying 15 to 25 farms and specifying 100 individuals was to provide DOE with flexibility in determining an appropriate water demand consistent with a farming community of that size. A community of 15 to 25 farms would pump a sufficiently large volume of water and involve a broad range of exposure pathways. Of primary importance is the ingestion pathway, through consumption of water, crops, and animal products. The Commission considers that the water demand of between 15 and 25 farms can be represented by a volume of at least 3,000 acre-feet and, thus, is consistent with the farming community proposed for comment in Part 63. Additionally, the preamble to EPA's final standards stated the NRC could use an approach to assess water usage in the hypothetical community, in which the RMEI resides, that was similar to the representative volume approach used for ground water protection (i.e., consider a representative volume of 3,000 acre-feet). Therefore, the Commission removed the flexibility provided DOE to determine an appropriate water demand. This revised approach limits speculation on water demand and provides DOE with a specific value for the water demand that the staff finds acceptable to estimate the RMEI dose. Part 63 specifies that the reasonably maximally exposed individual uses well water with an average concentration of radionuclides based on a representative volume of water of 3,000 acre-feet.

8. UNLIKELY FEATURES, EVENTS, AND PROCESSES

The EPA standards exclude unlikely features, events, and processes from analyses for estimating compliance with the standards for human intrusion and ground-water protection. However, the EPA standards do not specify a frequency for unlikely features, events, and processes, and acknowledges a value is to be specified by NRC (66 FR 32135). NRC fully supports excluding unlikely features, events, and processes from analyses for estimating compliance with the standards for human intrusion and ground-water protection. While we have provided no specific quantitative value for determining when exclusion of unlikely features, events, and processes is appropriate, the final regulations allow DOE to exclude unlikely features, events, and processes from the specified analyses with the prior approval of the Commission. The Commission recognizes that specification of a probability limit for unlikely features, events, and processes, as is done for "very" unlikely features, events, and processes, would be a more direct approach. Although the Commission considers a frequency for unlikely

features, events, and processes would fall somewhere between 10^{-8} to 10^{-4} per year, the Commission has decided not to specify a value in the regulations at this time. The Commission considers this approach to be consistent with the intent of EPA's final standards and may revisit the question of specifying a numerical value by rulemaking in the future.

9. TOTAL EFFECTIVE DOSE EQUIVALENT

The EPA standards use the term "annual committed effective dose equivalent" (annual CEDE) to denote the total dose resulting from internal and external exposure to radiation resulting from a single year's exposure. A distinction is made between internal and external doses, because internal exposures (e.g., ingestion and inhalation of radionuclides) continue as long as the radioactive material remains within the body, and disproportionately affect internal organs, depending on where a particular radionuclide is retained in the body. Thus, internal exposure is determined by calculating a CEDE that takes into account the fact that internally deposited nuclides may deposit radiation non-uniformly in the body over long and variable time frames. External exposure results from an individual's proximity to a radiation source present outside the body and does not require consideration of radionuclides retained in the body. The total dose is represented as an "annual CEDE" that is the summation of the internal and the external exposures.

The NRC and EPA approaches for estimating a total exposure to an individual are based on the summation of the internal exposure (determined using a CEDE approach) and the external exposure. However, EPA and NRC use different terminology in regulations and standards to describe this total exposure. EPA uses the term "annual CEDE" whereas NRC uses "total effective dose equivalent in a year" (TEDE in a year) to define the same concept. Specifically, NRC defines terms for dose extensively in 10 CFR Part 20, and uses terms consistent with traditional health physics definitions. By those definitions, Total Effective Dose Equivalent, or TEDE, is the sum of the dose from external exposure and the CEDE (for internal exposures).

Part 63 has adopted EPA's term "annual CEDE" for purposes of compliance with Subparts K and L. However, the Commission is aware that adopting CEDE in one portion of Part 63 and TEDE in another part of the Commission's regulations could be a source of confusion. Further, the dose estimation will be the same regardless of which agency's terminology is used. Therefore, the Commission would be inclined to accept a DOE demonstration in terms of either TEDE in a year or annual CEDE to meet the dose limits of Subparts K and L. [note: separate requirements for ground-water protection are still required to evaluate dose to the whole body and the organs for beta and photon emitting radionuclides].

10. REQUIREMENTS FOR ENVIRONMENTAL IMPACT STATEMENT

EPA's standards require DOE to estimate peak dose under the evaluations for individual protection and human intrusion. The results of these evaluations are to be included in DOE's environmental impact statement (EIS). The Commission has modified Part 63 to include the provision that DOE must include peak dose estimates in its EIS, but notes that there is no standard that must be met with respect to these peak dose calculations, and that there is no finding that the NRC must make with respect to these peak dose calculations nor may they be the subject of litigation in any NRC licensing proceedings for a repository at Yucca Mountain.

However, DOE still must carry out its responsibilities under the National Environmental Policy Act in accordance with the final EPA standards.

11. IMPORTANT TO WASTE ISOLATION

Proposed Part 63 defined “important to waste isolation” in the context of meeting the individual dose limit for the postclosure period of the repository (i.e., disposal). This use of the term is important in defining the scope of the requirements for: DOE’s quality assurance program (specified at Subpart G); multiple barriers (specified at 10 CFR 63.113); performance confirmation (specified at Subpart F); and changes, tests, and experiments (specified at 10 CFR 63.44). The Commission has expanded the definition of the term, “important to waste isolation” to include both the dose limit and the separate ground-water protection limits contained in the EPA standards.