FOR: The Commissioners

FROM: Luis A. Reyes
Executive Director for Operations

SUBJECT: PROPOSED RULE; 10 CFR PART 63: "IMPLEMENTATION OF A DOSE STANDARD AFTER 10,000 YEARS" (RIN 3150-AH-68)

PURPOSE:

To request Commission approval to publish a notice of proposed rulemaking that amends 10 CFR Part 63, to include licensing criteria, applicable after 10,000 years, for a proposed repository at Yucca Mountain, and specifies the use of current methods of dosimetry for calculating radiation exposures. The staff proposes adoption of these criteria and dosimetry methods consistent with environmental standards for Yucca Mountain, as proposed for publication by the U.S. Environmental Protection Agency (EPA).

BACKGROUND:

On November 2, 2001 (66 FR 55732), the U.S. Nuclear Regulatory Commission (NRC) published its final rule, 10 CFR Part 63, governing disposal of high-level radioactive wastes in a potential geologic repository at Yucca Mountain, Nevada. The U.S. Department of Energy (DOE) must comply with these regulations for NRC to authorize construction and license operation of a potential repository at Yucca Mountain. As mandated by the Energy Policy Act of 1992, Public Law 102-486 (EnPA), NRC's final rule was consistent with the radiation protection

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standards issued by EPA at 40 CFR Part 197 (66 FR 32074; June 13, 2001). EPA developed these standards pursuant to Congress' direction, in Section 801 of EnPA, to issue public health and safety standards for protection of the public from releases of radioactive materials stored or disposed of in a potential repository at the Yucca Mountain site. Such standards were to be "based upon and consistent with" the findings and recommendations of the National Academy of Sciences (NAS). The NAS issued its findings and recommendations in a report entitled *Technical Bases for Yucca Mountain Standards* on August 1, 1995.

The State of Nevada and other petitioners challenged both EPA's standards and NRC's regulations in court. On July 9, 2004, the United States Court of Appeals for the District of Columbia Circuit upheld both EPA's standards and NRC's regulations on all but one of the issues raised by the petitioners. See *Nuclear Energy Institute, Inc. v. Environmental Protection Agency,* 373 F.3d 1251 (D.C. Cir. 2004). The court disagreed with EPA's decision to adopt a 10,000-year period for compliance with the standards and NRC's adoption of that 10,000-year compliance period in NRC's implementing regulations. The court found that EPA's 10,000-year compliance period was not "based upon and consistent with" NAS findings, as required by Section 801 of EnPA. The NAS recommended a standard that provided protection when radiation doses reach their peak, within the limits imposed by long-term stability of the geologic environment. In addition, the NAS found no scientific basis for limiting application of the individual-risk standard to 10,000 years. Thus, the court vacated EPA's standards at 40 CFR Part 197 to the extent they specify a 10,000-year compliance period. The court also vacated NRC's regulations at 10 CFR Part 63 insofar as they incorporated EPA's 10,000-year compliance period.

In response to the remand, EPA is proposing to issue revised standards. To comply with EnPA and the court's remand, NRC must now revise 10 CFR Part 63 to be consistent with EPA's proposed revised standards. Where possible, staff proposes revisions to 10 CFR Part 63 that adopt wording from the EPA proposal, precisely, or nearly so, as it appears at proposed 40 CFR 197. This paper transmits the proposed revisions to 10 CFR Part 63.

DISCUSSION:

EPA proposes revisions to its standards that leave the criteria and limits for the first 10,000 years after disposal in place, and that provide additional criteria for DOE's use when estimating the peak dose after 10,000 years. In its proposal, EPA emphasizes that because uncertainties, in general, increase with time, it is not possible to project repository performance into the far future with the same confidence as for the near term. To ensure that performance assessments provide a reasonable basis for making safety decisions, EPA proposes a separate limit for the peak dose after 10,000 years and identifies criteria for performance assessments used to estimate peak dose. Additionally, EPA proposes "weighting factors" that DOE must use in calculating individual dose during the operational or preclosure phase as well as after the disposal or postclosure phase. These weighting factors are based on current dosimetry methods and models as contained in International Committee on Radiation Protection (ICRP) Publications 60 through 72.

Limit for Peak Dose after 10,000 Years

EPA proposes standards requiring DOE to estimate peak dose as part of the assessments for both individual protection and human intrusion. DOE must then compare the results of these estimates to an annual dose limit of 3.5 millisieverts/year (350 millirem/year). For this comparison, EPA proposes that DOE use the median value of the dose distribution of peak doses after 10,000 years. The staff proposes to incorporate the new EPA dose limit and statistical measure for compliance directly into NRC's regulations at § 63.311 for individual protection and at § 63.321 for human intrusion.

Performance Assessments Used to Estimate Peak Dose after 10,000 Years

EPA proposes using the performance assessment for the first 10,000 years as the basis for projecting repository performance after 10,000 years. EPA asserts that its requirements for performance assessment of the first 10,000 years (e.g., consideration for features, events, and processes with a probability of occurrence greater than 10^{-8} per year) provide a suitable basis for projecting performance after 10,000 years. NRC's existing regulations, at 10 CFR Part 63, already include additional requirements, governing the preparation of performance assessments, that ensure that features, events, and processes considered for inclusion in the assessment of the 10,000-year compliance period represent a wide range of both favorable and detrimental effects.

Because of the uncertainties associated with estimating performance over very long times (hundreds of thousands of years) and to limit boundless speculation, EPA proposes specific constraints on the consideration of new features, events, and processes beyond those evaluated during the initial 10,000 years. First, EPA asserts that data and models, used to prepare the performance assessment for the first 10,000 years, provide adequate support for projections used in the performance assessment after 10,000 years. For example, DOE may apply seismic hazard curves used in the 10,000-year assessment to project seismic activity after 10,000 years. Second, EPA proposes to: (1) limit the analysis of seismic activity to the effects caused by damage to the drifts and the waste package; (2) limit analysis of igneous activity to effects on the waste package that result in release of radionuclides to the atmosphere or ground water; (3) limit the effects of climate variation to those resulting from increased water flowing through the repository; and (4) require DOE to include general corrosion in its analysis of engineered barrier performance. EPA also proposes that NRC specify, in regulation, the steady-state (constant-in-time) values DOE should use to project the long-term impact of climate variation. The staff proposes to incorporate these criteria into NRC regulations at § 63.342. The staff also proposes to revise requirements for the performance assessment called for in § 63.114 to be consistent with EPA's proposal that the performance assessment for the first 10,000 years serve as the basis for projecting repository performance after 10,000 years.

Values Used to Project Climate Variation after 10,000 Years

EPA proposes that DOE assume the effects of climate variation, after 10,000 years, are limited to those resulting from increased water flowing through the repository. EPA also proposes that NRC specify, in regulation, the steady-state (constant-in-time) values DOE should use to project the long-term impact of climate variation after 10,000 years. This approach focuses on "average" climate conditions over the long term rather than on time-varying aspects of climate

(e.g., timing, size, and duration of short-term variations) that can be both uncertain and speculative. The staff has considered which parameter or parameters would represent the best average climate conditions. Precipitation and temperature are the most readily identified parameters associated with climate that directly influence the amount of water, or deep percolation, flowing to the repository horizon. It is the rate of deep percolation, however, that directly influences repository performance. Therefore, the staff proposes to specify use of the deep percolation rate to represent the effect of future climate in performance assessments after 10,000 years.

Estimates of deep percolation rate as a fraction of precipitation have been calculated for various climate conditions. Between 5 to 20 percent of precipitation could reach the repository depth under intermediate/monsoon to "full-glacial" climate conditions. The larger percentage reflects "full-glacial" conditions. Given that average deep percolation at Yucca Mountain is approximately 4 percent of precipitation, under current conditions, and assuming between 5 to 20 percent as the fraction of precipitation that remains as deep percolation under intermediate/monsoon climates, one may estimate higher average water flow to the repository than is observed today. On this basis, the staff proposes that DOE represent the effects of climate change after 10,000 years by assuming that deep percolation rates vary between 13 to 64 millimeters/year (0.51 to 2.6 inches/year)[1]. DOE would implement this assumption in its performance assessment by sampling values of deep percolation rates within this range, and, for a given realization, by assuming the deep percolation rate remained constant, at the same rate, after 10,000 years.

Dose Calculations

Finally, EPA proposes that DOE use specific weighting factors provided in Appendix A of its standards at 40 CFR 197. These weighting factors reflect current methods of dosimetry and updated models for calculating individual exposures from high-level radioactive waste. As the basis for this proposal, EPA cites recommendations and guidance from ICRP publications 60 through 72. The staff supports the use of current dosimetry and proposes to adopt this specification. Consistent with EPA's specification of dosimetry for calculating public doses, NRC proposes to revise its regulations to extend application of these dosimetry methods to calculations of doses to workers during the operational period.

STRATEGIC PLAN GOALS:

If adopted, the proposed rule amendments would help maintain high-level waste disposal safety and protection of the environment by implementing standards that protect public health and safety and the environment at the time of peak dose. They would also bring greater

[1] The low value of the range is derived using the lower estimated fraction of precipitation that results in deep percolation and the lower precipitation rate (i.e., 5 percent of 266 is appoximately 13) and the high value of the range from using the higher estimated fraction of precipitation that results in deep percolation and the higher value for precipitation rate (i.e., 20 percent of 321 is approximately 64).

effectiveness and efficiency to the licensing process for the proposed repository. The amendments clarify the assumptions DOE must use in assessing repository system performance after 10,000 years and provide for use of current weighting factors for calculating radiological doses.

RESOURCES:

The resources needed to complete this rulemaking action are estimated to be 1.0 full-time equivalent and $68K for fiscal year 2006, which are already reflected in the budget.

The information on resources and schedule reflects the current environment. If a significant amount of time (greater than 30 days) passes, or the Commission provides the staff direction that differs from, or adds to, the staff's recommended action(s), this section of the paper will need to be revisited after issuance of the draft SRM.

COMMITMENTS:

Upon Commission approval, the staff will take action to publish the proposed rule in the *Federal Register*.

RECOMMENDATIONS:

That the Commission:

1. Approve the proposed amendment to implement the EPA standards for a peak dose limit after 10,000 years for publication in the *Federal Register* (Attachment 1).

2. Note:

    a. That the proposed amendment will be published in the *Federal Register*, allowing 60 days for public comment.

    b. That the Chief Counsel for Advocacy of the Small Business Administration will be informed of the certification and the reasons for it, as required by the Regulatory Flexibility Act, 5 U.S.C. 605(b).

    c. That a draft “Regulatory Analysis” has been prepared for this rulemaking (Attachment 2).

    d. That appropriate Congressional committees will be informed of this action.

    e. That a press release will be issued by the Office of Public Affairs when the proposed rulemaking is filed with the Office of the Federal Register.

COORDINATION:

The Office of the General Counsel has no legal objection to the proposed rulemaking. To accommodate the expedited schedule for this rulemaking, the normal review and concurrence processes were bypassed. The Offices of the General Counsel, Chief Information Officer, and Administration were asked to review this paper. The Office of the Chief Financial Officer has reviewed this paper for resource implications and has no objection.

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Attachments:
1. *Federal Register* Notice
2. Draft "Regulatory Analysis"

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