POLICY ISSUE
(Notation Vote)

June 12, 2023 SECY-23-0053

FOR: The Commissioners

FROM: Daniel H. Dorman
Executive Director for Operations

SUBJECT: DENIAL OF PETITION FOR RULEMAKING ON VOLUNTARY ADOPTION OF REVISED DESIGN-BASIS ACCIDENT DOSE CRITERIA (PRM-50-121; NRC-2020-0055)

PURPOSE:

The purpose of the paper is to request Commission approval to deny petition for rulemaking (PRM) PRM-50-121, "Voluntary Adoption of Revised Design-Basis Accident Dose Criteria." The petition requests that the U.S. Nuclear Regulatory Commission (NRC) conduct rulemaking to revise Section 50.67 of Title 10 of the *Code of Federal Regulations* (10 CFR), "Accident source term," to allow the voluntary adoption of revised design-basis accident dose criteria. According to the petition, the revised design-basis accident dose criteria would reflect: (1) modern health physics recommendations and modern plant designs, (2) provide a better balance between protection of the control room operator and of the public and (3) relieve the unnecessary regulatory burden associated with meeting the current control room dose criteria. The petition also recommends revisions to clarify footnotes that discuss total effective dose. This paper does not address any new commitments or resource implications.

BACKGROUND:

John G. Parillo (the petitioner) filed a PRM with the NRC on November 23, 2019 (Agencywide Documents Access and Management System Accession No. ML20050M894). The petition requested that the NRC develop a rule allowing licensees to voluntarily adopt a revised accident dose acceptance criteria of 0.1 Sv (10 rem) total effective dose equivalent (TEDE) for the

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control room, the exclusion area boundary, and the low population zone boundary. The petition stated that the proposed dose criteria are consistent with current plant designs and health physics. The petition stated concerns with the current acceptance dose criteria in 10 CFR Section 100.11, "Determination of exclusion area, low population zone, and population center distance," (including its basis document, Technical Information Document (TID)-14844, "Calculation of Distance Factors for Power and Test Reactor Sites," United States Atomic Energy Commission, March 23, 1962), and the alternate accident source term requirements in 10 CFR Section 50.67. In addition, the petition requested revisions to clarify multiple footnotes in 10 CFR Parts 50, "Domestic Licensing of Production and Utilization Facilities," 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," and 100, "Reactor Site Criteria," that discuss dose criteria and reference the National Bureau of Standards (NBS) Handbook 69, "Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure," dated June 5, 1959.

With respect to the control room, 10 CFR 50.67(b)(2)(iii), "Accident source term – Requirements," provides a specific dose-based acceptance criteria of 0.05 sievert (Sv) (5 rem) TEDE for demonstrating the acceptability of the control room design. Additionally, 10 CFR Section 50.67(b)(2) specifies two other dose-based criteria: one for the exclusion area boundary of 0.25 Sv (25 rem) TEDE for any 2-hour period following the onset of the postulated fission product release, and the second of 0.25 Sv (25 rem) TEDE at the outer boundary of the low-population zone for the duration of the postulated fission product release.[1]

The NRC docketed the petition on February 19, 2020, and assigned it Docket No. PRM-50-121. On May 27, 2020, the NRC published a notice of docketing and request for comment in the *Federal Register* (FR) (85 FR 31709). The public comment period closed on August 10, 2020. The NRC received three comment submissions; one provided general support for the petition, one opposed the petition, and one addressed matters outside the scope of the petition.

DISCUSSION:

The Petition

The petition requested that the NRC:

- Develop a rule that would allow nuclear power plant licensees to voluntarily adopt a uniform 0.1 Sv (10 rem) TEDE dose criteria for control room design and siting criteria (e.g., 10 CFR 50.67(a), "Accident source term – Applicability.")

- Make conforming changes to Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," that correspond with the voluntary rule.

- Make revisions to clarify multiple footnotes in 10 CFR Parts 50, 52, and 100, including:

    - Multiple footnotes reference the NBS Handbook 69. The petitioner stated that this reference is outdated and should not be considered a relevant reference.

[1] A detailed rationale for the use of 0.25 Sv (25 rem) TEDE as an accident criterion and the use of the 2-hour exposure period resulting in the maximum dose for future light-water reactors is provided at 61 FR 65157 (December 11, 1996).

- Multiple footnotes are inconsistent in their use of “whole body dose” and “total effective dose equivalent” when discussing the 0.25 Sv (25 rem) criterion in 10 CFR Parts 50 and 52.

- Footnotes in 10 CFR Parts 50 and 52 lack a relationship between cancer and radiation exposure.

- A grammatical error exists in a footnote to 10 CFR Section 52.17(a)(1)(ix)(A), “Contents of applications; technical information.”

The petition stated that the current acceptance criterion in 10 CFR Section 50.67 emphasizes protection of the control room operator over the protection of the public. The control room design criterion in 10 CFR Section 50.67(b)(2)(iii) requires adequate radiation protection to permit access to and occupancy of the control room without personnel receiving radiation exposures in excess of 0.05 Sv (5 rem) TEDE for the duration of the accident. The siting criteria contained in Section 50.67 for the exclusion area boundary and the low population zone specify dose criteria of 0.25 Sv (25 rem) TEDE. The petition asserted that the dose acceptance criteria were derived from the siting practices of the earliest reactors and, as a result, the design of accident mitigation systems may not be optimized to best protect public health and safety.

Summary of Staff’s Evaluation

In evaluating the petition, the staff assessed the previous NRC decisions for the establishment of the numerical values in 10 CFR Section 50.67, the underlying intent of the regulations, modern health physics recommendations, current plant design information, and certain historical evaluations (e.g., State-of-the-Art Reactor Consequence Analysis, NUREG-1150, “Severe Accident Risks: An Assessment of Five U.S. Nuclear Power Plants,” and the ongoing Level 3 probabilistic risk assessment project). The NRC previously determined the 0.25 Sv (25 rem) and 0.5 Sv (5 rem) TEDE dose acceptance criteria are not intended to imply an acceptable limit for an emergency dose to the public or the control room operators under postulated accident conditions. Footnotes in 10 CFR Section 50.34, “Contents of applications; technical information,” and 50.67 state the 0.25 Sv (25 rem) value is a reference value that can be used to evaluate proposed design basis changes and plant design features intended to mitigate the radiological consequences of postulated reactor accidents. The control room design criterion is likewise used to assess the acceptability of design provisions for protecting the control room operators under postulated design basis accident conditions.

The staff reviewed the petition for rulemaking using criteria in 10 CFR Section 2.803, “Petition for rulemaking – NRC action,” and recommends that the petition be denied. This recommendation is based on the merits of the petition, the immediacy of safety concerns raised, public comments, and relevant NRC policies and past decisions. The staff concluded that the concerns presented do not reflect an immediate safety concern and the existence of defense-in-depth features make severe accidents and radiological releases that challenge the reference siting and control design room criteria unlikely. Further, denial of the petition is consistent with past NRC policy decisions, including the final rule on reactor site criteria for nuclear power plants (December 11, 1996; 61 FR 65157), the final rule for use of alternative source terms for operating reactors (December 23, 1999; 64 FR 71990), and the Commission’s decision to discontinue rulemaking activities to amend 10 CFR Part 20, “Standards for Protection Against Radiation,” in 2016 (December 28, 2016; 81 FR 95410). The NRC’s use of the 0.05 Sv (5 rem) and 0.25 Sv (25 rem) TEDE dose criteria continue to provide reasonable assurance of adequate protection of public health and safety. Specifically, the 5 rem control

room dose criteria continues to provide adequate radiation protection for occupancy and access of the control room and the 25 rem offsite dose criteria continues to remain sufficient as a design reference value for dose analysis to individuals in the exclusion area boundary and the low population zone for exceedingly low probability events. The enclosed *Federal Register* notice (Enclosure 1) contains a detailed evaluation of the petition and the NRC's responses to the public comments.

The staff also reviewed the language in the footnotes cited by the petition in 10 CFR Part 50, 52, and 100. While the staff agrees that it may be appropriate to clarify the footnotes to reflect the current basis for the siting and control room design criteria, the footnotes only provide explanatory information and are not separate regulatory requirements. Further, the footnotes have not caused regulatory issues with licensing actions. The staff determined that updating the footnotes does not, on its own, warrant rulemaking. Specifically, conducting rulemaking solely to update the language in the footnotes is unlikely to be cost beneficial and would be categorized as low priority in accordance with the NRC's Common Prioritization of Rulemaking process. In addition, the grammatical error in the footnote to 10 CFR 52.17(a)(1)(ix)(A) was corrected in the administrative correction rule published on November 14, 2022.

Alternative Views

The technical members of the working group found merit with some of the assertions and recommendations presented in the petition. The technical members of the working group assessed and reviewed each of the petition's recommendations and presented their recommendation to the Petition Review Board (PRB).[2] In developing this position, the technical members of the working group considered the petition's request to evaluate the current 0.25 Sv (25 rem) TEDE siting criteria against modern health physics knowledge.

The technical members of the working group independently reviewed the following: (1) the purpose of the regulations in question; (2) the evolution of the siting criteria through multiple rulemaking efforts; (3) "current health physics knowledge" as is it relates to 0.25 Sv (25 rem) TEDE; (4) other regulations citing the 0.25 Sv (25 rem) TEDE criteria value; (5) national and international organization recommendations; and (6) the use of the 0.25 Sv (25 rem) TEDE for current operating facilities and new reactor designs. The technical members of the working group also highlighted two proposed rules that involve the 0.25 Sv (25 rem) TEDE siting criteria (Part 53 Risk-Informed, Technology Inclusive Regulatory Framework for Advanced Reactors and Alternative Physical Security Requirements for Advanced Reactors) and noted that these activities would undergo stakeholder review and comment during the rulemaking process.

Lastly, the technical members of the working group considered the variations in TEDE value results produced from the radiological consequence analyses when modern human response models are used. While both the historical reference man and newer male model provide similar results, the age dependent models designed for more sensitive populations (e.g., children) were found to be higher. In other words, if the reference male and child models were assumed to have the same amount of exposure to radioactive material, the calculated dose is higher for the child model. The technical members of the working group explained to the PRB that this is not unexpected since using more realistic input parameters for these populations would produce increasingly conservative results.

[2] The PRB is composed of rulemaking, legal, and technical supervisory and management staff and is tasked with reviewing the working group's evaluation and developing a recommendation for petition closure.

As explained by the technical members of the working group, these results, however, do not account for the various standards as well as diverse regulatory and external stakeholder organizations who have determined that the use of a single criteria based on the adult reference man is sufficiently encompassing of radiosensitive populations regarding the underlying purpose of the regulation (see the final rule on reactor site criteria for nuclear power plants, issued December 11, 1996; 61 FR 65159, and the final rule for use of alternative source terms for operating reactors issued December 23, 1999; 64 FR 71990). Specifically, modeling these populations for the purposes of reactor siting and design is not the intended purpose of the regulation utilizing a dose-based criterion. The Commission's use of the original criterion of 25 rem to the whole body or 300 rem to the thyroid were not values implied to be acceptable limits for an emergency dose to the public under accident conditions. Rather, they represent reference values to be used for evaluating plant features and site characteristics intended to mitigate the radiological consequences of accidents in order to provide assurance of low risk to the public under postulated accidents. This policy was further re-enforced when the Commission adopted the single value of 0.25 Sv (25 rem) TEDE, replacing the whole body and thyroid gland criteria. The technical members of the working group acknowledged that the 0.25 Sv (25 rem) TEDE criterion is not limited to the scope of PRM-50-121 as it is cross-referenced throughout the regulations.

The technical members of the working group recommended to the PRB that staff should engage in researching a holistic reassessment of the 0.25 Sv (25 rem) TEDE siting criteria value because sufficient information to propose an alternate offsite reference dose criteria was not available. The technical members of the working group explained to the PRB that these efforts would be analogous to work described in NUREG-1530, Rev. 1, "Reassessment of NRC's Dollar Per Person-Rem Conversion Factor Policy, Final Report" (ML16147A319), to update Commission policy based on modern research. The reassessment would require research to review the criteria's technical basis with modern health physics and radiation epidemiology knowledge to understand if an update to the numerical value is warranted. This activity would involve engaging national and international experts who would assist the staff in assessing the current scientific, technical, and organizational recommendations in radiation protection and epidemiology when considering an optimized siting criteria for the public. If the staff determined a change to the 0.25 Sv (25 rem) TEDE reference value was warranted, the staff would recommend to the Commission, through a rulemaking plan, that rulemaking be pursued.

The Petition Review Board and Staff Management Assessment of Alternative Views

The technical members of the working group presented their recommendation to the PRB during meetings held on February 3, 4, and 11, 2022. The PRB and staff management carefully considered these views and found that the 0.25 Sv (25 rem) TEDE dose criterion serves as a reference value used in the evaluation of plant design features. Therefore, the use of a reference adult man as a dose receptor is not inconsistent with the policy objective of assuring a low risk of public radiation exposure from postulated reactor accidents. Information presented by the technical members of the working group also demonstrated that the results obtained from newer response modeling for an adult remain consistent with prior use of the adult reference man model. While the results of the comparative analysis prepared by the technical members of the working group highlighted age-related differences, as noted in the preamble for 1991 final rule on 10 CFR Part 20 (56 FR 23360), the PRB and staff management determined that use of the effective dose equivalent concept reduces the importance of age-dependent intake-to dose factors.

In addition, the PRB and staff management found that defense in depth features such as emergency planning, engineered safety features, and beyond design basis accident mitigation measures make severe accidents and significant releases of radioactivity to the environment highly unlikely. For example, Section 50.67 states that the 0.25 Sv (25 rem) TEDE criteria is not intended to imply that this value constitutes an acceptable limit for emergency doses to the public under accident conditions. Rather, the TEDE value serves as reference that can be used for evaluating proposed reactor design basis changes with respect to potential reactor accidents of exceedingly low probability of occurrence and low risk of public exposure to radiation. Further, review of past NRC policy decisions related to the final reactor siting rule and the alternate source term rule does not indicate that the Commission intended to apply the offsite dose criteria in a manner that provided equivalent protection across a full range of sensitive populations. Accordingly, the PRB and staff management agreed that denial of the PRM is appropriate.

RECOMMENDATION:

Consistent with the recommendations of the PRB, the staff recommends the Commission deny PRM-50-121 because the current approach for offsite dose criteria continues to provide reasonable assurance of adequate protection of the public. The petition did not present new information sufficient to support rulemaking, especially in light of the robust Commission decision-making history on this topic, and the proposed changes are not necessary to provide reasonable assurance of adequate protection of public health and safety.

The staff also recommends the Commission approve publication of the *Federal Register* notice (Enclosure 1) denying PRM-50-121. The enclosed letter for signature by the Secretary of the Commission (Enclosure 2) would inform the petitioner of the Commission's decision to deny the petition. The staff also will inform the appropriate Congressional committees of the Commission's decision.

RESOURCES:

This paper does not address any new commitments or resource implications.

COORDINATION:

The Office of the General Counsel reviewed this package and has no legal objection.

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Enclosures:
1. PRM-50-121 FRN - Closure on Voluntary Adoption of Revised Design Basis Accident Dose Criteria FRN
2. PRM-50-121 Ltr to Petitioner - Closure of Petition for Rulemaking on Voluntary Adoption of Revised Design-Basis Accident Dose Criteria

SUBJECT: DENIAL OF PETITION FOR RULEMAKING ON VOLUNTARY ADOPTION OFREVISED DESIGN-BASIS ACCIDENT DOSE CRITERIA (PRM-50-121; NRC-2020-0055). DATED: June 12, 2023.

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