

**NUCLEAR REGULATORY COMMISSION**

**10 CFR Part 50**

**[Docket No. PRM-50-122; NRC-2020-0150]**

**Accident Source Term Methodologies and Corresponding Release Fractions**

**AGENCY:** Nuclear Regulatory Commission.

**ACTION:** Petition for rulemaking; denial.

**SUMMARY:** The U.S. Nuclear Regulatory Commission (NRC) is denying a petition for rulemaking dated May 31, 2020, submitted by Brian Magnuson. The petitioner requested that the NRC revise its regulations to codify the source term methodologies and corresponding release fractions recommended in a report issued by Sandia National Laboratories; to codify a modified version of draft regulatory guide DG-1199, including the source term methodologies recommended in the report and the corresponding release fractions; and to account for high burnup fuel pellet fragmentation, relocation, and dispersal outside of the fuel rod during postulated design basis accidents. The NRC docketed the petition on June 18, 2020, and assigned it Docket No. PRM-50-122. The NRC is denying the petition because the proposed changes would unnecessarily reduce the intended flexibility in the NRC's regulatory approach, and they are not necessary to provide reasonable assurance of adequate protection of public health and safety.

**DATES:** The docket for PRM-50-122 is closed on **[INSERT DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**.

**ADDRESSES:** Please refer to Docket ID NRC-2020-0150 when contacting the NRC about the availability of information for this action. You may obtain publicly available information related to this action by any of the following methods:

- **Federal Rulemaking Website:** Go to <https://www.regulations.gov> and search for Docket ID NRC-2020-0150. Address questions about NRC Docket IDs to Dawn Forder; telephone: 301-415-3407; email: [Dawn.Forder@nrc.gov](mailto:Dawn.Forder@nrc.gov). For technical questions, contact the individuals listed in the FOR FURTHER INFORMATION CONTACT section of this document.

- **NRC Agencywide Documents Access and Management System (ADAMS):** You may obtain publicly available documents online in the ADAMS Public Documents collection at <https://www.nrc.gov/reading-rm/adams.html>. To begin the search, select "Begin Web-based ADAMS Search." For problems with ADAMS, please contact the NRC's Public Document Room (PDR) reference staff at 1-800-397-4209, 301-415-4737, or by sending an email to [PDR.Resource@nrc.gov](mailto:PDR.Resource@nrc.gov). For the convenience of the reader, instructions about obtaining materials referenced in this document are provided in the Availability of Documents section.

- **NRC's PDR:** You may examine and purchase copies of public documents, by appointment, at the NRC's PDR, Room P1 B35, One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852. To make an appointment to visit the PDR, please send an email to [PDR.Resource@nrc.gov](mailto:PDR.Resource@nrc.gov) or call 1-800-397-4209 or 301-415-4737, between 8:00 a.m. and 4:00 p.m. (ET), Monday through Friday, except Federal holidays.

**FOR FURTHER INFORMATION CONTACT:** Adakou Foli, Office of Nuclear Reactor Regulation; telephone: 301-415-1984; email: Adakou.Foli@nrc.gov, or Solomon Sahle, Office of Nuclear Material Safety and Safeguards; telephone: 301-415-3781; email: Solomon.Sahle@nrc.gov. Both are staff of the U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

**SUPPLEMENTARY INFORMATION:**

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**I. The Petition**

Section 2.802 of title 10 of the *Code of Federal Regulations* (10 CFR), “Petition for rulemaking—requirements for filing,” provides an opportunity for any interested person to petition the Commission to issue, amend, or rescind any regulation. On May 31, 2020, the NRC received a petition for rulemaking (PRM) from Brian Magnuson. The petitioner requested that the NRC amend its regulations in § 50.67, “Accident source term,” to codify the following:

- the source term methodologies recommended in the Sandia National Laboratories report SAND2008-6601, “Analysis of Main Steam Isolation Valve

Leakage in Design Basis Accidents Using MELCOR 1.8.6 and RADTRAD,” issued October 2008; and

- a modified version of draft regulatory guide (DG) DG-1199, “Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors,” issued October 2009, that would include the source term methodologies recommended in SAND2008-6601 and the corresponding release fractions.

The petition also requested that the NRC revise § 50.67 to account for high burnup fuel pellet fragmentation, relocation, and dispersal outside of the fuel rod during postulated design-basis accidents.

The DG-1199 was a proposed revision to Regulatory Guide (RG) 1.183, “Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors,” Revision 0, issued July 2000, and was not finalized as an update to RG 1.183. After the issuance of DG-1199 for public comment, the staff received a number of public comments and spent significant efforts in addressing the comments, including resolving different NRC staff views on the approach in addressing certain comments. The efforts included soliciting an independent review of certain aspects of the DG-1199 performed by Sandia National Laboratories. In 2017, the NRC received the final responses from Sandia National Laboratories associated with their independent review.

In late 2020, the NRC resumed RG 1.183 revision efforts after considering a significant amount of insight gained since the initial issuance of the DG-1199, including the 2017 Sandia National Laboratories responses and research pertaining to state-of-

the-art source term knowledge, such as the fuel fragmentation, relocation, and dispersal. The planned revision will include this information and also will update RG 1.183 to support accident tolerant fuel and higher enrichment and burnup levels.

The petition identified concerns with the NRC guidance used to calculate radiological doses to comply with the regulations in § 50.67, stating that 1) the current NRC guidance in RG 1.183 is “conceptually inaccurate” and “nonconservative” based on SAND2008-6601, and 2) nuclear power plants use varying regulatory guidance (e.g., Technical Information Document (TID)-14844, “Calculation of Distance Factors for Power and Test Reactor Sites,” issued March 1962; NUREG-1465, “Accident Source Terms for Light-Water Nuclear Power Plants,” issued February 1995; and RG 1.183) that relies on different source term methodologies and corresponding release fractions to satisfy the same regulations. The petition argued that due to these concerns, many nuclear power plants are “likely not in compliance with some, or all of their applicable regulations and requirements, which ultimately protect people and the environment.” The petitioner stated that the proposed revision to § 50.67 would eliminate inconsistencies resulting from the use of different source term methodologies and release fractions and would provide the requisite means to ensure compliance with the underlying regulations.

## **II. Public Comments on the Petition**

On August 24, 2020 (85 FR 52058), the NRC published a notice of docketing of PRM-50-122 and a request for public comment on the PRM in the *Federal Register*.

The public comment period closed on November 9, 2020. The NRC received two comment submissions: 1) one commenter (the petitioner) provided supplemental information in support of the petition, and 2) one commenter (an NRC staff member acting in his personal capacity) opposed the petition. This latter comment was withdrawn from the petition docket because it included non-public information. The NRC reviewed the comments in making its decision on the petition.

A summary of the comment from the petitioner and the NRC's response follows. The comment is available as indicated in the Availability of Documents section of this document.

**Comment:** The petitioner provided additional concerns related to RG 1.183, Revision 0, such as the treatment of uncertainties in the source terms and the behavior of main steam isolation valve leakage. He stated that such issues provide additional justification for codifying a modified version of DG-1199 in § 50.67.

**NRC Response:** As discussed in more detail in the Reasons for Denial section of this document, the NRC disagrees with the comment, and finds that RG 1.183, Revision 0 continues to provide an acceptable method to address design-basis accident radiological consequences to comply with the applicable regulations. With regard to the continued acceptability of RG 1.183, Revision 0, additional information also appears in the Differing Professional Opinion case file DPO-2020-002, available as indicated in the Availability of Documents section of this document.

### III. Reasons for Denial

The NRC is denying the petition because the requested changes would unnecessarily reduce the intended flexibility inherent in § 50.67 and the NRC's overall regulatory approach in the area of design-basis accident radiological consequence analyses. The NRC's current regulations and oversight activities continue to provide reasonable assurance of adequate protection of public health and safety.

Codifying a specific source term methodology and corresponding release fractions in § 50.67 would unnecessarily limit options for meeting the requirements, whereas § 50.67 currently allows the use of alternative sufficient methods of compliance. A detailed approach for determining source term is provided in RG 1.183, Revision 0, which describes one way to meet the requirements in § 50.67.

In § 50.67, the NRC provides requirements on the acceptable dose criteria from the design-basis analyses based upon a major accident assumed to result in substantial meltdown of the core with subsequent release of appreciable quantities of fission products (see § 50.67; see also TID-14844 and NUREG-1465). The regulatory approach of using design-basis accidents and applying performance-based regulatory requirements is consistent with the approach provided in other NRC regulations, including § 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," and § 50.65, "Requirements for monitoring the effectiveness of maintenance at nuclear power plants." Furthermore, when § 50.67 was promulgated, the NRC did not include a defined methodology for demonstrating compliance, consistent with other regulations related to radiological reactor siting criteria,

such as § 100.11, "Determination of exclusion area, low population zone, and population center distance," and § 50.34, "Contents of applications; technical information." Instead, § 50.67 allows changes to the defined source term or the development of other technically sound source term values without requiring additional rulemaking, and the NRC still finds this approach to be appropriate. Therefore, instead of codifying a particular source term methodology, the NRC used NUREG-1465 and other technical information to develop RG 1.183 to provide one acceptable methodology for complying with § 50.67, but not the only one. This has provided the NRC and the nuclear industry with both regulatory clarity and the flexibility to consider and incorporate new research and technical advancements while continuing to ensure safety. The approach in § 50.67 is to provide flexibility in applying basic principles to new situations and the use of evolving methods of analyses in the licensing process, and not to include prescriptive methodology in the regulation. This approach reflects the philosophy that the regulation only contains the high-level requirements and that the technical details are contained in guidance and updated, as appropriate, to reflect current knowledge. The NRC finds that § 50.67 continues to provide reasonable assurance of adequate protection and safety given new technologies and continued lessons learned. For example, the current § 50.67 requires that the application contain an evaluation of the consequences of applicable design basis accidents. In addition, § 50.90 requires that applications for license amendments fully describe the desired changes. Therefore, applicants and licensees are required to address significant changes to the fuel design such as increases to fuel burnup limits and potential fuel fragmentation, relocation, and dispersal issues, and the NRC will only approve an amendment if the applicant's analysis

demonstrates with reasonable assurance that dose values are met, consistent with the agency's process.

#### IV. Availability of Documents

The documents identified in the following table are available to interested persons through one or more of the following methods, as indicated.

DOCUMENT	DATE	ADAMS ACCESSION NO. OR FEDERAL REGISTER CITATION OR WEB SITE
PRM-50-122, "Petition to Amend 10 CFR 50.67, <i>Accident Source Term</i> , to Include Methodologies and Release Fractions"	May 31, 2020	ML20170B161
DG-1199, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors"	October 2009	ML090960464
SAND2008-6601, "Analysis of Main Steam Isolation Valve Leakage in Design Basis Accidents Using MELCOR 1.8.6 and RADTRAD"	October 2008	ML083180196
RG 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," Revision 0	July 2000	ML003716792
NUREG-1465, "Accident Source Terms for Light-Water Nuclear Power Plants"	February 1995	ML041040063
TID-14844, "Calculation of Distance Factors for Power and Test Reactors"	March 23, 1962	ML021720780
Accident Source Term Methodologies and Corresponding Release Fractions; Notice of Docketing and Request for Comment	August 24, 2020	85 FR 52058

DOCUMENT	DATE	ADAMS ACCESSION NO. OR FEDERAL REGISTER CITATION OR WEB SITE
Comment (002) of Brian Magnuson on PRM-50-122—Accident Source Term Methodologies and Corresponding Release Fractions	November 8, 2020	ML20330A276
Differing Professional Opinion (DPO) Case File for DPO-2020-002	March 8, 2021	ML21067A645

**V. Conclusion**

For the reasons cited in this document, the NRC is denying PRM-50-122. The current requirements in § 50.67 continue to provide reasonable assurance of adequate protection of public health and safety and should not be revised as proposed in the PRM.

Dated: July 19, 2022.

For the Nuclear Regulatory Commission.

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Brooke P. Clark,  
Secretary of the Commission.