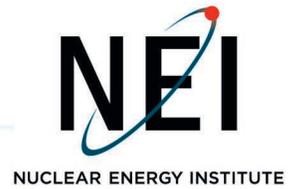


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March 3, 2023

Secretary
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
ATTN: Rulemakings and Adjudications Staff

Project Number: 689

Subject: Comments on the Petition for Rulemaking Requesting the NRC Revise its Regulations Regarding the Licensing Safety Analysis for Loss-of-Coolant Accidents (Docket ID: NRC-2022-0178) (Federal Register Notice 87FR71531)

Dear Ms. Brooke P. Clark,

The Nuclear Energy Institute (NEI)¹, on behalf of the industry, appreciates the opportunity to comment on the Petition for Rulemaking (PRM), PRM-50-124. The PRM requests that the NRC amend the regulations to 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," which limits peak cladding temperature and maximum cladding oxidation to satisfy General Design Criterion No. 35 of Appendix A to Part 50, "Emergency Core Cooling." The detailed comments in this letter are for the staff's consideration as they determine whether the issues raised in the PRM should be used as a basis to amend the regulations.

Industry disagrees with the premise of the petitioner's letter that the "licensing safety analysis for loss-of-coolant accidents (LOCAs) is no longer valid for fuel at moderate and higher burnups" and that the "current rule ... no longer ensures coolable geometry at higher burnups ...". Industry's position is that the current rule remains adequate for the protection of public health and safety and that this petition should be denied for rulemaking for the reasons discussed below.

The safety of the plants under moderate burnups has been studied and addressed by industry and the NRC. A 2012 NRC safety assessment² confirmed, on a plant-specific basis, the safe operation of the U.S. commercial nuclear fleet. This safety assessment was based on reports submitted by the Boiling Water

¹ The Nuclear Energy Institute (NEI) is responsible for establishing unified policy on behalf of its members relating to matters affecting the nuclear energy industry, including the regulatory aspects of generic operational and technical issues. NEI's members include entities licensed to operate commercial nuclear power plants in the United States, nuclear plant designers, major architect and engineering firms, fuel cycle facilities, nuclear materials licensees, and other organizations involved in the nuclear energy industry.

² NRC ECCS Performance Safety Assessment and Audit Report, February 10, 2012; ML12041A078.

Reactor Owners Group (BWROG)³ and the Pressurized Water Reactor Owners Group (PWROG)⁴ that documented no safety issue exists and that the plants have a sufficient margin of safety. These assessments have been updated by industry several times since the original issuance and have been maintained by the NRC on a yearly basis per the process established in the 2012 NRC safety assessment. Furthermore, the continued safe operation of plants with existing burnup limits and current styles of operation is well addressed in SECY-15-0148⁵ that also concluded, "Research and analyses provide reasonable assurance that no imminent safety concern exists with operating reactors."

Industry disagrees with the petitioner's statement:

"Calculations of temperature and oxidation within the burst region of a fuel rod are extremely difficult to the point of being meaningless. Independent of our conclusion, the Reactor Safety Commission (RSK) in Germany has stated that 'In the opinion of the RSK, such a safety demonstration is currently not possible.'"

LOCA methodologies utilized to demonstrate compliance with the 10 CFR 50.46 acceptance criteria are required to meet 10 CFR 50.46 (a)(1)(i) and the associated evaluation models must contain sufficient detail (and/or conservatisms) to perform the requisite analyses. Conservatism is included to ensure that regulatory criteria are met with high probability. For example, the calculations of the cladding temperature and local oxidation at the hottest spot on the most limiting rods are then used to demonstrate compliance with the 10 CFR 50.46 criteria for the entire core. As such, the current methods, which are benchmarked against meaningful experimental data and consider the uncertainties associated with important phenomena, are NRC approved to demonstrate compliance.

Additionally, industry believes the RSK statement related to the safety demonstration quoted in the paragraph above was taken out of context. To assess cladding within the deformation and burst range, the RSK indicated, "Since...the deformation and burst range is susceptible to embrittlement and cladding failure, there is a need for using different approaches to its assessment." As such, in Section 3.4,⁶ the RSK provides an applicable safety demonstration for the deformation and burst range composed of different elements and concludes:

"...the RSK comes to the conclusion that the ECR(H) limit curve of the NRC [Draft Regulatory Guide DG-1263⁷] can be used for the demonstration of a sufficient limitation of the ECR value in the deformation and burst range since – according to current knowledge – it sufficiently limits the degree of oxidation for the deformation and burst range in dependence of the operational hydrogen up-take. This covers implicitly the embrittling effect of the hydrogen up-take from secondary hydrogen up-take. The present experiment results show that if the ECR value is limited in

³ BWROG-TP-11-010 (Rev.1), Evaluation of BWR LOCA Analyses and Margins Against High Burnup Fuel Research Findings, June 2011; ML111950139.

⁴ PWROG Letter Report OG-11-143, 10CFR50.46(b) Margin Assessment Report, April 29, 2011; ML11139A309.

⁵ NRC SECY-15-0148, "Evaluation of Fuel Fragmentation, Relocation and Dispersal Under Loss-Of-Coolant Accident (LOCA) Conditions."

⁶ RSK, "Demonstration," Section 3.4.

⁷ It is noted the draft Regulatory Guide DG-1263 has been superseded by draft Regulatory Guide 1.224. However, the relevant content discussed herein is unchanged between DG-1263 and draft RG-1.224.

accordance with the limit curve of the NRC, a sufficient residual strength in the deformation and burst area is ensured so that a fragmentation of the cladding upon quenching can be excluded. Hence, no additional data beyond the operational hydrogen content and the maximum ECR value resulting from the high-temperature oxidation are necessary for the demonstration."

The PRM supports its proposed change to a core-wide rupture criterion on the basis that "safety analyses in Germany are required to show that no more than 1% of the fuel rods in a core would rupture during a small-break LOCA and no more than 10% of fuel rods in a core would rupture during a large-break LOCA." However, these criteria are not for core coolability assessments; instead, the 10% failure rate (2A leak) and 1% (0.1A leak) are radiological criteria, as described in tab.3.1c. of "Safety Requirements for Nuclear Power Plants."⁸ While some work was done by German utilities to evaluate potential consequences of fuel release on fuel coolability, the scope was limited to potential steam diversion assuming a high percentage of channel blockage at the hottest location⁹ and did not consider conditions in the blockage. Furthermore, the German method did not distinguish the burnup of the burst rods relevant for fuel dispersal consequences. In fact, German core designs are typically within U.S. burnup limits and very few of those rods that are at the end of that spectrum burst in a typical German core design.¹⁰

While the petitioner states the current acceptance criteria and their analyses are not straight forward; the criteria and their application to the single worst rod remain conservative with respect to the overarching goal of core coolability. This relationship is well understood by those responsible for developing the evaluation models and ensuring the adequacy of a plant ECCS design. Fuel vendors have significant experience in modeling the fuel rod performance under postulated LOCA conditions, with a focus on a compliance demonstration for the most limiting rods in the core (thereby assuring compliance for all the rods operating in the core).

With respect to the resources necessary to promulgate and implement the proposed new criteria, the petitioner states that the "*effort will be small and worthwhile*" and industry analyses and NRC reviews "*will be simpler (less expensive)*." Contrary to what the petitioner describes, significant resources would be required to:

- 1) develop the technical and regulatory bases (e.g., rule language, performance-based metrics and criteria, analytical requirements, and regulatory guidance) for a core-wide performance and compliance demonstration,
- 2) develop and calibrate analytical models, quantify uncertainties, complete software verification and validation, and license (i.e., NRC review) new LOCA methodologies (current NRC approved methods do not evaluate core wide rupture),
- 3) implement new methodologies on a plant-specific basis,

⁸ RS-Handbuch "Sicherheitsanforderungen an Kernkraftwerke" vom 22. November 2012, Neufassung vom 3. März 2015 (Banz AT 30.03.2015 B2).

⁹ Wensauer, A, "German 10% Burst Criterion Overview", Electric Power Research Institute (EPRI) High Burnup Workshop, Charlotte, Jan 2020.

¹⁰ Wensauer, A, "German 10% Burst Criterion Overview", EPRI High Burnup Workshop, Charlotte, Jan 2020.

- 4) submit plant-specific license amendment requests (LARs) for NRC approval of new LOCA analyses-of-record, and
- 5) update plant-specific Updated Final Safety Analysis Reports (UFSARs). The analyses may also need to be performed on a cycle-specific basis.

Furthermore, many of the same industry and NRC staff resources currently working to finalize and license new advanced fuel technologies (e.g., coated cladding), which provides real, measurable safety benefits, would be delayed and redirected toward the additional substantial effort listed above without the measurable safety benefits.

In the recent SRM-SECY-21-0109 dated March 16, 2022, the Commission directed the staff to use a risk-informed approach when developing the regulatory basis and guidance to address fuel fragmentation, relocation, and dispersal issues relevant to fuels of higher enrichment and burnup levels. Furthermore, the industry notes that SECY-16-0033 dated March 16, 2016, on the proposed Draft Final 10 CFR 50.46c rule has not been updated to include the progress made over the past seven years. Industry supports moving forward with efforts to develop a more holistic, modernized, technology neutral (in particular, considering accident tolerant fuels¹¹), and risk-informed rulemaking and encourages continued dialogue between the staff, industry, and scientific community stakeholders.

The comments provided in this letter were aggregated from contributions by several member utilities, Framatome, GE-Hitachi, Westinghouse, BWROG, and PWROG. We appreciate the NRC's effort to consider the issues raised in the PRM as part of new rulemaking and trust that you will find these collective comments useful and informative when determining whether the issues raised in the PRM should be used as a basis to amend the regulations.

Please contact me at fap@nei.org or (202) 739-8132 with any questions.

Sincerely,



Frances A. Pimentel

c: Joseph Donoghue, NRR, NRC
Andrea Kock, NRR, NRC
Blake Purnell, NMSS, NRC
Andrea Veil, NRR, NRC
NRC Document Control Desk

¹¹ ML21243A298 – “NRC Project Plan to Prepare the U.S. Nuclear Regulatory Commission for Efficient and Effective Licensing of Accident Tolerant Fuels,” Version 1.2, September 2021.

From: [PIMENTEL, Frances](#)
To: [RulemakingComments Resource](#)
Cc: [Joseph Donoghue](#); [Andrea Kock \(She/Her/Hers\)](#); [Blake Purnell](#); [Andrea Veil](#)
Subject: [External_Sender] Comments on the Petition for Rulemaking Requesting the NRC Revise its Regulations Regarding the Licensing Safety Analysis for Loss-of-Coolant Accidents (Docket ID: NRC-2022-0178) (Federal Register Notice 87FR71531)
Date: Friday, March 03, 2023 1:04:18 PM
Attachments: [03-03-23 PRM for 10 CFR 50.46 Rulemaking.pdf](#)

THE ATTACHMENT CONTAINS THE COMPLETE CONTENTS OF THE LETTER

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Secretary
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Sincerely,

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^[1] The Nuclear Energy Institute (NEI) is responsible for establishing unified policy on behalf of its members relating to matters affecting the nuclear energy industry, including the regulatory aspects of generic operational and technical issues. NEI's members include entities licensed to operate commercial nuclear power plants in the United States, nuclear plant designers, major architect and engineering firms, fuel cycle facilities, nuclear materials licensees, and other organizations involved in the nuclear energy industry.

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