UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 3, 2025

MEMORANDUM TO: Jennivine K. Rankin, Branch Chief
Licensing Projects Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

FROM: James Delosreyes, Project Manager ***/RA/***
Licensing Projects Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

SUBJECT: MEETING SUMMARY OF THE SEPTEMBER 18-19, 2025, U.S. NUCLEAR REGULATORY COMMISSION'S ACCIDENT TOLERANT FUEL FRAGMENTATION, RELOCATION, AND DISPERSAL CONSEQUENCES WORKSHOP

On September 18-19, 2025, the U.S. Nuclear Regulatory Commission (NRC) staff held a public workshop with representatives of industry to discuss topics related to Fuel Fragmentation, Relocation, and Dispersal (FFRD) including a proposed white paper submittal from the Nuclear Energy Institute (NEI) on materials degradation research and initiatives. The meeting was held in a hybrid format (i.e., attendance in-person, virtual, and teleconference) and conducted over two days. The meeting notice is available in the Agencywide Documents Access and Management System (ADAMS) under Accession No. ML25260A589. The presentation slides are available in ADAMS under Accession No. ML25260A541. The list of attendees is enclosed.

The NRC staff began the public meeting with an introduction and explanation of logistical information. Jen Whitman, NRC's Director of the Division of Safety Systems, and Al Csontos, NEI's Director of Fuels, provided opening and closing remarks. The topics discussed during the meeting are summarized below.

Please direct any inquiries to James Delosreyes at James.Delosreyes@nrc.gov.

BACKGROUND

This workshop was the third in a series of workshops to discuss topics related to FFRD to take place over the span of several months with the first two held on May 20-21 and July 30-31, 2025. Most, if not all, of these workshops will also serve as a venue to discuss draft submittals from industry for white papers related to the topics of discussion.

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Performance Monitoring Through Inspections and Demonstrating Acceptable Seismic Failure Risk

The NRC staff presented on a topic related to performance monitoring as part of a risk informed approach to plant licensing. The topic focused on the role of and managing seismic risk for reactor coolant pressure boundary components, emphasizing that inspections are the most effective tool for ensuring degradation remains within acceptable limits, especially for passive components where other monitoring methods are limited. The presentation reviewed the evolution of risk-informed in-service inspection (RI-ISI) practices which allow for targeted sampling based on risk categories and degradation mechanisms. These approaches aim to optimize inspection scope while maintaining safety margins.

Additionally, the presentation addressed how seismic risk can be managed through existing evaluations like seismic probabilistic risk assessment and margin assessments. It proposed a screening approach to identify and evaluate high-risk welds and materials for potential loss of fracture toughness due to aging. The goal is to demonstrate that seismic-induced failure risk remains lower than that from normal operations, ensuring continued plant safety. The presentation concluded with considerations for fleet-wide and plant-specific inspection strategies to maintain acceptable risk levels.

Demonstration of the Proven Effectiveness of Existing Materials Management and Inspection Programs

The Electric Power Research Institute (EPRI) presented next on a proposed white paper being developed in collaboration with NEI. The topic demonstrated the continued effectiveness of the nuclear industry's materials management and inspection programs, emphasizing that current practices remain sufficient to ensure safe plant operation without the need for additional weld inspections or fabrication record searches. The NEI 03-08 Materials Initiative, a cornerstone of industry coordination, was highlighted for its proactive approach to identifying and managing degradation mechanisms. The initiative has received positive feedback from the NRC and is recognized internationally as a model for aging management.

The presentation also reaffirmed the validity of NUREG-1829 conclusions, supported by updated probabilistic fracture mechanics analyses using the xLPR tool. These analyses confirmed that the likelihood of a break larger than the Transition Break Size remains extremely low, even with extended plant lifetimes. RI-ISI programs, along with augmented inspection protocols and leak-before-break evaluations, were shown to effectively target high-risk components. The industry's inspection infrastructure, including the Performance Demonstration Initiative, continues to provide robust assurance of structural integrity across the fleet.

NRC Efficiency Improvements

The NEI presented last on regulatory efficiency improvements revolving around the Increased Enrichment (IE) and Title 10 of the *Code of Federal Regulations* 50.46a/c rulemakings. The IE rulemaking seeks to raise the enrichment limit, supporting advanced fuels, accident-tolerant fuel (ATF), and extended fuel cycles. The previously discontinued 50.46a rule, a voluntary risk-informed alternative to traditional loss-of-coolant accident criteria, and the withdrawn 50.46c rule, which addressed fuel embrittlement, are now being reconsidered in a combined framework. This integrated approach aims to enhance regulatory realism, enable higher burnups and power uprates, and reduce unnecessary burdens while maintaining safety through existing aging management programs and updated analytical models.

DISCUSSION

During the open discussion, the NRC staff and industry representatives reviewed survey results on inspection practices for similar metal welds in primary loop piping. It was noted that inspection coverage varies based on reactor design, material types, and historical practices. While some units continue to inspect these welds regularly, others meet risk-informed requirements through alternative selections, particularly where technical limitations exist. The conversation also addressed whether inspections are being performed on the largest connected piping systems, with examples illustrating how such components are typically categorized under risk-informed frameworks and may warrant targeted sampling.

Further clarification was provided on the use of augmented inspection strategies, such as Appendix L, which focuses on the most fatigue-limiting locations and can complement broader inspection programs. The NRC staff emphasized the importance of documenting this information in the white paper to support a comprehensive understanding of inspection coverage. While some components are no longer inspected due to challenges like cast materials or limited access, the survey was considered broadly representative. The NRC staff encouraged including more detail on inspection locations and rationale to ensure all plants are adequately reflected in the overall evaluation.

The conversation shifted to how seismic risk is being addressed across the fleet, with NRC staff outlining a path forward for demonstrating that seismic risk remains lower than normal operational risk. It was acknowledged that while existing seismic risk analyses show low overall risk and minimal contribution from primary loop piping, these analyses often do not account for how material degradation over time could affect component fragility. To bridge that gap, the NRC staff emphasized the need to integrate multiple sources of technical evidence to build a comprehensive case that piping integrity under seismic loading remains robust, even in the context of aging.

The group discussed how various technical elements can be combined to support this conclusion. While each plant may rely on different pieces of this broader technical framework, the goal is to ensure that, collectively, the evidence demonstrates acceptable seismic performance across the fleet. The NRC staff noted that this integrated approach should be clearly documented, potentially using the screening methodology discussed in earlier presentations, and tailored to reflect plant-specific conditions while maintaining a consistent risk-informed basis.

The details of this latter discussion were captured in email and forwarded to EPRI for consideration in its MRP-480 program available at Accession No. ML25323A523.

PUBLIC COMMENTS

A member of the Union of Concerned Scientists emphasized the importance of incorporating seismic risk into the NRC's evaluation process and urged the NRC staff not to compromise on the technical rigor required. The member criticized the notion that plant-specific analyses might not be necessary, calling it unreasonable given the scope of the proposed strategy. The member argued that NRC decisions should be based on technical merit, not industry convenience, and highlighted seismic risk as a critical vulnerability that must be thoroughly addressed.

No regulatory decisions were made during this meeting.

Enclosure:
List of Attendees

LIST OF ATTENDEES

U.S. Nuclear Regulatory Commission Workshop
Accident Tolerant Fuel Fragmentation, Relocation, And Dispersal Consequences
September 18-19, 2025
9:00 am – 12:00 pm

U.S. Nuclear Regulatory Commission	
First Name	**Last Name**
Steve	Bajorek
Michelle	Bales
Ron	Ballinger
Michael	Benson
Andrew	Bielen
Angie	Buford
Alex	Collier
James	Corson
Stephen	Cumblidge
Vic	Cusumano
James	Delosreyes
Elijah	Dickson
Dave	Dijamco
Hossein	Esmaili
Carolyn	Fairbanks
Richard	Fu
David	Garmon
Craig	Harrington
Emma	Haywood
Kevin	Hsueh
Lois	James
Meena	Khanna
Scott	Krepel
John	Lehning
Anna	Luczak
Don	Marksberry
Robert	Martin
David	McClain
Sean	Meighan
Joseph	Messina
Seung	Min
Ching	Ng
Jamie	Pelton
Ravi	Penmetsa
Jennie	Rankin
Aida	Rivera-Varona
David	Rudland
Alex	Terres
Robert	Tregoning

U.S. Nuclear Regulatory Commission	
First Name	**Last Name**
Chris	Van Wert
Shilp	Vasavada
Gokul	Vasudevamurthy
Weidong	Wang
Jen	Whitman
Dan	Widrevitz
Brandon	Wise
John	Wise
On	Yee

Non-NRC		
First Name	**Last Name**	**Organization (if provided)**
Victoria	Anderson	Nuclear Energy Institute (NEI)
Kevin	Barber	Westinghouse Electric Company (Westinghouse)
Thomas	Basso	NEI
Jana	Bergman	Curtiss-Wright
Greg	Broadbent	Entergy
Jim	Cirilli	Electric Power Research Institute (EPRI)
Aladar	Csontos	NEI
Kris	Cummings	NuScale
Thomas	Damiani	EPRI
Dennis	Earp	Duke
Jerrod	Ewing	Westinghouse
John	Fisher	Energy Northwest
Rick	Fougerousse	EPRI
Lisa	Gerken	Framatome Inc. (Framatome)
Nate	Glunt	EPRI
Tim	Graf	Simpson Gumpertz & Heger
Fred	Grant	Simpson Gumpertz & Heger
Stanley	Hayes	Duke
Zachary	Hollcraft	Alva Energy
Jerald	Holm	Framatome
Susan	Hoxie-Key	Public
Zeses	Karoutas	Westinghouse
Austin	Keller	Duke
Thomas	Kindred	Southern
David	Kortge	Constellation
Doug	Kull	EPRI
Matthew	Leonard	Westinghouse
Guangjun	Li	General Electric (GE)
Edwin	Lyman	Union of Concerned Scientists
Alex	Markivich	Dominion
Tara	Matheny	Duke
Brian	Mount	Dominion
Kurshad	Muftuoglu	EPRI

Non-NRC		
First Name	**Last Name**	**Organization (if provided)**
Ion	Munteanu	Energy Northwest
Carole	Naugle	Framatome
Matthew	Nudi	EPRI
Stephen	O'Hearn	Dominion
Pat	O'Regan	EPRI
Nathan	Palm	EPRI
Frances	Pimentel	NEI
Ian	Porter	GE
John	Richards	EPRI
Baris	Sarikaya	Constellation
Gideon	Schmidt	Dominion
Fred	Smith	EPRI
Scott	Stanchfield	Entergy
Tim	Stuhldreher	NEI
Ronnie	Swain	EPRI
Lewis	Wells	Constellation

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GVasudevamurthy
WWang, ACRS
JWhitman, NRR
DWidrevitz, NRR
BWise, NRR
JWise, NRR
OYee, NRR

ADAMS Accession Nos.:
Package: ML25323A413
Meeting Summary: ML25323A415
Meeting Notice: ML25260A589
Meeting Slides: ML25260A541 ***via eConcurrence** **NRC-001**

OFFICE	DORL/LLPB/PM	DORL/LLPB/LA	DORL/LLPB/BC	DORL/LLPB/PM
NAME	JDelosreyes	DHarrison	JRankin	JDelosreyes
DATE	11/20/2025	11/25/2025	12/3/2025	12/3/2025

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