



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

April 13, 2020

MEMORANDUM TO: Tara Inverso, Acting Deputy Director  
Division of Fuel Management  
Office of Nuclear Materials Safety and Safeguards

FROM: Paul Kallan, Project Manager */RA/*  
New Reactor Licensing Branch  
Division of New and Renewed Licenses  
Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF THE MARCH 25-26, 2020, CATEGORY 1 PUBLIC  
WORKSHOP ON SPENT FUEL PERFORMANCE MARGINS

On March 25 - 26, 2020, the U.S. Nuclear Regulatory Commission (NRC) held a Category 1 public workshop with the Nuclear Energy Institute (NEI) and other industry representatives to discuss NEI's white paper on Spent Fuel Performance Margins (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19318D971). This workshop built upon discussions held during the January 22, 2020, public workshop (summary available at ADAMS Accession No. ML20028F277) and focused on two technical areas: thermal margins and source terms. The goal of the workshop was to align on the problem statement, requested regulatory products, and next steps for the associated recommendations. Approximately 64 people, including NRC staff, industry and members of the public, participated in the meetings via Skype and bridgeline.

The public workshop notice dated March 9<sup>th</sup>, 2020, can be found in ADAMS under Accession No. ML20077J441. This meeting notice was also posted on the NRC public website. Enclosed is the meeting agenda (Enclosure 1), list of participants (Enclosure 2), an overview of the meeting (Enclosure 3) and a Table providing a summary of the discussion surrounding the problem statements, requested regulatory products, and next steps (Enclosure 4).

NRC's presentation material is available in ADAMS:

- Spent Fuel Storage and Transportation Issue Resolution Plan – Recommendation III-3 (Category II): ADAMS Accession No. ML20078J643

NEI's presentation materials are available in ADAMS:

- Source Term Road Map – March 2020: ADAMS Accession No. ML20079J069
- Spent Fuel Performance Margins: Source Terms – Presentation March Workshop: ADAMS Accession No. ML20079J118
- RIRP I-20-01 Revision: ADAMS Accession No. ML20080F975
- Proposed Table of Contents (TOC) for Thermal Fuel Performance Topical Report: ADAMS Accession No. ML20080F893
- RIRP I-20-02 Revision 3: ADAMS Accession No. ML20080K386
- NEI Workshop Introduction: ADAMS Accession No. ML20080K251

- SFWST Perspectives on Thermal Modeling: ADAMS Accession No. ML20085F142

In terms of next steps, the NRC is planning on conducting future workshops, including on the following topics:

- Dose Rates, Graded Approach, Reviews of Applications that Utilize Phenomena Identification and Ranking Tables, Gross Rupture (~ April 2020)
- PIRTs, Remaining Category 3 Items (Summer 2020)

These workshops will be posted to the NRC's public meeting website in advance of each meeting date.

Enclosures:

1. Meeting Agenda
2. List of Attendees
3. Meeting Overview
4. Table

CONTACT: Paul Kallan, NRR/DNRL  
301-415-2809

SUBJECT: SUMMARY OF THE MARCH 25-26, 2020, CATEGORY 1, AND PUBLIC  
 WORKSHOP ON SPENT FUEL PERFORMANCE MARGINS  
 DATE: APRIL 13, 2020.

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<b>OFFICE</b>	<b>DNRL/NRLB/PM</b>	<b>NRR/DRO/Special Assistant</b>	<b>DNRL/NRLB/PM</b>
<b>NAME</b>	PKallan*	TInverso*	PKallan* (signed)
<b>DATE</b>	4/13/20	4/13/20	4/13/20

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**U.S. NUCLEAR REGULATORY COMMISSION**

**CATEGORY 1 PUBLIC WORKSHOP ON SPENT FUEL PERFORMANCE MARGINS**

**PUBLIC MEETING AGENDA**

**March 25<sup>TH</sup>, 2020 (Day 1)**

<b><i>Time</i></b>	<b><i>Topic</i></b>	<b><i>Speaker</i></b>
9:00 AM	Introductions/Opening Remarks	NRC/NEI
TBD	Break (as needed)	
9:15 AM	Industry Presentations on Thermal Margins	NEI
12:00 PM	Break for Lunch	
1:00 PM	Presentation on Approach for Draft Best Practices Guide for Thermal Modelling	NRC/NEI
TBD	Break (as needed)	
3:30 PM	Opportunity for Public Comment	All
3:50 PM	Closing Remarks	NRC/NEI
4:00 PM	Meeting Adjourn	

**U.S. NUCLEAR REGULATORY COMMISSION**

**CATEGORY 1 PUBLIC WORKSHOP ON SPENT FUEL PERFORMANCE MARGINS**

**PUBLIC MEETING AGENDA**

**March 26<sup>TH</sup>, 2020**

<b><i>Time</i></b>	<b><i>Topic</i></b>	<b><i>Speaker</i></b>
9:00 AM	Introductions/Opening Remarks	NRC/NEI
TBD	Break (as needed)	
9:15 AM	Industry Presentations on Source Terms	NEI
12:00 PM	Break for Lunch	
1:00 PM	Industry Presentation on Draft Source Term Conservatism Road Map	NRC/NEI
TBD	Break (as needed)	
2:00 PM	NRC Presentation on Source Term	Members of the Public
3:30 PM	Opportunity for Public Comment	All
3:50 PM	Closing Remarks	NRC/NEI
4:00 PM	Meeting Adjourn	

**U.S. NUCLEAR REGULATORY COMMISSION**

**CATEGORY 1 PUBLIC WORKSHOP ON SPENT FUEL PERFORMANCE MARGINS**

**LIST OF ATTENDEES**

**March 25 - 26<sup>th</sup>, 2020**

<b>Name</b>	<b>Organization</b>
Andrea Kock	U.S. Nuclear Regulatory Commission (NRC)
Chris Regan	NRC
Tara Inverso	NRC
Yaira Diaz	NRC
Paul Kallan	NRC
Donald Chung	NRC
Don Algama	NRC
John McKirgan	NRC
Jorge Solis	NRC
Meraj Rahimi	NRC
Joann Ireland	NRC
Timothy McCarthy	NRC
John Wise	NRC
Ghani Zigh	NRC
Chris Bajwa	NRC
Jennifer Dulzell	NRC
Daniel Forsyth	NRC
Eliezer Goldfeiz	NRC
Richard Jervey	NRC
Caylee Kenny	NRC
Richard Lee	NRC
Haile Lindsay	NRC
Jason Piotter	NRC
April Smith	NRC
Jeremy Smith	NRC
Brian Wagner	NRC
Veronica Wilson	NRC
Donnie Harrison	NRC
David Decker	NRC
Jimmy Chang	NRC
Rod McCullum	Nuclear Energy Institute (NEI)
Mark Richter	NEI
Kris Cummings	Curtis Wright
Jana Bergman	Curtis Wright
Tom Tramm	Certrec
David Tomlinson	Dominion Energy
Aladar Csontos	Electric Power Research Institute (EPRI)
Hatice Akkurt	EPRI
Keith Waldrop	EPRI

Jeremy Renshaw	EPRI
Jack Desando	Exelon
Nancy Buschman	Department of Energy (DOE)
Ned Larson	DOE
Michael Ford	Ford ES&H Solutions
Debu Majumdar	Holtec International
Stefan Anton	Holtec International
Steve Frishman	Nevada Agency for Nuclear Project
Brady Hanson	Pacific Northwest National Laboratory
Kevin Braico	PG&E
Richard Hagler	PG&E
Don Shaw	TN Orano
Rick Migliore	TN Orano
Venkata Venigalla	TN Orano
Andrea Jennetta	Platts
Glenn Schwartz	PSEG Nuclear
Samuel Durbin	Sandia National Laboratories
Sylvia Salzstein	Sandia National Laboratories
Paul Plante	The Yankee Companies
Steven Baker	Transware
Zita Martin	TVA
Robert Quinn	Westinghouse
John Phabe	Westinghouse
Kale Walker	Public
Marvin Lewis	Public

## **U.S. NUCLEAR REGULATORY COMMISSION**

### **CATEGORY 1 PUBLIC WORKSHOP ON SPENT FUEL PERFORMANCE MARGINS**

On March 25 - 26, 2020, the U.S. Nuclear Regulatory Commission (NRC) held a Category 1 public workshop with the Nuclear Energy Institute (NEI) and other industry representatives, to discuss NEI's White Paper on Spent Fuel Performance Margins (White Paper) (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19318D971). This workshop built upon discussions held during the January 22, 2020, public workshop (summary available at ADAMS Accession No. ML20028F277) and focused on two technical areas: thermal margins and source terms. The goal of the workshop was to align on the problem statement, requested regulatory products, and next steps for the associated recommendations. Approximately 64 people, including NRC staff, industry and members of the public, participated in the meetings via Skype and bridgeline.

The staff participated in NEI's presentation on its plans for a subset of recommendations listed in the white paper under Category 1, "Actions that industry can take within the confines of existing regulations and guidance." The NRC presented on a recommendation in Category 2, "Actions that NRC can take by tailoring their regulatory guidance as well as their review and inspection practices to recognize the existence of performance margin."

In the morning session on March 25, 2020, NEI presented opening remarks on its goals for workshops on the White Paper:

- Utilize risk principles and graded approach wherever possible to optimize focus on safety significant issues.
- Recognize that when large safety margins are known to exist, both preparers and reviewers should be able to accept small uncertainties without additional analyses.
- Create deliverables that will change both NRC staff and industry licensing practices.
- Build into new practices an understanding of the performance record achieved through over 30 years of experience with dry storage.
- Achieve a regulatory transformation that focuses on safety and optimizes resources.

Industry then presented its RIRP on how to develop an industry best practices guide for thermal modeling, including the following industry-led milestones:

- Identify the current industry issues regarding the implementation of the current best practices guidance.
- Using the identified recommendations from the Thermal Modelling and Decay Heat Phenomena Identification and Ranking Tables (PIRTs) (Recommendation IV-1), create guidance for a risk-informed approach.
- Develop a Topical Report.
- Submit the Topical Report to NRC for review, approval and endorsement as part of a durable licensing approach that recognizes and enables use of thermal margins

The NRC and NEI determined that these recommendations should be discussed in more detail at a future workshop.



Next industry presented on the Spent Fuel Performance and Waste Science and Technology (SFWST) perspectives on thermal modelling for storage and transportation of commercial spent fuel. Below is a summary of the presentation:

- Thermal modeling is mature, and the physics and phenomena well understood.
- Inputs to the models are typically conservative and biased, such that predicted temperatures are considerably higher than actual temperatures.
- Temperatures are important because they drive degradation phenomena.
- Peak cladding temperature (PCT) represents a very small fraction of total cladding surface temperature distribution.
- From a cladding perspective, degradation effects may be present across a continuum of temperatures and there is no “cliff edge” effect at PCTs greater than 400°C.

In the afternoon session, the industry presented the proposed Table of Contents (TOC) for the Thermal Fuel Performance Topical Report. Both NRC and industry agreed the TOC was in its early stages. From this discussion, NRC and industry agreed that there should a future workshop on the topic of PIRT to further discuss the gross rupture performance.

At the end of the day, the NRC staff provided an opportunity to the public to provide any comments or questions. There were three comments from the public that were out of scope to the topics discussed at the meeting. However, NRC staff asked the members of the public to write their questions to the NRC and the NRC would respond to their questions.

In the morning of March 26, NEI presented its plans to address recommendations related to source terms, including the following highlights:

- Industry would work to establish a set (or sets) of acceptable input parameters, assumptions, and codes for source term calculation. For cask loading, this should:
  - Result in source terms close to “best estimate” since subsequent analyses using the source terms already include conservatisms.
  - Provide clarification on where parameter values are taken from and what, if any, adjustments needs to be applied.
  - Allow for simplified source term analyses, unless simplifications would result in significant conservatisms.

Next NEI discussed a road map on source terms, specifically, recommendations III-1 and III-2. The discussion focused on the differences between the evaluations documented as part of the safety evaluations (FSAR), and those performed to support cask loading.

In the afternoon, the NRC presented its draft RIRP on Recommendation III-1. The NRC indicated that it was developing options for transformative review approaches and would present those options during a workshop in Summer 2020.

At the end of the meeting, the NRC staff provided an opportunity to the public to provide any comments or questions. There were three comments from the public that were that were addressed at the meeting.

**Summary Table:  
March 25-26 Workshop on Spent Fuel Performance Margins**

Topic	Recommendation	Lead	Problem Statement (short)	Desired Regulatory Product	Next Milestone
Thermal Margins	Best Practices Guide <sup>1</sup>	NEI	<p>Ensure gross rupture does not happen; ensure compliance with 10 CFR 72.122(h); incorporate results of EPRI PIRTs to focus on inputs that matter most.</p> <ul style="list-style-type: none"> <li>• Define fuel performance metric (e.g., temperature, stress, combination of both).</li> <li>• Establish modeling techniques to meet performance metric and create best practices (margin, inputs).</li> </ul> <p>(This activity will address White Paper Recommendations IV-1 through IV-5.)</p>	<ul style="list-style-type: none"> <li>• Establish performance metric (could be a separate working group activity)</li> <li>• Best practices document</li> <li>• Topical report</li> </ul>	<ul style="list-style-type: none"> <li>• (NEI Action) Evaluate Recommendations IV-1 through IV-5 and revise, as necessary. Provide updated, documented recommendation.</li> </ul> <p>Issue draft PIRT reports.</p> <ul style="list-style-type: none"> <li>• Conduct focused public workshop (with appropriate subject matter experts (e.g., fuels, criticality, retrievability, repackaging experts) to ensure mutual understanding of “gross rupture” interpretation (72.122(h)). <ul style="list-style-type: none"> <li>○ NEI to provide presentation of historical interpretation, including how the interpretation has changed over time.</li> <li>○ NEI to document any suggested changes to interpretation, with basis for changes.</li> <li>○ NRC to review and provide feedback on industry presentation. NRC will provide overview on areas impacted by “gross rupture” requirement.</li> </ul> </li> <li>• Conduct focused public workshop on potential performance metrics (subset of white paper participants).<sup>2</sup></li> </ul>

<sup>1</sup> Title likely to change as a result of public meeting discussion.

<sup>2</sup> Thermal margins will no longer be a topic on the April 15-16, 2020, workshop agenda to allow time for these indicated milestones to evolve.

Source Terms	Conservatism Roadmap  (Recommendation III-1 and III-2)	NEI	<p>Incorporate knowledge of spent fuel performance margins to enhance industry implementation consistent with NRC regulations/guidance and focus on items of highest safety significance.</p> <p>Ensure implementation is informed by certification process. (And vice versa.)</p> <p>Identify whether significant margin exists and can be captured during design certification or implementation activities.</p>	Industry report documenting compilation of information and conclusions. NRC would review and (as appropriate) issue letter indicating that the report is consistent with existing guidance/regulations.	<ul style="list-style-type: none"> <li>• (NEI lead) Discuss public workshop feedback and adjust approach for bifurcation suggestion (licensing versus implementation)</li> <li>• (NEI lead) Provide more detailed draft document (publicly)</li> <li>• Conduct follow-on public workshop</li> </ul>
Source Terms	Review Approach (Recommendation III-3)	NRC	Identify and evaluate transformative approaches and develop review guidance based on known conservatism and appropriate level of review within the defined source terms. As part of this effort, NRC will include thermal technical experts.	Revised guidance.	<p>NRC to develop options for revising review approach and associated guidance, with pros and cons. NRC to conduct a public workshop to obtain feedback on options.</p> <ul style="list-style-type: none"> <li>• NRC selects optimal option and develops review criteria.</li> </ul>