

July 23, 2014

MEMORANDUM TO: Tara Inverso, Chief
Rulemaking Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

FROM: Alysia G. Bone, Project Manager /RA/
Rulemaking Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF PUBLIC MEETING ON THE PERFORMANCE-
BASED EMERGENCY CORE COOLING SYSTEMS CLADDING
ACCEPTANCE CRITERIA (TITLE 10 OF THE CODE OF
FEDERAL REGULATIONS SECTION 50.46c) PROPOSED RULE
AND ASSOCIATED DRAFT REGULATORY GUIDANCE

The U.S. Nuclear Regulatory Commission (NRC) held a two and a half day Category 3 public meeting on June 24-26, 2014, to discuss the Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.46c proposed rule and associated draft regulatory guidance. The meeting was held at the NRC headquarters location in Rockville, Maryland. The purpose of the meeting was to discuss several items related to the proposed rule and draft regulatory guidance to enhance understanding and to aide in the development of public comments. This meeting was follow-on to a Category 3 public meeting on the same subject conducted on April 29-30, 2014. The NRC did not accept formal written comments during the meeting. The meeting was attended by 50 individuals including industry representatives, private citizens, and NRC staff on Day 1, 11 who participated through audio teleconferencing and webinar. On Day 2, 40 individuals attended the meeting, including 7 who participated through audio teleconferencing and webinar. On Day 3, 31 individuals attended the meeting, including 7 who participated through audio teleconferencing and webinar.

The meeting slides and handouts are available in the NRC's Agencywide Document Access and Management System (ADAMS) package under Accession No. ML14177A018. In addition to the material presented in the slides, the major areas of discussion are summarized as follows:

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Introductory Remarks:

- During introductory remarks, Tara Inverso, Rulemaking Branch Chief, noted that there were topics identified at the April 29-30, 2014, Category 3 public meeting that needed further discussion and that these are the subject of this meeting. The NRC also noted that there is a new project manager for the 10 CFR 50.46c proposed rulemaking, Alysia Bone.
- An industry representative noted that there is a large group of subject matter experts within the nuclear industry which are devoting a significant effort to engage with this rulemaking.

Industry Presentations on the Risk-Informed Alternative

- Mark Richter of the Nuclear Energy Institute (NEI) provided general background and a status update on Generic Safety Issue-191 (GSI-191) (ADAMS Accession No. ML14175A128).
- The NRC staff provided several clarifying comments regarding the options for resolving GSI-191. The NRC staff also clarified that some of the dates provided on the last slide are internal and subject to adjustment if required, but ultimately the final rule and final guidance will be published together.
- Roger Thomas of Duke Energy and the Boiling Water Reactor Owners Group (BWROG) provided a presentation on the BWROG perspective of the 10 CFR 50.46c rulemaking (ADAMS Accession No. ML14175A099), noting several areas of concern.
- The NRC took an action to schedule a follow-on public meeting to hear BWROG concerns regarding the intersection of the 10 CFR 50.46c rulemaking and GSI-191. The NRC staff clarified that the 10 CFR 50.46c rulemaking and GSI-191 are not entirely combined efforts; the only overlapping aspect is the risk-informed option to resolve GSI-191. The other GSI-191 resolutions paths are outside of the 10 CFR 50.46c rulemaking.
- A member of the public noted that it was unfortunate that GSI-191 cannot be detached from the 10 CFR 50.46c rulemaking efforts.

Industry Technical Recommendations: Breakaway Oxidation and Appendix K

- There were three industry presentations regarding breakaway oxidations and loss-of-coolant accident (LOCA) basis testing:
 - Yang-Pi Lin of General Electric Hitachi (GEH) (ADAMS Accession No. ML14175A116)
 - Lisa Gerken of AREVA (ADAMS Accession No. ML14175A095)
 - David Mitchell of Westinghouse Electric Power Company (ADAMS Accession No. ML14175A148)

- There was follow-on dialogue regarding how the quality assurance program addresses the range of alloys and the sensitivity of breakaway oxidation at different temperatures.
- Members of the public noted that there are may be other variables that contribute to breakaway oxidation that are unknown and that the current testing is being conducted under controlled conditions, unlike during a LOCA.
- Bert Dunn from AREVA provided a presentation recommending relocating the requirements in Appendix K to a regulatory guide (ADAMS Accession No. ML14175A094).
- There was a significant amount of follow-on discussion on this topic, and the NRC staff noted that this was the first time this recommendation had been presented. Industry noted that this recommendation will likely come to the NRC in the form of a formal written comment, associated with the request for comment on renumbering the regulations.
- In a later discussion on the Appendix K topic, NRC's Office of General Counsel (OGC) noted that there is no legal reason why this information cannot be moved to a regulatory guide, but that both NRC and industry need to be aware of the implications.

Industry Technical Recommendations: Reporting Requirements

- David Medek, a consulting engineer for Arizona Public Service Company, provided a presentation on industry's perspective regarding reporting requirements, corrective actions, and change management (ADAMS Accession No. ML14175A162).
- Follow-on discussion highlighted that industry desires flexibility with respect to lead test assemblies and proposes that it be clearer in the technical specifications what requirements apply to lead test assemblies and what apply to batch fuel.
- The NRC staff agrees with the objective to keep PRA guidance consistent across subjects.
- A topic that generated a significant amount of discussion was whether the debris generation model will be part of the ECCS evaluation model for the deterministic approach and/or the risk-informed approach. The NRC staff acknowledged that greater clarity is needed on this.

Petition for Rulemaking 50-84: Crud-Related and Breakaway Oxidation Issues

- Mark Leyse provided a presentation on the petition for rulemaking (PRM), which the 10 CFR 50.46c proposed rule addresses (PRM-50-84). Mr. Leyse's presentation can be found under ADAMS Accession No. ML14174A850.
- A member of the NRC staff noted that during a fuel cycle there could be "fluffy," non-tenacious crud on the fuel rods that would not be observed at the end of the fuel cycle.

- A member of the NRC staff questioned a proposed revision to the rule language provided in Mr. Leyse's presentation. Specifically, the new wording described "observed crud and oxide layers" and "projected changes in crud and oxide layers". The NRC staff questioned whether Mr. Leyse's proposal would necessitate pool-side inspections after each reload cycle to establish "observed" crud and oxide layers. Mr. Leyse stated that he did not intend to require pool-side measurements after each reload cycle and that model predictions were satisfactory.
- There were requests for additional references to Mr. Leyse's presentation material, and Mr. Leyse offered to provide them. Mr. Leyse provided this information to the NRC, and these documents can be found under ADAMS Accession Nos. ML14191A003, ML14191A004, and ML14191A017.

Industry perspective on Long-Term Cooling Issues

- There were three industry presentations regarding long term cooling (LTC) issues:
 - Kurt Flaig, Dominion (ADAMS Accession No. ML14176A067)
 - David Fink, Westinghouse (ADAMS Accession No. ML14176A068)
 - Kurshad Muftuoglu GEH (ADAMS Accession No. ML14176A066)
- During follow-up conversation (based on industry concerns listed in the above presentations), the NRC staff noted that they would welcome comments that offer a definition of an end to the LTC period.
- Members of industry highlighted the complexity and depth of required analysis.
- A member of the public pointed out the complexity of the subject and noted that definitions (e.g., single-failure and LTC) aren't clear.
- A key message in the industry presentations was the proposal for the NRC to develop additional regulatory guidance for LTC. This would include graded risk-informed methods and test procedures. Further, a member of industry elaborated that lack of guidance creates a challenge and deviating from Appendix K is a significant hurdle.
- The NRC staff noted that the deterministic requirement for GSI-191 debris consideration is already part of 10 CFR 50.46 as determined by the Commission and that the only new addition is the risk-informed aspect.
- A member of the public noted that he'd like to hear concepts such as "resiliency" and "recovery" be a part of the conversation and related the topic to documents regarding Hurricane Sandy.

Industry Presentations on Implementation Topics and Issues

- There were three industry presentations regarding implementation:

- Jason Castro, Tennessee Valley Authority (ADAMS Accession No. ML14176A064)
 - Thomas Eichenberg, EPRI Fuel Reliability Program (ADAMS Accession No. ML14176A065)
 - Thomas Eichenberg, EPRI Fuel Reliability Program (ADAMS Accession No. ML14177A046)
- Mr. Castro's presentation focused on past examples of phased rule implementation, and a member of the industry noted that this worked very well in the past due to close communication between NRC and the industry.
- The NRC staff encouraged a formal comment that would explain the industry's proposal and supporting statements (including regulatory precedent) for a phased implementation.
- In his first presentation, Mr. Eichenberg noted a series of industry issues with the proposed implementation of 10 CFR 50.46c. In particular, there was a significant amount of discussion regarding concerns of regulatory uncertainty (as discussed on slide 32 of the presentation).
- Regarding the industry's proposal for development of a Regulatory Issue Summary (RIS), the NRC staff noted that a RIS is meant to consolidate existing information and not create new guidance. A member of the industry noted that a review standard or interim staff guidance would be more appropriate to address the industry's concerns.
- The NRC staff noted that it would be helpful if formal comments on this subject described specific examples that worked well or included the details that industry felt are needed.
- In his second presentation on implementation issues, Mr. Eichenberg discussed that compliance with the proposed rule would require new license amendment requests, topical reports, and updates to the technical specifications and core operating limit reports. He noted that this could be a substantial burden on licensees. Mr. Eichenberg also provided a Gantt chart that illustrated the timelines for licensees in tracks 1, 2, and 3 to come into compliance with the proposed rule. A key message was that some analyses may not be completed in time to support full implementation of the rule for some plants. Following this presentation, a table-top discussion arose.
- A member of the NRC staff noted that every plant (PWR and BWR) must use deterministic methods to address the impact of debris on short-term emergency core cooling system (ECCS) performance. Plants using the risk-informed approach can use risk only to assess the effects of debris on LTC. Licensees must still deterministically demonstrate that their ECCS can meet LTC requirements absent of debris. A member of the industry asked the follow-on question of whether the impact of debris on short-term ECCS performance can be assessed using the risk-informed approach. The NRC's OGC representative replied that the proposed rule does not explicitly address the use of a risk-informed approach to address debris during the

short term, but the rule also does not prohibit it from being used. The current rule implicitly requires that debris be considered and neither expressly permits or prohibits addressing debris through risk-informed methods (although there is a long history of interpreting the current rule as being limited to deterministic approaches). The proposed rule does not change the regulatory requirement for licensees to have an ECCS which meets the performance requirements specified in the rule. However, the proposed rule affords the opportunity for the NRC staff to evolve away from its current practice and interpretation by allowing licensees to use risk-informed approaches for addressing short term debris issues. A member of the industry noted that there is a concern that 10 CFR 50.46c would obviate or change the current BWR voluntary approach to debris issues. An NRC OGC representative noted that the proposed rule doesn't change the current rule's requirement that licensees must account for debris when considering ECCS performance. Thus, the proposed rule leaves unchanged the status of the BWR licensees with respect to current compliance, including any voluntary actions taken by BWR licensees. Compliance with the proposed rule doesn't require licensees to change their current approach for evaluating debris for long term core cooling. However, the proposed rule provides the licensee the *option* of adopting a risk-informed approach for evaluating the effects of debris on long term core cooling.

- In response to a question from industry, the NRC staff noted that there is not currently a regulatory position on whether fuel fragmentation would be considered in 10 CFR 50.46c.

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- In response to a question from industry, the NRC staff noted that there is not currently a regulatory position on whether fuel fragmentation would be considered in 10 CFR 50.46c.

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Accession Nos.: Pkg: ML14177A048; Notice ML14156A098; Summary ML14204A009, NRC Presentation ML14171A067, ML14114A499; Industry Presentations ML14175A094, ML14175A095, ML14175A099, ML14175A116, ML14175A128, ML14175A148, ML14175A162, ML14175A175, ML14176A064, ML14176A065, ML14176A066, ML14176A067, ML14176A068, ML14177A046; Public Presentations: ML14174A850, ML14191A003, ML14191A004, ML14191A017 NRC-001

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NAME	ABone	GLappert	TInverso	ABone
DATE	7/21/2014	7/23/2014	7/23/2014	7/23/2014

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LIST OF MEETING ATTENDEES (Day 1 – June 24, 2014)

Name	Organization
Steven Hutchins	NEI
Robert Florian	Southern Nuclear
David Medek	APS
Mark Richter	NEI
Gordon Cleifton	NEI
Ken Yueh	EPRI
Yong Yan	ORNL
David Mitchell	Westinghouse
C.J. Fong	NRC
Lisa Gerken	Areva
Bert Dunn	Areva
Alan Meginnis	Areva
Jason Castro	TVA
Don Williamson	SCE&G
Shanlai Lu	NRC
Andy Olson	Exelon
Yang-Pi Lin	GHF/GEH
Kurt F. Flaig	Dominion
Mark Leyse	
Alysia Bone	NRC
Yun Ho Kim	KMNP
Gregg Swindlehurst	GSNuclear
Kurshad Muftuoglu	GEH/GNF
John Alvis	AWATech
Charles Albury	STPNOC
Harold Scott	NRC
Aby Mohseni	NRC
Tom Eichenberg	TVA
Victor Cusumano	NRC
Roger Thomas, Jr.	Duke Energy/BWROG
Steve Smith	NRC
Ashley Guzzetta	NRC
Michelle Flanagan	NRC
Daniel Doyle	NRC
Mitch Nissley	Westinghouse
Rober Krsek	NRC
David Boirel	NRC
Leon Rafner	Centrec Corp
Nasser Nik	Entergy
Mark Handrick	Duke Energy
Patricia Quaglia	Westinghouse Electric Sweden
Thomas Remicik	Arizona public Service
Diane Darrigo	NIRS

Enclosure

Name	Organization
Alfred Strasser	Aquarius Services Corp.
Jim Smith	WEC
Paul Leonard	
Lesla Hill	BWROG
Kenneth McCall	BWROG
Tara Inverso	NRC
Paul Clifford	NRC

LIST OF MEETING ATTENDEES (Day 2 – June 25, 2014)

Name	Organization
Gordon Cleifton	NEI
Yun Ho Kim	ICHNP
Don Williamson	SCE & G
Alan Meginnis	AREVA
David Mitchell	Westinghouse
Steven Hutchins	NEI
Dave Medek	APS
Mitch Nissley	Westinghouse
Jason Castro	TVA
Steve Smith	NRC
Vic Cusumano	NRC
Lisa Gerken	AREVA
Yang-Pi Lin	GEH/GNF
John Alvis	AWATECH
Andy Olson	Exelon
Bert Dunn	AREVA
C.J. Fong	NRC
Alysia Bone	NRC
Tara Inverso	NRC
Paul Clifford	NRC
Kurt F. Flaig	Dominion
Kurshad Muftuoglu	GEH
Charles Albury	STPNOC
Robert Florian	Southern Nuclear
Michelle Flanagan	NRC
Aby Mohseni	NRC
Gregg Swindlehurst	GSNuclear
David Boirel	NRC
David Fink	Westinghouse
Roger Thomas	Duke Energy
Harold Scott	NRC
Tom Eichenberg	TVA
Paul Leonard	
Thomas Remick	APS
Patricia Quaglia	Westinghouse Electric Sweden

Name	Organization
Alfred Strasser	Aquarius Services Corp.
Mark Handrick	Duke Energy
Jim Smith	WEC
Nasser Nik	Entergy

LIST OF MEETING ATTENDEES (Day 3 – June 26, 2014)

Name	Organization
Gordon Cleffton	NEI
Gregg Swindlehurst	GSNuclear
Steven Hutchins	NEI
Bert Dunn	AREVA
Alan Meginnis	AREVA
Robert Florian	Southern Nuclear
Yang-Pi Lin	GEH/GNF
Ken Yueh	EPRI
David Boirel	NRC
Don Williamson	SCE&G
C.J. Fong	NRC
Charles Albury	STPNOC
John Alvis	ANATECH
David Medek	APS
Roger Thomas, Jr.	Duke Energy
Mitch Nissley	Westinghouse
Kurshad Muftuoglu	GEH
Harold Scot	NRC
Aby Mohseni	NRC
Jason Castro	TVA
Kurt F. Flaig	Dominion
Tara Inverso	NRC
Paul Clifford	NRC
Paul Leonard	
Thomas Remick	APS
Patricia Quaglia	Westinghouse Electric Sweden
Alfred Strasser	Aquarius Services Corp.
Mark Handrick	Duke Energy
Jim Smith	WEC
Nasser Nik	Entergy