U.S. Nuclear Regulatory Commission Public Meeting Summary

Title: Public Meeting: Regulatory Basis on Increased Enrichment of Conventional and Accident Tolerant Fuel Designs for Light-Water Reactors

Meeting Identifier: 20231108

Date of Meeting: October 25, 2023

Location: Webinar (via Microsoft Teams)

Type of Meeting: Information Meeting with a Question-and-Answer Session

Purpose of Meeting: The U.S. Nuclear Regulatory Commission (NRC) staff hosted a public meeting to engage with the public to provide an overview of the increased enrichment of conventional and accident tolerant fuel designs for light-water reactors regulatory basis, discuss the rulemaking process, and provide information to facilitate stakeholders' comments on the regulatory basis.

Related Documents:

- ML23278A141 – Notice of Public Meeting to Discuss the Regulatory Basis for Increased Enrichment of Conventional and Accident Tolerant Fuel Designs for Light-Water Reactors

- ML23290A267 – Regulatory Basis on Increased Enrichment of Conventional and Accident Tolerant Fuel Designs for Light-Water Reactors Public Meeting Slides

- ML23319A260 – Transcript for Increased Enrichment of Conventional and Accident Tolerant Fuel Designs for Light-Water Reactors Public Meeting

General Details:

- The NRC is requesting comments on a regulatory basis to support a rulemaking to amend the NRC's regulations related to increased enrichment in conventional and accident tolerant light-water reactor fuel designs. The NRC's goal is to establish effective and efficient licensing of applications using fuels enriched to greater than 5.0 and less than 20.0 weight percent uranium-235. The NRC held a public meeting to promote a full understanding of the planned rulemaking and facilitate public comment on the regulatory basis.

- The regulatory basis was published in the *Federal Register* on September 8, 2023 (88 FR 61986) for a 75-day comment period that was scheduled to end on November 22, 2023. As mentioned during the public meeting, the NRC was considering a request to extend the public comment period. On November 6, 2023, the NRC extended the comment period by 60 days to end on January 22, 2024 (88 FR 76143) to allow more time for members of the public to develop and submit their comments.

- The meeting consisted of one NRC presentation providing an overview of the Increased Enrichment of Conventional and Accident Tolerant Fuel Designs for Light-Water Reactors regulatory basis, with a short question-and-answer session after each of the topics where the public was invited to pose questions to the NRC. The meeting was attended by

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approximately 103 people participating through webinar or phone, including NRC staff and members of the public.

Summary of Presentation and Public Questions:

- Philip Benavides of the NRC opened the meeting, introducing himself as the Rulemaking Project Manager for this regulatory basis and acting as the meeting's facilitator. Benavides recalled that a public meeting was held on June 22, 2022 (ML22208A001), and the feedback from that meeting was used to help develop the regulatory basis. Benavides acknowledged the other facilitators for the meeting, including Carla Roque-Cruz and Daniel King, both of the NRC. Benavides provided the purpose of the meeting, which was to facilitate stakeholders' comments on this regulatory basis, and reminded everyone that the NRC was not collecting comments during the meeting, but that comments could be submitted elsewhere. Benavides provided the agenda for the meeting and logistics for the question-and-answer sessions.

- Andrea Kock, NRC's Deputy Office Director for Engineering for the Office of Nuclear Reactor Regulation provided opening remarks. Kock provided background to the increased enrichment regulatory basis and explained how the NRC got to where they currently are. Kock briefly explained the rulemaking process and emphasized that nothing is currently set in stone, and that this meeting was meant to get stakeholders involved early in the process. Kock thanked everyone for attending the meeting and looked forward to hearing the discussions.

- Benavides provided an overview of the rulemaking background process and status. Benavides gave a brief overview of the identified issues that this regulatory basis is addressing, the Commission's approval to undertake this rulemaking, and the specific technical topics to be discussed during the rest of the presentation.

  Criticality Accident Requirements of 10 CFR 50.68

  - Charley Peabody of the NRC presented the first topic of the regulatory basis on the criticality accident requirements of 10 CFR 50.68. Peabody provided a summary of the regulation issue, explained the meaning of K-effective, and presented three alternatives for the issue:
    - No Action - New and Spent Fuel Criticality Safety is determined in accordance with 10 CFR 70.24 or an approved plant-specific exemption.
    - Rulemaking - Increase Enrichment limit in 10 CFR 50.68(b)(7) to less than 20.0 weight percent uranium-235.
    - Rulemaking - Remove Specific Enrichment Limit and replace with Tech Spec Design Feature Limits. (**NRC staff recommended**)

    Peabody also provided an explanation of why the NRC staff recommended alternative 3.

  - A member of the public inquired if the NRC was allowing licensees to use higher enrichment without having to validate safety, and that changing the limit would mean licensees would not have to justify using higher enrichment. Peabody explained that this was not the case and that licensees would still have to submit a license amendment

request and demonstrate to the NRC in advance that they are still meeting acceptance criteria, essentially having to reform their analysis for the higher enriched fuel.

Environmental Requirements of 10 CFR 51.51 and 10 CFR 51.52

- Donald Palmrose of the NRC presented the next topic of the regulatory basis on the environmental requirements of 10 CFR 51.51 and 51.52.
    - Palmrose gave a summary of the regulation issues and presented three alternatives for the issue concerning 10 CFR 51.51:
        - No Action - Maintain current regulatory framework by assessing environmental impacts from the uranium fuel cycle on a case-by-case site-specific basis with Table S-3 data as bounding.
        - Rulemaking - Pursue the necessary environmental analysis to justify continued use of Table S-3 for increased enrichment and then pursue rulemaking to modify Table S-3. (**NRC staff recommended**)
        - Rely on Revised or Updated Environmental Analysis - Rely on the updated analysis when reviewing licensing actions for the use of increased enrichment fuels.

    - Palmrose presented three alternatives for the issue concerning 10 CFR 51.52:
        - No Action - Maintain current regulatory framework by assessing environmental impacts from transportation of fresh fuel enriched above 5 weight percent uranium-235 per 10 CFR 51.52(b) on a case-by-case site-specific basis.
        - Rulemaking - Pursue the necessary environmental analysis to justify continued use of Table S-4 for increased enrichment and then pursue rulemaking to modify Table S-4. (**NRC staff recommended**)
        - Rely on Revised or Updated Environmental Analysis - Rely on the updated analysis when reviewing licensing actions for the use of increased enrichment fuels.

    - After the presentation, there were no questions asked.

Fissile Packaging Requirement of 10 CFR 71.55

- Jason Piotter of the NRC presented the next topic of the regulatory basis on the packaging requirements of 10 CFR 71.55.
    - Piotter provided a summary of the regulation issue, a list of options for Certificate of Compliance (CoC), and presented three alternatives for the issue:
        - No Action - Utilize Existing Certificate of Compliance Options. (**NRC staff recommended)**
        - Rulemaking - Increase Enrichment limit to less than 20.0 weight percent uranium-235.
        - Rulemaking - Remove Enrichment Limit.
    - Piotter also described why the NRC staff recommended alternative 1 and presented a *Federal Register* Notice (FRN) question to the public and requested public input.

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- A member of industry asked about whether fuel forms other than uranium hexafluoride (UF_6) were being considered for this packaging requirement effort. Piotter responded that 10 CFR 71.55(g) is only focused on UF_6, so other fuel forms are not being considered for this specific rulemaking. Piotter recognized that other fuel forms do have their own technical challenges, but they are not related to the scope of this rulemaking.

- A member of the public asked if this change would affect transportation of spent fuel. Piotter responded that this specific rulemaking was only looking at specified enrichment limits and not on other areas such as spent fuel. The member of the public asked if there were any efforts to address spent fuel transportation, pointing out that the increase in enrichment should push the NRC to find ways to address this. Piotter responded that the NRC is considering these topics, however this effort in particular is not as concerned with downstream effects. Palmrose pointed out that this topic is being addressed in NUREG-2266, "Environmental Evaluation of Accident Tolerant Fuels with Increased Enrichment and Higher Burnup Levels," and the environmental impact statement, saying that these issues are covered under environmental review. The member of the public expressed concern that NUREG-2266 did not address spent fuel well enough. Palmrose responded that NUREG-2266 is still open for public comment until October 31, 2023, which can be found on www.regulations.gov under Docket ID NRC-2023-0113.

Control Room Design Criterion of 10 CFR 50.67 and GDC-19

- Elijah Dickson of the NRC presented the next topic of the regulatory basis on the control room design criterion of 10 CFR 50.67 and GDC-19.
    - Dickson provided a summary of the regulation issue, discussed the background of the control room design criterion, and presented three alternatives for the issue:
        - No Action - Maintain the current regulatory framework.
        - Pursue Rulemaking to Amend the Control Room Design Criteria and Update the Current Regulatory Guidance Accordingly with Revised Assumptions and Models and Continue to Maintain Appropriate and Prudent Safety Margins. (**NRC staff recommended)**
        - Update the Current Regulatory Guidance with Revised Assumptions and Models and Continue to Maintain Appropriate and Prudent Safety Margins.
    - Dickson also provided an explanation of why the NRC staff recommended alternative 2 and presented two FRN questions to the public and requested public input.

- A member of industry asked for clarification related to the 2nd Control Room FRN question and clarity in larger view related to the risk informed process. This included providing an example, where a very remote event may have one design dose limit where a more frequent event may have a lower design dose limit. Dickson acknowledged that these were the types of ideas that would be helpful.

- A member of industry asked about how answers to the FRN questions should be given, whether the commenter should provide exact numbers along with a basis, or enough to

allow discussion/dialogue. Dickson clarified that with the FRN questions, the NRC staff is looking for more than yes or no answers and requested that commenters provide context to any response provided. The member of industry also mentioned that the regulatory guide update should be transparent and allow the public to have good discussion and dialogue during the process. Dickson agreed with that and mentioned that the plan forward with the regulatory guide update will allow members of the public to participate.

- A member of industry asked if alternatives two and three provided were not mutually exclusive. Dickson responded that the biggest distinction between the two alternatives was that there would be no rulemaking in alternative three, and that the intent was to provide additional flexibility without any rulemaking.

Fuel Fragmentation, Relocation and Dispersal

- Ashley Smith and Joseph Messina of the NRC presented the last topic of the regulatory basis on fuel fragmentation, relocation, and dispersal (FFRD).
    - Smith presented the background on FFRD, including what it was and how it was caused and provided a summary of the regulatory issue.
    - Messina presented five alternatives for the issue, noting that the issues are mutually inclusive, and that NRC may consider other approaches based on public comments:
        - No action.
        - 50.46a-style modification of Emergency Core Cooling System requirements.
        - Safety demonstration for post-FFRD consequences.
        - Generic bounding assessment of dose and use risk insights for post-FFRD consequences.
        - Probabilistic fracture mechanics to show that leaks in large pipes will be identified before failure, precluding the need to analyze large break Loss of Coolant Accidents (LOCAs).
    - Messina explained that the NRC staff currently does not have a recommendation at this time.
    - Messina presented six FRN questions to the public and requested public input.

- A member of the public asked about how fuel waste resulting from a LOCA in the reactor would be handled. Messina answered that fuel waste would be handled on a case-by-case basis.

- A member of the public commented that there is a petition for rulemaking at the Commission that discusses replacing the current embrittlement criteria, namely the peak cladding temperature and maximum oxidation limits, with some limit on the number of burst balloon rods in the core. The member of the public also clarified that though the presentation seemed to suggest that fuel dispersal could only occur under certain conditions, and that if those conditions were not present then there would be no need to worry about dispersal, fuel dispersal can still take place even with very low burnup fuel. The member of the public emphasized that the conditions for dispersal are always present and needs to be dealt with using engineering judgment. Lastly, the member of

the public pointed out that any option that uses the current embrittlement criteria would not be viable due to the inadequacy of the criteria as pointed out in the petition. Messina acknowledged that the NRC was aware of the petition for rulemaking and suggested that a formal comment be submitted. The member of the public closed out by saying that employing higher enrichment limits to increase power level at high burnups will cause problems.

- A member of industry asked about how the NRC published paper "NRC's Methodology to Estimate Fuel Dispersal during a Large Break Loss of Coolant Accident" related to the FRN questions being asked. The person requested clarification as to whether the paper was NRC's position towards dealing with this issue or if it was a research activity. Messina responded that the paper was a research activity and was an opportunity for the Office of Research to gain a better understanding of fuel dispersal. The person responded asking how the results from this research and any similar research in the future impacts the proposed alternatives for this proposal. Messina emphasized that the results come from the desire to improve calculations, but until the alternative to pursue is decided, will not spend too many resources in this area.

- The industry member asked a second question about the process to provide the NRC with meaningful comments. The industry member pointed out that getting meaningful responses put together to answer and address everything presented would take different amounts to time for different specific requests, and asked what the best way was to provide the holistic response. Benavides answered the question by saying that the questions are put out there as interested target areas where public input could help inform the proposed rule, but that they are not required questions. Benavides made clear that the public was free to answer any areas they wanted and were free to add anything they felt like adding.

  A member of the public asked if the NRC was going to further credit the chromium cladding technology, pointing out that the interim staff guidance ATF-ISG-2020-01, "Supplemental Guidance Regarding the Chromium-Coated Zirconium Alloy Fuel Cladding Accident Tolerant Fuel Concept," talks about problems that can happen with that coating. Messina responded that the NRC was aware of this document and that chromium cladding was only called out as potentially having benefits, but benefits related to this effort were still not yet known.

Closing Remarks:

- Benavides presented a slide with the regulatory basis summary that showed all the topics discussed during the meeting.

- Benavides displayed a slide with the rule's www.regulations.gov Docket ID number (NRC-2020-0034). The next couple of slides explained the methods that members of the public could use to submit comments, including on regulations.gov, email, fax, or mail, and information on the commenter's checklist.

- Benavides explained next steps for the regulatory basis, which included when the public comment period would end, and the estimated dates for when the proposed rule and final rule would reach the Commission. A visual timeline of the schedule was shown.

- The next slide displayed contact information for Benavides and Roque-Cruz.

- Benavides informed participants of the public feedback form available on the NRC website. At this point the slide presentation was complete, and the floor was opened for any final public comments.

- A member of the public asked a question about how to find the petition that was submitted and mentioned earlier by another member of the public. Cindy Bladey of the NRC provided the ML reference number to find the document. The document was PRM-50-124, "Licensing Safety Analysis for Loss-of-Coolant Accidents," (ML22284A087).

- Benavides opened the floor for final remarks from NRC managers. Joseph Donoghue of the NRC thanked everyone for their attention and participation.

- Benavides ended the meeting by thanking everyone for their time and attention.

Action Items/Next Steps:

- There were no significant or major actions for NRC staff as a result of the meeting.

- The NRC staff will monitor for incoming public comments including any responses to the specific request for comment.

- At the time of the public meeting, the NRC had received a request to extend the public comment period which was scheduled to be open until November 22, 2023. On November 6, 2023, a notice in the *Federal Register* was published which extended the public comment period to January 22, 2024 (88 FR 76143).

LIST OF ATTENDEES*

OCTOBER 25, 2023, PUBLIC MEETING TO DISCUSS THE REGULATORY BASIS FOR INCREASED ENRICHMENT OF CONVENTIONAL AND ACCIDENT TOLERANT FUEL DESIGNS FOR LIGHT-WATER REACTORS

NAME	AFFILIATION	NAME	AFFILIATION
Zena Abdullahi	NRC	Uriel Bachrach	Westinghouse
Joseph Azeizat	NRC	Kevin J Barber	Westinghouse
Philip Benavides**	NRC	Philippe Bellanger	Framatome
Ilka Berrios	NRC	Allyson Callaway	NuScale
Cindy Bladey	NRC	Paul Clifford	Framatome
Helen Chang	NRC	Aladar Csontos	Nuclear Energy Institute (NEI)
Alex Collier	NRC	Kris Cummings	
James Corson	NRC	Sarah Davis	ICF International
Vic Cusumano	NRC	Bradley Wicker Dolan	Tennessee Valley Authority (TVA)
Mari de Jesus	NRC	Steven Dolley	S&P Global
James Delosreyes	NRC	Frankie	
Elijah Dickson**	NRC	Lisa Gerken	Framatome
Joseph Donoghue	NRC	Robert Hall	Duke Energy
Julie Ezell	NRC	Nathaniel Hall	South Texas Nuclear Generating Station (STPEGS)
Mike Franovich	NRC	Mark Conrad Handrick	Duke Energy
Gerond George	NRC	Stan Hayrs	
Kevin Heller	NRC	Justin W Hiller	Ameren
Kevin Hsueh	NRC	Chad M Holderbaum	Westinghouse
Daniel King	NRC	Jerald Holm	Framatome
Andrea Kock**	NRC	Susan Hoxie-Key	
Scott Krepel	NRC	Zeses Karoutas	Westinghouse
Aaron Kwok	NRC	Kristin Kaspar	South Texas Nuclear Generating Station (STPEGS)
Marilyn Diaz Maldonaldo	NRC	Kasey L Kennett	Dominion Energy
Damaris Marcano	NRC	Thomas A Kindred	Southern Co
Lawrence McKenzie	NRC	Jeffrey Kobelak	Westinghouse
Sean Meighan	NRC	Elizabeth Kurz	ICF International
Joseph Messina**	NRC	Samuel Lafountain	Southern Co
Rodnika Murphy	NRC	Michel Lee	
Donald Palmrose**	NRC	Andrea Maioli	Westinghouse
John Parillo	NRC	Alex J Markivich	Dominion Energy
Charley Peabody**	NRC	Tara Elizabeth Matheny	Duke Energy
Jason Piotter**	NRC	Ralph Meyer	
Ronald Rauniker	NRC	Brian L Mount	Dominion Energy
Patrick Raynaud	NRC	Kurshad Muftuoglu	Electric Power Research Institute (EPRI)
Carla Roque-Cruz	NRC	Ewa Muzikova	

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NAME	AFFILIATION	NAME	AFFILIATION
Dan Ruby	NRC	Jacob W Nery	Westinghouse
Stewart Schneider	NRC	David S Orr	Duke Energy
Jen Scro	NRC	Danielle Page Blair	Framatome
Neil Sheehan	NRC	Gary Peters	Framatome
Ashley Smith**	NRC	PF	
Jack Vande Polder	NRC	Frances Pimentel	Nuclear Energy Institute (NEI)
Kimberly Webber	NRC	Douglas P Pollock	Tennessee Valley Authority (TVA)
		Deann Raleigh	Curtiss-Wright
		Baris Sarikaya	Constellation
		Raymond E Schneider	Westinghouse
		Michael Smith	Nuclear Energy Institute (NEI)
		Eric Smith	ICF International
		Charlyne Smith	Breakthrough Institute
		Fred Smith	Electric Power Research Institute (EPRI)
		Steve Sparks	NuScale
		Rebecca L Steinman	Constellation
		Storm	
		Charles Stroupe	Duke Energy
		Christie Taylor	Duke Energy
		Maribel Valdez	Florida Power and Light (FPL)
		David Vu	Evergy
		Kalene Walker	
		Gordon Wissinger	Framatome

** List does not contain attendees who participated via a phone line*

*** Presenter*

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