

U.S. Nuclear Regulatory Commission Public Meeting Summary

Title: Development of guidance documents to support license renewal for 100 years of plant operation

Meeting Identifier: 20201407

Date of Meeting: January 21, 2021, 9:00 A.M. to 5:00 P.M. (Eastern Time)

Location: Microsoft Teams

Type of Meeting: This was a Category 3 meeting. Public participation is actively sought for this meeting to fully engage the public in a discussion of regulatory issues.

Purpose of the Meeting(s):

The U.S. Nuclear Regulatory Commission (NRC) sought public dialogue related to license renewal for nuclear power reactors, specifically the need for the NRC to consider the potential technical issues and guidance document development related to license renewal that would authorize operation for up to 100 years, including:

- Should the NRC begin to consider the potential technical issues and the development of guidance documents to support license renewal to authorize operation for up to 100 years, and if so, when?
- What are the technical issues that could be potential challenges for license renewal to 100 years?
- What approaches should be used to optimize the development of data to address potential technical challenge areas?

General Details:

The NRC staff held a public meeting to discuss with the public potential technical issues related to license renewal that would authorize operation for up to 100 years. The meeting began at 9:00 a.m. and ended at approximately 5:00 p.m. There were at least 184 named participants, including NRC staff and external stakeholders from the Nuclear Energy Institute (NEI), the Electric Power Research Institute (EPRI), Oak Ridge National Laboratory (ORNL), Pacific Northwest National Laboratory (PNNL), Beyond Nuclear, Nuclear Information and Resource Service (NIRS), Exelon Nuclear, Texas A&M, University of Colorado and members of the public (Attachment 1). An additional 28 Teams participants were identified by unique phone numbers and as many as 73 unique Teams participants were identified as "Unknown User." Some of the latter participants may be internal duplicates or may be tied to named participants.

A description of this meeting is provided in the NRC's Agencywide Documentation and Management Systems (ADAMS) using Accession No. ML21019A481. The meeting agenda is provided at ADAMS Accession No. ML21019A073. The meeting was transcribed (ADAMS Accession No. ML21042B878). A list of the presentations and ADAMS Accession Nos. is provided in Attachment 2.

Enclosure

Summary of Meeting:

The meeting started with Anna Bradford, the Director of the NRC Division of New and Renewed Licenses, welcoming every participant and providing opening remarks. The meeting followed the agenda (ADAMS Accession No. [ML21019A073](#)) as planned.

The following topics were discussed during the meeting:

License Renewal Overview and History – NRC, Allen Hiser: Dr. Hiser of the NRC's Division of New and Renewed Licenses described the basis for license renewal in the U.S., the process for the NRC to review license renewal applications, the development of guidance documents for subsequent license renewal, and the status of both license renewal (to extend operating licenses from 40 to 60 years) and subsequent license renewal (to extend operating licenses from 60 to 80 years). Dr. Hiser also provided an overview of the agenda for the meeting, including the meeting purpose.

Topic 1 – Timing of Guidance Document Development

NEI, Chris Earls: Mr. Earls provided NEI's perspective that the meeting was not to discuss licensing to allow plants to operate for 100 years, since he was not aware of any utility that is actively discussing that or intends to in the near future. Given that status, Mr. Earls stated that it is still prudent to continue relevant research on aging to extend our current level of knowledge, given the lead time needed to implement and complete research activities.

EPRI, Emma Wong: Ms. Wong provided EPRI's perspective on the value of research on long-term operation (LTO) of nuclear power plants, including supporting the business cases related to life extension and refurbishments, and providing knowledge to manage plant assets through an extended lifetime. She also described EPRI's approach to support LTO and considerations for LTO.

Beyond Nuclear, Paul Gunter: Mr. Gunter provided perspectives from Beyond Nuclear on whether the NRC should develop guidance to extend reactor operating licenses to 100 years, with a response of "no." He stated that the technical issues needed to meet the required "reasonable assurance" standard for operational reliability and safety throughout any requested relicensing period are but one of a set of significant issues that need to be addressed.

ORNL, Tom Rosseel: Dr. Rosseel provided ORNL's perspectives on the need for preparation for plant operation to 100 years. He also described the goals and objectives of current Department of Energy (DOE) materials research. The latter includes developing the scientific basis for understanding and predicting long-term environmental degradation behavior of materials in nuclear power plants, along with providing data and methods to assess the performance of systems, structures, and components essential for the safe and economically sustainable operation of the US nuclear power plant fleet.

Open Discussion: The open discussion included numerous questions and comments, as provided on pages 69 to 89 of the meeting transcript.

Topic 2 – Technical Issues for Mechanical Components

NRC, Carol Moyer: Ms. Moyer provided an overview of "NRC Materials Research for Aging Management." She described the NRC's approach using domestic and international research

partnerships along with ex-plant materials harvesting, to conduct confirmatory research to establish technical bases that support regulatory decisions and development of regulatory guidance documents. Ms. Moyer stated that long-lead-time confirmatory research is an important consideration in proactive aging management.

Beyond Nuclear, Paul Gunter: Mr. Gunter provided perspectives on technical issues for mechanical components. He advocated harvesting of ex-plant materials to enable closure of technical knowledge gaps, citing a poster session from the NRC Regulatory Information Conference in 2018, a draft report from PNNL, and NUREG/CR-7153, Volume 2.

ORNL, Mikhail Sokolov: Dr. Sokolov described thermal annealing of the reactor pressure vessel (RPV) as an approach to recover irradiated beltline material transition temperature shift and recover upper shelf energy properties lost during radiation exposure, thereby extending the RPV service life. He described the positive experience with thermal annealing on Russian-design VVER-440/1000 and pressurized-water reactor (PWR) RPVs in the beltline region.

Texas A&M, Frank Garner: Mr. Garner described potential materials issues for stainless steel reactor internals in PWRs during extended plant life to 80-100 years. He recommended additional research to address second-order processes that could grow to first-order importance, previously unidentified phenomena at higher exposure, and enhanced synergisms between various phenomena with extended operation times.

EPRI, Mike Burke: Mr. Burke described EPRI's approach for structural metallic materials to address light-water reactor (LWR) operation beyond 80 years, using Issue Management Tables and the Materials Degradation Matrix. He identified EPRI activities related to boiling-water reactor plants, PWR reactor vessel internals, PWR reactor pressure vessel neutron embrittlement, and low alloy steel aging (neutron embrittlement of RPV supports and thermal embrittlement at high temperature).

Open Discussion: The open discussion included numerous questions and comments, as provided on pages 141 to 156 of the meeting transcript.

Topic 3 – Technical Issues for Civil Structures and Concrete

NRC, Madhumita Sircar: Ms. Sircar described NRC's confirmatory research program related to radiation effects on concrete. This program includes domestic collaborations with DOE and EPRI, and international collaborative activities include bilateral and multilateral agreements, the International Committee on Irradiated Concrete, and strategic international partnerships with France, Japan, and Canada.

ORNL, Yann Le Pape: Dr. Le Pape described ORNL's work on concrete aging. He described the various relevant structures and types of aggregate used in LWRs, along with the principal aging mechanisms of interest and knowledge gaps. Dr. Le Pape also identified possible interactions of the aging mechanisms with longer plant operating times.

EPRI, Sam Johnson: Mr. Johnson described EPRI's program related to concrete and civil structures for LTO. He described joint research road maps, that have been developed in coordination with NRC and DOE, for alkali-silica reaction, concrete irradiation, and nondestructive evaluation.

Univ. of Colorado, Victor Saouma : Dr. Saouma provided his perspectives on technical issues for civil structures and concrete for 100 years of plant operation. He described his personal lessons learned related to the Crystal River and Seabrook plants, and provided recommendations related to identifying and reaching resolution of technical issues related to civil structures and concrete for 100 years of plant operation.

Open Discussion: The open discussion included numerous questions and comments, as provided on pages 187 to 212 of the meeting transcript.

Topic 4 – Technical Issues for Electrical and I&C Components

NRC, Darrell Murdock: Mr. Murdock described NRC’s confirmatory research program related to cable aging. The NRC’s program is evaluating the effectiveness of commonly used cable condition monitoring methods, in cooperation with EPRI, DOE and the Analysis and Measurement Services Corporation (AMS). The research is addressing thermal and radiation aging of cables.

EPRI, Andrew Mantey: Mr. Mantey described EPRI’s program on long term operation of electrical and instrumentation and control (I&C) components. He described cable aging management activities, research activities, a joint roadmap with NRC and DOE, and establishment of a Cable Users Group to promote sharing and monitoring of industry operating experience.

Beyond Nuclear, Paul Gunter: Mr. Gunter provided the Beyond Nuclear perspective that, for non-metallic systems and structures (electric cable and concrete), “projecting age management programs for safety-critical systems and structures out to 100-year begins with observing and assessing the foundation for assuring safety margins during the initial (40-60 years) and subsequent license renewal (60-80 years) periods.”

PNLL, Leo Fifield: Dr. Fifield described the DOE LWRS program on cables research. He described several elements to ensure continued use of aging cables, including Cable Aging Management Programs, halting/reversing aging (mitigation and rejuvenation), aging management tools (monitoring and simulation), and condition-based management (test bed and validation).

Open Discussion: The open discussion included numerous questions and comments, as provided on pages 245 to 261 of the meeting transcript.

Final discussion and summary

Final discussion by the presenters and the public, along with a brief meeting summary are provided on pages 261 to 275 of the meeting transcript.

Closing remarks

Anna Bradford provided closing remarks, first thanking all of the meeting participants. She emphasized that the NRC did not have plans to revise license renewal durations to allow operation for 100 years and did not have any requests from licensees to approve them to operate up to 100 years. She then encouraged participation in a public meeting scheduled for February 18, to discuss the possibility of extending the time period for renewed licenses for nuclear power plants from 20 years to 40 years.

Public Comment Topics:

Members of the public announced themselves on the phone or informed the NRC staff that they were participating in the teleconference. The public's comments covered a range of topics. Comments that were aligned with the meeting purpose include: concerns over reactor pressure vessel surveillance specimens; concerns over a lack of discussion of new materials for actual remediation or repair of concrete cracks or other defects; the age of foundations for plants with extended construction times; parts of the plant that cannot be inspected; and, degradation in the cement from tritium.

Topics of other public comments included: nuclear waste, including plans for interim storage, cask storage of high burn-up fuel, and inability to inspect storage canisters for cracking; impact of effluents and reporting; license renewal of fuel fabrication facilities; and lack of consideration of external factors (e.g., plant siting, climate change).

Attachments:

Attachment 1 – Meeting Attendees

Attachment 2 – ADAMS Accessions Nos. for Presentations

ATTACHMENT 1 – Meeting Attendees

Annette Marie Adkins	
Gary Adkins	
Paul Aitken	Dominion Energy (Dominion)
Brian Allik	NRC/Office of Nuclear Reactor Regulation (NRR)
Lydiana Alvarado	NRC/NRR
Kyle Amberge	EPRI
Chris Bagley	MPR Associates
Matt Bandyk	
Sherry Bernhoft	EPRI
Stephanie Bilenko	
Eric A. Blocher	Dominion
Jan Boudart	Nuclear Energy Information Service
Jeremy Bowen	NRC/ Office of Nuclear Regulatory Research (RES)
John Bozga	NRC/Region III (RIII)
Anna Bradford	NRC/NRR
Michael H Breisch	
Michael Burke	EPRI
Scott Burnell	NRC/Office of Public Affairs (OPA)
Matthew Burton	NRC/NRR
Alexander Butcavage	NRC/Region II (RII)
Robert Caldwell	NRC/NRR
Roberto Caricchio	
Edward Carley	
Roberto Carlos	
Alec Casillo	
Connie Cline	
John Conly	Certrec Corporation
Paula Cooper	NRC/RII
Diane Curran	Harmon Curran
Diane D'Arrigo	NIRS
Robert Davis	NRC/NRR
Adilson de Alcantara	
Oriano de Oliveira e Silva	
Jesse Deer In Water	CRAFT
Jonathan DeLaune	
Megan DesAutels	Rep. Mirra's Office
Steven Dolley	S&P Global
Peter Donahue	
Chris Earls	NEI
Kurt Edsinger	EPRI
Shanna Eismar	Global Research for Safety
Carolyn Fairbanks	NRC/NRR

Carlos Fernandez	
Leo Fifield	PNNL
Wyldon King Fishman	
Michael Fluss	
Eric Focht	NRC/RES
Cindy Folkers	Beyond Nuclear
Istvan Frankl	NRC/RES
Eric Frevold	
Bart Fu	NRC/NRR
Pablo Garcia Schuabb	
Frank Garner	Texas A&M
James Gavula	NRC/NRR
Sally Gellert	Indian Point Safe Energy Coalition
Anita Ghosh Naber	NRC/Office of General Counsel (OGC)
John Gibson	
Lauren Gibson	NRC/NRR
Gionanna Giovanardi	
Bill Glass	
Hipolito Gonzalez	NRC/NRR
Matthew Gordon	NRC/RES
Erica Gray	Virginia Sierra Club
Dan Green	
Pamela Greenlaw	
Jeff Gromatzky	
Karl Grossman	
Paul Gunter	Beyond Nuclear
Maxim Gussev	ORNL
Steven Hamrick	
Tom Henry	Environmental-Energy Writer, The (Toledo) Blade
Terry Hermann	Structural Integrity
John Hilditch	Exelon Nuclear
Natalie Hildt Treat	Executive Director, C-10
Allen Hiser	NRC/NRR
Matthew Hiser	NRC/RES
Ace Hoffman	
Robert Hoffman	NRC/Office of Nuclear Material Safety and Safeguard (NMSS)
Kent Howard	NRC/Advisory Committee on Reactor Safety (ACRS)
Amy Hull	NRC/RES
Gregory Imbrogno	
Ata Istar	NRC/NRR
Raj Iyengar	NRC/RES
Ronaldo Jenkins	NRC/RES
Janelle Jessie	NRC/Office of the Commission (OCM)
Marieliz Johnson	NRC/NRR
Sam Johnson	EPRI

Stephen Johnson	
Travis Jones	NRC/OGC
Timothy Judson	NIRS
Roger Kalikian	NRC/NRR
Bob Kalinowski	
Michael J. Keegan	
Bob Kellner	NRC/RII
Connie Kline	
Robert Krsek	NRC/OCM
Sandra Kurtz	Blue Ridge Environmental Defense League, Bellefonte Efficiency and Sustainability Team
Yann Le Pape	ORNL
Michael Lee	NRC/NRR
Michel Lee	Chairman, CIECP
Bryce Lehman	NRC/NRR
Sue Lesica	
Donghui Li	
Ryan K Lighty	
Wayne Lunceford	EPRI
Juan Lopez	NRC/NRR
Louise Lund	NRC/RES
Eric Magnuson	NRC/RIII
William Maher	Florida Power & Light
Andrew Mantey	EPRI
Bill Maier	NRC/Region IV
Chad Mason	
Nancy Martinez	NRC/NMSS
Benjamin E. Mays	Westinghouse
Matthew McConnell	NRC/NRR
Michael McCoppin	NRC/Office of the Executive Director for Operation
Alfred Meyer	
Eric Ashley Michael	
Jeff Mitchell	NRC/NRR
Viktoria Mitlyng	NRC/OPA
Carol Moyer	NRC/RES
Darrell Murdock	NRC/RES
Daniel Mussatti	NRC/NMSS
Rie Nakamura	Japan NUS Co
Duc Nguyen	NRC/NRR
Jinsuo Nie	NRC/RES
Mary Olsen	
William Orders	NRC/OCM
Yiming Pan	
Andrew Parish	
Kevin Petty	

Jose Pires	NRC/RES
Jeffrey Poehler	NRC/RES
David Pratt	NRC/NRR
Andrew Prinaris	NRC/NRR
Pat Purtscher	NRC/RES
Robert Reese	Lower Richland Community Action Committee
Hector Rodriguez	NRC/NRR
Bill Rogers	NRC/NRR
Elliot Rosenfeld	NJ Dept. Environmental Protection
William J. Rosko	Rolls-Royce Civil Nuclear
Tom Rosseel	ORNL
David Rudland	NRC/NRR
Gary Sachs	
Mo Sadollah	NRC/NRR
Don Safer	Tennessee Environmental Council
Kaori Saito	
Victor Saouma	University of Colorado
Michael Schneider	
Kraig Schultz	Michigan Safe Energy Future
Dogan Seber	NRC/RES
Min Seung	NRC/NRR
Neil Sheehan	NRC/OPA
Rennan Silva	
John Simons	
Madhumita Sircar	NRC/RES
Patricia L. Skibbee	
Jean Smith	EPRI
Sten Spinella	
Frederick Sock	NRC/RES
Mikhail Sokolov	ORNL
Michael Starr	
Steve Swilley	EPRI
George Thomas	NRC/NRR
Charles A Tomes	Dominion
Robert Tregoning	NRC/RES
Raymond Trelka	NRC/RIII
Peter Tutinas	
Jeremy Wachutka	NRC/OGC
Kalene Walker	
Shakur Walker	NRC/OCM
George Wang	NRC/NRR
Barbara Warren	Citizens' Environmental Coalition
Chris Wax	EPRI
B. Waybright	
Heather Westra	

Lynnea Wilkins	NRC/OCA
Chris Wilson	Exelon Nuclear
Brandon Wise	NRC/NRR
Emma Wong	EPRI
Mary Woods	NRC/OGC
Angela Wu	NRC/NRR
Zuhan Xi	NRC/NRR
Jim Xu	NRC/RES
Albert Ye	(court reporter)
On Yee	NRC/NRR
Sho Yoshinaga	

ATTACHMENT 2 – ADAMS Accessions Nos. for Presentations

- 00 – License Renewal Background and Status – ADAMS Accession No. [ML21015A336](#)
- 1B – Technical Considerations for 100 years of Operation – ADAMS Accession No. [ML21015A289](#)
- 1C – Should NRC consider developing guidance to operate U.S. reactors to 100 years? – ADAMS Accession No. [ML21019A017](#)
- 1D – Is there Life Beyond Eighty? Why we should prepare for License Renewal to 100 years – ADAMS Accession No. [ML21019A355](#)
- 2A – NRC Materials Research for Aging Management of Metals – ADAMS Accession No. [ML21015A197](#)
- 2B – Technical Issues for Mechanical Components– ADAMS Accession No. [ML21019A019](#)
- 2C1 – Reactor Pressure Vessel Aging at Extended Operation – Thermal Annealing of Reactor Pressure Vessels – ADAMS Accession No. [ML21019A344](#)
- 2C2 – Potential materials issues to monitor for stainless steel reactor internals during extended plant life to 80-100 years – revised slides ADAMS Accession No. [ML21047A142](#) (presented slides at ADAMS Accession No. [ML21019A346](#))
- 2D – Structural Metallic Materials: Long Term Operations – ADAMS Accession No. [ML21015A315](#)
- 3A – Long Term Operation NRC’s Current Research on Concrete – ADAMS Accession No. [ML21015A198](#)
- 3B – Life Beyond 80. Concrete Aging – ADAMS Accession No. [ML21019A347](#)
- 3C – Concrete and Civil Structures: Long Term Operations – ADAMS Accession No. [ML21015A320](#)
- 3D – License Renewal for 100 years of Plant Operation, Technical Issues for Civil Structures and Concrete – revised slides ADAMS Accession No. [ML21047A145](#) (presented slides ADAMS Accession No. [ML21019A071](#))
- 4A – NRC Materials Research for Aging Management of Cables – ADAMS Accession No. [ML21015A199](#)
- 4B – Electrical and I&C Components: Long Term Operations – ADAMS Accession No. [ML21015A321](#)
- 4C – Technical Issues for Electrical Cables – ADAMS Accession No. [ML21019A064](#)
- 4D – Reliable Use of Old Electrical Systems in Extended Operation – ADAMS Accession No. [ML21019A352](#)