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

September 24, 2020

MEMORANDUM TO: Dennis C. Morey, Chief
Licensing Processes Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

FROM: Michael D. Orenak, ATF Lead Project Manager ***/RA/***
Licensing Processes Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF THE JULY 30, 2020, HIGHER BURNUP WORKSHOP CATEGORY 2 PUBLIC MEETING

On July 30, 2020, the U.S. Nuclear Regulatory Commission (NRC) staff held the Higher Burnup Workshop, a Category 2 public teleconference with representatives from the nuclear industry, including the Nuclear Energy Institute (NEI), Westinghouse Electric Company (Westinghouse), Electric Power Research Institute (EPRI), and Nuclear Energy Agency (NEA). The meeting had three purposes: (1) provide the general public with information about higher burnup (HBU) and increased enrichment (IE), (2) provide an open question and answer period on accident tolerant fuel (ATF) subjects for the public, and (3) hold an exchange of information with industry on HBU and IE, focusing on the components of a quality submittal. The meeting notice can be found in Agencywide Documents Access and Management System (ADAMS) at Accession No. ML20211L893. The meeting slides can be found at ADAMS Accession No. ML20211L075. The NRC staff requested the meeting be recorded, but a problem with the bridgeline operator's system prevented recording.

At the start of the meeting, the NRC staff stated that the meeting was focused on HBU and IE, and as with all NRC public meetings, no regulatory decisions will be made. After Joe Donoghue, Director of the Division of Safety Systems, in the Office of Nuclear Reactor Regulation (NRR) made opening remarks, a combination of Michael Orenak, Kevin Heller, Roberto Torres, and Marilyn Diaz from the NRC discussed an overview of HBU and IE. The presentation detailed what are HBU and IE; anticipated impacts HBU and IE, and the associated regulations. The presentation also detailed NRC's activities related to HBU and IE and provided a short demonstration of the revised ATF public website.

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Next, Ben Holtzman of NEI presented the wholistic industry perspective on HBU and IE. Then Jeffrey Kobelak of Westinghouse presented Westnghouse's progress and plans to incorporate HBU and IE in its fuel designs. Afterward, Fred Smith of EPRI presented on a developing method to risk-inform the analysis of fuel fragmentation, relocation, and dispersal (FFRD). Dr. Tatiana Ivanova of the NEA gave the last presentation on the International Perspective and Framework for Irradiation Experiments (FIDES) Program.

After the industry presentations, the NRC held a public question and answer period. Some of the significant questions and answers were:

- A member of the public asked how can the NRC be putting HBU fuel in reactors today if the presentation states there is a need for data. The NRC staff first clarified the question by phrasing it as "How can the NRC be putting HBU fuel in reactors if the data needed to approve its use hasn't been collected yet?" The staff then began describing the lead test assembly program that allows limited quantities of fuel rods (a very few rods) in non-limiting locations (that being locations that ensure there are wide margins to safety limits) that allow data to trickle in while maintaining safety limits. As an example, the staff discussed the FFRD phenomenon where HBU fuel would be put in locations with such wide margins that it would preclude the possibility of FFRD manifesting.

- A member of the public asked if the NRC's decision to explore rulemaking for IE could ultimately result in the decision of not to proceed with rulemaking. The NRC staff indicated yes, clarifying that there is the possibility the NRC may not decide to do rulemaking because part of the decision to pursue it is highly dependent upon the number of licensees seeking to adopt IE. If only one licensee decides to adopt IE, then the NRC would not see a need to complete resource-intensive rulemaking and the NRC would instead review only an exemption request. The questioner appreciated the answer but responded by saying that the NRC should do rulemaking even if only one licensee adopts because they thought it is more rigorous. The questioner also requested the proposed rule also include a realistic accident and consequence analysis that would all comments from the public.

- A member of the public inquired why the NRC is defining IE using an enrichment range of 5 percent to 10 percent, why the NRC does not just call it HALEU [high enriched low assay uranium], and why the NRC doesn't just define IE and HALEU based on reactivity instead of enrichment. The NRC staff responded by explaining that IE and HALEU have different delineations within transportation and storage space. The NRC staff asked for clarification on "defining based on reactivity" since enrichment level directly impacts reactivity, but did not receive a clarification on this point.

- A member of the public inquired about research work previously conducted by Argonne National Laboratory (ANL) and why the work was not included in the recent NRC's assessment on HBU fuel in dry storage and transportation, as documented in NUREG-2224. The NRC staff responded that the caller had previously asked the question at a prior public meeting on spent fuel activities and informed the member of the public that NUREG-2224 did address ANL's research on ductility of HBU spent fuel during ring compression testing. The NRC staff was then corrected by the member of the public that the question pertained to other ANL research. The NRC staff requested information on the name of the researcher and type of work, and provided an option for the member of the public to contact directly the NRC staff to provide this information.

The staff clarified that until that information is received, it is difficult for the staff to address the specifics of that research and relevance to HBU fuel. The member of the public has not yet contacted the NRC staff to provide the information.

After the lunch break, the NRC provided a presentation that detailed the NRC's expectations for submittal quality and submittal timelines to support the industry's target date(s) for batch loading. The NRC staff detailed what should be contained within each type of HBU and IE submittal to address NRC licensing concerns. The NRC staff also discussed obtaining knowledge of the types and dates of forthcoming submittals so the agency can adequately prepare. Afterward, a short NRC-industry dialogue was held where the industry stated that they generally agreed with the submittal timelines provided by the NRC and had no significant comments on the rest of the NRC presentation.

After this dialogue, the NRC held another public question and answer period. Some of the significant questions and answers during this period were:

- A member of the public inquired where in the regulations is there an explicit limit on burnup, and where an explicit limit on enrichment exists. The NRC staff answered by drawing attention back to the presentation slides. For burnup, there is no explicit limit, but Title 10 of the *Code of Federal Regulations* (10 CFR) 50.34 requires licensees to perform safety analyses using codes and methods. These codes and methods are reviewed by the NRC to ensure technical accuracy and compliance with the regulations, and it is in the approval of these methods that the NRC places limits on burnup. The basis for the burnup limit is the range of data presented in code validation and knowledge of FFRD existing beyond 62 gigawatt days per metric ton of uranium (GWd/MTU). The IE limit is explicitly stated in 10 CFR 50.68(b)(7) and 10 CFR 71.55(g)(4).

- Regarding slide 8 of the second NRC presentation, a member of the public inquired as to why depletion code validation was important for the safety analyses related to fresh fuel transportation. The NRC staff clarified that depletion code validation is only relevant to spent fuel management.

- Various members of the public inquired about the state of knowledge related to high burnup fuel, and whether there exists sufficient technical basis for licensing of HBU fuels, particularly when considering their extended storage. The NRC staff clarified that the licensing and certification for dry storage of spent fuel is based on the safety basis provided in NRC applications. The NRC staff recognizes that there are a number of technical information needs that applicants will have to address to support the safe storage of HBU fuels, as discussed in the workshop (i.e., beyond 62 GWd/MTU). The staff further clarified that data on the performance of HBU fuels is still being generated to address these technical information needs (e.g., post-irradiation examination data to be generated from irradiated lead test assemblies). The NRC staff will continue to assess the information to ensure that applicant's conclusions are consistent with the results. The NRC staff also clarified that the NRC is sponsoring various research activities in support of analytical codes and other assessments that will allow the staff to perform confirmatory calculations, as needed.

- A member of the public inquired whether the NRC is relaxing regulatory requirements to meet industry's schedule for the deployment of HBU fuels on a batch load basis. The

member of the public expressed particular concerns about the safety of transportation of HBU fuels. The staff clarified that the regulatory requirements are not being relaxed due to industry's proposed schedule for batch loading of HBU fuels. The NRC staff clarified that applications for transportation packages will be reviewed per the regulatory requirements for normal conditions of transport per 10 CFR 71.71 and hypothetical accident conditions per 10 CFR 71.73. The NRC staff clarified that these regulatory requirements codify the specific tests and test sequences that need to be evaluated to demonstrate safety during transport.

No regulatory decisions were made in the meeting.

Enclosure:
List of Attendees

SUBJECT: SUMMARY OF THE JULY 30, 2020, HIGHER BURNUP WORKSHOP CATEGORY 2 PUBLIC MEETING DATED SEPTEMBER 24, 2020

DISTRIBUTION:
PUBLIC
RidsACRS_MailCTR Resource
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JGlisan
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NMertz
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HPage
JPark
DJu
TMcCartin
JThorp
HMarchlewski
DMcIntyre
JGrasso
MHiser
ABarto
MPanicker
CRegan
JJimenez-Guzman
CDukehart
BDoan
UShoop

ADAMS Accession Nos.:
ML20260H000 (Summary)
ML20211L893 (Meeting Notice)
ML20211L075 (Meeting Slides) ***via e-mail**

OFFICE	NRR/DORL/LLPB/PM	NRR/DORL/LLPB/LA	NRR/DORL/LLPB-1/BC
NAME	MOrenak	DHarrison	DMorey
DATE	9/18/20	9/23/2020	9/24/20

OFFICE	NRR/DORL/LLPB/PM
NAME	MOrenak
DATE	9/24/20

OFFICIAL RECORD COPY

List of Attendees

July 30, 2020, Higher Burnup Workshop

First Name	Last Name	Organization
Al	Csontos	Electric Power Research Institute (EPRI)
Kristy	Bucholtz	U.S. Nuclear Regulatory Commission (NRC)
Hatice	Akkurt	Unknown
John	Budzynski	NRC
Josh	Borromeo	NRC
Hang	Vu	NRC
Kent	Wood	NRC
Daniel	Ju	NRC
Ronda	Lane	Unknown
Ashley	Smith	NRC
Kent	Halac	Global Nuclear Fuels (GNF)
Jeff	Seals	Unknown
Antonio	Gomez	NRC
Clinton	Hobbs	NRC
Nathan	Capps	Unknown
Andrea	Kock	NRC
Joshua	Miller	NRC
Bob	St. Clair	Unknown
Natreon	Jordan	NRC
Jeffrey	Reed	Unknown
John	McKirgan	NRC
James	Stavely	Unknown
Storm	Kauffman	Unknown
Diane	Jackson	NRC
Gregory	Suber	NRC
Donald	Palmrose	NRC
Kim	Webber	NRC
Michael	Orenak	NRC
Kenneth	Kellar	Unknown
Norbert	Carte	NRC
James	Hammelman	NRC
Jeff	Seals	Unknown
Ken	Yueh	Unknown
Charles	Folsom	Unknown
Carl	Thurston	NRC
Tam	Tran	NRC
Aaron	Totemeier	Unknown
Stephanie	Devlin-Gill	NRC
Ryan	Nolan	NRC

Enclosure

First Name	Last Name	Organization
Steven	Hayes	US Department of Energy (DOE)
Diane	Jackson	NRC
Mohammed	Abdoelatef	Unknown
Andrea	Jennetta	Unknown
Kevin	Pusateri	NRC
Kim	green	NRC
Eva	Brown	NRC
Jean	Trefethen	NRC
Devonte'	Hinton	NRC
Frank	Goldner	DOE
Bob	Hoffman	NRC
Michel	Call	NRC
Kate	Lenning	NRC
Timothy	Tate	Unknown
Joan	Olmstead	NRC
MJ	Ross-Lee	NRC
Fred	Smith	EPRI
Kevin	Heller	NRC
Jeffrey	Kobelak	Westinghouse Electric Company (Westinghouse)
Marilyn	Diaz	NRC
Josh	Whitman	NRC
Ricardo	Torres	NRC
Ben	Holtzman	Nuclear Energy Institute (NEI)
Paul	Clifford	NRC
Tatiana	Ivanova	Nuclear Energy Agency (NEA)
Joe	Donoghue	NRC
Michelle	Bales	NRC
Elijah	Dickson	NRC
Cecile	Dame	MPR
Rob	Daum	EPRI
Alexus	Willis	NRC
Michael	Keegan	Unknown
Sam	Lafountain	Enercon
Zeses	Karoutas	Westinghouse
Kayleh	Hartage	NRC
Juan	Arellano	NRC
Brandon	Wise	NRC
Scott	Stanchfield	Entergy
John	Masse	NRC
Valerie	Gray	NRC
Justin	Coury	NRC
Karen	Sida	NRC

First Name	Last Name	Organization
Alex	Siwy	NRC
Matthew	Abenante	Strategic IR
Luis	Colon	NRC
Rodmon	Kliewer	Framatome
Michael	Boone	Westinghouse
Dennis	Morey	NRC
Christina	Jones	Framatome
Rebecca	Steinman	Exelon
Camille	Levine	NRC
Gary	Jenkins	NRC
Nicholas	Szewczyk	Southern Nuclear Operating Company (SNC)
Nima	Ashkeboussi	NEI
Thomas	Meade	Energy Resources International
Donna	Gilmore	Unknown
Emma	Haywood	NRC
Muzammil	Siddiqui	NRC
Jack	Gwo	NRC
Manna	Greene	Unknown
Jenny	Tobin	NRC
Susan	Hoxie-Key	SNC
Louis	Caponi	NRC
Dan	Wachs	DOE
Barbara	Warren, RN, MS	Unknown
Timothy	Hooker	NRC
Tyler	Beck	NRC
Seth	Grae	Lightbridge
Ernie	Dee	Unknown
Kirk	Tien	NRC
Russell	Chazell	NRC
Brian	Wagner	NRC
Michael	Shockling	Westinghouse
Joseph	Messina	NRC
Kristopher	Cummings	NuScale
Ed	Stutzcage	NRC
Corey	Dukehart	Unknown
Ruwan	Ratnayake	EPRI
Robert	Quinn	Westinghouse
Jonathan	Marcano	NRC
Jordan	Glisan	NRC
Dave	Mitchell	Westinghouse
Kate	Richardson	DOE
Madeline	Feltus	DOE

First Name	Last Name	Organization
Lucas	Kyriazidis	NRC
Nick	Mertz	NRC
Andrew	Atwood	Westinghouse
Hayden	Brundage	NRC
Hayden	Page	NRC
Kallie	Metzger	Westinghouse
James	Park	NRC
William	Maxson	Framatome
Jason	Harp	DOE
Jeffery	Norrell	Westinghouse
Tanya	Sloma-DeLosier	Westinghouse
Nicolas	Woolstenhulme	DOE
Daniel	Ju	NRC
Tim	McCartin	NRC
John	Thorp	NRC
Henry	Marchlewski	NRC
David	McIntyre	NRC
John	Grasso	NRC
Matt	Hiser	NRC
Jerry	Holm	Framatome
Lisa	Matis	Tetra Tech
Andrew	Barto	NRC
Kalene	Walker	Unknown
Mathew	Panicker	NRC
Christopher	Regan	NRC
Jose	Jimenez-Guzman	NRC
James	Fornof	Lightbridge
John	Williams	SNC
Corey	Dukehart	NRC
Brian	Doan	NRC
Undine	Shoop	NRC