



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

January 9, 2019

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

FROM: Joseph A. Golla, Project Manager /RA/  
Licensing Processes Branch  
Division of Licensing Projects  
Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF CLOSED MEETING WITH GLOBAL NUCLEAR  
FUEL ON OCTOBER 17, 2018, REGARDING ARMOR FUEL

On October 17, 2018, the U.S. Nuclear Regulatory Commission (NRC) staff held a closed meeting with representatives of Global Nuclear Fuel (GNF) and General Electric Hitachi (GEH) regarding GNF's "ARMOR" fuel technology. The purpose of the meeting was for GNF to provide the NRC staff with an update on the ARMOR fuel qualification plan and to identify focus areas for upcoming meetings regarding ARMOR. A public version of GNF's presentation slides for the meeting may be viewed on the NRC's Agencywide Documents Access and Management System (ADAMS) at Accession No. ML18338A439. A list of attendees is enclosed with this summary.

This meeting was the first of what is intended to be an ongoing series of meetings at approximately quarterly intervals. Discussion topics included ARMOR technology, licensing plan overview, material properties test plan and irradiation programs. In the meeting, GNF representatives shared information that is specific to ARMOR and is proprietary. A GNF representative indicated he believes that ARMOR (abrasion resistant, more oxidation resistant) will likely be the first of the accident tolerant fuel (ATF) technologies to be licensed. ARMOR technology consists of a thin coating on existing zircalloy fuel rods utilizing a proprietary surface preparation process. The following short statements indicate the discussion that took place at the meeting:

[

]

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NRC staff inquired about quality control for the coating process and how the process will work when scaling up.

GNF asked about the licensing process that thin coatings on previously approved claddings should follow, [

]

NRC asked if GNF anticipated seeking an exemption from 10 CFR 50.46 for ARMOR. It is unclear whether an exemption is needed for either stage 1 or stage 2. The proposed 50.46c rule provides a regulatory framework to address the ATF features of the coating.

NRC asked what the potential benefits of this technology might be.

GNF responded: [

]

GNF is working with NEI on safety benefits and stated that benefits, operational or safety, may not be recognized at the same time. They will likely be realized as the testing program moves forward.

GNF stated there could be interest in [ ]

NRC noted that generic severe accident 10 CFR Part 100 questions might arise, i.e., does the coating affect source term or release timing? GNF responded that they should be ready to respond to this question as the development process moves forward.

NRC staff noted that the licensing basis of approved claddings without coatings, which have an exemption to 10 CFR 50.46, and are then coated, would need to be revisited. GNF stated that the licensing basis for that situation needs to be presented and GNF believes they will be able to prove it would not affect the basis for the exemption.

NRC staff suggested that changes in coping times, success criteria, etc., may change risk-informed analyses and a plant's PRA may be rendered invalid. Also, the benefits of ARMOR that will be learned later will have to be addressed in PRAs and that oversight strongly depends on risk information. GNF responded that they would have to be mindful of not harming an existing PRA when they install ARMOR.

NRC staff asked if the ARMOR coating process introduces any worker radiation protection concerns.

NRC staff asked what would be submitted to support spent fuel transportation. GNF responded that this would highlight a focus area for future discussion.

NRC staff asked about delamination over time and how this would affect performance. [ ]

NRC staff noted an EPRI gap analysis report indicates that coatings can affect creep properties. GNF responded that how uncertainties are treated and propagate counter measures throughout the system should be another focus area for future discussion.

An NRC manager asked the NRC staff members present what we're doing in the PIRT (phenomena identification and ranking table) arena. Note PIRT is an exercise to identify phenomena important to safety. An NRC staff member indicated that NRC research is in the early stages of planning for a PIRT. NRC has a contract with PNNL to conduct information gathering on Cr-coated technologies. PNNL will produce a "pre-PIRT" information report that could be used by a future expert panel as their starting point for discussion. PNNL's report is scheduled to be complete by 12/31/2018. The staff is currently considering ways to execute an expert panel but are still working out details. The staff is hoping the panel will convene shortly after PNNL completes the report and have something produced by spring 2019. The staff is still deciding what format the panel's product will take.

NRC indicated that severe accidents and storage and transportation will be important discussion topics for the future.

GNF discussed potential licensing strategies and schedule for ARMOR technology. The project timelines show submittal of an ARMOR topical report in [ ]

[ ] Cross-referencing the LTA schedule, the NRC staff questioned the [ ]

[ ] GNF added that fuel rod segments irradiated in the Idaho National Lab advanced test reactor up to 10 GWd/MTU will be available in 2021.

GNF emphasized that the [ ]  
[ ] GNF discussed [ ]

]

GNF describes testing on unirradiated coated rods to demonstrate [ ]

]

It was decided that the next meeting regarding ARMOR licensing will be scheduled in February or March 2019.

Enclosure:  
Attendees List

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OCTOBER 17, 2018, REGARDING ARMOR FUEL DATE: JANUARY 9, 2019

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**ADAMS Accession Nos.:****PKG ML18341A208****Summary ML18341A218****Notice ML18290A522****\*concurred via e-mail****NRC-001**

OFFICE	NRR/DLP/PLPB/PM	NRR/DLP/PLPB/BC	NRR/DLP/PLPB/PM
NAME	JGolla	DMorey	JGolla
DATE	1/7/2019	1/9/2019	1/9/2019

**OFFICIAL RECORD COPY**

**NRC CLOSED MEETING WITH**  
**GLOBAL NUCLEAR FUEL REGARDING ARMOR FUEL**

**OCTOBER 17, 2018**

**ATTENDEES LIST**

Myles Connor	GNF
Sarah DeSilva	GNF
Russ Fawcett	GNF
Michelle Catts	GEH
Patty McCumbee	GNF
Martin Swan	GNF
Yang-Pi Lin	GNF
Kent Halac	GNF
Andrew Proffitt	NRC
Mirela Gavrilas	NRC
Paul Clifford	NRC
Andy Hon	NRC
Michelle Bales	NRC
Louis Betancourt	NRC
Tae Ahn	NRC
Ian Porter	NRC
Bob Lukes	NRC
Dennis Morey	NRc
Scott Krepel	NRC
Jane Marshal	NRC
Joe Golla	NRC
Kevin Ledford*	GNF
Paul Cantonwine*	GNF

\*attended via phone

Enclosure