

ENCLOSURE 2

M190003

GE2000 SAR Amendment Meeting Presentation

Non-Proprietary Information

IMPORTANT NOTICE

This is a non-proprietary version of Enclosure 1 to M190003, which has the proprietary information removed. Portions of the document that have been removed are indicated by an open and closed bracket as shown here [[]].



HITACHI

NRC Meeting – Technical Approach for the GE Model No. 2000 Safety Analysis Report Amendment to Support Accident Tolerant Fuel

February 5, 2019

Non-Proprietary Information

Meeting Agenda

Non-Proprietary Discussion

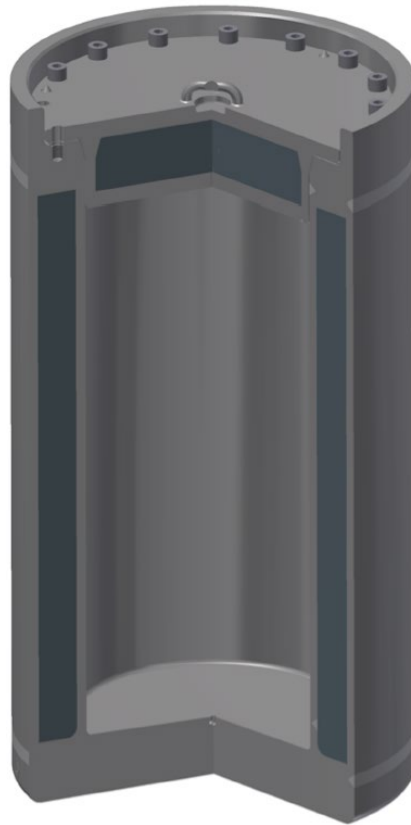
- Purpose
- History of the GE Model No. 2000 (GE2000) Safety Analysis Report (SAR)
- General Overview of the GE2000 SAR Amendment Strategy

Proprietary Discussion

- Chapter-by-Chapter Technical Approach for Amending the GE2000 SAR to Support the Accident Tolerant Fuel (ATF) Program, Including Technical Approach to Address the Previous NRC Requests for Additional Information (RAIs) for Irradiated Fuel Rods
- Planning and Timing for Next Meeting

Purpose

- To review the planned technical approach for amending the GE2000 SAR to allow for the transport of fueled IronClad and ARMOR ATF rods.



History of the GE2000 SAR

- November 22, 1989: NRC approves original GE2000 Certificate of Compliance (CoC) USA/9228/B(U)F-96 Rev. 0 [8912040124].
 - Issued to cover transportation of irradiated fuel rods, irradiated byproducts, and Special Nuclear Materials (SNM) up to 600 Watts (W).
- The GE2000 CoC was revised and approved several times for design improvements and new content. The CoC revisions were often separate supplements and not incorporated into a single cohesive SAR.
 - CoC Rev. 5, 1994: Additional content for Oak Ridge National Laboratory (ORNL) High Flux Isotope Reactor (HFIR) fuel assemblies [9403020085].
 - CoC Rev. 8, 1995: Upgraded the GE2000 cask to 2000 W for shipments of irradiated byproducts [9509200285].
 - CoC Rev. 10, 1996: Additional content for transportation of Material Test Reactor (MTR) assemblies from Idaho National Laboratory (INL) and Tower Shielding Reactor (TSR) fuel elements from ORNL [9607110303].
 - CoC Rev. 11, 1997: Additional content for TRIGA fuel elements [9711070108].



HITACHI

History of the GE2000 SAR Continued

- April 2016: GEH submits the consolidated GE2000 SAR NEDO-33866 Rev. 0 to the NRC [[ML16126A490](#) and [ML16126A499](#)].
 - Irradiated fuel rods were part of the content in NEDO-33866 Rev. 0 and previously approved under Rev. 26 of the CoC [[ML14245A208](#)].
 - Content in NEDO-33866 Rev. 0 was similar to the content previously approved in Rev. 26 of the CoC.
 - NEDO-33866 Rev. 0 was submitted as a single SAR to consolidate the four (4) unique GE2000 SARs.
 - NEDO-33866 Rev. 0 also included updates to the analysis methodology, qualified new GE2000 components, added Cobalt-60 isotope rod content, and increased the irradiated hardware/byproduct payload.
- August 2016: NRC issues RAIs for NEDO-33866 Rev. 0 to GEH [[ML16235A154](#)].

History of the GE2000 SAR Continued

- September 2017: GEH submits NEDO-33866 Rev. 1 and subsequent RAI Responses to the NRC [[ML17164A290](#)].
 - As part of the GEH RAI responses, irradiated fuel rods and SNM were removed from the approved content in NEDO-33866 Rev. 1 [[ML17272A721](#) and [ML17272A728](#)].
- January 2018: Per the NRC's request, GEH submits NEDO-33866 Rev. 2 to incorporate additional clarification and administrative changes [[ML18009723](#)].
- February 2018: Per the NRC's request, GEH submits NEDO-33866 Rev. 3 to incorporate minor administrative changes [[ML18058A112](#)].
- April 17, 2018: The NRC approves NEDO-33866 Rev. 3 and issues Rev. 27 of the CoC [[ML18102B446](#)].

General Overview of the GE2000 SAR Amendment

- A proposed GE2000 CoC mark-up for including irradiated fuel rods as an approved content will be provided as part of the amendment submittal.
- Irradiated fuel rods will be re-introduced as approved content by amendment to the GE2000 SAR (NEDO-33866 Rev. 3).
- The GE2000 SAR amendment will incorporate the irradiated fuel rod RAI responses.
- GEH will not re-submit formal responses to the RAIs for irradiated fuel rods.
- No cask or hardware modifications.
- A revision to NEDO-33866 Rev. 3 will not be submitted.

End of Public Session

Chapter 1 Amendment

- The legacy Chapter 1 RAI 1.1 is for SNM, and NEDO-33866 Rev. 3 will not be amended to address it.
- Amended to administratively reincorporate irradiated fuel rods as approved content.
- No drawing or cask description amendments.

[[

Chapter 2 Amendment

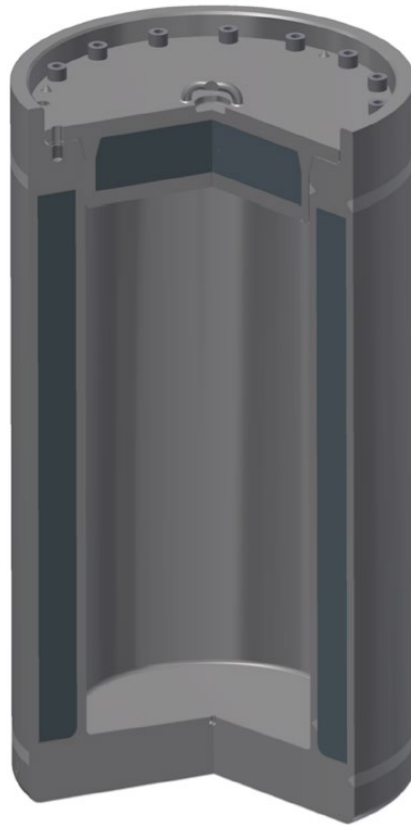
- No legacy RAIs for Chapter 2.
- No amendments to structural evaluation.
- No amendment to Chapter 2.
- Relevant background information from Chapter 2:
 - The Material Baskets are classified as a Type-B safety component.
 - The Material Basket will be required for transporting irradiated fuel rods and will be specified in other areas of the SAR amendment.
 - Rod Segment Holders are considered shoring and do not perform a safety function.

Chapter 3 Amendment

- No legacy RAIs for Chapter 3.
- Amended to administratively reinclude irradiated fuel rods as a contributor to package decay heat in Section 3.1.2.
- No new thermal analysis or amendments to the GE2000 thermal limit.
- Relevant background information from Chapter 3:
 - The GE2000 was designed for 3000 W of decay heat, but it is limited to 1500 W.
 - A decay heat of 3000 W was conservatively used for the thermal analysis.

Chapter 4 Amendment

- No legacy RAIs for Chapter 4.
- No changes to container containment boundary.
- No amendments to Chapter 4.



Chapter 5 Amendment

- Amended to address legacy RAIs 5.1, 5.2, and 5.6.
- Amended to include a shielding analysis for irradiated fuel rods.
- No amendment to the dose rate and thermal limits currently imposed in Chapter 5.
 - Dose rates are limited to 90% of the [10 CFR 71.47](#) and [10 CFR 71.51](#) regulatory limits.
 - Decay heat thermal limit is 1500 W.
- The Normal Condition of Transport (NCT) and Hypothetical Accident Condition (HAC) shielding evaluations will have similar source geometry assumptions for irradiated fuel rods as in NEDO-33866 Rev. 0.
 - NCT will assume a 10-inch line source.
 - HAC will assume a point source.

Chapter 5 Amendment – RAI 5.1

- RAI 5.1: *“Justify the gamma and neutron source term strength. Typical spent fuel source terms for gammas increase linearly with burnup and to the fourth power for neutrons as discussed in NUREG/CR-6802. [...] The applicant needs to justify this atypical source term strength increase with increasing burnup.”*
- Approach: Develop a new bounding source term for irradiated fuel rods.
 - The methodology will be different than the approach used in NEDO-33866 Rev. 0.
 - The source term will cover a range of U-235 enrichments for different exposures/burnups.
 - [[
]]
 - The source term will start with the maximum isotopes listed in ASTM C996 for Type-B UO₂ prior to irradiation (applies to the constituents in the fresh fuel at 0 GWD/MTU).

Chapter 5 Amendment – RAI 5.2

- RAI: 5.2: *“Discuss how fuel assemblies other than GE 10x10 meet both thermal and external dose rate regulations. Chapter 1 of the SAR does not limit what kind of irradiated fuel will be shipped. All decay heat and external dose rate evaluations are based on source terms from GE 10x10 fuel [...]”*
- Approach: The irradiated fuel rod source term will be exclusively limited to GE BWR fuel designs. ORIGEN-ARP accounts for BWR lattice physics and the cross-section libraries are based on BWR fuel.
 - Ensure this amendment clearly states that the content is limited to only GE BWR irradiated fuel rods.
 - This approach is to focus on the immediate ATF program needs.
 - ATF is considered a GE BWR fuel design.
 - ATF claddings (zirconium and IronClad) are considered irradiated hardware and are already covered under the current CoC.
 - Cladding is independent of the irradiated fuel rod source term.



Chapter 5 Amendment – RAI 5.6

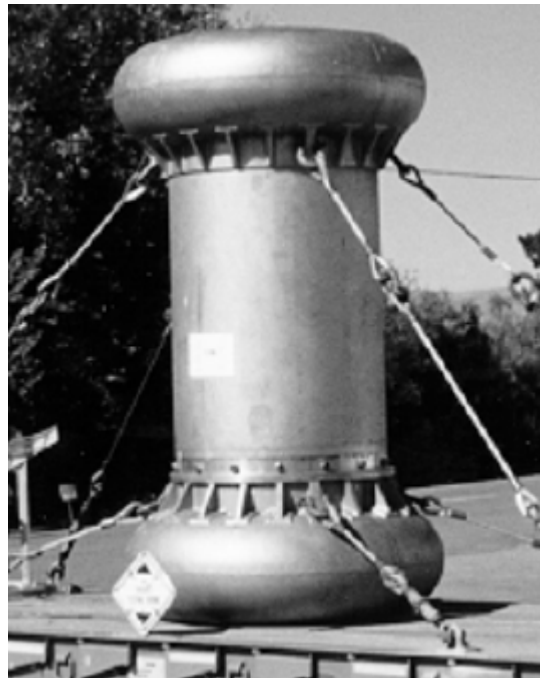
- RAI: 5.6: *"Justify that the irradiated fuel content will meet the package external dose rate regulatory limits considering the burnup profile. [...] The applicant needs to discuss how they account for the irradiated fuel burnup profile. [...] The applicant needs to discuss how fuel qualified for loading is classified [...]."*
- Approach: [[

]]
 - This approach will reduce human performance errors when filling out the loading tables in Chapter 7 and ensure public safety.



Chapter 6 Amendment

- Amended to address legacy RAI 6.2.
- Amended to reinclude the criticality analyses for irradiated fuel rods from NEDO-33866 Rev. 0.



Chapter 6 Amendment – RAI 6.2

- RAI: 6.2: *“Provide specifications for all rod types to be shipped by the GE-2000 package and demonstrate that the criticality safety analyses presented in the SAR bound all fuel types to be shipped. The applicant performed criticality safety analyses for the GE-2000 package containing irradiated fuel rod segments. [...] The applicant needs to provide specifications for all rod types to be shipped by the GE-2000 package [...].”*
- Approach: Irradiated fuel rods will be limited to only GE BWR fuel rods.
 - Reinclude the criticality analyses from NEDO-33866 Rev. 0.
 - Provide a table in the amendment that shows the general parameters of typical GE BWR fuel rods.
 - This will demonstrate that the criticality analyses performed bound the intended content and is consistent with other NRC approved packages (i.e. the RAJ-II [[ML18247A218](#)]).

Chapter 7 Amendment

- No legacy RAls for Chapter 7.
- Reininclude a loading table and procedure for the pre-shipment evaluation of irradiated fuel rods similar to those currently listed in Section 7.5 of NEDO-33866 Rev. 3.
- Remove the high-level operating procedures in Sections 7.1 through 7.4 from NEDO-33866 Rev. 3.
 - Key parameters like bolt torque values and decontamination requirements would remain from these subsections.
 - These generic operating procedures do not add value in the context of a SAR. They do not provide a safety benefit and/or demonstrate compliance to a NRC regulation. Therefore, these handling procedures should be removed as part of the GE2000 amendment.
 - The NEDO-33866 Rev. 3 operating procedures are superseded by GEH's more restrictive internal package handling procedures.



Chapter 8 Amendment

- No legacy RAIs for Chapter 8.
- Irradiated fuel rods do not impact acceptance testing or package maintenance.
- No amendment to Chapter 8.

[[

[[Planning and Timing for Next Meeting