



**UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001**

July 27, 2023

Mr. Daniel H. Dorman
Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

**SUBJECT: VOGTLE ELECTRIC GENERATING PLANT, UNITS 1 AND 2, USE
OF ACCIDENT TOLERANT FUEL LEAD TEST ASSEMBLIES**

Dear Mr. Dorman:

During the 707th meeting of the Advisory Committee on Reactor Safeguards, July 12-14, 2023, we completed our review of the Southern Nuclear Operating Company's (SNC) license amendment request (LAR) and associated exemption requests to load accident tolerant fuel (ATF) lead test assemblies (LTAs) at Vogtle Electric Generating Plant (Vogtle), Units 1 and 2. We also reviewed the Nuclear Regulatory Commission (NRC) staff safety evaluation (SE) report approving the loading of the LTAs and the associated exemptions. Our Fuels, Materials, and Structures subcommittee reviewed this topic on June 21, 2023. During these meetings, we had the benefit of discussions with the NRC staff and representatives from SNC. We also had the benefit of the referenced documents.

CONCLUSIONS AND RECOMMENDATION

1. Allowing SNC the use of four ATF LTAs (each with four higher enriched fuel rods) in Vogtle, Unit 2, will not adversely affect public safety.
2. Data obtained from these LTAs will inform future ATF and higher enrichment applications.
3. The SE report should be issued.

BACKGROUND

The Vogtle, Units 1 and 2, reactors each contain 193 fuel assemblies. Each assembly consisting of a matrix of Zircaloy, ZIRLO, or Optimized ZIRLO clad fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO₂) as fuel material, not to exceed 5 weight-percent (wt%) enrichment.

SNC, the licensee of Vogtle, Units 1 and 2, requests license exemptions, to allow loading four LTAs of Westinghouse PRIME Optimized Fuel Assembly designs, with each LTA containing:

- Up to 132 rods with Westinghouse ADOPT UO₂ pellets at a maximum of 5 wt% enrichment and chromium coated AXIOM cladding.
- Three rods with Westinghouse ADOPT UO₂ pellets at a maximum of 6 wt% enrichment and chromium coated AXIOM cladding.
- One rod with Westinghouse ADOPT UO₂ pellets at a maximum of 6 wt% enrichment and uncoated AXIOM cladding.

The remaining rods are standard fuel material in the Integral Fuel Burnable Absorber rods.

SNC has not requested an increase in the current licensing basis burnup limit of 60 GWd/MTU. The associated topical report for higher burnup (WCAP-18446) is currently under staff review. The licensee indicated they plan to request high burnup extension for Vogtle, Units 1 and 2.

To support the proposed loading of the ATF LTAs, the licensee has requested exemptions to Title 10 of the *Code of Federal Regulations* (CFR):

- 10 CFR 50.46 and 10 CFR Part 50, Appendix K, to allow the use of coated AXIOM cladding, and
- 10 CFR 50.68(b)(7) to allow enrichment greater than 5 wt% U-235.

SNC also requested technical specification (TS) changes that amend License Condition 2.D and TSs: (1) TS 3.7.18, "Fuel Assembly Storage in the Fuel Storage Pool," (2) TS 4.2.1, "Fuel Assemblies," and (3) TS 4.3, "Fuel Storage."

This LAR is the first request by a licensee to load fuel with increased enrichment and the complete set of Westinghouse ATF characteristics: advanced cladding, coated cladding, and doped fuel. The staff previously approved both ADOPT fuel pellets and AXIOM cladding. The staff review of Westinghouse chromium coating was informed by ATF-ISG-2020-1, which considered generic studies of chromium coating, including a phenomena identification and ranking table.

DISCUSSION

SNC has conducted a thorough and detailed analysis of the effect of the ATF LTAs, including the increased enrichment, on design basis accident and transient response, core source term, and radiological dose consequences. Results indicate there are negligible changes. Large and small break loss of coolant accident (LOCA) analyses demonstrate that 10 CFR 50.46 acceptance criteria will be met. Also, the loading of the LTAs will have minimal impact on the results of the non-LOCA analyses. The effect on core physics and thermal hydraulics analysis results is negligible.

Typically, LTAs are placed in non-limiting locations. Because the limiting transient is rod ejection, SNC will not place LTAs in rod-ejection limiting locations. Within this constraint, SNC has elected to put LTAs in higher power locations to accumulate burnup under more prototypic conditions.

With respect to the fuel characteristics, the chromium coating is expected to improve the enhanced performance of the AXIOM cladding, especially with respect to corrosion resistance and hydrogen pickup. However, the SNC analyses took no credit for the presence of the chromium coating. The effect of the doping, as described in detail in the approved topical report, is to result in an increase in fuel grain size with an accompanying decrease in fission gas release. The increase in fuel enrichment, as well as a small increase in fuel density due to the doping, will result in an increase in the quantity of fissile material resulting in a postulated increase in sensitivity to reactivity-initiated accidents. This will be an important consideration for full core applications of higher enriched ATF.

Last, analysis results demonstrate the effect of the LTAs in new fuel storage and spent fuel storage are minimal; however, the aforementioned exemption to 10 CFR 50.68 (b)(7) is still required.

SUMMARY

Allowing SNC the use of four ATF LTAs (each with four higher enriched fuel rods) in Vogtle, Unit 2, will not adversely affect public safety. Data obtained from these LTAs will inform future ATF and higher enrichment applications. The SE report should be issued.

No response to this letter is required.

Sincerely,



Signed by Rempe, Joy
on 07/27/23

Joy L. Rempe
Chairman

REFERENCES

1. Office of Nuclear Reactor Regulation, "Vogtle Electric Generating Plant, Units 1 and 2, Issuance of Amendments Nos. 220 And 203, Regarding Use Of Accident Tolerant Fuel Lead Test Assemblies (EPID L-2022-LLA-0097)" [includes Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment No. 220 to Renewed Facility Operating License NPF-68 and Amendment No. 203 to Renewed Facility Operating License NPF-81, Southern Nuclear Operating Company, Inc., Vogtle Electric Generating Plant, Units 1 and 2], Docket Nos. 50-424 and 50-425," June 2023 (Non-Public ML23093A028)
2. Southern Nuclear Operating Company, "Vogtle Electric Generating Plant, Units 1 and 2, License Amendment Request and Exemptions to Allow Use of Lead Test Assemblies for Accident-Tolerant Fuel," June 30, 2022 (Public ML22181B156, Non-Public ML22181B155)
3. Westinghouse, WCAP-18446-P/NP, Revision 0, "Incremental Extension of Burnup Limit for Westinghouse and Combustion Engineering Fuel Designs," December 2020 (Public ML20350B834, Non-Public ML20349A273)

4. Westinghouse, WCAP-18482-P/NP, Revision 0, " Westinghouse Advanced Doped Pellet Technology (ADOPT™) Fuel," May 2020, (Public ML20132A014, Non-Public ML22005A015)
5. Westinghouse, WCAP-18546-P/NP, "Westinghouse AXIOM® Cladding for Use in Pressurized Water Reactor Fuel," March 2021 (Public ML21090A113, Non-Public ML21090A112)
6. U.S. NRC, ATF-ISG-2020-01, "Supplemental Guidance Regarding the Chromium-Coated Zirconium Alloy Fuel Cladding Accident Tolerant Fuel Concept," January 2020 (ML19343A121)
7. Pacific Northwest National Laboratory, "Degradation and Failure Phenomena of Accident Tolerant Fuel Concepts: Chromium Coated Zirconium Alloy Cladding," June 2019 (ML19172A154)
8. Southern Nuclear Operating Company, "Vogtle Electric Generating Plant, Units 1 and 2, Response to NRC Requests for Information License Amendment Request and Exemptions to Allow Use of Lead Test Assemblies for Accident-Tolerant Fuel," September 13, 2022 (Public ML22256A198, Non-Public ML22256A197)
9. Southern Nuclear Operating Company, "Vogtle Electric Generating Plant, Units 1 and 2, Post-Audit Supplement to License Amendment Request and Exemptions to Allow Use of Lead Test Assemblies for Accident-Tolerant Fuel," January 20, 2023 (Public ML23020A148, Non-Public ML23020A147)
10. Southern Nuclear Operating Company, "Vogtle Electric Generating Plant, Units 1 and 2 License Amendment Request and Exemptions to Allow Use of Lead Test Assemblies for Accident-Tolerant Fuel," June 30, 2022 (Public ML22181B156, Non-Public ML22181B155)
11. Southern Nuclear Operating Company, "Vogtle Electric Generating Plant, Units 1 and 2 Supplement to License Amendment Request and Exemptions to Allow Use of Lead Test Assemblies for Accident-Tolerant Fuel," May 5, 2023 (ML23125A269)

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