**[7590-01-P]**

**NUCLEAR REGULATORY COMMISSION**

**[Docket Nos. 50-327 and 50-328; NRC-2021-0178]**

**Tennessee Valley Authority; Sequoyah Nuclear Plant, Units 1 and 2**

**AGENCY:** Nuclear Regulatory Commission.

**ACTION:** Exemption; issuance.

**SUMMARY:** The U.S. Nuclear Regulatory Commission (NRC) has issued an exemption in response to a September 23, 2020, request from the Tennessee Valley Authority to allow for the use of Optimized ZIRLO™ fuel rod cladding at Sequoyah Nuclear Plant, Units 1 and 2.

**DATES:** The exemption was issued on October 26, 2021.

**ADDRESSES:** Please refer to Docket ID **NRC-2021-0178** when contacting the NRC about the availability of information regarding this document. You may obtain publicly available information related to this document using any of the following methods:

- **Federal Rulemaking Website:** Go to https://www.regulations.gov and search for Docket ID **NRC-2021-0178**. Address questions about Docket IDs in Regulations.gov to Stacy Schumann; telephone: 301-415-0624; email: Stacy.Schumann@nrc.gov. For technical questions, contact the individual listed in the **FOR FURTHER INFORMATION CONTACT** section of this document.

- **NRC's Agencywide Documents Access and Management System (ADAMS):** You may obtain publicly available documents online in the ADAMS Public Documents collection at https://www.nrc.gov/reading-rm/adams.html. To begin the search, select "Begin Web-based ADAMS Search." For problems with ADAMS, contact the NRC's Public Document Room (PDR) reference staff at 1-800-397-4209, 301-415-4737, or by email to pdr.resource@nrc.gov. For the convenience of the reader, instructions about obtaining materials referenced in this document are provided in the "Availability of Documents" section.

- **Attention**: The PDR, where you may examine and order copies of public

documents, is currently closed. You may submit your request to the PDR via email at pdr.resource@nrc.gov or call 1-800-397-4209 or 301-415-4737, between 8:00 a.m. and 4:00 p.m. (ET), Monday through Friday, except Federal holidays.

**FOR FURTHER INFORMATION CONTACT:** Perry Buckberg, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; telephone: 301-415-1383, email: Perry.Buckberg@nrc.gov.

**SUPPLEMENTARY INFORMATION:** The text of the exemption is attached.

Dated: October 28, 2021.

For the Nuclear Regulatory Commission.

**Perry H. Buckberg,**
*Senior Project Manager, Plant Licensing Branch II-2,*
*Division of Operating Reactor Licensing,*
*Office of Nuclear Reactor Regulation.*

**Attachment –** Exemption

**NUCLEAR REGULATORY COMMISSION**

**Docket Nos. 50-327 and 50-328**

**Tennessee Valley Authority**

**Sequoyah Nuclear Plant, Units 1 and 2**

**Exemption**

## I. Background.

The Tennessee Valley Authority (TVA) is the holder of Renewed Facility Operating License Nos. DPR-77 and DPR-79, which authorize operation of Sequoyah Nuclear Plant, Units 1 and 2 (Sequoyah). The licenses provide, among other things, that the facilities are subject to all rules, regulations, and orders of the NRC now, or hereafter, in effect. The Sequoyah units are pressurized-water reactors located in Hamilton County, Tennessee, approximately 9.5 miles northeast of Chattanooga. TVA plans to use fuel rods with Optimized ZIRLO™ cladding. Optimized ZIRLO cladding was developed to provide enhanced corrosion resistance in more adverse in-reactor primary chemistry environments and at higher fuel duties with higher burnups.

## II. Request/Action.

By letter dated September 23, 2020, TVA requested an exemption from title 10 of the *Code of Federal Regulations* (10 CFR) section 50.46, "Acceptance criteria for emergency core cooling systems [ECCS] for light-water nuclear power reactors," and 10 CFR part 50, appendix K, "ECCS Evaluation Models," to allow the use of Optimized ZIRLO fuel rod cladding for future core reload applications. The regulations in 10 CFR 50.46 contain acceptance criteria for the ECCS for reactors fueled with zircaloy or ZIRLO® fuel rod cladding material. In addition, paragraph I.A.5 of 10 CFR part 50, appendix K, requires that the Baker-Just equation be used to predict the rates of energy release, hydrogen concentration, and cladding oxidation from the metal/water reaction.

The Baker-Just equation presumes the use of zircaloy or ZIRLO cladding material. Therefore, an exemption to 10 CFR 50.46 and 10 CFR part 50, appendix K, was requested to support the use of Optimized ZIRLO fuel rod cladding at Sequoyah.

The exemption request relates solely to the specific types of cladding material specified in these regulations for use in light-water reactors (i.e., fuel rods with zircaloy or ZIRLO cladding). This request will provide for the application of the acceptance criteria of 10 CFR 50.46 and 10 CFR part 50, appendix K, to fuel assembly designs using Optimized ZIRLO fuel rod cladding.

**III. Discussion.**

Pursuant to 10 CFR 50.12, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR part 50 when: 1) the exemptions are authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security; and 2) when special circumstances are present. Under 10 CFR 50.12(a)(2), special circumstances include, among other things, when application of the specific regulation in the particular circumstance would not serve, or is not necessary to achieve, the underlying purpose of the rule.

The Optimized ZIRLO fuel cladding is different from standard ZIRLO in two respects: 1) the tin content is lower and 2) the microstructure is different. This difference in tin content and microstructure can lead to differences in some material properties. Westinghouse Electric Company (Westinghouse), the manufacturer of Optimized ZIRLO fuel rod cladding, has provided irradiated data and validate fuel performance models ahead of burnups achieved in batch application (i.e., a group of fuel assemblies).

The NRC staff's safety evaluation dated June 10, 2005, related to Optimized ZIRLO, which is included as Addendum 1 of Westinghouse topical report WCAP-12610-P-A & CENPD-404-P-A, included ten conditions and limitations. The NRC staff reviewed TVA’s exemption request found in enclosure 5 of TVA’s letter dated September 23,

2020, and enclosure 1, attachment 8 of the same letter, which addresses the licensee's compliance with each of the ten conditions and limitations. Based on its review, the NRC staff determined that the licensee satisfied all applicable conditions and limitations. The NRC staff evaluation of how the licensee addressed each of the ten conditions and limitations may be found in Section 3.8.10 of the staff Safety Evaluation related to Amendment Nos. 356 and 349 to Renewed Facility Operating License Nos. DPR-77 and DPR-79 for Sequoyah, dated October 26, 2021, which authorizes the transition to Westinghouse RFA-2 fuel.

**A. The Exemption is Authorized by Law.**

This exemption would allow the use of Optimized ZIRLO fuel rod cladding material at Sequoyah. As stated above, 10 CFR 50.12 allows the NRC to grant exemptions from the requirements of 10 CFR part 50, provided, among other things, it finds that special circumstances are present. As described here and in the sections below, the NRC staff makes the requisite exemption findings. The fuel that will be irradiated at Sequoyah contains cladding material that differs from the cladding material that is explicitly defined in 10 CFR 50.46 and implicitly defined in 10 CFR part 50, appendix K. However, the criteria of these regulations will continue to be satisfied for the operation of the Sequoyah cores containing Optimized ZIRLO fuel cladding. The NRC staff has determined that granting the licensee's proposed exemption would not result in a violation of the Atomic Energy Act of 1954, as amended, other laws, or the Commission's regulations. Therefore, the exemption is authorized by law.

**B. The Exemption Presents no Undue Risk to Public Health and Safety.**

The NRC-approved Optimized ZIRLO topical report, WCAP-12610-P-A & CENPD-404-P-A, Addendum 1-A, has demonstrated that predicted chemical, thermal, and mechanical characteristics of the Optimized ZIRLO-alloy cladding are bounded by those approved for ZIRLO under anticipated operational occurrences and postulated accidents. The report demonstrates an acceptable retention of post-quench ductility up to 2200 degrees Fahrenheit and oxidation of not more than 17 percent cladding

thickness within 10 CFR 50.46 limits. Reload cores are required to be operated in accordance with the operating limits specified in the TSs and core operating limits report. Thus, the granting of this exemption request will not pose an undue risk to public health and safety.

**C. The Exemption is Consistent with the Common Defense and Security.**

The exemption request would allow the licensee to use an improved fuel rod cladding material. In its letter dated September 23, 2020, the licensee stated that all the requirements and acceptance criteria will be maintained. Therefore, the use of Optimized ZIRLO-clad fuel rods will not adversely affect plant operations. Further, the licensee is required to handle and control special nuclear material in these assemblies in accordance with its approved procedures. Therefore, the NRC staff determined that this exemption does not adversely impact common defense and security.

**D. Special Circumstances.**

Special circumstances, in accordance with § 50.12(a)(2)(ii), are present whenever application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule. The underlying purposes of 10 CFR 50.46 and 10 CFR part 50, appendix K, are to establish acceptance criteria for ECCS performance. The underlying purpose of the rule to maintain post-quench ductility in the fuel cladding material through ECCS performance criteria, and to ensure that analyses of fuel response are conservatively calculated, will continue to be achieved through the application of 10 CFR 50.46 and 10 part 50, appendix K, to the new cladding. The regulations ensure that nuclear power reactors fueled with uranium oxide pellets within zircaloy or ZIRLO cladding must be provided with an ECCS designed to provide core cooling following postulated loss-of-coolant accidents. Westinghouse demonstrated in its NRC-approved topical report WCAP-12610-P-A & CENPD-404-P-A Addendum 1-A that ECCS effectiveness will not be adversely affected by a change from zircaloy or ZIRLO clad fuel to Optimized ZIRLO clad fuel. The Westinghouse analysis also demonstrated that the ECCS acceptance criteria applied to reactors with fuel in zircaloy

or ZIRLO fuel rod cladding are also applicable to reactors fueled with Optimized ZIRLO clad fuel. Normal safety analyses performed prior to core reload will confirm that there is no adverse impact on ECCS performance. Therefore, because the underlying purposes of 10 CFR 50.46 and 10 CFR part 50, appendix K, are achieved through the use of Optimized ZIRLO fuel rod cladding material, the special circumstances required by 10 CFR 50.12(a)(2)(ii) for the granting of an exemption exist.

**E. Environmental Considerations.**

In 10 CFR 51.22, the Commission determined that certain NRC actions are eligible for categorical exclusion from the requirement to prepare an environmental assessment or an environmental impact statement because each action category does not individually or cumulatively have a significant effect on the human environment.

The NRC staff determined that the exemption discussed herein meets the eligibility criteria for the categorical exclusion set forth in 10 CFR 51.22(c)(9) because it is related to a requirement concerning the installation or use of a facility component located within the restricted area, as defined in 10 CFR part 20, and the granting of this exemption involves: 1) no significant hazards consideration [NSHC], 2) no significant change in the types or a significant increase in the amounts of any effluents that may be released offsite, and 3) no significant increase in individual or cumulative occupational radiation exposure. Therefore, in accordance with § 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the NRC staff's consideration of this exemption request. The basis for the NRC staff's determination is in the licensee’s discussion of the 10 CFR § 51.22(c)(9) criteria in the associated LAR noticed in the *Federal Register* on December 1, 2020 (85 FR 77265). In addition, because Optimized ZIRLO cladding has essentially the same material properties and performance characteristics, and is adequately controlled by 10 CFR 50.46 and 10 CFR part 50, appendix K.I.A.5, the use of Optimized ZIRLO will not significantly increase the types or amounts of effluents that may be released offsite, significantly increase individual occupational radiation exposure, or significantly increase

cumulative occupational radiation exposure. Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the NRC staff's consideration of this exemption request.

## IV. Availability of Documents.

The documents identified in the following table are available to interested persons through one or more of the following methods, as indicated.

| DOCUMENT | ADAMS ACCESSION NO. |
|---|---|
| TVA, "Application to Modify the Sequoyah Nuclear Plant Units 1 and 2 Technical Specification to Allow for Transition to Westinghouse RFA-2 Fuel (SQN-TS-20-09)" (September 23, 2020) | ML20267A617 |
| Westinghouse, "Final Safety Evaluation for Addendum 1 to Topical Report WCAP-12610-P-A & CENPD-404-P-A Addendum 1-A, 'Optimized ZIRLO'" (June 10, 2005) | ML051670395 |
| NRC Safety Evaluation related to Amendment Nos. 356 and 349 to Renewed Facility Operating License Nos. DPR-77 and DPR-79 for Tennessee Valley Authority Sequoyah Nuclear Plant, Units 1 and 2, Docket Nos. 50 327 And 50 328 (October 26, 2021) | ML21245A267 |

## V. Conclusions.

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12, the exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. Also, special circumstances are present. Therefore, the Commission hereby grants TVA an exemption from 10 CFR 50.46 and 10 CFR part 50, appendix K paragraph I.A.5, to allow for the use of Optimized ZIRLO fuel rod cladding material at Sequoyah.

Dated this 26 day of October, 2021

For the Nuclear Regulatory Commission.

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Bo M. Pham, Director,
Division of Operating Reactor Licensing,
Office of Nuclear Reactor Regulation

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