

NUCLEAR REGULATORY COMMISSION

[Docket Nos. 50-348, 50-364, 50-424, and 50-425; NRC-2016-0169]

Southern Nuclear Operating Company;

Farley Nuclear Plant, Units 1 and 2, and Vogtle Electric Generating Plant, Units 1 and 2;

Use of Optimized ZIRLO™ Fuel Rod Cladding Material

AGENCY: Nuclear Regulatory Commission.

ACTION: Exemption; issuance.

SUMMARY: The U.S. Nuclear Regulatory Commission (NRC) is issuing an exemption in response to a March 16, 2016, request from Southern Nuclear Operating Company (SNC or the licensee) in order to use Optimized ZIRLO™ fuel rod cladding material at the Farley Nuclear Plant (FNP), Units 1 and 2, and the Vogtle Electric Generating Plant (VEGP), Units 1 and 2.

DATES: The exemption was issued on August 4, 2016.

ADDRESSES: Please refer to Docket ID **NRC-2016-0169** 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 Web Site:** Go to <http://www.regulations.gov> and search for Docket ID **NRC-2016-0169**. Address questions about NRC dockets to Carol Gallagher; telephone: 301-415-3463; e-mail: Carol.Gallagher@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 <http://www.nrc.gov/reading-rm/adams.html>. To begin the search, select “[ADAMS Public Documents](#)” and then select “[Begin Web-based ADAMS Search](#).” For problems with ADAMS, please contact the NRC’s Public Document Room (PDR) reference staff at 1-800-397-4209, 301-415-4737, or by e-mail to pdr.resource@nrc.gov. The ADAMS accession number for each document referenced (if that document is available in ADAMS) is provided the first time that a document is referenced.

- **NRC’s PDR:** You may examine and purchase copies of public documents at the NRC’s PDR, Room O1-F21, One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852.

FOR FURTHER INFORMATION CONTACT: Robert Martin, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington DC 20555-0001; telephone: 301-415-1493, e-mail: Robert.Martin@nrc.gov.

SUPPLEMENTARY INFORMATION:

I. Background

Southern Nuclear Operating Company is the holder of Renewed Facility Operating License Nos. NPF-2, NPF-8, NPF-68, and NPF-81, which authorize operation of FNP, Units 1 and 2, and VEGP, Units 1 and 2, respectively. The licenses provide, among other things, that each facility is subject to all rules, regulations, and orders of the NRC now or hereafter in effect.

The FNP and VEGP units are pressurized-water reactors located in Houston County, Alabama, and Burke County, Georgia, respectively.

II. Request/Action

Pursuant to § 50.12 title 10 of the *Code of Federal Regulations* (10 CFR), “Specific exemptions,” the licensee has requested by letter dated March 16, 2016 (ADAMS Accession No. ML16076A217), an exemption from 10 CFR 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 fuel rods clad with Optimized ZIRLO™. The regulations in 10 CFR 50.46(a) require that the calculated cooling performance following postulated loss-of-coolant accidents (LOCAs) at reactors fueled with zircaloy or ZIRLO® cladding conforms to the criteria set forth in 10 CFR 50.46(b). In addition, 10 CFR part 50, appendix K, requires, in part, that the Baker-Just equation be used to predict the rates of energy release, hydrogen generation, and cladding oxidation from the metal/water reaction. The Baker-Just equation assumes the use of zircaloy materials that have different chemical compositions from Optimized ZIRLO™. As written, these regulations presume only the use of zircaloy or ZIRLO® fuel rod cladding and do not contain provisions for use of fuel rods with other cladding materials. Therefore, an exemption from the requirements of 10 CFR 50.46 and 10 CFR part 50, appendix K, is needed to support the use of a different fuel rod cladding material. Accordingly, the licensee requested an exemption to allow the use of Optimized ZIRLO™ fuel rod cladding at FNP and VEGP.

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 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. However, 10 CFR 50.12(a)(2) states that the Commission will not consider granting an exemption unless special circumstances are present as set forth in 10 CFR 50.12(a)(2). Under 10 CFR 50.12(a)(2)(ii), special circumstances are present when application of the regulation in the particular circumstances would not serve, or is not necessary to achieve, the underlying purpose of the rule.

A. Special Circumstances

Special circumstances, in accordance with 10 CFR 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 purpose of 10 CFR 50.46 and 10 CFR part 50, appendix K, is to establish acceptance criteria for ECCS performance to provide reassurance of safety in the event of a LOCA. Although the wording of the regulations in 10 CFR 50.46 and 10 CFR part 50, appendix K, is not expressly applicable to Optimized ZIRLO™, the evaluations described in the following sections of this exemption show that the purpose of the regulations is met by this exemption in that subject to certain conditions, the acceptance criteria are valid for Optimized ZIRLO™ fuel cladding material, Optimized ZIRLO™ would maintain better post-quench ductility, and the Baker-Just equation conservatively bounds LOCA scenario metal-water reaction rates and is applicable to Optimized ZIRLO™. Because the underlying purposes

of 10 CFR 50.46 and 10 CFR part 50, appendix K, can be achieved through the application of these requirements to 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.

B. Authorized by Law

This exemption would allow the use of fuel rods clad with Optimized ZIRLO™ in future core reload applications for FNP and VEGP. The regulations in 10 CFR 50.12 allow the NRC to grant exemptions from the requirements of 10 CFR part 50 provided that the exemptions are authorized by law. The NRC staff determined that special circumstances exist to grant the proposed exemption and that granting the exemption would not result in a violation of the Atomic Energy Act of 1954, as amended. Therefore, the exemption is authorized by law.

C. No Undue Risk to Public Health and Safety

The provisions of 10 CFR 50.46 establish acceptance criteria for ECCS performance. Westinghouse Electric Company, LLC (Westinghouse), Topical Report “WCAP-12610-P-A & CENPD-404-P-A, Addendum 1-A, “Optimized ZIRLO™,”” dated July 2006, contain the justification to use Optimized ZIRLO™ fuel rod cladding material, in addition to Zircaloy-4 and ZIRLO®. The complete topical report is not publicly available because it contains proprietary information; however, a redacted version and the NRC safety evaluation are available in ADAMS under Accession No. ML062080569. The NRC staff found that the Westinghouse topical report demonstrates the applicability of the ECCS acceptance criteria to Optimized ZIRLO™, subject to the compliance with the specific conditions of approval established therein. The NRC staff reviewed the March 16, 2016, application against these specific conditions and concluded that the licensee is in compliance with all of the applicable conditions. The NRC

staff's review of these specific conditions for FNP and VEGP can be found in ADAMS under Accession No. ML16179A386.

Ring compression tests performed by Westinghouse on Optimized ZIRLO™ were reviewed and approved by the NRC staff in Topical Report WCAP-14342-A & CENPD-404-NP-A, Addendum 1-A, and demonstrate an acceptable retention of post-quench ductility up to the 10 CFR 50.46 limits of 2,200 degrees Fahrenheit and 17 percent equivalent clad reacted. Furthermore, the NRC staff has concluded that oxidation measurements provided by Westinghouse illustrate that oxide thickness (and associated hydrogen pickup) for Optimized ZIRLO™ at any given burnup would be less than that for both zircaloy and ZIRLO® (ADAMS Package Accession No. ML073130555). Hence, the NRC staff concludes that Optimized ZIRLO™ would be expected to maintain acceptable post-quench ductility.

The provisions of 10 CFR part 50, appendix K, paragraph I.A.5, "Metal-Water Reaction Rate," serve to ensure that cladding oxidation and hydrogen generation are limited appropriately during a LOCA and are conservatively accounted for in the ECCS evaluation model. That regulation requires that the Baker-Just equation be used in the ECCS evaluation model to determine the rate of energy release, cladding oxidation, and hydrogen generation. Since the use of the Baker-Just equation presumes the use of zircaloy-clad fuel, strict application of the rule would not permit use of the equation for Optimized ZIRLO™ cladding for determining acceptable fuel performance. As concluded in the NRC staff's safety evaluation for the associated topical report, Westinghouse demonstrated that the Baker-Just model is conservative in all post-LOCA scenarios with respect to the use of the Optimized ZIRLO™ as a fuel cladding material.

The NRC-approved topical report 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. Reload cores are required to be operated in accordance with the operating limits specified in the technical specifications (TSs) and the core operating limits report.

Based on the above, no new accident precursors are created by using Optimized ZIRLO™; therefore, the probability of postulated accidents is not increased. Also, based on the above, the consequences of postulated accidents are not increased. Therefore, there is no undue risk to public health and safety due to using Optimized ZIRLO™.

D. Consistent with Common Defense and Security

The proposed exemption would allow the use of Optimized ZIRLO™ fuel rod cladding material at FNP and VEGP. This change to the plant configuration is adequately controlled by TS requirements and is not related to security issues. Because the common defense and security is not impacted by this exemption, the exemption is consistent with the common defense and security.

E. Environmental Considerations

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 issuance of this exemption involves: (i) no significant hazards consideration, (ii) no significant change in the types or a significant increase in the amounts of any effluents that may be released offsite, and (iii) no significant increase in individual or cumulative occupational radiation exposure. Therefore, in accordance with 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in

connection with the NRC's consideration of this exemption request. The basis for the NRC staff's determination is discussed as follows, with an evaluation against each of the requirements in 10 CFR 51.22(c)(9)(i)-(iii).

Requirements in 10 CFR 51.22(c)(9)(i)

The NRC staff evaluated whether the exemption involves no significant hazards consideration using the standards described in 10 CFR 50.92(c), as presented below:

1. Does the proposed exemption involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No.

The proposed change would allow the use of Optimized ZIRLO™ clad nuclear fuel in the reactors. The NRC approved Topical Report WCAP-12610- P-A & CENPD-404-P-A, Addendum 1-A, "Optimized ZIRLO™," prepared by Westinghouse, addresses Optimized ZIRLO™ and demonstrates that Optimized ZIRLO™ has essentially the same properties as currently licensed ZIRLO®. The fuel cladding itself is not an accident initiator and does not affect accident probability. Use of Optimized ZIRLO™ fuel cladding has been shown to meet all 10 CFR 50.46 acceptance criteria and, therefore, will not increase the consequences of an accident.

Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed exemption create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No.

Use of Optimized ZIRLO™ clad fuel will not result in changes in the operation or configuration of the facility. Topical Report WCAP-12610-P-A & CENPD-404-P-A demonstrate that the material properties of Optimized ZIRLO™ are similar to those of ZIRLO®. Therefore, Optimized ZIRLO™ fuel rod cladding will perform similarly to those fabricated from ZIRLO®, and, therefore, precludes the possibility of the fuel becoming an accident initiator and causing a new or different type of accident.

Therefore, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the proposed exemption involve a significant reduction in a margin of safety?

Response: No.

The proposed change will not involve a significant reduction in the margin of safety because it has been demonstrated that the material properties of Optimized ZIRLO™ are not significantly different from those of ZIRLO®. Optimized ZIRLO™ is expected to perform similarly to ZIRLO® for all normal operating and accident scenarios, including both LOCA and non-LOCA scenarios. For LOCA scenarios, plant-specific evaluations have been performed, which allow the use of fuel assemblies with fuel rods containing Optimized ZIRLO™. These LOCA evaluations address the NRC safety evaluation report conditions and limitations for Optimized ZIRLO™ fuel rod cladding and provide continued compliance with the acceptance criteria of 10 CFR 50.46.

Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, the NRC staff concludes that the proposed exemption involves no significant hazards consideration. Accordingly, the requirements of 10 CFR 51.22(c)(9)(i) are met.

Requirements in 10 CFR 51.22(c)(9)(ii)

The proposed exemption would allow the use of Optimized ZIRLO™ fuel rod cladding material in the reactors. Optimized ZIRLO™ has essentially the same material properties and performance characteristics as the currently licensed ZIRLO® cladding. Therefore, the use of Optimized ZIRLO™ fuel rod cladding material will not significantly change the types of effluents that may be released offsite or significantly increase the amount of effluents that may be released offsite. Therefore, the requirements of 10 CFR 51.22(c)(9)(ii) are met.

Requirements in 10 CFR 51.22(c)(9)(iii)

The proposed exemption would allow the use of Optimized ZIRLO™ fuel rod cladding material in the reactors. Optimized ZIRLO™ has essentially the same material properties and performance characteristics as the currently licensed ZIRLO® cladding. Therefore, the use of Optimized ZIRLO™ fuel rod cladding material will not significantly increase individual occupational radiation exposure or significantly increase cumulative occupational radiation exposure. Therefore, the requirements of 10 CFR 51.22(c)(9)(iii) are met.

Conclusion

Based on the above, the NRC staff concludes that the proposed exemption meets the eligibility criteria for the categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, in accordance with 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the NRC's proposed issuance of this exemption.

IV. Conclusions

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12(a), the exemption is authorized by law, will not present an undue risk to the public health and safety, is consistent with the common defense and security, and that special circumstances are present to warrant issuance of the exemption. Therefore, the Commission hereby grants SNC an exemption from the requirements of 10 CFR 50.46 and 10 CFR part 50, appendix K, paragraph I.A.5, to allow the application of these criteria to, and the use of, Optimized ZIRLO™ fuel rod cladding material at FNP and VEGP.

Dated at Rockville, Maryland, this 4th day of August 2016.

For the Nuclear Regulatory Commission.

/RA/

Anne T. Boland, Director,
Division of Operating Reactor Licensing,
Office of Nuclear Reactor Regulation.