

NUCLEAR REGULATORY COMMISSION
SOUTH CAROLINA ELECTRIC AND GAS COMPANY
VIRGIL C. SUMMER NUCLEAR STATION, UNIT 1
DOCKET NO 50-395
EXEMPTION
[NRC-2010-0077]

1.0 BACKGROUND

The South Carolina Electric and Gas Company (SCE&G, the licensee) is the holder of Facility Operating License No. NPF-12 which authorizes operation of the Virgil C. Summer Nuclear Station, Unit 1 (VCSNS). The license provides, among other things, that the facility is subject to all rules, regulations, and orders of the Nuclear Regulatory Commission (NRC, the Commission) now or hereafter in effect.

The facility consists of a pressurized-water reactor located in Fairfield County in South Carolina.

2.0 REQUEST/ACTION

Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," requires, among other items, that:

Each boiling or pressurized light-water nuclear power reactor fueled with uranium oxide pellets within cylindrical zircaloy or ZIRLO cladding must be provided with an emergency core cooling system (ECCS) that must be designed so that its

calculated cooling performance following postulated loss-of-coolant accidents [LOCAs] conforms to the criteria set forth in paragraph (b) of this section.

Appendix K to 10 CFR Part 50, "ECCS Evaluation Models," requires, among other items, that the rate of energy release, hydrogen generation, and cladding oxidation from the metal/water reaction shall be calculated using the Baker-Just equation. The regulations of 10 CFR 50.46 and 10 CFR Part 50, Appendix K, make no provision for use of fuel rods clad in a material other than zircaloy or ZIRLO™. Since the chemical composition of the Optimized ZIRLO™ alloy differs from the specifications for zircaloy or ZIRLO™, a plant-specific exemption is required to allow the use of the Optimized ZIRLO™ alloy as a cladding material at VCSNS. Therefore, by letter dated June 9, 2009, the licensee requested an exemption that would allow the use of Optimized ZIRLO™ fuel rod cladding at VCSNS.

3.0 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 and safety, and are consistent with the common defense and security; and (2) when special circumstances are present.

Authorized by Law

This exemption results in allowing the use of Optimized ZIRLO™ fuel rod cladding material at the VCSNS. As stated above, 10 CFR 50.12 allows the NRC to grant exemptions from the requirements of 10 CFR Part 50. The NRC staff has determined that granting of the licensee's proposed exemption will not result in a violation of the Atomic Energy Act of 1954, as amended, or the Commission's regulations. Therefore, the exemption is authorized by law.

No Undue Risk to Public Health and Safety

The underlying purpose of 10 CFR 50.46 is to establish acceptance criteria for adequate ECCS performance. By letter dated June 10, 2005, the NRC staff issued a safety evaluation (Addendum 1 SE) approving Addendum 1 to Westinghouse Topical Report WCAP-12610-P-A and CENPD-404-P-A, "Optimized ZIRLO™" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML051670408), wherein the NRC staff approved the use of Optimized ZIRLO™ as a fuel cladding material. The NRC staff approved the use of Optimized ZIRLO™ as a fuel cladding material based on: 1) similarities with standard ZIRLO™, 2) demonstrated material performance, and 3) a commitment to provide irradiated data and validate fuel performance models ahead of burnups achieved in batch application. The NRC staff's safety evaluation for Optimized ZIRLO™ includes 10 conditions and limitations for its use.

As previously documented in that safety evaluation, and subject to compliance with the specific conditions of approval established therein, the NRC staff finds that the applicability of the ECCS acceptance criteria to Optimized ZIRLO™ has been demonstrated by Westinghouse. Ring compression tests performed by Westinghouse on Optimized ZIRLO™ (documented in Appendix B of Addendum 1-A to WCAP-12610-P-A and CENPD-404-P-A, "Optimized ZIRLO™," July 2006, ADAMS Accession No. ML062080576) demonstrate an acceptable retention of post-quench ductility up to 10 CFR 50.46 limits of 2200 degrees Fahrenheit (°F) and 17 percent equivalent clad reacted (ECR). Furthermore, the NRC staff concludes that oxidation measurements provided by Westinghouse in a letter to the NRC, "SER [Safety Evaluation Report] Compliance with WCAP-12610-P-A & CENPD-404-P-A Addendum 1-A 'Optimized ZIRLO™' (Proprietary)," LTR-NRC-07-58, November 2007, ADAMS Accession No. ML073130562) illustrate that oxide thickness (and associated hydrogen pickup) for Optimized ZIRLO™ at any given burnup would be less than for both zircaloy-4 and ZIRLO™. Hence, the NRC staff concludes that Optimized ZIRLO™ would be expected to maintain better

post-quench ductility than ZIRLO™. This finding is further supported by an ongoing loss-of-coolant accident (LOCA) research program at Argonne National Laboratory, which has identified a strong correlation between cladding hydrogen content (due to in-service corrosion) and post-quench ductility.

In addition, utilizing currently-approved LOCA models and methods, the licensee states that Westinghouse will perform an evaluation to ensure that the Optimized ZIRLO™ fuel rods continue to satisfy 10 CFR 50.46 acceptance criteria. For the reasons stated above, the NRC staff finds that granting the exemption request for the VCSNS will be consistent with the underlying purpose of the regulation.

Paragraph I.A.5 of Appendix K to 10 CFR Part 50 states that the rates of energy release, hydrogen concentration, and cladding oxidation from the metal-water reaction shall be calculated using the Baker-Just equation. Since 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. However, the NRC staff has found that metal-water reaction tests performed by Westinghouse on Optimized ZIRLO™ (documented in Appendix B of WCAP-12610-P-A and CENPD-404-P-A, Addendum 1-A and subject to compliance with the specific conditions of approval established therein) demonstrate conservative reaction rates relative to the Baker-Just equation. Thus, the NRC staff finds that the use of Optimized ZIRLO™ will achieve the underlying purpose of paragraph I.A.5 of Appendix K in this circumstance.

Based on the above, no new accident precursors are created by using Optimized ZIRLO™, thus, the probability of postulated accidents is not increased. Also, based on the above, the consequences of postulated accidents are not increased. In addition, the licensee will use NRC-approved methods for the reload design process for VCSNS reloads with

Optimized ZIRLO™. Therefore, there is no undue risk to public health and safety due to using Optimized ZIRLO™.

Consistent with Common Defense and Security

This exemption results in allowing the use of Optimized ZIRLO™ fuel rod cladding material at the VCSNS. This change to the plant core configuration has no relation to security issues. Therefore, the common defense and security is not impacted by this exemption.

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 Appendix K to 10 CFR Part 50 is to establish acceptance criteria for ECCS performance. Therefore, since the underlying purposes of 10 CFR 50.46 and 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 granting of an exemption from 10 CFR 50.46 and Appendix K exist.

4.0 CONCLUSION

The NRC staff has reviewed the licensee's request to use Optimized ZIRLO™ for fuel rod cladding material. Based on the NRC staff's evaluation as set forth above, the NRC staff concludes 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, and is consistent with the common defense and security. Also, special circumstances are present. Therefore, the Commission hereby grants SCE&G an exemption from the requirements of 10 CFR 50.46 and Appendix K to 10 CFR Part 50, to allow the use of Optimized ZIRLO™ up to a burnup of 62 GWd/MTU for the VCSNS.

Pursuant to 10 CFR 51.32, the Commission has determined that the granting of this exemption will not have a significant impact on the quality of the human environment as published in the *Federal Register* on March 3, 2010 (75 FR 9619). This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 8th day of March 2010.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

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