

March 11, 2008

Vice President, Operations
Entergy Operations, Inc.
Waterford Steam Electric Station, Unit 3
17265 River Road
Killona, LA 70057-3093

SUBJECT: WATERFORD STEAM ELECTRIC STATION, UNIT 3 - EXEMPTION FROM SPECIFIC REQUIREMENTS IN 10 CFR 50.46 AND FROM APPENDIX K TO 10 CFR PART 50, TO ALLOW THE USE OF OPTIMIZED ZIRLO™ FUEL ROD CLADDING MATERIAL (TAC NO. MD5426)

Dear Sir or Madam:

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.12, the Commission has granted an exemption from specific requirements to the cladding material specified in 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," and from Appendix K to 10 CFR Part 50, "ECCS Evaluation Models" to allow the use of Optimized ZIRLO™ fuel rod cladding material in future core reload applications for the Waterford Steam Electric Station, Unit 3. This action is in response to your letter dated April 24, 2007.

A copy of the exemption has been forwarded to the Office of the Federal Register for publication.

Your amendment request, which proposes to revise the Technical Specifications, is being reviewed and will be addressed separately from this exemption request, which, as noted above, is granted in the document included with this letter.

Sincerely,

/RA/

N. Kalyanam, Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-382

Enclosure:
Exemption

cc w/encl: See next page

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Waterford Steam Electric Station, Unit 3

(2/25/08)

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ENERGY OPERATIONS, INC.
WATERFORD STEAM ELECTRIC STATION, UNIT 3
DOCKET NO. 50-382
EXEMPTION

1.0 BACKGROUND

Entergy Operations, Inc. (the licensee), is the holder of Facility Operating License No. NPF-38, which authorizes operation of the Waterford Steam Electric Station, Unit 3 (Waterford 3). The license provides, among other things, that the facility is subject to all rules, regulations, and orders of the U.S. Nuclear Regulatory Commission (NRC, the Commission) now or hereafter in effect.

The facility consists of one pressurized-water reactor located in St. Charles Parish, Louisiana.

2.0 REQUEST/ACTION

Title 10 of the *Code of Federal Regulations* (10 CFR), Paragraph 50.46 (a)(1)(i), "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," states:

"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 conforms to the criteria set forth in paragraph (b) of this section.”

Paragraph I.A.5 of Appendix K to 10 CFR Part 50 states:

“Metal--Water Reaction Rate. The rate of energy release, hydrogen generation, and cladding oxidation from the metal/water reaction shall be calculated using the Baker-Just equation (Baker, L., Just, L.C., “Studies of Metal Water Reactions at High Temperatures, III. Experimental and Theoretical Studies of the Zirconium-Water Reaction,” ANL-6548, page 7, May 1962).”

The April 24, 2007, exemption request relates to the specific types of cladding material specified in the regulations. As written, the regulations presume the use of zircaloy or ZIRLO™ fuel rod cladding. Also, 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. Thus, exemptions from the specific requirements of 10 CFR 50.46 and Appendix K to 10 CFR Part 50 are needed to allow a cladding alloy other than zircaloy or ZIRLO™.

Accordingly, this exemption would result in changes to the plant by allowing only the use of an alternative cladding alloy other than zircaloy or ZIRLO™ in lieu of meeting the specific cladding requirements of 10 CFR 50.46 and Appendix K to 10 CFR Part 50. Specifically, the exemption would allow the use of Optimized ZIRLO™ cladding. All other requirements of 10 CFR 50.46 and of Appendix K to 10 CFR Part 50 would remain applicable.

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 or

safety, and are consistent with the common defense and security; and (2) when special circumstances are present. As discussed below, special circumstances are present because the continued operation of Waterford 3 with zircaloy or ZIRLO™ fuel rod cladding, rather than with Optimized ZIRLO™, is not necessary to achieve the underlying purpose of the rule.

Authorized by Law

This exemption would result in changes to the plant by allowing use of an alternative cladding (Optimized ZIRLO™) alloy other than zircaloy or ZIRLO™ in lieu of meeting the requirements of 10 CFR 50.46 and Appendix K to 10 CFR Part 50. As stated above, 10 CFR 50.12 allows the NRC to grant exemptions from the requirements of 10 CFR 50.46 and Appendix K to 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. The underlying purpose of Paragraph I.A.5 of Appendix K to 10 CFR Part 50 is to calculate the rates of energy, hydrogen concentration, and cladding oxidation from the metal-water reaction using the Baker-Just equation. Based on the above and on the NRC staff's previously documented topical report safety review as discussed further below, in the context of the proposed exemption, no new accident precursors are created by allowing the use of an alternative cladding (Optimized ZIRLO™) alloy other than zircaloy or ZIRLO™. Thus, the probability of postulated accidents is not increased. For the same reasons, the consequences of postulated accidents are not increased. Therefore, there is no undue risk to public health and safety.

Consistent with Common Defense and Security

The proposed exemption would allow the use of an alternative cladding (Optimized ZIRLO™) alloy other than zircaloy or ZIRLO™. This change to the plant has no relation to security issues. Therefore, the common defense and security is not impacted by this exemption.

Special Circumstances

Pursuant to 10 CFR 50.12(a)(2)(ii), special circumstances are present whenever application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule. The underlying purpose of 10 CFR 50.46 is to establish acceptance criteria for adequate ECCS performance. As previously documented in the NRC staff's review of topical reports submitted by Westinghouse Electric Company, LLC (Westinghouse), and subject to compliance with the specific conditions of approval established therein, the NRC staff finds that the applicability of these ECCS acceptance criteria to Optimized ZIRLO™ has been demonstrated by Westinghouse. Ring compression tests performed by Westinghouse on Optimized ZIRLO™ (NRC-reviewed, approved, and documented in Appendix B of WCAP-12610-P-A and CENPD-404-P-A, Addendum 1-A, "Optimized ZIRLO™," July 2006, Agencywide Documents Access and Management System (ADAMS) Accession No. ML062080576) demonstrate an acceptable retention of post-quench ductility up to 10 CFR 50.46 limits of 2200 degrees Fahrenheit and 17 percent equivalent clad reacted (ECR). Furthermore, the NRC staff has concluded that oxidation measurements provided by the licensee (letter from Westinghouse to NRC, "SER Compliance with WCAP-12610-P-A & CENPD-404-P-A Addendum 1-A 'Optimized ZIRLO™'," LTR-NRC-07-58, November 6, 2007, ADAMS Accession No. ML073130562) illustrate that oxide thickness (and associated hydrogen pickup) for Optimized ZIRLO™ at any given burnup would be less than 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, 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 above, granting the exemption request will ensure that the underlying purpose of the rule is achieved.

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™ (NRC-reviewed, approved, and 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 agrees that application of Appendix K, paragraph I.A.5 is not necessary to achieve the underlying purpose of the rule in these circumstances. Accordingly, the NRC staff has determined that the special circumstances required by 10 CFR 50.12 (a)(2)(ii) for granting an exemption from the aforementioned specific paragraphs of 10 CFR 50.46 and Appendix K of 10 CFR Part 50 exist.

4.0 CONCLUSION

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, and is consistent with the common defense and security. Also, special circumstances are present. Therefore, the Commission hereby grants Entergy Operations, Inc., an exemption from the specific cladding requirements of 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," and of Appendix K to 10 CFR Part 50, "ECCS Evaluation Models," to allow the use of Optimized ZIRLO™ fuel rod cladding material in future core reload applications for Waterford 3.

Pursuant to 10 CFR 51.32, the Commission has determined that the granting of this exemption will not have a significant effect on the quality of the human environment as published in the *Federal Register* on October 22, 2007 (72 FR 59560).

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 11th day of March 2008.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Catherine Haney, Director
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation