



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 3, 2010

Mr. Mark J. Ajluni
Manager, Nuclear Licensing
Southern Nuclear Operating Company, Inc.
40 Inverness Center Parkway
P.O. Box 1295
Birmingham, Alabama 35201

SUBJECT: EDWIN I. HATCH NUCLEAR PLANT, UNIT NO. 2 - EXEMPTIONS FROM
THE REQUIREMENTS OF 10 CFR PART 50, SECTION 50.46, AND
APPENDIX K (TAC NO. ME3946)

Dear Mr. Ajluni:

The U.S. Nuclear Regulatory Commission (NRC) has approved the enclosed exemption from specific requirements of Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," and Appendix K, "ECCS Evaluation Models," for the Edwin I. Hatch Nuclear Plant, Unit No. 2 (HNP-2). This action is in response to Southern Nuclear Company's (SNC's, the licensee) letter dated May 12, 2010. The exemption would allow the use of four (Global Nuclear Fuel (GNF)) GNF2 lead test fuel assemblies (LTA) that are clad with GNF-Ziron cladding. These LTAs would be used in HNP-2 during fuel cycles 22, 23, and 24.

In addition to SNC's request for an exemption from certain parts of 10 CFR 50.46 and Appendix K, pursuant to 10 CFR 50.12, Section III of Enclosure 4, to SNC's letter dated May 12, 2010, also addressed how other regulatory requirements related to the use of the LTAs are to be met by SNC. Specifically, the letter indicated that loading and irradiation of the LTAs will also be evaluated by SNC as a change to the plant as required by 10 CFR 50.59, "Changes, tests and experiments." This approach is consistent with the HNP Technical Specifications which allows a limited number of LTAs, provided they are placed within non-limiting locations. As such, the NRC staff review in the enclosure addresses the exemption request pursuant to 10 CFR 50.12, and does not address core physics, core thermal hydraulics, fuel thermal-mechanical design, or updated final safety analysis report safety analyses aspects of the LTAs nor their placement in non-limiting core locations.

M. Ajluni

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

Sincerely,

A handwritten signature in black ink that reads "Robert E. Martin". The signature is written in a cursive style with a large, prominent initial "R".

Robert E. Martin, Senior Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-366

Enclosure:
Exemption

cc w/encl: Distribution via Listserv

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
SOUTHERN NUCLEAR OPERATING COMPANY, INC.
EDWIN I HATCH NUCLEAR PLANT, UNIT NO. 2
DOCKET NO. 50-366
EXEMPTION

1.0 BACKGROUND

The Southern Nuclear Operating Company, Inc. (SNC, the licensee) is the holder of the Renewed Facility Operating License No. NPF-5 which authorizes operation of the Edwin I. Hatch Nuclear Plant, Unit No. 2 (HNP-2). 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 a boiling-water reactor located in Appling County in Georgia.

2.0 REQUEST/ACTION

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.12, "Specific Exemptions", SNC has, by letter dated May 12, 2010 (the application), requested an exemption from the fuel cladding material requirements in 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems [ECCS] for Light-Water Nuclear Power Reactors", and Appendix K to 10 CFR 50, "ECCS Evaluation Models," (Appendix K). The regulation in 10 CFR 50.46 contains acceptance criteria for ECCS for reactors fueled with zircaloy or ZIRLO™ cladding. In addition, 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 exemption request relates solely to the specific types of cladding material

specified in these regulations. As written, the regulations presume the use of zircaloy or ZIRLO™ fuel rod cladding. Thus, an exemption from the requirements of 10 CFR 50.46 and Appendix K is needed to irradiate a lead test assembly (LTA) comprised of different cladding alloys at HNP-2.

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. Under Section 50.12(a)(2) of 10 CFR, 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.

Authorized by Law

This exemption would allow the licensee to insert four (Global Nuclear Fuel (GNF)) GNF2 lead test fuel assemblies manufactured with a cladding material called GNF-Ziron, which is outside of the cladding materials specified in the regulations (i.e., zircaloy or ZIRLO™) into the core of HNP-2, during fuel cycles 22, 23 and 24. This exemption is similar to a previous exemption regarding the use of GE14 LTAs with a limited number of fuel rods clad in GNF-Ziron at HNP-2 that was issued on November 7, 2008. The differences are that if GNF2 fuel is being used, all rods will be clad in GNF-Ziron, and evaluations of the LTAs will be performed using the PRIME code methodology. 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

In regard to the fuel mechanical design, the exemption request relates solely to the specific types of cladding material specified in the regulations. The underlying purpose of 10 CFR 50.46 is to establish acceptance criteria for ECCS performance. In Section V of the application, SNC provides a technical basis supporting the continued applicability of the 10 CFR 50.46, Paragraph (b), fuel criteria to GNF-Ziron. Quench tests under a restrained load have been conducted on GNF-Ziron samples oxidized to various levels at elevated loss-of-coolant accident (LOCA) temperatures. While these tests differ from the post-steam oxidized ring-compression testing (which forms the basis of the 10 CFR 50.46 post-quench ductility criteria), these results provide reasonable assurance that the 17 percent oxidation and 2200 degree Fahrenheit criteria are valid for GNF-Ziron and meet the underlying purpose of the rule, which is to maintain a degree of post-quench ductility in the fuel cladding material.

Based on an ongoing LOCA research program at Argonne National Laboratory as discussed in NRC Research Information Letter 0801, "Technical Basis for Revision of Embrittlement Criteria in 10 CFR 50.46," (Agencywide Documents Access and Management Systems (ADAMS) Accession No. ML081350225), cladding corrosion (and associated hydrogen pickup) has a significant impact on post-quench ductility. Post-irradiation examinations provided by the licensee in Enclosure 6 of its application demonstrate the favorable hydrogen pickup characteristics of GNF-Ziron as compared with standard Zircaloy-2. Hence, the GNF-Ziron fuel rods would be less susceptible to the detrimental effects of hydrogen uptake during normal operation and their impact on post-quench ductility.

Paragraph I.A.5 of Appendix K to 10 CFR Part 50 states that the rates of energy, 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 the LTA cladding for determining acceptable fuel performance. Metal-water reaction tests performed by GNF on GNF-Ziron (Figure B-15 of Enclosure 5) of the application demonstrate conservative reaction rates relative to the Baker-Just equation. Thus, application of Appendix K, Paragraph I.A.5, is not necessary for the licensee to achieve its underlying purpose in these circumstances.

High temperature burst test results are provided in Figure B-6 (Enclosure 5 of Reference 1). These test results illustrate similar burst characteristics of GNF-Ziron as compared with standard Zry-2. In addition, Enclosure 6 of Reference 1 provides further comparisons of material properties between GNF-Ziron and Zry-2. Based upon this comparison of material properties, GNF and SNC believe that currently approved methods and models are directly applicable to GNF-Ziron. Based upon the material properties provided in References 1 and 2, the NRC staff finds the use of current LOCA models and methods acceptable for the purpose of evaluating LTAs containing GNF-Ziron fuel rods.

In support of its exemption request, SNC submitted a GNF document entitled, "GNF-Ziron Performance Benefits and Licensing Requirements Assessment" (Enclosure 6 of the application). This report provides a logical assessment of the potential impact of differences in material properties on the PRIME fuel thermal-mechanical methodology. While not directly related to the 10 CFR 50.46 exemption request, the NRC staff finds the conclusion of this report acceptable for the purpose of evaluating LTAs containing GNF-Ziron fuel rods. Further NRC staff review may be necessary prior to use of PRIME for batch application of GNF-Ziron fuel cladding material.

Through mechanical testing and a comparison of material properties, SNC has provided reasonable assurance that anticipated in-reactor performance will be acceptable. Further, the licensee has demonstrated that the use of current methods and models are reasonable for

evaluating the cladding's performance to anticipated operational occurrences and accidents. Nevertheless, as with any developmental cladding alloy, the NRC staff requires a limitation on the total number of fuel rods clad in a developmental alloy in order to ensure a minimal impact on the simulated progression and calculated consequences of postulated accidents. This limitation is directly related to the available material properties (both unirradiated and irradiated) used to judge the cladding alloy's anticipated in-reactor performance.

Based upon results of metal-water reaction tests and mechanical testing which ensure the applicability of ECCS models and acceptance criteria, the limited number and anticipated performance of the advanced cladding fuel rods, and the use of approved LOCA models to ensure that the LTAs satisfy 10 CFR 50.46 acceptance criteria, the NRC staff finds it acceptable to grant an exemption from the requirements of 10 CFR 50.46 and Appendix K to 10 CFR Part 50 for the use of four GNF2 LTAs within HNP-2.

Consistent with Common Defense and Security

The proposed exemption would allow the licensee to insert four lead test fuel assemblies with fuel rod cladding that does not meet the definition of Zircaloy or ZIRLO™ as specified by 10 CFR 50.46, and Appendix K, into the core of HNP-2, during fuel cycles 22, 23 and 24. This change 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, 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 emergency core cooling system performance. The wording of the regulations in 10 CFR 50.46 and Appendix K is not directly applicable to these advanced cladding alloys, even though the evaluations discussed above

show that the intent of the regulations is met. Therefore, since the underlying purpose of 10 CFR 50.46 and Appendix K is achieved with the use of these advanced cladding alloys, the special circumstances required by 10 CFR 50.12 for the granting of an exemption from 10 CFR 50.46 and Appendix K exist.

4.0 CONCLUSION

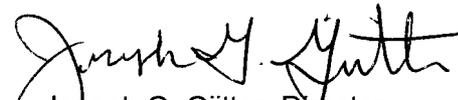
Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12(a), the exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. Also, special circumstances are present. Therefore, the Commission hereby grants SNC exemptions from the requirements of 10 CFR 50.46, and 10 CFR Part 50, Appendix K, to allow the limited use of four LTAs with GNF-Ziron cladding during fuel cycles 22, 23 and 24 for the HNP-2 plant.

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 (75 FR 69137; November 10, 2010).

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 3rd day of December 2010.

FOR THE NUCLEAR REGULATORY COMMISSION



Joseph G. Gitter, Director
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

M. Ajluni

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

Sincerely,

/RA/

Robert E. Martin, Senior Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-366

Enclosure:
Exemption

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