

**NUCLEAR REGULATORY COMMISSION**

**[Docket No. 50-315; NRC-2011-0188]**

**Indiana Michigan Power Company**

**Donald C. Cook Nuclear Plant, Unit 1**

**Exemption**

**1.0 BACKGROUND**

Indian Michigan Power Company (the licensee) is the holder of Facility Operating License No. DPR-58, which authorizes operation of the Donald C. Cook Nuclear Plant, Unit 1 (CNP-1). 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 Berrien County in Michigan.

**2.0 REQUEST/ACTION**

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.12, "Specific exemptions," the licensee has, by letter dated December 16, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML103630358), requested an exemption from 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," and Appendix K to 10 CFR 50, "ECCS Evaluation Models." The regulations in 10 CFR 50.46 contain acceptance criteria for the emergency core cooling system (ECCS) for reactors fueled with zircaloy or ZIRLO™ cladding. In addition, Appendix K to 10 CFR Part 50 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 assumes the use of a zirconium alloy, which is a material different from Optimized ZIRLO™. The licensee's requested exemption 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 support the use of a different fuel rod cladding material. Accordingly, the licensee requested an exemption that would allow the use of Optimized ZIRLO™ fuel rod cladding at CNP-1.

### 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 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.

#### Authorized by Law

This exemption would allow the use of Optimized ZIRLO™ fuel rod cladding material at CNP-1. 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 ECCS performance. Westinghouse topical reports WCAP-12610-P-A and 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™ (these topical reports are non-publicly available because they contain proprietary information). The NRC staff approved the use of these topical reports, subject to the conditions stated in the NRC staff's safety evaluation for each topical report. Ring compression tests performed by Westinghouse on Optimized ZIRLO™ were reviewed and approved by the NRC staff (ADAMS Accession No. ML062080569), and demonstrate an acceptable retention of post-quench ductility up to the 10 CFR 50.46 limits of 2200 degrees Fahrenheit and 17 percent equivalent clad reacted. Furthermore, the NRC staff has concluded that oxidation measurements provided by the licensee (ADAMS Accession No. ML073130560) 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™. Hence, the NRC staff concludes that Optimized ZIRLO™ would be expected to maintain improved post-quench ductility over ZIRLO™. Finally, the licensee stated that Westinghouse will perform an evaluation to ensure that the Optimized ZIRLO™ fuel rods continue to satisfy 10 CFR 50.46 acceptance criteria utilizing currently NRC-approved loss-of-coolant accident (LOCA) models and methods.

The underlying purpose of 10 CFR Part 50, Appendix K, Section I.A.5, "Metal-Water Reaction Rate," is to ensure that cladding oxidation and hydrogen generation are appropriately limited during a LOCA and conservatively accounted for in the ECCS evaluation model. Appendix K of 10 CFR Part 50 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. Westinghouse has demonstrated that

the Baker-Just model is conservative in all post-LOCA scenarios with respect to the use of the Optimized ZIRLO™ advanced alloy as a fuel cladding material.

The NRC-approved topical reports have 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 and the core operating limits report.

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

#### Consistent with Common Defense and Security

The proposed exemption would allow the use of Optimized ZIRLO™ fuel rod cladding material at CNP-1. This change to the plant 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. The wording of the regulations in 10 CFR 50.46 and Appendix K is not directly applicable to Optimized ZIRLO™, even though the evaluations above show that the intent of the regulation is met. 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 the granting of an exemption exist.

#### 4.0 CONCLUSION

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 the licensee 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™ fuel rod cladding material at CNP-1.

Pursuant to 10 CFR 51.32, the Commission published an environmental assessment for this exemption on August 22, 2011 (76 FR 52356).

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 24<sup>th</sup> day of August 2011.

FOR THE NUCLEAR REGULATORY COMMISSION

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