



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

August 23, 2012

Mr. Lawrence J. Weber  
Senior Vice President and  
Chief Nuclear Officer  
Indiana Michigan Power Company  
Nuclear Generation Group  
One Cook Place  
Bridgman, MI 49106

SUBJECT: DONALD C. COOK NUCLEAR PLANT, UNIT 2, EXEMPTION FROM THE  
REQUIREMENTS OF 10 CFR SECTION 50.46 AND APPENDIX K TO  
10 CFR PART 50 TO ALLOW THE USE OF OPTIMIZED ZIRLO™ CLAD FUEL  
RODS (TAC NO. ME7722)

Dear Mr. Weber:

The Nuclear Regulatory Commission has approved the enclosed exemption from specific requirements of Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.46, "Acceptance criteria for emergency core cooling systems [ECCS] for light-water nuclear power reactors," and Appendix K to 10 CFR Part 50, "ECCS Evaluation Models," for Donald C. Cook Nuclear Plant, Unit 2. This action is in response to the licensee's application dated September 29, 2011, for exemption and amendment regarding the use of Optimized ZIRLO™ clad fuel rods. The requested amendment is addressed under separate correspondence.

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

Sincerely,

A handwritten signature in black ink that reads "Peter S. Tam". The signature is stylized with a large, sweeping flourish at the end.

Peter S. Tam, Senior Project Manager  
Plant Licensing Branch III-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-316

Enclosure: Exemption

cc w/encl: Distribution via Listserv

NUCLEAR REGULATORY COMMISSION

[NRC-\_\_\_\_\_]

INDIANA MICHIGAN POWER COMPANY

DONALD C. COOK NUCLEAR PLANT, UNIT 2

DOCKET NO. 50-316

EXEMPTION

1.0 BACKGROUND

Indian Michigan Power Company (the licensee) is the holder of Renewed Facility Operating License No. DPR-74, which authorizes operation of the Donald C. Cook Nuclear Plant, Unit 2 (CNP-2). The license provides, among other things, that the facility is subject to all rules, regulations, and orders of the Nuclear Regulatory Commission (NRC, or 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), Section 50.12, "Specific exemptions," the licensee has, by letter dated September 29, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML11286A198), 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-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 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-2. 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. 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™ (see Appendix B of non-public NRC-approved topical report WCAP-12610-P-A & CENPD-404-P-A, Addendum 1-A, "Optimized ZIRLO™," July 2006, ADAMS Accession No. ML062080576; the public version is WCAP-14342-A & CENPD-404-NP-A at ADAMS Accession No. ML062080569) demonstrate an acceptable retention of post-quench ductility up to 10 CFR 50.46 limits of 2,200 °F and 17 percent equivalent clad reacted (ECR). Furthermore, the NRC staff has concluded that oxidation measurements previously provided by Westinghouse ("SER Compliance with WCAP-12610-P-A & CENPD-404-P-A Addendum 1-A 'Optimized ZIRLO™,'" November 2007, non-public version at ADAMS Accession No. ML073130562, public version at ADAMS Accession No. ML073130560 ) 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, the provisions of 10 CFR 50.46 require the licensee to periodically evaluate the performance of the emergency core cooling system (ECCS), using currently approved LOCA models and methods, to ensure that the fuel rods will continue to satisfy 10 CFR 50.46 acceptance criteria. Granting the exemption to allow the licensee to use Optimized ZIRLO™ fuel rods in addition to the current mix of fuel rods does not diminish this requirement of periodic

evaluation of ECCS performance. Thus, the underlying purpose of the rule will continue to be achieved for Donald C. Cook Nuclear Plant, Unit 2.

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 this provision of the rule would not permit use of the equation for Optimized ZIRLO™ cladding for determining acceptable fuel performance. However, the NRC staff previously found that metal-water reaction tests performed by Westinghouse on Optimized ZIRLO™ (see Appendix B of WCAP-12610-P-A & CENPD-404-P-A, Addendum 1-A) 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. Since these evaluations demonstrate that the underlying purpose of the rule will be met, there will be no undue risk to the public health and safety.

#### Consistent with Common Defense and Security

The proposed exemption would allow the use of Optimized ZIRLO™ fuel rod cladding material at CNP-2. 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

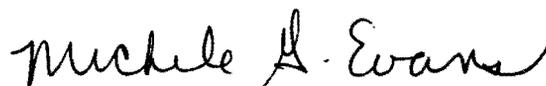
Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12, the exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. Also, special circumstances are present. Therefore, the Commission hereby 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-2.

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 and has published an environmental assessment for this exemption on August 23, 2012 (77 FR 51071).

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 23<sup>rd</sup> day of August, 2012.

FOR THE NUCLEAR REGULATORY COMMISSION

A handwritten signature in black ink that reads "Michele A. Evans". The signature is written in a cursive style with a large initial 'M' and a distinct 'A'.

Michele Evans, Director  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

August 23, 2012

Mr. Lawrence J. Weber  
Senior Vice President and  
Chief Nuclear Officer  
Indiana Michigan Power Company  
Nuclear Generation Group  
One Cook Place  
Bridgman, MI 49106

SUBJECT: DONALD C. COOK NUCLEAR PLANT, UNIT 2, EXEMPTION FROM THE  
REQUIREMENTS OF 10 CFR SECTION 50.46 AND APPENDIX K TO  
10 CFR PART 50 TO ALLOW THE USE OF OPTIMIZED ZIRLO™ CLAD FUEL  
RODS (TAC NO. ME7722)

Dear Mr. Weber:

The Nuclear Regulatory Commission has approved the enclosed exemption from specific requirements of Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.46, "Acceptance criteria for emergency core cooling systems [ECCS] for light-water nuclear power reactors," and Appendix K to 10 CFR Part 50, "ECCS Evaluation Models," for Donald C. Cook Nuclear Plant, Unit 2. This action is in response to the licensee's application dated September 29, 2011, for exemption and amendment regarding the use of Optimized ZIRLO™ clad fuel rods. The requested amendment is addressed under separate correspondence.

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

Sincerely,  
/RA/

Peter S. Tam, Senior Project Manager  
Plant Licensing Branch III-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-316

Enclosure: Exemption

cc w/encl: Distribution via Listserv

DISTRIBUTION:

PUBLIC  
LPL3-1 r/f  
RidsAcrsAcnw\_MailCTR Resource  
RidsNrrDorIDpr Resource  
RidsNrrDorLpl3-1 Resource  
SWu, NRR

RidsNrrLABTully Resource  
RidsNrrPMDCCook Resource  
RidsOgcRp Resource  
RidsRgn3MailCenter Resource  
RidsNrrDssSnpb Resource  
SWilliams, EDO R-III

Package Accession No.: **ML12142A277**

Letter Accession No.: **ML12142A287**

Exemption Accession No.: **ML12142A299**

OFFICE	LPL3-1/PM	LPL3-1/LA	SNPB/BC*	OGC NLO	LPL3-1/BC	DORL/D	LPL3-1/PM
NAME	PTam	BTully	AMendiola	MSmith	IFrankl	MEvans	PTam
DATE	6/5/12	6/4/12	5/8/12	8/14/12	8/16/12	8/22/12	8/15/12

\*Safety Evaluation transmitted by memo of May 8, 2012 (Accession No. ML12128A352).

OFFICIAL RECORD COPY