

August 30, 2006

Mr. R. T. Ridenoure
Vice President - Chief Nuclear Officer
Omaha Public Power District
Fort Calhoun Station FC-2-4 Adm.
Post Office Box 550
Fort Calhoun, NE 68023-0550

SUBJECT: FORT CALHOUN STATION, UNIT NO. 1 - ISSUANCE OF AMENDMENT
RE: USE OF M5 FUEL CLADDING (TAC NO. MC8096)

Dear Mr. Ridenoure:

The U.S. Nuclear Regulatory Commission (the Commission) has issued the enclosed Amendment No. 241 to Renewed Facility Operating License No. DPR-40 for the Fort Calhoun Station, Unit No. 1 (FCS). The amendment consists of changes to the Technical Specifications (TSs) in response to your application dated August 11, 2005, as revised by letter dated November 8, 2005, and supplemented by letter dated April 12, 2006.

The amendment revises TS 4.2.1, "Fuel Assemblies," to permit the use of AREVA (Framatome ANP) M5 advanced alloy for fuel rod cladding and structural components such as guide tubes, intermediate spacer grids, end plugs, and guide thimble tubes at the FCS. M5 will be used beginning with Refueling Cycle 24. The M5 cladding is a proprietary zirconium-based alloy that is chemically different from that of zircaloy and ZIRLO, which are the fuel cladding materials currently approved for use in the FCS TS. In addition, TS 5.9, "Reporting Requirements," was revised to include the Framatome ANP topical report evaluating the impact of M5 material properties on NRC-approved methodologies used at the FCS.

A copy of the related Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

Sincerely,

/RA/

Alan B. Wang, Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-285

Enclosures: 1. Amendment No. 241 to DPR-40
2. Safety Evaluation

cc w/encls: See next page

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Ft. Calhoun Station, Unit 1

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April 2006

OMAHA PUBLIC POWER DISTRICT

DOCKET NO. 50-285

FORT CALHOUN STATION, UNIT NO. 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 241
License No. DPR-40

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by the Omaha Public Power District (the licensee) dated August 11, 2005, as revised by letter dated November 8, 2005, and supplemented by letter dated April 12, 2006, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;
 - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
 - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
 - D. The issuance of this license amendment will not be inimical to the common defense and security or to the health and safety of the public; and
 - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, Renewed Facility Operating License No. DPR-40 is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 3.B. of Facility Operating License No. DPR-40.
3. The license amendment is effective as of its date of issuance and shall be implemented within 90 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

David Terao, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical
Specifications and Facility Operating License

Date of Issuance: August 30, 2006

ATTACHMENT TO LICENSE AMENDMENT NO. 241

RENEWED FACILITY OPERATING LICENSE NO. DPR-40

DOCKET NO. 50-285

Replace the following page 3 of the Facility Operating License with the attached revised page 3.

Replace the following pages of the Appendix A Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain vertical lines indicating the areas of change.

REMOVE

4.0 - Page 1
5.0 - Page 9

INSERT

4.0 - Page 1
5.0 - Page 9

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 241 TO RENEWED FACILITY

OPERATING LICENSE NO. DPR-40

OMAHA PUBLIC POWER DISTRICT

FORT CALHOUN STATION, UNIT NO. 1

DOCKET NO. 50-285

1.0 INTRODUCTION

By application dated August 11, 2005 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML052240083), as revised by letter dated November 8, 2005 (ADAMS Accession No. ML053120421), and as supplemented by letter dated April 12, 2006 (ADAMS Accession No. ML061040257), Omaha Public Power District (OPPD, the licensee) requested changes to the Technical Specifications (Appendix A to Renewed Facility Operating License No. DPR-40) for the Fort Calhoun Station, Unit No. 1 (FCS).

The proposed amendment would revise Technical Specification (TS) 4.2.1, "Fuel Assemblies," and TS 5.9, "Reporting Requirements." Specifically, the proposed changes would revise TS 4.2.1, "Fuel Assemblies," to permit the use of AREVA (Framatome ANP) M5 advanced alloy for fuel rod cladding and structural components such as guide tubes, intermediate spacer grids, end plugs, and guide thimble tubes at the FCS. M5 will be used beginning with Refueling Cycle 24. The M5 cladding is a proprietary zirconium-based alloy that is chemically different from that of zircaloy and ZIRLO, the fuel cladding materials currently approved for use in the FCS TS. In addition, OPPD proposed to revise TS 5.9 to include the Framatome ANP topical report evaluating the impact of M5 material properties on NRC-approved methodologies used at the FCS.

The supplemental letter dated April 12, 2006, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on December 6, 2005 (70 FR 72675).

2.0 REGULATORY EVALUATION

By letter dated June 18, 2003, the NRC-approved Framatome Topical Report BAW-10227P-A, Revision 1, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR [pressurized-water reactor] Reactor Fuel." This topical report describes Framatome M5 fuel and provides justification for its use in PWR fuel cladding and core structural components. The licensee has stated in its submittal that operating FCS with M5 in the reactor core will continue to meet the licensing limits required for FCS. The licensee has proposed TS revisions to account for the presence of M5 fuel in the FCS core.

The Nuclear Regulatory Commission (NRC) staff reviewed the licensee's amendment request to ensure that operation with M5 fuel cladding, in accordance with the proposed changes, will be within the conditions of operation necessary for application of BAW-10227P-A, Revision 1. In addition, the NRC staff ensured that the licensee will continue to operate the plant within its design basis and comply with applicable regulatory requirements following implementation of the proposed changes. These include Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.46; General Design Criteria 4, 10, 33, 34, and 35; and as described in Standard Review Plan Section 4.2. The NRC staff has approved similar submittals at plants implementing BAW-10227P-A, Revision 1, specifically at Crystal River Unit 3, Oconee Units 1, 2, and 3, Davis Besse Unit 1, Three Mile Island Unit 1, and Arkansas Nuclear One Unit 1.

3.0 TECHNICAL EVALUATION

The license amendment request would revise the Design Features section of FCS TS 4.2.1 to include the allowance to use M5 advanced alloy as a fuel rod cladding and fuel assembly structural material. Specifically, TS 4.2.1 adds two words, "or M5," such that the revised TS would read, "Each assembly shall consist of a matrix of zircaloy, ZIRLO®, or M5 clad fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO₂) as fuel material."

3.1 Analyses and Evaluations

Topical report BAW-10227P-A, Revision 1, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel" (Reference 3), provides the technical licensing basis for the use of M5 fuel cladding material and structural material. The M5 cladding is a Framatome ANP proprietary material comprised of approximately 99 percent zirconium and 1 percent niobium. M5 cladding provides improved performance over standard zircaloy cladding in the areas of fuel cladding corrosion and hydrogen pickup, fuel assembly and fuel rod growth, fuel rod bowing, and fuel rod cladding creep. The M5 fuel cladding alloy has been tested in both reactor and non-reactor environments to establish its enhanced mechanical and structural properties.

Framatome ANP has evaluated the properties of M5 and determined that the use of M5 as cladding and structural material either would have no significant impact or would produce an improvement in performance and increased margins for the following parameters and analyses:

- Fuel assembly and rod growth
- Fuel assembly handling and shipping loads
- Fuel rod internal pressure
- Fuel rod cladding transient strain
- Fuel centerline melting temperature
- Fuel rod cladding fatigue
- Fuel rod cladding creep collapse
- Fuel rod bow
- High temperature swelling and rupture
- High temperature oxidation

Framatome ANP has determined that the M5 advanced alloy will perform acceptably at all normal operating conditions.

The licensee evaluated the performance of the M5 cladding performance for both loss of coolant accident (LOCA) and non-LOCA scenarios. The licensee's conclusion was that the results with M5 fuel would not be substantially different from the results obtained with only zircaloy in the core. This conclusion is consistent with the conclusions in Framatome Topical Report BAW-10227P-A, Revision 1 (Reference 3). Based on the review of the licensee's submittal, the NRC staff concludes that the licensee may perform reload analyses to evaluate FCS operation with cores including M5 fuel cladding with its present NRC-approved models adjusted to compensate for the presence of M5 fuel cladding. This ensures that the licensee will continue to meet the currently applicable regulatory requirements for LOCA and non-LOCA events.

3.1.1 LOCA Analyses

Framatome ANP has performed an evaluation of the LOCA performance of the M5 cladding alloy for the generic accident scenarios described in BAW-10227P-A, Revision 1 (Reference 3). The LOCA evaluation is performed with a set of analyses demonstrating compliance with 10 CFR 50.46. Framatome ANP stated that a comparison of the results obtained using the base evaluation model methods with zircaloy cladding and the results obtained for an identical case using M5 swelling and rupture model shows that the M5 cladding performance should not adversely affect core operation or operating limits.

In a supplemental letter, dated April 12, 2006 (Reference 4), OPPD provided the following large-break LOCA (LBLOCA) and small-break LOCA (SBLOCA) analysis results. These results were provided to confirm that FCS will meet the criteria set forth in 10 CFR 50.46(b).

Peak Cladding Temperature, EF	1675
Maximum Local Oxidation, %	0.82
Total Oxidation (whole core hydrogen), %	0.02
Coolable Geometry	Confirmed
Long Term Cooling	Confirmed

The LBLOCA results are for the fresh fuel in the core. According to FCS, the LBLOCA results are conservative relative to the once-burned and beyond fuel, and are more limiting (higher PCT) than the SBLOCA results.

A comparison of the results for zircaloy-4 and M5 cladding is provided below. These data are obtained from Topical Report EMF-2103PA for LBLOCA and from BAW-10240(P)-A for SBLOCA.

	<u>Differences</u>	
	<u>LBLOCA</u>	<u>SBLOCA</u>
Peak Cladding Temperature	<10 EF	<10 EF
Maximum Local Oxidation	<0.1%	<0.3%
Total Oxidation (whole core hydrogen)	<0.1%	<0.1%

At the NRC staff's request, the licensee also addressed a concern that the resident fuel may have pre-existing oxidation that needs to be considered in estimating the maximum local oxidation in the event of a LOCA. In its supplemental letter dated April 12, 2006, the licensee provided its response to the concern, including reference to information in the Framatome Topical Report EMF-2103(P)(A), "Realistic Large Break LOCA Methodology for Pressurized Water Reactors" (Reference 5), where this issue was also addressed and approved by the NRC staff.

The NRC staff finds that the results of the LOCA analyses for FCS considered the total LOCA oxidation and meets the oxidation criterion of less than or equal to 17 percent of the total cladding thickness for oxidation set forth in 10 CFR 50.46(b)(2).

The NRC staff also finds that the preexisting oxidation of the fuel is not expected to contribute to the LOCA maximum core-wide hydrogen generation. Therefore, the NRC staff concludes that the core-wide hydrogen generation analysis results demonstrate that FCS meets the core-wide hydrogen generation criterion of 10 CFR 50.46(b)(3).

As discussed above, the licensee has performed LBLOCA and SBLOCA analyses for FCS using LBLOCA and SBLOCA methodologies approved for FCS. The licensee's LBLOCA and SBLOCA calculations are demonstrated in the following:

- E. The calculated LBLOCA and SBLOCA values for peak cladding temperature (PCT), maximum local oxidation, and core-wide hydrogen generation are less than the limits of 2200 EF, 17 percent, and 1.0 percent, respectively, as specified in 10 CFR 50.46(b)(1)-(3).
- F. Compliance with 10 CFR 50.46(b)(1)-(3) and (5) assures that the core will remain amenable to cooling as required by 10 CFR 50.46(b)(4). The staff notes that no other matters that could affect coolable geometry are involved in the requested amendment.

In summary, the NRC staff concludes that the licensee's LOCA analyses were performed with approved LOCA methodologies that demonstrate FCS complies with the requirements of 10 CFR 50.46(b)(1)-(5). Therefore, the NRC staff finds the licensee's LOCA analyses acceptable.

3.1.2 Non-LOCA Analyses

Framatome ANP determined that the non-LOCA safety analyses performed using zircaloy material properties apply equally to M5 cladding. The licensee referred to Framatome Topical Report BAW-10227P-A, Revision 1 (Reference 3), which draws the conclusion that the difference in zircaloy and M5 fuel cladding alone would not cause a substantial change in the analysis results. Based on information provided by the licensee and because the material properties of M5 cladding are similar to those of zircaloy, the NRC staff has determined that this conclusion is reasonable. Therefore, it is not necessary to recalculate any of the non-LOCA safety analyses solely because the cladding material is changed from zircaloy to M5. As part of the regular reload process, the licensee will perform analyses of non-LOCA events for Refueling Cycle 24 using the methodology identified in the NRC-approved Topical Report BAW-10179P-A, "Safety Criteria and Methodology for Acceptable Cycle Reload Analysis." Accordingly, the NRC staff concludes that the use of M5 will not substantially affect

the non-LOCA analyses and the FCS licensing basis for non-LOCA events will remain the same. Therefore, the NRC staff finds that the licensee has acceptably addressed non-LOCA events.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Nebraska State official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration and there has been no public comment on such finding published on December 6, 2005 (70 FR 72675). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

7.0 REFERENCES

1. Letter from Ross T. Ridenoure (OPPD) to NRC, "Fort Calhoun Station Unit No. 1 - License Amendment Request to Support Use of M5 Fuel Cladding, and 10 CFR 50.46 and 10 CFR Appendix K Exemption Request," dated August 11, 2005.
2. Letter from Ross T. Ridenoure (OPPD) to NRC, "Fort Calhoun Station Unit No. 1 - Revised License Amendment Request to Support Use of M5™ Fuel Cladding," dated November 8, 2005.
3. BAW-10227P-A, Revision 1, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel," dated June 18, 2003.
4. Letter from Harry J. Faulhaber (OPPD) to NRC, "Response to Request for Additional Information Related to the Use of M5 Fuel Cladding," dated April 12, 2006.
5. EMF-2103(P)(A), "Realistic Large Break LOCA Methodology for Pressurized Water Reactors," dated April 30, 2003.

6. BAW-10240(P)-A, "Incorporation of M5™ Properties in Framatome ANP Approved Methods," dated May 2004.

Principal Contributor: Tanya Ford

Date: August 30, 2006