September 14, 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 - CORRECTION TO THE SAFETY EVALUATION FOR THE ISSUANCE OF AMENDMENT RE: USE OF M5 FUEL CLADDING (TAC NO. MC8096)

Dear Mr. Ridenoure:

In its letter dated August 30, 2006, the Nuclear Regulatory Commission issued the Amendment No. 241 to Renewed Facility Operating License No. DPR-40 for the Fort Calhoun Station, Unit No. 1. In the safety evaluation (SE), an incorrect topical report reference was made. In addition, we clarified a sentence within Section 2.0, "Regulatory Evaluation." Enclosed are the two corrected pages of the SE. The revisions are identified by a line in the margin.

This letter should be a supplement to our initial letter dated August 30, 2006. This change corrects the SE.

We regret any inconvenience this error has caused you.

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

Enclosure: As stated

cc w/encl: See next page

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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. The following regulations were considered in the review: Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.46 and General Design Criteria 4, 10, 33, 34, and 35. 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 ($UO_2$) 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.

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 EMF-2310(P)(A), "SRP Chapter 15 Non-LOCA Methodology for Pressurized Water Reactors." Accordingly, the NRC staff concludes that the use of M5 will not substantially affect