Omaha Public Power District

444 South 16th Street Mall
Omaha NE 68102-2247

August 11, 2005
LIC-05-0089

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Reference: 1. Docket No. 50-285
2. Letter from D. J. Bannister (OPPD) to Document Control Desk (NRC) dated November 23, 2004, Fort Calhoun Station Unit No. 1 License Amendment Request, "Revisions of Technical Specifications Table 1-1 and Section 4.0" (LIC-04-0117) (ML043290064)

SUBJECT: 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

Pursuant to 10 CFR 50.90, Omaha Public Power District (OPPD) hereby requests the following amendment to the Fort Calhoun Station Unit 1 Technical Specifications (TS). The proposed amendment will modify TS 4.3.2, "Reactor Core and Control," (proposed to be changed to TS 4.2.1, "Fuel Assemblies," by Reference 2) 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, beginning with Cycle 24. In addition, OPPD proposes to modify TS 5.9 to include the Framatome ANP Topical Report evaluating the impact of M5 material properties on NRC approved methodology. M5 is a proprietary, zirconium based alloy that is a variant of Zr1Nb to replace Zircaloy-4 in the construction of fuel assembly components. OPPD concludes that the proposed amendment presents no significant hazards considerations under the standards set forth in 10 CFR 50.92(c).

This letter also requests an exemption pursuant to 10 CFR 50.12 from 10 CFR 50.46, *Acceptance Criteria for emergency core cooling systems for light-water nuclear power reactors* and 10 CFR 50, Appendix K to Part 50 -- *ECCS Evaluation Models.* Since M5 cladding is a zirconium-based alloy that is chemically different than Zircaloy or ZIRLO fuel cladding materials which are approved for use in these 10 CFR sections, a plant specific exemption from these regulations is required to support the use of M5 cladding. Information supporting the exemption request is contained in Attachment 4. OPPD has concluded that special circumstances defined by 10 CFR 50.12 exist to warrant the exemption and that granting the exemption request will not present undue risk to the public health and safety and is consistent with the common defense and security.

Attachment 1 provides the No Significant Hazards Evaluation and the technical bases for this requested change to the TS. Attachments 2 and 3 contain the marked-up (changes shown in italics) and clean-typed TS pages reflecting the requested TS changes. Attachment 4 contains the 10 CFR 50.46 and 10 CFR 50, Appendix K Exemption Request.

Please note that the information in TS 4.3.2 has been proposed to be transferred to TS 4.2.1 as part of the amendment request in Reference 2. Therefore, the TS pages provided in Attachments 2 and 3 for the TS 4.0 changes are based on the pages provided in Reference 2.

The proposed change has been evaluated in accordance with 10 CFR 50.91(a)(1) using criteria in 10 CFR 50.92(c) and it has been determined that this change involves no significant hazards considerations. The bases for these determinations are included in Attachment 1.

The NRC has approved similar TS changes for other plants. In particular, fuel with M5 cladding is used at Oconee Units 1, 2, and 3, Three Mile Island Unit 1, Davis Besse, and Crystal River Unit 3, which are Babcock and Wilcox plants, and at North Anna Units 1 and 2 which are Westinghouse plants.

OPPD requests approval of the proposed amendment and exemption by July 31, 2006 to support fuel procurement and core design for the Fall 2006 refueling outage. OPPD requests 120 days to implement this amendment. No commitments are made to the NRC in this letter.

I declare under penalty of perjury that the foregoing is true and correct. (Executed on August 11, 2005)

If you have any questions or require additional information, please contact Mr. Thomas R. Byrne at (402) 533-7368.

Sincerely,

Ross T. Ridenoure
Vice President

Attachments:

1. OPPD's Evaluation of the proposed change(s)
2. Markup of Technical Specification Pages
3. Clean Typed Technical Specification Pages
4. 10 CFR 50.46 and 10 CFR 50, Appendix K Exemption Request

c: Division Administrator – Public Health Assurance, State of Nebraska

ATTACHMENT 1

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

Attachment 1

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

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

1.0 DESCRIPTION

This letter is a request to amend Operating License DPR-40 for Fort Calhoun Station Unit No. 1 (FCS). The proposed changes to Technical Specifications (TS) Design Features, TS 4.3.2, "Reactor Core and Control" (proposed to be changed to TS 4.2.1, "Fuel Assemblies," by Reference 8.10), and modification to TS 5.9 "Reporting Requirements" would permit the use of the M5 advanced alloy. FCS is planning to use an enhanced AREVA fuel design, which uses M5 material for fuel cladding and other assembly structural components, for replacement fuel assemblies in future core reload designs starting with Cycle 24.

In addition, the Omaha Public Power District (OPPD) requests an exemption from 10 CFR 50.46, *Acceptance criteria for emergency core cooling systems in light-water nuclear power reactors* and 10 CFR Appendix K to Part 50 -- *ECCS Evaluation Models* in accordance with 10 CFR 50.12. (see Attachment 4). These exemption requests are related to the proposed use of the M5 advanced zirconium alloy for FCS fuel rod cladding and fuel assembly material.

2.0 PROPOSED CHANGE

The proposed change will add the allowance to use the M5 advanced alloy fuel to FCS TS Section 4 Design Features, Section 4.2.3 "Reactor Core and Control" (proposed to be changed to TS 4.2.1 by Reference 8.10), thereby permitting the use of M5 cladding for replacement fuel assemblies in future core reloads. The M5 fuel cladding is chemically different than Zircaloy, which is currently specified in TS 4.3.2 (proposed to be changed to TS 4.2.1 by Reference 8.10). A modification of TS 5.9 "Reporting Requirements" to include the Framatome Topical report BAW-10240(P)(A), Revision 0, "*Incorporation of M5^{TM} Properties in Framatome ANP Approved Methods*," that evaluate the M5 cladding and structural components is also proposed. The approved version of this topical report will be specified in the FCS Core Operating Limits Report (COLR) per the allowance of TSTF-363. TSTF-363 allows licensees to use current topical reports to support limits in the COLR without having to submit an amendment request every time the topical report is revised.

An exemption to 10 CFR 50.46 and 10 CFR Appendix K is also proposed in accordance with 10 CFR 50.12 to support the use of M5 cladding. This is included as Attachment 4 to this submittal.

In summary, OPPD proposes to amend the FCS TS to permit the use of the M5 advanced alloy as fuel rod cladding and fuel assembly structural components.

3.0 BACKGROUND

Currently FCS fuel cladding is Zircaloy-4, which is allowed by TS 4.3.2 (proposed to be changed to TS 4.2.1 by Reference 8.10). The fuel rod cladding is designed to maintain its integrity for the anticipated operating transients throughout core life. The effects of gas release, fuel dimensional changes, and corrosion-induced or irradiation-induced changes in the mechanical properties of cladding are considered in the design of fuel assemblies. The Zircaloy-4 cladding is designed to withstand strain resulting from combined effects of reactor pressure, fission gas pressure, fuel expansion, and thermal and irradiation growth. Materials testing and actual reactor in-service operation with Zircaloy cladding have demonstrated that Zircaloy-4 material has sufficient corrosion resistance and mechanical properties to maintain the integrity and serviceability required for the design burnup.

In order to provide an improvement in performance and improved margins during normal operation, AREVA has developed the M5 advanced fuel rod cladding and fuel assembly structural material. M5 is an alloy comprised primarily of zirconium (98.9%), niobium (1%) and oxygen (0.1%). The absence of tin in M5 has resulted in superior corrosion resistance and reduced irradiation-induced growth relative to standard Zircaloy (1.7% tin) and low tin Zircaloy (1.2% tin). The addition of niobium increases ductility, which is desirable to avoid brittle failures.

M5 has completed several cycles of irradiation in US and European reactors. Results from the irradiation of the M5 fuel rod cladding has demonstrated that the maximum fuel rod corrosion rate is 40 to 50% that of low-tin Zircaloy-4. In addition, the hydrogen pickup is a quarter of that experienced with Zircaloy-4. Similar improvements have been shown for the fuel assembly structural components, such as guide tubes and spacer grids.

The fuel rod growth measurements have shown a reduced irradiation-induced growth of approximately 80% relative to standard Zircaloy-4. The M5 cladding will provide additional margin to the fuel assembly and fuel rod growth limits for fuel assemblies with high burnups. Since fuel rod bow is driven by the irradiation growth of the fuel rods, the reduced fuel assembly growth will help reduce irradiation-induced fuel rod bow and distortion, which can be detrimental to fuel handling activities. Since the creep rate of M5 is considerably slower than that of standard Zircaloy-4 cladding, the creep collapse life of M5 fuel rods is much greater than the standard rods and is not limiting at burnups up to 62 GWD/MTU. This decrease in creep collapse rate can benefit the fuel rod internal pressure performance.

4.0 TECHNICAL ANALYSIS

Topical Report BAW-10227P-A, Revision 1, *Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel* (Reference 8.1), approved by the NRC on June 18, 2003 provides the technical licensing basis for the use of M5 fuel cladding material and structural material. The M5 cladding is an AREVA proprietary material comprised of approximately 99% zirconium, and 1% niobium. As mentioned in Section 3, M5 cladding provides improved performance in fuel cladding corrosion and hydrogen pickup, fuel assembly and fuel rod growth, fuel rod bowing, and fuel rod cladding creep over standard Zircaloy-4 cladding. The M5 fuel cladding alloy has been tested in both reactor and non-reactor environments to establish its superior mechanical and structural properties.

AREVA has evaluated the properties of M5 and determined that the use of M5 as cladding and structural material would have either 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

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

AREVA has performed an evaluation of the LOCA and non-LOCA performance of the M5 cladding alloy for the generic accident scenarios described in Reference 8.1. The LOCA evaluation is performed with a set of analyses to show compliance with 10 CFR 50.46. A comparison of results obtained using the base evaluation model methods with Zircaloy-4 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.

AREVA is performing a plant-specific realistic Large Break LOCA (RLBLOCA) for FCS using approved RLBLOCA methodology (Reference 8.3). OPPD plans to submit a separate, but related license amendment request based on the AREVA RLBLOCA analysis.

AREVA will perform an assessment of the impact of the M5 alloy on the safety performance of nuclear fuel. The results of these calculations are not expected to differ substantially from Zircaloy-4 based calculations and no limiting criteria are expected to be challenged.

AREVA has determined that the use of the M5 alloy will have no significant adverse impact on radiological doses, which may result from any accident involving the radionuclides in the gap or fuel pellet.

The AREVA topical report BAW-10240(P)(A) justifies the use of a variety of NRC approved topical reports with fuel assemblies containing M5 material. The FCS TS and COLR include topical reports not considered in the evaluation presented in BAW-10240(P)(A) of the impact of M5 cladding on previously approved topical reports. The topical report ANF-89-151(P)(A) (Reference 8.9) contains non-LOCA transient analyses methodology similar to EMF-2310(P)(A) (Reference 8.6). BAW-10240(P)(A) evaluates the impact of M5 properties on EMF-2310(P)(A) (Reference 8.6).

An overview of NRC approved OPPD methodology for FCS reload core analysis is included in OPPD-NA-8301, Revision 8, *Omaha Public Power District Reload Core Analysis Methodology Overview* (Reference 8.11). Neutronics design methods implemented for FCS Unit 1 core reload analysis are described in the NRC approved document, OPPD-NA-8302, Revision 6, *Omaha Public Power District Reload Core Analysis Methodology, Neutronics Design Methods and Verification* (Reference 8.12). FCS unit 1 core thermal hydraulics, transient and accident analysis methods and computer codes for core reload analysis are described in the NRC approved document, OPPD-NA-8303, Revision 6, *Omaha Public Power District Reload Core Analysis Methodology Transient and Accident Methods and Verification* (Reference 8.13). Use of these documents was approved by the NRC in Reference 8.14.

The report BAW-10240(P)(A) demonstrates that neutronic, non-LOCA and DNB related topical reports do not require revision to address the use of M5 cladding. There is a negligible impact of the M5 cladding on non-LOCA transients and no impact on the DNB correlations or neutronic methods. It is thus concluded that it is acceptable to reference these topical reports in the FCS TS without modification for M5 cladding.

This proposed amendment does not involve application or use of risk-informed decisions.

5.0 REGULATORY SAFETY ANALYSIS

The technical analysis performed to justify the use of the fuel assemblies containing M5 material will be performed with methods contained in NRC approved topical reports. Since the M5 material has either a small or beneficial impact of the safety analyses it is expected that no significant impact on the safety analyses will be observed.

5.1 NO SIGNIFICANT HAZARDS CONSIDERATION

OPPD has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1. **Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?**

   Response: No.

   The NRC approved topical report BAW-1027P-A (Reference 8.1) that provides the licensing basis for M5 cladding and structural material, has shown that the M5 alloy exhibits superior properties to the currently used Zircaloy-4 material. The cladding by itself does not initiate an accident and therefore does not affect accident probability. It has been determined that M5 cladding will not significantly affect the consequences of an accident.

   Therefore, operation of the facility in accordance with the proposed amendment would not involve a significant increase in the probability or consequences of an accident previously analyzed.

2. **Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?**

   Response: No.

   The proposed change does not result in changes in the operation or overall configuration of the facility. Topical report BAW-10227P-A (Reference 8.1) demonstrated that the M5 alloy will perform similar to or better than Zircaloy-4, thus precluding the possibility of the fuel becoming an accident initiator and causing a new or different type of accident.

   Since the material properties of M5 alloy are similar to or better than Zircaloy-4, there will not be any significant change in the types of effluents that may be released off-site. There will not be any significant increase in occupational or public radiation exposure.

Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. **Does the proposed change involve a significant reduction in a margin of safety?**

   Response: No.

   AREVA has performed generic LOCA and non-LOCA evaluations and demonstrated the use of the M5 material will have only a small, or beneficial, impact on the event consequences.

   Plant-specific analyses using NRC approved methodology for the mixed core will demonstrate that the reactor core safety limits will continue to be met.

   Therefore, the proposed amendment does not involve a significant reduction in a margin of safety.

Based on the above, OPPD concludes that the proposed amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

5.2 APPLICABLE REGULATORY REQUIREMENTS/CRITERIA

The proposed changes have been evaluated to determine whether applicable regulations and requirements continue to be met.

5.2.1 Regulations

The proposed amendment to allow the use of M5 fuel rod cladding must comply with Criterion 10 of 10 CFR 50, Appendix A, *General Design Criteria for Nuclear Power Plants*. OPPD has determined that the proposed change that allows the use of M5 fuel rod cladding material requires exemptions from 10 CFR 50.46, *Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors* and 10 CFR 50, Appendix K, *ECCS Evaluation Models.* Attachment 4 provides the basis and justification for exemption from these regulations.

5.2.2 Design Basis

The proposed change to use the M5 fuel rod cladding will not affect the design bases of the plant and is therefore acceptable. The AOOs and postulated accidents listed in Chapter 14 of the FCS USAR are either analyzed or dispositioned for each cycle of operation. All incidents listed in Chapter 14 of the USAR are analyzed using NRC approved methodologies to show that no specified acceptable fuel design limits (SAFDL) are exceeded. To assure that adequate protection is provided for the public, conservative assumptions are incorporated into the analyses.

5.2.3 Approved Methodologies

AREVA topical report BAW-10240(P)(A) (Reference 8.7) justifies the use of a variety of NRC approved methods with fuel assemblies containing M5 material. The FCS TS and COLR include topical reports not considered in the evaluation presented in BAW-10240(P)(A) of the impact of M5 cladding on previously approved topical reports. The topical report ANF-89-151(P)(A) (Reference 8.9) contains non-LOCA transient analyses methodology similar to EMF-2310(P)(A) (Reference 8.6). BAW-10240(P)(A) evaluates the impact of M5 properties on the EMF-2310(P)(A) (Reference 8.6) methodology.

An overview of NRC approved OPPD methodology for Fort Calhoun Unit 1 reload core analysis is included in OPPD-NA-8301, Revision 8, *Omaha Public Power District Reload Core Analysis Methodology Overview* (Reference 8.11). Neutronics design methods implemented for FCS Unit 1 core reload analysis are described in the NRC approved document, OPPD-NA-8302, Revision 6, *Omaha Public Power District Reload Core Analysis Methodology, Neutronics Design Methods and Verification* (Reference 8.12). FCS unit 1 core thermal hydraulics, transient and accident analysis methods and computer codes for core reload analysis are described in the NRC approved document, OPPD-NA-8303, Revision 6, *Omaha Public Power District Reload Core Analysis Methodology Transient and Accident Methods and Verification* (Reference 8.13). Use of these documents was approved by the NRC in Reference 8.14.

The report BAW-10240(P)(A) demonstrates that neutronic, non-LOCA and DNB related topical reports do not require revision to address the use of M5 cladding. There is a negligible impact of the M5 cladding on non-LOCA transients and no impact on the DNB correlations or neutronic methods. It is thus concluded that it is acceptable to reference these topical reports in the FCS TS without modification for M5 cladding.

OPPD plans to submit a separate license amendment request to support the analyses of a Large Break LOCA for a core containing assemblies with M5 cladding.

5.2.4 Analysis

AREVA has incorporated NRC approved M5 material properties (Reference 8.1) into a set of approved AREVA methodologies for fuel mechanical analysis, realistic large break LOCA analysis, small break LOCA analysis and non-LOCA analysis (Reference 8.7). AREVA has performed an evaluation of the LOCA and non-LOCA performance of the M5 cladding alloy for the generic LOCA and non-LOCA accident scenarios described in Reference 8.1. A comparison of results obtained using the base evaluation model methods with Zircaloy-4 cladding and the results obtained for an identical case using the M5 swelling and rupture model shows that the M5 cladding performance should not adversely affect core operation or operating limits.

5.2.5 Conclusion

In conclusion, based on the considerations discussed above: (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.

6.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

7.0 PRECEDENCE

7.1 Letter from David E. LaBarge (NRC) to William R. McCollum (Duke Energy) dated June 21, 2000, Oconee Nuclear Station Units 1, 2, and 3, Re: Issuance of Amendments (TAC Nos. MA8674, MA8675, and MA8676) (ML003726452)

7.2 Letter from Douglas V. Pickett (NRC) to Guy G. Campbell (FirstEnergy) dated March 15, 2000, Issuance of Amendment – Davis Besse Station (TAC No. MA3552) (ML003696350)

7.3 Letter from Timothy G. Colburn (NRC) to Mark E. Warner (Amergen Energy Company) dated May 10, 2001, TMI-1 Amendment Re: Expanded Use of M5 Cladding Alloy (TAC No. MB0788) (ML011300351)

7.4 Letter from Brenda Mozafari (NRC) to Dale E. Young (Crystal River Plant) dated October 1, 2003, Crystal River Unit 3 - Issuance of Amendment Regarding Technical Specification Change Request For the Use of M5 Advanced Alloy Fuel Cladding (TAC No. MB6590) (ML032760276)

7.5 Letter from Stephen Monarque (NRC) to David A, Christian (Virginia Electric and Power Company) dated April 1, 2004, North Anna Power Station, Unit 2 - Issuance of Amendment Re: Use of Framatome ANP Advanced Mark-BW Fuel (TAC NO. MB4715) (ML040960040)

8.0 REFERENCES

8.1 BAW-10227P-A, Revision 1, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel," Framatome Cogema Fuels, June 2003.

8.2 EMF-92-153(P)(A), EMF-92-153(P)(A) Supplement 1, "HTP: Departure From Nucleate Boiling Correlation For High Thermal Performance Fuel," Siemens Power Corporation, March 1994.

8.3 EMF-2103(P)(A), Revision 0, "Realistic Large Break LOCA Methodology for Pressurized Water Reactors," Framatome ANP Richland, Inc., April 2003.

8.4 EMF-2328(P)(A), Revision 0, "PWR Small Break LOCA Model, S-RELAP5 Based," Framatome ANP, Inc., March 2001.

8.5 XN-75-21(P)(A), Revision 2, "XCOBRA-IIIC, A Computer Code to Determine the Distribution of Coolant During Steady-State and Transient Core Operation," Exxon Nuclear Company, January 1986.

8.6 EMF-2310(P)(A), Revision 1, "SRP Chapter 15 Non-LOCA Methodology for Pressurized Water Reactors," Framatome ANP, Inc., May 2004.

8.7 BAW-10240(P)(A), Revision 0, "Incorporation of M5™ Properties in Framatome ANP Approved Methods," Framatome ANP, Inc., May 2004.

8.8 EMF-1961(P)(A), Revision 0, "Statistical Setpoint/Transient Methodology for Combustion Engineering Type Reactors," Siemens Power Corporation, July 2000.

8.9 ANF-89-151(P)(A), Revision 0, "ANF-RELAP Methodology for Pressurized Water Reactors: Analysis of Non-LOCA Chapter 15 Events," Advanced Nuclear Fuels Corporation, May 1992.

8.10 Letter from D. J. Bannister (OPPD) to Document Control Desk (NRC) dated November 23, 2004, Fort Calhoun Station Unit No. 1 License Amendment Request, "Revisions of Technical Specifications Table 1-1 and Section 4.0" (LIC-04-0117) (ML043290064)

8.11 OPPD-NA-8301, Revision 8, "Omaha Public Power District Reload Core Analysis Methodology Overview."

8.12 OPPD-NA-8302, Revision 6, "Omaha Public Power District Reload Core Analysis Methodology, Neutronics Design Methods and Verification."

8.13 OPPD-NA-8303, Revision 6, "Omaha Public Power District Reload Core Analysis Methodology, Transient and Accident Methods and Verification."

8.14 Letter from Alan B. Wang (NRC) to R. T. Ridenoure (OPPD) dated March 11, 2005, Fort Calhoun Station , Unit No. 1 – Issuance of Amendment 233, (NRC-05-0031) (ML050750534)

ATTACHMENT 2

Markup of
Technical Specification Pages

4.0 **DESIGN FEATURES**

4.1 Site

The site for Fort Calhoun Station Unit No. 1 is in Washington County, Nebraska, on the west bank of the Missouri River and approximately nineteen miles north, northwest of the city of Omaha, Nebraska. The exclusion area, as defined in 10 CFR Part 100, Section 100.3(a), consists of approximately 1242 acres. The exclusion area boundary extent includes approximately 660 acres in Washington County, Nebraska, owned by the Omaha Public Power District (OPPD), and 582 acres in Harrison County, Iowa, on the east bank of the river directly opposite the facility, on which the District retains perpetual easement rights. The minimum exclusion area boundary point is located approximately at the 187.0 degree radial from the outer wall of the containment building and at a distance of 910 meters.

4.2 Reactor Core

4.2.1 Fuel Assemblies

The reactor shall contain 133 fuel assemblies. Each assembly shall consist of a matrix of Zircalloy, ~~or~~ ZIRLO, *or M5 clad* fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO_2) as fuel material. Limited substitutions of zirconium alloy or stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions.

4.2.2 Control Element Assemblies

The reactor core shall contain 49 control element assemblies (CEAs). The control material shall be silver indium cadmium, boron carbide, or hafnium metal as approved by the NRC.

4.3 Fuel Storage

4.3.1 Criticality

4.3.1.1 The spent fuel storage racks are designed and shall be maintained with:

a. Fuel assemblies having a maximum U-235 enrichment of 4.5 weight percent,

b. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 9.5 of the USAR,

5.0 **ADMINISTRATIVE CONTROLS**
5.9 Reporting Requirements (Continued)

1. OPPD-NA-8301, "Reload Core Analysis Methodology Overview" approved version as specified in the COLR.

2. OPPD-NA-8302, "Neutronics Design Methods and Verification", approved version as specified in the COLR.

3. OPPD-NA-8303, "Transient and Accident Methods and Verification", approved version as specified in the COLR.

4. WCAP-12610-P-A, "VANTAGE + Fuel Assembly Report," April 1995 (Westinghouse Proprietary) as approved in the Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment No. 178 to Facility Operating License No. DPR-40, Omaha Public Power District, Fort Calhoun Station Unit No. 1, Docket No. 50-285, dated October 25, 1996.

5. XN-75-32(P)(A) Supplements 1, 2, 3, & 4, "Computational Procedure for Evaluating Fuel Rod Bowing," approved version as specified in the COLR.

6. XN-NF-82-06(P)(A) and Supplements 2, 4, and 5, "Qualification of Exxon Nuclear Fuel for Extended Burnup," approved version as specified in the COLR.

7. XN-NF-85-92(P)(A), "Exxon Nuclear Uranium Dioxide/Gadolinia Irradiation Examination and Thermal Conductivity Results," approved version as specified in the COLR.

8. ANF-88-133(P)(A) and Supplement 1, "Qualification of Advanced Nuclear Fuels PWR Design Methodology for Rod Burnups of 62 GWd/MTU," approved version as specified in the COLR.

9. EMF-92-116(P)(A), "Generic Mechanical Design Criteria for PWR Fuel Designs," approved version as specified in the COLR.

10. *BAW-10240(P)(A), "Incorporation of M5™ Properties in Framatome ANP Approved Methods," Framatome ANP, Inc., approved version as specified in the COLR.*

c. The core operating limits shall be determined so that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulics limits, Emergency Core Cooling System (ECCS) limits, nuclear limits such as shutdown margin (SDM), transient analysis limits, and accident analysis limits) of the safety analysis are met.

d. The COLR, including any mid-cycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

ATTACHMENT 3

Clean Typed
Technical Specification Pages

4.0 DESIGN FEATURES

4.1 Site

The site for Fort Calhoun Station Unit No. 1 is in Washington County, Nebraska, on the west bank of the Missouri River and approximately nineteen miles north, northwest of the city of Omaha, Nebraska. The exclusion area, as defined in 10 CFR Part 100, Section 100.3(a), consists of approximately 1242 acres. The exclusion area boundary extent includes approximately 660 acres in Washington County, Nebraska, owned by the Omaha Public Power District (OPPD), and 582 acres in Harrison County, Iowa, on the east bank of the river directly opposite the facility, on which the District retains perpetual easement rights. The minimum exclusion area boundary point is located approximately at the 187.0 degree radial from the outer wall of the containment building and at a distance of 910 meters.

4.2 Reactor Core

4.2.1 Fuel Assemblies

The reactor shall contain 133 fuel assemblies. Each assembly shall consist of a matrix of Zircalloy, ZIRLO, or M5 clad fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO_2) as fuel material. Limited substitutions of zirconium alloy or stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions.

4.2.2 Control Element Assemblies

The reactor core shall contain 49 control element assemblies (CEAs). The control material shall be silver indium cadmium, boron carbide, or hafnium metal as approved by the NRC.

4.3 Fuel Storage

4.3.1 Criticality

4.3.1.1 The spent fuel storage racks are designed and shall be maintained with:

a. Fuel assemblies having a maximum U-235 enrichment of 4.5 weight percent,

b. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 9.5 of the USAR,

5.0 **ADMINISTRATIVE CONTROLS**
5.9 Reporting Requirements (Continued)

1. OPPD-NA-8301, "Reload Core Analysis Methodology Overview" approved version as specified in the COLR.

2. OPPD-NA-8302, "Neutronics Design Methods and Verification", approved version as specified in the COLR.

3. OPPD-NA-8303, "Transient and Accident Methods and Verification", approved version as specified in the COLR.

4. WCAP-12610-P-A, "VANTAGE + Fuel Assembly Report," April 1995 (Westinghouse Proprietary) as approved in the Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment No. 178 to Facility Operating License No. DPR-40, Omaha Public Power District, Fort Calhoun Station Unit No. 1, Docket No. 50-285, dated October 25, 1996.

5. XN-75-32(P)(A) Supplements 1, 2, 3, & 4, "Computational Procedure for Evaluating Fuel Rod Bowing," approved version as specified in the COLR.

6. XN-NF-82-06(P)(A) and Supplements 2, 4, and 5, "Qualification of Exxon Nuclear Fuel for Extended Burnup," approved version as specified in the COLR.

7. XN-NF-85-92(P)(A), "Exxon Nuclear Uranium Dioxide/Gadolinia Irradiation Examination and Thermal Conductivity Results," approved version as specified in the COLR.

8. ANF-88-133(P)(A) and Supplement 1, "Qualification of Advanced Nuclear Fuels PWR Design Methodology for Rod Burnups of 62 GWd/MTU," approved version as specified in the COLR.

9. EMF-92-116(P)(A), "Generic Mechanical Design Criteria for PWR Fuel Designs," approved version as specified in the COLR.

10. BAW-10240(P)(A), "Incorporation of M5™ Properties in Framatome ANP Approved Methods," Framatome ANP, Inc., approved version as specified in the COLR..

c. The core operating limits shall be determined so that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulics limits, Emergency Core Cooling System (ECCS) limits, nuclear limits such as shutdown margin (SDM), transient analysis limits, and accident analysis limits) of the safety analysis are met.

d. The COLR, including any mid-cycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

ATTACHMENT 4

10 CFR 50.46 and 10 CFR Appendix K Exemption Request

10 CFR 50.46 and 10 CFR 50, Appendix K Exemption Request

In accordance with 10 CFR 50.12, *Specific Exemptions,* the Omaha Public Power District (OPPD) requests exemptions from the requirements for Fort Calhoun Unit 1 (FCS) as specified in 10 CFR 50.46, *Acceptance criteria for emergency core cooling systems for light- water nuclear power reactors,* section (a)(1)(i), which explicitly identifies Zircaloy or ZIRLO as a fuel rod cladding material, and 10 CFR 50 Appendix K to Part 50 - *ECCS Evaluation Models.* These exemption requests are related to the proposed use of the M5 advanced zirconium alloy for FCS fuel rod cladding and fuel assembly structural material.

10 CFR 50.12 states that the Commission may grant an exemption from requirements contained in 10 CFR 50 provided that: 1) the exemption is authorized by law, 2) the exemption will not present an undue risk to public health and safety, 3) the exemption is consistent with the common defense and security, and 4) special circumstances, as defined in 10 CFR 50.12(a)(2) are present. The requested exemptions to allow the use of advanced zirconium alloys other than Zircaloy or ZIRLO for fuel cladding material for reloads at FCS satisfy these requirements as described below.

1. The requested exemption is authorized by law.

   Transition to an alternate, but similar fuel product is not precluded by law. The fuel that will be irradiated at FCS contains cladding material that does not conform to the cladding material designations explicitly defined in 10 CFR 50.46 and implicitly included in 10 CFR 50, Appendix K. However, the criteria of these sections will continue to be satisfied for the operation of the FCS Unit 1 core containing M5 fuel rod cladding and fuel assembly structural material.

2. The requested exemption does not present an undue risk to the public health and safety.

   The M5 fuel rod cladding and fuel assembly structural material has been evaluated to confirm that operation of the plant with this fuel product does not increase the probability of occurrence or the consequences of an accident. The evaluation also concluded that no new or different type of accident will be initiated that could pose a risk to public health and safety. In addition, appropriate full-core and mixed-core safety analyses will be performed to demonstrate that this fuel type does not present an undue risk to the public health and safety. OPPD, in conjunction with AREVA, plans to utilize NRC approved methods for the reload design process for FCS reload cores containing M5 fuel rod cladding and fuel assembly structural materials.

3. The requested exemption will not endanger the common defense and security.

   The M5 fuel rod cladding is similar in design to the current cladding material used at FCS. OPPD plans to continue to handle and control the special nuclear material in this fuel product in accordance with approved procedures. It has been confirmed through evaluation, that M5 fuel rod cladding and fuel assembly structural material will not endanger the common defense and security.

4. Special circumstances are present which necessitate the request of an exemption to the regulations of 10 CFR 50.46 and 10 CFR 50 Appendix K.

The special circumstance necessitating the request for an exemption to 10 CFR 50.46 and 10 CFR 50 Appendix K is that neither of these regulations explicitly allows the use of M5 fuel rod cladding material.

The underlying purpose of 10 CFR 50.46 is to ensure that nuclear power facilities have adequately demonstrated the cooling performance of their Emergency Core Cooling System (ECCS). Framatome-ANP demonstrates in its topical report BAW-10227P-A, *Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel,* approved by the NRC by letter dated February 4, 2000, that the effectiveness of the ECCS will not be affected by a change from Zircaloy fuel rod cladding to M5 fuel rod cladding. Normal reload safety analyses will confirm that the safety analyses performed to support the use of this fuel type will remain applicable for the FCS core. Consequently, the use of the M5 fuel cladding and fuel assembly structural material will not have a detrimental impact on the performance of the FCS Unit 1 core under loss of coolant accident (LOCA) conditions.

The underlying purpose of 10 CFR 50.46(b)(2) and (b)(3), and 10 CFR 50 Appendix K I.A.5 is to ensure that cladding oxidation and hydrogen generation are appropriately limited during a LOCA and conservatively accounted for in the ECCS evaluation model. Specifically, Appendix K 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. AREVA demonstrates in Appendix D of BAW-10227P-A, that the Baker-Just model is conservative in all post-LOCA scenarios with respect to the use of the M5 advanced alloy as a fuel rod cladding material.

Therefore, the intent of 10 CFR 50.46 and 10 CFR 50, Appendix K will continue to be satisfied for the planned operation with AREVA M5 fuel rod cladding and fuel assembly structural material. Issuance of an exemption from these regulations for the use of M5 fuel rod cladding and structural material in the FCS core will not compromise the safe operation of the reactor.