APPLICATION FOR AMENDMENT

TO

FACILITY OPERATING LICENSE NUMBER NPF-3

DAVIS-BESSE NUCLEAR POWER STATION

UNIT NUMBER 1

Attached are the requested changes to the Davis-Besse Nuclear Power Station, Unit Number 1 Facility Operating License Number NPF-3. Also included is the Safety Assessment and Significant Hazards Consideration.

The proposed changes (submitted under cover letter Serial Number 2552) concern:

Appendix A, Technical Specification:

5.3.1 Design Features - Reactor Core - Fuel Assemblies

Appendix A, Technical Specification Bases:

2.1.1 and 2.1.2 Safety Limits - Bases - Reactor Core.

I, John K. Wood, state that (1) I am Vice President - Nuclear of the Centerior Service Company, (2) I am duly authorized to execute and file this certification on behalf of the Toledo Edison Company and The Cleveland Electric Illuminating Company, and (3) the statements set forth herein are true and correct to the best of my knowledge, information and belief.

By: John K Wood

John K. Wood, Vice President - Nuclear

Affirmed and subscribed before me this 8th day of September, 1998.

Nora Lynn Flood

Notary Public, State of Ohio

Nora Lynn Flood, My Commission expires September 4, 2002.

The following information is provided to support issuance of the requested changes to the Davis-Besse Nuclear Power Station (DBNPS), Unit Number 1 Operating License Number NPF-3, Appendix A, Technical Specification (TS) 5.3.1, Design Features - Reactor Core - Fuel Assemblies and TS Bases Section 2.1.1 and 2.1.2, Safety Limits - Bases - Reactor Core:

A. Time Required to Implement: The License Amendment associated with this license amendment application is to be implemented within 120 days of NRC issuance.

B. Reason for Change (License Amendment Request Number 98-0006):

These changes are proposed to permit the use of the Framatome Cogema Fuels (FCF) "M5" advanced alloy for fuel rod cladding and fuel assembly spacer grids. Technical Specification 5.3.1 presently limits the fuel rod cladding material to either zircaloy or ZIRLO. Bases 2.1 presently refers to only zircaloy spacer grids. The M5 alloy is a proprietary zirconium-based alloy which provides for improvements in fuel cladding corrosion and hydrogen pickup, fuel assembly and fuel rod growth, and fuel rod cladding creep relative to the zircaloy cladding currently in use at the DBNPS.

Toledo Edison intends to use the M5 alloy in operating Cycle 13. Fuel assemblies for Cycle 13 are presently scheduled to be delivered to the DBNPS in February of 2000 and loaded into the core in April of 2000. The inability to obtain reload fuel utilizing M5 cladding for the DBNPS would result in significantly larger reload batches in future operating cycles and may restrict cycle lengths to less than the currently NRC-approved twenty-four months. Use of M5 cladding at the DBNPS will require NRC review and approval, by December 31, 1998, of FCF Topical Report BAW-10227P, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel." This Topical Report was submitted to the NRC by FCF on September 30, 1997.

C. Safety Assessment and Significant Hazards Consideration: See Attachment.

Docket Number 50-346
License Number NPF-3
Serial Number 2552
Attachment

SAFETY ASSESSMENT AND SIGNIFICANT HAZARDS CONSIDERATION
FOR
LICENSE AMENDMENT REQUEST NUMBER 98-0006

(9 pages follow)

SAFETY ASSESSMENT AND SIGNIFICANT HAZARDS CONSIDERATION FOR LICENSE AMENDMENT REQUEST 98-0006

TITLE

Proposed Modification to the Davis-Besse Nuclear Power Station (DBNPS) Unit 1, Facility Operating License NPF-3 Appendix A Technical Specifications, to Revise Technical Specification (TS) 5.3.1, Design Features - Reactor Core - Fuel Assemblies, to Allow Use of the M5 Advanced Alloy For Fuel Rod Cladding and Fuel Assembly Structural Components.

DESCRIPTION

The purpose of this license amendment request is to propose changes to TS 5.3.1 (Design Features - Reactor Core - Fuel Assemblies) and TS Bases Section 2.1 (Safety Limits - Bases - Reactor Core) to permit the use of the Framatome Technology, Incorporated's (FTI's) M5 advanced alloy as a suitable material for fuel rod cladding and fuel assembly spacer grids. The M5 alloy will also be used for fuel rod end plugs and fuel assembly guide tubes and instrument tubes. Currently, the TS only permit the use of Zircaloy or ZIRLO for such components. Use of the M5 alloy, with its enhanced corrosion resistance and reduced growth rate, will permit longer fuel residence times, higher fuel burnups, and reduced reload feed batch sizes, with corresponding improvements in fuel cycle economics. Reduced feed batch sizes will also help to reduce the spent fuel storage burden at the DBNPS.

SYSTEMS, COMPONENTS, AND ACTIVITIES AFFECTED

The only systems, components, or activities affected by this proposed operating license modification are the reactor core and the nuclear fuel.

FUNCTIONS OF THE AFFECTED SYSTEMS, COMPONENTS, AND ACTIVITIES

The nuclear fuel design is described in the DBNPS Updated Safety Analysis Report (USAR) Appendix 4B, "Reload Report" (latest reload report: TE Serial Number 2536, dated May 19, 1998). The nuclear fuel in the reactor core produces heat through the fissioning of uranium and plutonium. This heat is ultimately used to produce steam which drives the turbine-generator to produce electricity. The safety functions performed by the reactor core and nuclear fuel are to retain the fuel in an appropriate geometry for the fission process and for heat removal, to provide a means of controlling the fission reaction through the insertion of control rods, and to prevent the migration of radioactive fission products away from the fuel pellets. Fuel assembly spacer grids retain the fuel rods in the appropriate geometry for the fission process and for cooling. Fuel assembly guide tubes provide a path for the insertion of control rods into the fuel assemblies and also provide the structural support for the spacer grids. The fuel rod cladding and fuel rod end plugs prevent fission products from escaping from the fuel rods and, as such, they represent the first fission product barrier between the nuclear fuel pellets and the environment.

EFFECTS ON SAFETY

The M5 advanced alloy was developed by FTI's parent company in France as an improved fuel cladding and fuel assembly structural material. Detailed properties of the M5 alloy are presented in the FTI topical report BAW-10227P, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel" (Reference 1), which was submitted by FTI to the Nuclear Regulatory Commission (NRC) for review and approval on September 30, 1997.

The M5 alloy is an FTI proprietary material comprised primarily of zirconium (~99 percent) and niobium (~1 percent). This composition provides for improvements in fuel cladding corrosion and hydrogen pickup, fuel assembly and fuel rod growth, and fuel rod cladding creep relative to the Zircaloy-4 cladding currently in use at the DBNPS. The M5 alloy has been tested in both reactor and non-reactor environments to ascertain its mechanical and structural properties, as described in Reference 1.

Results of test irradiations of M5 fuel rod cladding in commercial power reactors in both the U.S. and Europe have demonstrated that both the maximum fuel cladding corrosion rate and the hydrogen pickup rate are only about 50 percent of that observed for low-tin Zircaloy-4 cladding of the type currently used at the DBNPS. Therefore, use of M5 cladding will provide significantly greater margin to the 100 micron corrosion limit than can be afforded by low-tin Zircaloy-4. These improvements in corrosion and hydrogen uptake are also applicable to fuel assembly structural components, such as guide tubes and spacer grids. Such improvements are particularly important in twenty-four month fuel cycles, such as those used at the DBNPS, where the reactor coolant system chemistry (i.e., high boron and high lithium concentrations) is more challenging to fuel rod cladding performance.

These same tests have also shown that the M5 alloy exhibits significantly less irradiation induced growth in fuel rods and fuel assembly guide tubes when compared to Zircaloy-4. This will provide additional margin to the fuel assembly and fuel rod growth limits for fuel assemblies with high burnups such as those that will be produced in twenty-four month fuel cycles at the DBNPS. Reduced fuel assembly growth will also help reduce irradiation-induced fuel assembly bow and distortion, which can be detrimental to fuel handling. Fuel cladding creep collapse is also greatly reduced for the M5 alloy relative to Zircaloy-4, which can benefit fuel rod internal pressure performance.

In evaluating the properties of the M5 alloy, FTI determined in Reference 1 that the use of the M5 alloy would have either no significant impact or would produce a benefit for the following parameters and analyses:

- 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 axial growth.
- Fuel rod bow.

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

FTI demonstrated in BAW-2149-A, "Evaluation of Replacement Fuel Rods in BWFC Fuel Assemblies" (Reference 4), that FTI fuel assemblies with Zircaloy-4 cladding and structural materials can meet all safety criteria with up to ten (10) stainless steel replacement fuel rods. The substitution of M5 for Zircaloy-4 in the fuel rod cladding, fuel rod end plugs, guide tubes, instrument tubes and intermediate spacer grids does not change that allowable fuel assembly configuration (Reference 5). M5 has been shown to be compatible when in contact with stainless steel, Zircaloy-4, and Inconel-718. In making this determination, FTI evaluated issues of structural strength, available growth space, differential thermal expansion, and corrosion.

FTI also evaluated, in Reference 1, the performance of the M5 alloy for both non-LOCA and LOCA accident scenarios which bound the scenarios defined in the

DBNPS Updated Safety Analysis Report. The only non-LOCA events in which the cladding material could affect the overall accident outcome were those in which departure from nucleate boiling (DNB) performance was an acceptance criterion. For such accidents, a change from Zircaloy-4 to M5 fuel rod cladding and fuel assembly spacer grids produces no adverse consequences in DNB performance. This is to be expected, since both M5 and Zircaloy-4 have very similar heat transfer properties. In some cases, due to the reduced clad creep rate of M5, a DNB benefit can be produced since the reduced clad creep rate results in greater heat transfer surface area and, therefore, lower heat flux.

In Reference 1, FTI determined that the five LOCA acceptance criteria from 10 CFR 50.46 are applicable to fuel rods clad with the M5 alloy. Generic LOCA analyses for both B&W- and Westinghouse-type plants and fuel have been performed using M5-specific material properties which accounted for the following:

- Lower alpha-beta phase transition temperature for M5 relative to Zircaloy-4.
- Slower clad creep collapse for M5 relative to Zircaloy-4.
- Slightly lower beginning of life yield strength for M5 relative to Zircaloy-4 (by 3 GWd/mtU (approximately 3 months of irradiation) the yield strength of M5 is equivalent to that of unirradiated Zircaloy-4).
- M5-specific clad swelling and rupture models determined through experimental measurements.

These generic LOCA analyses using M5-specific material properties have demonstrated: that all five of the LOCA acceptance criteria mandated by 10 CFR 50.46 can be readily met in cores using M5 cladding; that the use of M5 cladding will not require any reductions in LOCA linear heat rate limits; and that there are no adverse LOCA-related issues that would prevent the acceptable use of M5 cladding. A plant-specific LOCA reanalysis will be performed for the DBNPS prior to the use of the M5 alloy in fuel assemblies in batch quantities, and the results of that analysis will be documented in the cycle-specific reload report associated with that first M5 fuel batch. This LOCA reanalysis is required by TS 6.9.1.7, "Core Operating Limits Report."

Also, FTI determined in Reference 1 that, for those accidents which result in radionuclide release (e.g., LOCA, CRA ejection accident, fuel handling accident), the use of M5 cladding and structural components will have no adverse impact on radiological doses. Again, this is due to the similar material properties and similar DNB performance of both M5 and Zircaloy-4 during these accident scenarios.

Based on the above, it can be concluded that the use of the M5 alloy for fuel rod cladding, fuel rod end plugs, and fuel assembly structural components will have no adverse effect on safety.

SIGNIFICANT HAZARDS CONSIDERATION

The Nuclear Regulatory Commission has provided standards in 10 CFR 50.92(c) for determining whether a significant hazard exists due to a proposed amendment to an Operating License for a facility. A proposed amendment involves no significant hazards consideration if operation of the facility in accordance with the proposed changes would: (1) Not involve a significant increase in the probability or consequences of an accident previously evaluated; (2) Not create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) Not involve a significant reduction in a margin of safety. The Davis-Besse Nuclear Power Station has reviewed the proposed changes and determined that a significant hazards consideration does not exist because operation of the Davis-Besse Nuclear Power Station in accordance with these changes would:

1a. Not involve a significant increase in the probability of an accident previously evaluated because it has been demonstrated that the material properties of the M5 alloy are not significantly different from those of Zircaloy-4. Further, there are no evaluated accidents in which the fuel cladding or fuel assembly structural components are assumed to arbitrarily fail as an accident initiator. The fuel handling accident assumes that the cladding does, in fact, fail as a result of an undefined fuel handling event. However, the probability of that undefined initiating event is independent of the properties of the fuel rod cladding.

1b. Not involve a significant increase in the consequences of an accident previously evaluated because it has been demonstrated that the material properties of the M5 alloy are not significantly different from those of Zircaloy-4. Therefore, in both non-LOCA and LOCA accident scenarios, there will be no significant increase in cladding failure or fission product release.

2. Not create the possibility of a new or different kind of accident from any accident previously evaluated because it has been demonstrated that the material properties of the M5 alloy are not significantly different from those of Zircaloy-4. Therefore, M5 fuel cladding and fuel assembly structural components will perform similarly to those fabricated from Zircaloy-4, thus precluding the possibility of the fuel becoming an accident initiator and causing a new or different kind of accident.

3. Not involve a significant reduction in a margin of safety because it has been demonstrated that the material properties of the M5 alloy are not significantly different from those of Zircaloy-4. The M5 alloy is expected to perform similarly to Zircaloy-4 for all normal operating and accident scenarios, including both non-LOCA and LOCA scenarios. For LOCA scenarios, where the slight differences in M5 material properties relative to Zircaloy-4 could have some impact on the overall accident scenario, plant-specific LOCA analyses will be performed prior to the use of batch quantities of fuel assemblies containing either fuel rod cladding, fuel rod end plugs, or fuel assembly structural components fabricated from M5. These plant-specific LOCA analyses, required by TS 6.9.1.7, "Core Operating Limit Report," will either demonstrate that all current, applicable, and appropriate margins of safety will be maintained during the use of the M5 alloy or their results will be submitted for NRC review and approval prior to use of the M5 alloy.

CONCLUSION

On the basis of the above, the Davis-Besse Nuclear Power Station has determined that the License Amendment Request does not involve a significant hazard consideration. As this License Amendment Request concerns a proposed change to the Technical Specifications that must be reviewed by the Nuclear Regulatory Commission, this License Amendment Request does not constitute an unreviewed safety question.

ATTACHMENT

Attached are the proposed marked-up changes to the Operating License.

REFERENCES

1. Framatome Technologies, Inc. (FTI) Topical Report BAW-10227P, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel," September, 1997.

2. DBNPS Operating License NPF-3, Appendix A, Technical Specifications, through Amendment No. 225.

3. DBNPS Updated Safety Analysis Report (USAR), Revision 20.

4. Framatome Technologies, Inc. (FTI) Topical Report BAW-2149-A, "Evaluation of Replacement Fuel Rods in BWFC Fuel Assemblies," September, 1993.

5. Letter from J. R. Lojek (FTI) to F. L. Swanger (TE), dated July 30, 1998, BWT-98-4494, subject: Davis-Besse Nuclear Power Station Unit No. 1 Response to Toledo Edison's Questions Regarding M5.