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INDIANA MICHIGAN POWER

April 6, 2004

AEP:NRC:4565
10 CFR 50.90

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop O-P1-17
Washington, DC 20555-0001

SUBJECT: Donald C. Cook Nuclear Plant Unit 1 and Unit 2
Docket Nos. 50-315 and 50-316
Proposed Technical Specification Changes and Exemption Requests to Support Use of Framatome ANP, Inc. Fuel

Dear Sir or Madam:

Pursuant to 10 CFR 50.90 and 10 CFR 50.12, Indiana Michigan Power Company (I&M), the licensee for Donald C. Cook Nuclear Plant (CNP) Unit 1 and Unit 2, proposes to amend Facility Operating Licenses DPR-58 and DPR-74 and requests exemptions from 10 CFR 50.44, 10 CFR 50.46, and 10 CFR 50, Appendix K. The amendments and exemptions will permit CNP Unit 1 to use Framatome ANP, Inc. (FANP) fuel beginning with Cycle 20 and CNP Unit 2 to use FANP fuel beginning with Cycle 16. Unit 1 Cycle 20 is planned for Spring 2005 and Unit 2 Cycle 16 is planned for Spring 2006.

I&M proposes to revise Technical Specification (TS) design features for fuel assemblies and new fuel storage criticality limitations. In addition, I&M requests Nuclear Regulatory Commission (NRC) approval of the criticality analysis methodology supporting the spent fuel storage rack and new fuel storage rack in accordance with 10 CFR 50.59(c)(2)(viii). An additional license amendment request is planned specific to Unit 1 for late June 2004 to request TS changes related to the use of FANP methodology at CNP and to submit the Unit 1 Realistic Large Break Loss of Coolant Accident (LOCA) and a Unit 1 Non-LOCA analysis performed using FANP methodology.

Enclosure 1 provides an affirmation statement pertaining to this letter. Enclosure 2 provides I&M's evaluation of the proposed TS changes and criticality analysis methodology. Enclosure 3 provides the FANP criticality analyses for the new fuel and spent fuel storage racks in support of the proposed

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amendment. Enclosure 4 provides the basis and justification for exemption from the requirements of 10 CFR 50.44, 10 CFR 50.46, and 10 CFR 50, Appendix K to use M5 advanced alloy cladding. Enclosure 5 provides basis and justification for requesting a continuation of CNP's exemption to 10 CFR 70.24. Attachments 1A and 1B provide marked up TS pages for Unit 1 and Unit 2, respectively. Attachments 2A and 2B provide the proposed TS pages with the changes incorporated for Unit 1 and Unit 2, respectively. There are no new commitments in this letter.

I&M requests NRC approval of this amendment no later than December 15, 2004 to support CNP Unit 1 new fuel receipt inspection, fuel storage, and the scheduled start of Cycle 20. I&M requests a 30-day implementation period following approval.

No previous submittals affect TS pages that are submitted in this request. If any future submittals affect these TS pages, then I&M will coordinate changes to the pages with the NRC Project Manager to ensure proper TS change control when the associated license amendment requests are approved.

Copies of this letter and its attachments are being transmitted to the Michigan Public Service Commission and Michigan Department of Environmental Quality, in accordance with the requirements of 10 CFR 50.91.

Should you have any questions, please contact Mr. John A. Zwolinski, Director of Design Engineering and Regulatory Affairs at (269) 697-5007.

Sincerely,

Joseph N. Jensen
Site Vice President

KS/rdw

Enclosures:

1. Affirmation
2. Evaluation of Proposed Changes
3. Criticality Analyses for the Spent and New Fuel Storage Racks
4. Exemption Request Basis and Justification for Use of M5 Advanced Alloy Cladding
5. Exemption Request Basis and Justification for Exemption from 10 CFR 70.24

Attachments:

1A. CNP Unit 1 Technical Specification Pages Marked To Show Proposed Changes

1B. CNP Unit 2 Technical Specification Pages Marked To Show Proposed Changes

2A. CNP Unit 1 Technical Specification Pages Retyped With Proposed Changes Incorporated

2B. CNP Unit 2 Technical Specification Pages Retyped With Proposed Changes Incorporated

c: J. L. Caldwell, NRC Region III
K. D. Curry, Ft. Wayne AEP, w/o enclosures/attachments
J. T. King, MPSC, w/o enclosures/attachments
MDEQ – WHMD/HWRPS, w/o enclosures/attachments
NRC Resident Inspector
J. F. Stang, Jr., NRC Washington, DC

Enclosure 1 to AEP:NRC:4565

<u>**AFFIRMATION**</u>

I, Joseph N. Jensen, being duly sworn, state that I am Site Vice President of Indiana Michigan Power Company (I&M), that I am authorized to sign and file this request with the Nuclear Regulatory Commission on behalf of I&M, and that the statements made and the matters set forth herein pertaining to I&M are true and correct to the best of my knowledge, information, and belief.

Indiana Michigan Power Company

Joseph N. Jensen
Site Vice President

SWORN TO AND SUBSCRIBED BEFORE ME

THIS 6th DAY OF April, 2004

Notary Public

My Commission Expires 6/10/2007

BRIDGET TAYLOR
Notary Public, Berrien County, MI
My Commission Expires Jun. 10, 2007

Enclosure 2 to AEP:NRC:4565

EVALUATION

Subject: Evaluation of Proposed Changes

1.0 DESCRIPTION

This letter is a request by Indiana Michigan Power Company (I&M) to amend Facility Operating Licenses DPR-58 and DPR-74 for the Donald C. Cook Nuclear Plant (CNP) Unit 1 and Unit 2. I&M is planning to use Framatome ANP, Inc. (FANP) fuel design for Unit 1, Cycle 20 and Unit 2, Cycle 16. The FANP fuel design uses M5 advanced alloy cladding, which is chemically different from cladding material currently specified in CNP Unit 1 and Unit 2 Technical Specification (TS) 5.3.1, "Fuel Assemblies." FANP fuel design uses Gadolinia-bearing fuel rods to ensure adequate reactivity margin in the new fuel storage rack instead of integral fuel burnable absorber (IFBA) rods as specified in TS 5.6.2, "Criticality – New Fuel." Criticality analyses have been completed in support of the storage of FANP fuel assemblies in the spent and new fuel storage racks. In accordance with 10 CFR 50.59(c)(2)(viii) the criticality analyses require Nuclear Regulatory Commission (NRC) approval since the methodology used in the analyses is a departure from a method described in the CNP Updated Final Safety Analysis Report (UFSAR).

2.0 PROPOSED CHANGE

I&M proposes the following changes to the CNP Unit 1 and Unit 2 TS:

- Revise the fuel assemblies design feature stated in TS 5.3.1 to allow "M5" cladding in addition to Zircaloy-4 or ZIRLO.
- Revise the design feature that ensures adequate reactivity margin for new fuel in the new fuel storage racks as stated in TS 5.6.2.a to replace requirements for IFBA pins with requirements for Gadolinia-bearing fuel rods.

These changes are shown in Attachments 1A, 1B, 2A, and 2B.

In addition to the TS changes, I&M requests NRC approval of the methodology used in the FANP criticality analyses for the spent and new fuel storage racks. I&M had criticality analyses performed to support the above described changes to TS 5.6.2.a and to verify compliance with TS 5.6.1.1, "Criticality – Spent Fuel." I&M has determined, in accordance with 10 CFR 50.59, that the criticality analyses include departures from a method of evaluation previously described in the CNP UFSAR. The departures in methodology are as follows:

1) Reactivity equivalencing was used in both the spent fuel storage and new fuel storage analyses to determine reactivity differences between FANP fuel assembly designs and the design basis fuel assemblies. The reactivity difference was applied as a penalty to the current CNP design basis maximum effective neutron multiplication factor (K_{eff}) demonstrated in the spent fuel storage (Holtec) or new fuel storage (Westinghouse) criticality analyses.

2) Uncertainties, tolerances, and biases calculated in the Holtec and Westinghouse criticality analyses were utilized.
3) The Monte Carlo code MCNP-4B was used for reactivity equivalencing in the new fuel storage rack analysis in place of KENO-IV and Phoenix-P for verifying TS requirements are met and evaluating the FANP fuel burnable absorber, Gadolinia.
4) Gadolinia was credited by reactivity equivalencing in the new fuel storage racks for higher enrichment fuel assemblies.

The criticality analyses are provided as Enclosure 3 to this letter.

In summary, the proposed change will revise TS governing design feature requirements for fuel assemblies and fuel burnable absorbers for storage of fuel assemblies in the new fuel storage racks. The changes to fuel assembly design features will allow use of M5 cladding in addition to Zircaloy-4 and ZIRLO cladding. New fuel burnable absorber requirements are proposed to replace current requirements specifying a Westinghouse fuel product with equivalent requirements for a FANP fuel product to ensure adequate reactivity margin in the new fuel storage racks. Methodology changes for the criticality analyses supporting the storage of FANP fuel assemblies in the spent and new fuel storage racks are proposed in accordance with 10 CFR 50.59.

3.0 BACKGROUND

I&M is transitioning to a new fuel vendor who uses the M5 alloy for fuel rod cladding and fuel assembly structural material beginning with Unit 1, Cycle 20 and Unit 2, Cycle 16. TS 5.3.1 requires, in part, that the fuel rods be clad with Zircaloy-4 or ZIRLO. Limited substitutions of zirconium alloy or stainless steel filler rods, in accordance with NRC-approved applications of fuel rod configurations, may be used. Fuel assemblies are limited to those with fuel designs that have been analyzed with applicable NRC staff-approved codes and methods, and shown by tests or analysis to comply with all fuel safety design bases. The current fuel assemblies are designed to perform satisfactorily throughout their lifetime as described in the CNP UFSAR Section 3.1.3. The loads, stresses, and strains resulting from the combined effects of flow induced vibrations, earthquakes, reactor pressure, fission gas pressure, fuel growth, thermal strain, and differential expansion during both steady state and transient reactor operating conditions have been considered in the design of the current fuel rods and fuel assembly. The current fuel cladding is designed to withstand operating pressure loads without rupture and to maintain encapsulation of the fuel throughout the design life. The current TS requirements for fuel cladding are based on the assumption that only fuel rods clad in Zircaloy-4 and ZIRLO have been evaluated and found acceptable for meeting these criteria.

TS 5.6.1.1 and TS 5.6.2 specify design requirements for the spent and new fuel storage racks. CNP UFSAR Section 9.7.2 describes the spent fuel storage rack design configuration for holding fuel assemblies based on enrichment and burnup, or equivalent fuel assembly reactivity as defined by equations in the UFSAR. The new fuel storage racks are designed such that it is impossible to insert assemblies in locations other than the storage cells in the racks, thereby maintaining the designed separation between fuel assemblies as described in CNP UFSAR Section 9.7.1. TS design requirements for the spent and new fuel storage racks are intended to ensure that adequate reactivity margin is maintained to prevent an inadvertent criticality. Reactivity margin is maintained by controlling maximum enrichment and spacing of fuel assemblies in the storage racks. For the new fuel storage racks, current TS requirements use a Westinghouse fuel burnable absorber for fuel assemblies with higher base reactivity (higher enrichments) to maintain the required reactivity margin.

As stated in UFSAR Section 9.7.1 and 9.7.2 and the TS, the design basis for preventing inadvertent criticality in the spent and new fuel storage racks is to ensure a K_{eff} of 0.95 is not exceeded with racks fully loaded with fuel assemblies of the highest anticipated reactivity, flooded with unborated water. The new fuel storage racks are also designed to ensure that a K_{eff} of 0.98 is not exceeded assuming optimum moderation by aqueous foam with the racks fully loaded with fuel of the highest anticipated reactivity. The design basis analyses for preventing criticality is that, at a 95 percent probability and a 95 percent confidence level, K_{eff} will be less than the TS limit when including uncertainties, tolerances, and biases.

I&M plans a subsequent license amendment to address TS changes associated with CNP adoption of FANP methodology for accident analysis and evaluation of the reactor core with FANP fuel assembly designs as part of the transition to FANP as the CNP fuel vendor.

4.0 TECHNICAL ANALYSIS

Technical Basis for Use of M5 Cladding in Fuel Assemblies

I&M plans to use M5, an advanced alloy for fuel cladding and structural material, for both Unit 1 and Unit 2 fuels. The technical basis for use of the M5 alloy is provided in topical report BAW-10227P-A, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel," February 2000 (Reference 1). This topical report was approved by the NRC by Safety Evaluation dated February 4, 2000 (Reference 2). The M5 alloy is a FANP proprietary material comprised primarily of zirconium (approximately 99 percent) and niobium (approximately 1 percent). This composition has demonstrated superior corrosion resistance and reduced irradiation induced growth relative to both standard and low-tin zircaloy. The M5 alloy has been tested in both reactor and non-reactor environments to ascertain its mechanical and structural properties, as described in BAW-10227P-A.

Results of test irradiations of the M5 alloy as fuel rod cladding in commercial power reactors, in both the United States and Europe, demonstrated that the maximum fuel cladding corrosion rate is 40 to 50 percent of that occurring in Zircaloy-4, and the hydrogen pickup rate is 25 percent of that experienced with Zircaloy-4 cladding. Similar improvements have been shown for fuel assembly structural components such as guide tubes and spacer grids.

These same tests have also shown that the M5 alloy exhibits significantly less radiation induced growth in fuel rods and fuel assembly guide tubes when compared to Zircaloy-4. This property provides additional margin to the fuel assembly and fuel rod growth limits for fuel assemblies with high burnups. 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 will be 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, FANP determined 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.

The NRC staff concluded in Reference 2 that the M5 alloy properties and mechanical design methodology described in Reference 1 are in accordance with Standard Review Plan Section 4.2, 10 CFR 50.46, and 10 CFR 50, Appendix K, and are acceptable for fuel reload licensing applications. In Reference 2, the NRC stated that material properties of the M5 alloy are similar to those of other zirconium-based materials which have been previously licensed for use as cladding material. Based on this similarity, the NRC found it appropriately conservative to apply the criteria of 10 CFR 50.46 and 10 CFR 50, Appendix K when reviewing M5 fuel applications.

Technical Basis for Use of Gadolinia Fuel Burnable Absorber in New Fuel Storage Racks

Fuel vendors use fuel burnable absorbers for core design reactivity controls. Westinghouse utilizes IFBA which consists of a coating of zirconium diboride around the fuel pellet. IFBA uses the isotope Boron-10 for reactivity control which typically burns out after a third to a half of an operating cycle. FANP utilizes Gadolinia (gadolinium oxide) which is mixed homogeneously with the fuel pellets. Gadolinium isotopes are used for reactivity control and typically burn out near the end of an operating cycle, however, there are residual amounts of Gadolinium which remain over a lifetime of operation with the fuel assembly.

The TS design requirements for the new fuel storage racks are intended to ensure that adequate reactivity margin is maintained to prevent an inadvertent criticality. Reactivity margin is maintained by controlling maximum enrichment. Previous calculations approved by the NRC by

Safety Evaluation on May 17, 1990 (Reference 3) have shown that fuel assemblies with enrichments up to 4.55 weight percent U-235 can be safely stored in the CNP new fuel storage racks. For enrichments greater than 4.55 weight percent U-235, the concept of reactivity equivalencing was approved by the NRC by Safety Evaluation on February 27, 1997 (Reference 4). Enclosure 3 includes a criticality analysis, FANP Report 77-5040212-00, which determined FANP fuel assemblies with up to 5.0 weight percent U-235 with Gadolinia were less reactive than FANP fuel assemblies at 4.55 weight percent U-235. The criticality analysis documents the use of reactivity equivalencing to credit the reactivity decrease due to the addition of a fuel burnable absorber, Gadolinia, thereby maintaining reactivity margin for the new fuel storage racks. The analysis concludes that FANP assemblies with a maximum enrichment (including enrichment tolerance) between 4.55 weight percent U-235 and 5.0 weight percent U-235 must contain a minimum of four symmetrically loaded Gadolinia-bearing fuel rods with a minimum of 2.0 weight percent Gadolinia in the new fuel storage racks. FANP fuel assemblies meeting these requirements will always be less reactive than fuel with no Gadolinia at 4.55 weight percent U-235. The proposed TS requirements ensure adequate reactivity margin with higher enrichment using the FANP fuel burnable absorber, Gadolinia.

Additionally, the technical basis for use of Gadolinia as a fuel burnable absorber is provided in topical report XN-NF-85-92(P)(A), "Exxon Nuclear Uranium Dioxide / Gadolinia Irradiation Examination and Thermal Conductivity Results," dated September 1986 (Reference 5). The NRC approved the use of Gadolinia in a Safety Evaluation dated September 26, 1986 (Reference 6).

Technical Basis for Methodology Changes to Spent and New Fuel Storage Criticality Analyses

The current design and licensing basis criticality analysis (Holtec) for storage of fuel in the spent fuel storage rack was approved by the NRC by Safety Evaluation on January 14, 1993 (Reference 7). The current design and licensing basis criticality analysis (Westinghouse) for storage of fuel in the new fuel storage rack was approved by the NRC by the Reference 4 Safety Evaluation. Neither analysis considered an FANP fuel assembly or the use of Gadolinia as a fuel burnable absorber to demonstrate TS requirements are met. FANP performed criticality analyses (Enclosure 3) for the spent and new fuel storage racks to bound both the existing fuel assemblies and FANP fuel assemblies using the results of the Holtec and Westinghouse analyses as a base case, identifying reactivity differences between FANP assemblies and previously analyzed assemblies, and adding penalties for cases identifying a more reactive FANP fuel assembly.

Holtec Analysis

The Holtec criticality analysis for storage of fuel in the three region spent fuel pool was performed with the KENO-Va Monte Carlo computer code. Since the KENO-Va code package does not have burnup capability, depletion analyses and the determination of equivalent enrichments (reactivity equivalencing) were made with the two-dimensional transport theory code, CASMO-3. These codes are widely used for the analysis of fuel rack reactivity and have been benchmarked against results from numerous critical experiments. These experiments simulate the CNP spent fuel racks as realistically as possible with respect to important parameters such as enrichment, assembly spacing, and absorber thickness. As stated in the Reference 7 Safety Evaluation, these two independent methods of analysis (KENO-Va and CASMO-3) showed very good agreement both with experimental data and with each other. The intercomparison between different analytical methods is an acceptable technique for validating calculational methods for nuclear criticality safety.

The Holtec criticality analysis was performed with several assumptions which tend to maximize the spent fuel storage rack reactivity. The analysis assumptions include unborated water in the spent fuel pool at the temperature yielding the highest reactivity (68°F), an infinite radial array of storage cells except for the boundary storage cells where leakage is inherent, and neglecting the neutron absorption effect of structural material. The nominal storage cell design accounted for uncertainties due to tolerances associated with boron loading, boral width, cell lattice spacing, stainless steel thickness, fuel enrichment and density, and eccentric fuel positioning and minimum water-gap. In addition, a calculation bias and uncertainty were determined from benchmark calculations as well as an allowance for uncertainty in depletion calculations and the effect of the axial distributions in burnup. The final calculated maximum K_{eff} was 0.940. This maximum value includes the manufacturing tolerances, uncertainties and biases, and axial burnup effects and was determined at a 95 percent probability and 95 percent confidence level.

Westinghouse Analysis

The Westinghouse criticality analysis for storage of fuel in the new fuel storage rack was performed with the Monte Carlo computer code KENO-IV. Reactivity equivalencing was performed using the transport theory computer code PHOENIX-P for storage of fuel assemblies having initial enrichments above 4.55 weight percent U-235. The Westinghouse criticality analysis was performed with several assumptions to develop the nominal case KENO-IV model for storage of fresh fuel in the new fuel storage rack under full density and low density optimum moderation (aqueous foam) conditions. The analysis assumptions include use of the highest TS allowed enrichment of 4.55 weight percent U-235 with no credit taken for any burnable poison in the fuel rods or any lower enriched axial blankets, conservatively modeling the 4.55 weight percent U-235 fuel assembly to reflect an enrichment of 4.65 weight percent U-235, and not crediting spacer grids or sleeves.

The Westinghouse analysis demonstrated that the TS requirements were met for a new fuel storage rack fully flooded with unborated water with a maximum K_{eff} of 0.9495. This maximum value includes material tolerances, mechanical tolerances, method bias, uncertainties, and any spacing between assemblies less than the nominal new fuel storage rack spacing, at a 95 percent probability and 95 percent confidence level. The analysis demonstrated that TS requirements were met under the optimum moderation condition with a maximum K_{eff} of 0.8974. This maximum value also includes material and mechanical tolerances, method bias, and uncertainties. The storage of Westinghouse fuel assemblies above 4.55 weight percent U-235 was demonstrated to be acceptable given the minimum number of IFBA pins delineated in the CNP TS. The technique of reactivity equivalencing was used to determine sufficient IFBA requirements for assembly enrichments greater than 4.55 weight percent U-235. Reactivity equivalencing credited the reactivity decrease due to the IFBA material for fuel assemblies of higher enrichment to ensure sufficient reactivity margin in the new fuel storage racks.

FANP Analyses

The FANP criticality analyses for the spent and new fuel storage racks were performed using a reactivity equivalencing analysis. This analysis compares the proposed FANP fuel assemblies with the current design basis assemblies using the nominal fuel assembly dimensions analyzed in the context of the storage racks in the spent and new fuel storage racks. A reactivity difference, or penalty, was calculated between the different assembly types and added to the appropriate design basis maximum K_{eff}. Since small reactivity differences are computed between different assembly types, it is not necessary to evaluate the full range of accidents (misplaced fresh assembly within the rack or outside but adjacent to the rack), off-center fuel placement, tolerances, biases, or uncertainties.

FANP calculated reactivity differences using the deterministic transport code CASMO-3 for the various spent fuel storage rack configurations and the Monte Carlo code MCNP-4B within the new fuel storage rack. CASMO-3 was also used to provide depletion data for burnup credit in the spent fuel storage rack analysis and for Gadolinia credit in the new fuel storage rack analysis. CASMO-3 and MCNP-4B have been routinely used throughout the industry in performing criticality calculations.

The reactivity equivalencing approach is justified for use in both the spent and new fuel storage racks criticality analyses because each analysis:

1) was performed within the context of the storage racks and under the same environmental conditions as performed in the previous analyses,
2) was performed with fuel assemblies of very similar geometries, with only minor differences in assembly loadings and pellet diameters,
3) confirmed small reactivity differences existed due to the minor differences between the FANP fuel assemblies and the design basis fuel assemblies.

The basis for utilizing the previously calculated manufacturing tolerances, uncertainties, and axial burnup effects is the FANP assembly design resemblance to the design basis fuel assemblies. Additionally, the Holtec tolerance reactivity penalties of the spent fuel storage racks are inherent in the computation of maximum K_{eff}. The maximum K_{eff} calculations performed by Holtec and Westinghouse considered an enrichment tolerance. The reactivity differences between fuel assembly designs in the spent fuel pool were performed using the minimum required Boron–10 areal density. Nominal Boral plate dimensions were included in the Holtec analysis. All other assembly and rack dimensions used are nominal dimensions and are suitable for computing a reactivity difference between similar fuel assembly designs.

The new fuel storage rack analysis credited Gadolinia fuel burnable absorber rods for fuel assemblies in the new fuel storage rack above 4.55 weight percent U-235 and enrichment equal to or below 5.0 weight percent U-235. Reactivity equivalencing was used to credit the reactivity decrease due to the Gadolinia. The presence of Gadolinia-bearing fuel rods was evaluated for both the Unit 1 15x15 and Unit 2 17x17 fuel assembly designs within the reactor context using CASMO-3 and within the new fuel storage rack context using MCNP-4B. The CASMO-3 results indicate, for both fuel assembly designs under flooded conditions, that a minimum of 4 symmetrically loaded Gadolinia-bearing fuel rods at a minimum of 2.0 weight percent Gadolinia with an enrichment of 5.0 weight percent U-235 are always less reactive than fuel with no Gadolinia at 4.55 weight percent U-235 regardless of the symmetric Gadolinia pattern chosen. These results were verified by evaluating the more limiting FANP 15x15 assembly in the new fuel storage rack with MCNP-4B for both flooded and optimum moderated conditions. The results demonstrate that the presence of only 4 Gadolinia-bearing fuel rods with a minimum of 2.0 weight percent Gadolinia are required to ensure FANP fuel assemblies between 4.55 weight percent U-235 and 5.0 weight percent U-235 are less reactive than fuel assemblies with no Gadolinia at 4.55 weight percent U-235. Therefore, FANP assemblies with enrichment above 4.55 weight percent U-235 and equal to or below 5.0 weight percent U-235 must have at least 4 symmetrically loaded Gadolinia-bearing fuel rods at a minimum of 2.0 weight percent Gadolinia.

The criticality analyses with the proposed changes in methodology demonstrate that the TS requirements as discussed in Section 3, above, for preventing inadvertent criticality are met with changes in the fuel assembly design.

5.0 REGULATORY SAFETY ANALYSIS

5.1 No Significant Hazards Consideration

Indiana Michigan Power Company (I&M) has evaluated whether 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 of occurrence or consequences of an accident previously evaluated?

   Response: No

   The proposed Technical Specification (TS) changes allow the zirconium-based alloy, M5, to be used in addition to Zircaloy-4 and ZIRLO in Donald C. Cook Nuclear Plant fuel assemblies. TS changes are also proposed to allow Gadolinia to be used in fuel assemblies in the new fuel storage racks to ensure adequate reactivity margin. In addition, methodology changes were proposed for a criticality analysis supporting new and spent fuel rack design criteria. M5 is a Nuclear Regulatory Commission (NRC)-approved alloy for fuel cladding and Gadolinia is an NRC-approved fuel burnable absorber used in the maintenance of reactivity margin in the new fuel storage rack. The use of NRC-approved cladding and fuel absorbers and methodology changes to criticality analyses to support TS design criteria for the spent and new fuel storage racks are not initiators of any accident previously evaluated. As a result, the probability of any accident previously evaluated is not significantly increased. M5 cladding has been shown to meet all 10 CFR 50.46 acceptance criteria. Analysis has shown that the use of Gadolinia assures sufficient reactivity margin to prevent a criticality accident in the new fuel storage rack. Changes in methodology for criticality analyses were performed to demonstrate TS requirements are met or to support proposed TS changes and do not affect plant equipment. Therefore, the consequences of an accident are not significantly increased.

Therefore, the proposed change does not involve a significant increase in the probability of occurrence or consequences of an accident previously evaluated.

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 to use the M5 alloy is based on an NRC-approved topical report which demonstrates that the material properties of the M5 alloy are not significantly different from those of Zircaloy-4. The design and performance criteria continue to be met and no new failure mechanisms have been identified. Therefore, M5 fuel rod 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 type of accident.

   The proposed TS change to use Gadolinia to ensure adequate reactivity margin for higher enrichment fuel assemblies prevents reactivity limits from being exceeded. An NRC-approved topical report demonstrates that Gadolinia is acceptable for use in fuel assemblies. The proposed change only modifies the type of fuel burnable absorber and does not affect any permanent plant equipment or plant operating procedures, and can not be an initiator of an accident.

   The proposed criticality analysis supports TS design criteria for spent and new fuel racks. The analysis evaluates reactivity margin based on conservative assumptions on fuel assembly design and burnup and does not affect any plant equipment. The criticality analysis can not be an initiator of an accident.

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

   The proposed TS change to allow the use of fuel rods clad with the M5 alloy does not change the reactor fuel reload design and safety limits. For each cycle reload core, the fuel assembly design and core configuration are evaluated using NRC-approved reload design methods, including consideration of the core physics analysis peaking factors and core average linear heat rate effects. The design basis and modeling techniques for fuel assemblies with Zircaloy-4 and ZIRLO clad fuel rods remain valid for fuel assemblies with M5 clad fuel rods. Use of the M5 alloy as cladding material has no effect on the criticality analysis for the spent fuel storage racks and the new fuel storage racks. Furthermore, it has no effect on the thermal-hydraulic and structural analysis for the spent fuel pool. Therefore, the design and safety analysis limits specified in the TS are maintained with this proposed change.

   The proposed TS change to use Gadolinia as a fuel burnable absorber for fuel assemblies with higher enrichments of Uranium-235 to ensure proper reactivity control in the spent fuel storage rack is consistent with the current method of reducing reactivity of high enrichment fuel assemblies. Each method reduces the equivalent uranium enrichment to below that found acceptable by the NRC for safe storage of new fuel.

   The proposed criticality analyses use NRC-approved codes with a methodology different than previously approved by the NRC. The criticality analysis results for the spent fuel storage rack flooded with unborated water condition and for the new fuel storage rack moderated by aqueous foam condition remain less than the limiting TS values. Analysis results for the new fuel storage rack flooded with unborated water condition are consistent with previous analysis results.

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

In summary, based upon the above evaluation, I&M has concluded that the proposed amendment involves 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

Donald C. Cook Nuclear Plant (CNP) Unit 1 and Unit 2 is currently exempt from the requirements of 10 CFR 70.24, "Criticality Accident Requirements." The exemption was granted on October 28, 1996. Upon approval of the proposed changes, CNP Unit 1 and Unit 2 will remain in compliance with 10 CFR 70.24 as required by the approved exemption to 10 CFR 70.24, however due to the design configuration changes associated with Framatome ANP, Inc. fuel assemblies I&M has requested a new exemption from the requirements of 10 CFR 70.24. This exemption request is included in this submittal as Enclosure 5.

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 or to the health or safety of the public.

6.0 ENVIRONMENTAL CONSIDERATIONS

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, or would change an inspection or surveillance requirement. 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(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

7.0 REFERENCES

1. BAW-10227P-A, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel," Framatome Cogema Fuels (FCF), Lynchburg, Virginia, dated February 2000.

2. Letter from Stuart A. Richards (NRC) to T. A. Coleman (FCF), "Revised Safety Evaluation (SE) For Topical Report BAW-10227P: 'Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel,' (TAC NO. M99903)," dated February 4, 2000.

3. Letter from Joseph Giitter (NRC) to Milton P. Alexich (I&M), "Amendment Nos. 136 and 121 to Facility Operating License Nos. DPR-58 and DPR-74: (TAC Nos. 75798 and 75799)," dated May 17, 1990.

4. Letter from John B. Hickman (NRC) to E. E. Fitzpatrick (I&M), "Donald C. Cook Nuclear Plant, Unit Nos. 1 and 2 – Issuance of Amendments Re: New Fuel Enrichment Increase (TAC Nos. M94877 and M94878)," dated February 27, 1997.

5. XN-NF-85-92(P)(A), "Exxon Nuclear Uranium Dioxide / Gadolinia Irradiation Examination and Thermal Conductivity Results," Exxon Nuclear Company (ENC), Inc. dated September 1986.

6. Letter from Charles E. Rossi (NRC) to G. N. Ward (ENC), "Acceptance for Referencing of Licensing Topical Reports XN-NF-85-92(P), 'Exxon Nuclear Uranium Dioxide/Gadolinia Irradiation Examination and Thermal Conductivity Results' and XN-75-27(P), Supplement 4, 'Exxon Nuclear Neutronics Design Methods For Pressurized Water Reactors,'" dated September 26, 1986.

7. Letter from William M. Dean (NRC) to E. E. Fitzpatrick (I&M), "Amendment Nos. 169 and 152 to Facility Operating License Nos. DPR-58 and DPR-74: (TAC Nos. M80615 and M80616)," dated January 14, 1993.

8.0 PRECEDENTS

The use of the M5 alloy as fuel rod cladding was previously approved for the following pressurized water reactors:

1. Letter from Brenda L. Mozafari (NRC) to Dale E. Young (Florida Power Corporation), "Crystal River Unit 3 – Issuance of Amendment Regarding Technical Specification Change Request for the Use of M5 Advanced Alloy Fuel Cladding (TAC NO. MB6590)," dated October 1, 2003.

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

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

4. Letter from Douglas V. Pickett (NRC) to Guy G. Campbell (FirstEnergy Nuclear Operating Company), "Issuance of Amendment – Davis Besse Nuclear Power Station, Unit 1 (TAC NO. MA3552)," dated March 15, 2000.

5. Letter from Ronald W. Hernan (NRC) to J. A. Scalice (Tennessee Valley Authority), "Sequoyah Nuclear Plant, Units 1 and 2 – Issuance of Amendments Regarding Use of M5 Alloy in the Construction of Fuel Assemblies (TAC NOS. MA8490 and MA8491)," dated July 31, 2000.