UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

May 24, 2021

Mr. Peter Dietrich
Senior Vice President
and Chief Nuclear Officer
DTE Electric Company
Fermi 2 – 260 TAC
6400 North Dixie Highway
Newport, MI 48166

SUBJECT: FERMI 2 - ISSUANCE OF AMENDMENT NO. 220 RE: REVISION TO THE RENEWED FACILITY OPERATING LICENSE INCLUDING THE TECHNICAL SPECIFICATIONS TO UTILIZE NEUTRON ABSORBING INSERTS IN CRITICALITY SAFETY ANALYSIS FOR SPENT FUEL POOL STORAGE RACKS (EPID L-2019-LLA-0199)

Dear Mr. Dietrich:

The U.S. Nuclear Regulatory Commission (NRC, the Commission) has issued the enclosed Amendment No. 220 to Renewed Facility Operating License No. NPF-43 for Fermi 2 in response to your application dated September 5, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19248C679), as supplemented by letters dated July 30, 2020 (ADAMS Accession No. ML20212B303) and August 24, 2020 (ADAMS Accession No. ML20237F291).

The amendment revises Renewed Facility Operating License No. NPF-43 including the Technical Specifications (TSs). Specifically, the amendment deletes license condition 2.C.(26)(c), and modifies Technical Specification (TS) 4.3, "Fuel Storage," and TS 5.5, "Programs and Manuals" to permit the insertion of neutron absorbing inserts in the spent fuel pool at Fermi 2.

The NRC has determined that the related safety evaluation contains proprietary information pursuant to Title 10 of the *Code of Federal Regulations* Section 2.390, "Public inspections, exemptions, requests for withholding." The proprietary information is indicated by text enclosed within double brackets. Accordingly, the NRC staff has also prepared a non-proprietary publicly available version of the safety evaluation, which is provided as Enclosure 2. The proprietary version of the safety evaluation is provided as Enclosure 3.

Enclosure 3 to this letter contains proprietary information. When separated from Enclosure 3, this document is DECONTROLLED.

A Notice of Issuance will be included in the Commission's monthly *Federal Register* notice.

Sincerely,

/RA/

Surinder S. Arora, Project Manager
Plant Licensing Branch III
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-341

Enclosures:
1. Amendment No. 220 to NPF-43
2. Safety Evaluation (non-proprietary)
3. Safety Evaluation (proprietary)

cc without Enclosure 3: Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

DTE ELECTRIC COMPANY

DOCKET NO. 50-341

FERMI 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 220
Renewed License No. NPF-43

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by DTE Electric Company dated September 5, 2019, as supplemented by letters dated July 30, 2020 and August 24, 2020, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance: (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the license and the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Renewed Facility Operating License No. NPF-43 is hereby amended to read as follows:

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 220, and the Environmental Protection Plan contained in Appendix B, are hereby incorporated into this renewed license. DTE Electric Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

In addition, the license is amended by deletion of paragraph 2.C.(26)(c); therefore, paragraph 2.C.(26)(c) of Renewed Facility Operating License No. NPF-43 is hereby amended to read as follows:

(c) Deleted.

3. This license amendment is effective as of its date of issuance and shall be implemented within 90 days following either NRC approval or complete installation of the neutron absorbing inserts, whichever is later.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA Robert F. Kuntz for/

Nancy L. Salgado, Chief
Plant Licensing Branch III
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Renewed Facility
Operating License No. NPF-43
and Technical Specifications

Date of Issuance: May 24, 2021

ATTACHMENT TO LICENSE AMENDMENT NO. 220

RENEWED FACILITY OPERATING LICENSE NO. NPF-43

FERMI 2

DOCKET NO. 50-341

Renewed Facility Operating License No. NPF-43

Replace the following pages of Renewed Facility Operating Licenses No. NPF-43 with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

REMOVE	INSERT
-4-	-4-
-8-	-8-

Technical Specifications

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

REMOVE	INSERT
4.0-1	4.0-1
4.0-2	4.0-2
5.0-19	5.0-19

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 220, and the Environmental Protection Plan contained in Appendix B, are hereby incorporated into this renewed license. DTE Electric Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

(3) Antitrust Conditions

DTE Electric Company shall abide by the agreements and interpretations between it and the Department of Justice relating to Article I, Paragraph 3 of the Electric Power Pool Agreement between DTE Electric Company and Consumers Power Company as specified in a letter from The Detroit Edison Company to the Director of Regulation, dated August 13,1971, and the letter from Richard W. McLaren, Assistant Attorney General, Antitrust Division, U.S. Department of Justice, to Bertram H. Schur, Associate General Counsel, Atomic Energy Commission, dated August 16, 1971.

(4) Deleted

(5) Deleted

(6) Deleted

(7) Deleted

(8) Deleted

(9) Modifications for Fire Protection (Section 9.5.1, SSER #5 and SSER #6)*

DTE Electric Company shall implement and maintain in effect all provisions of the approved fire protection program as described in its Final Safety Analysis Report for the facility through Amendment 60 and as approved in the SER through Supplement No. 5, subject to the following provision:

(a) DTE Electric Company may make changes to the approved fire protection program without prior approval of the Commission only if those changes would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire.

* The parenthetical notation following the title of many license conditions denotes the section of the Safety Evaluation Report (SER) and/or its supplements wherein the license condition is discussed.

activities to be completed before the period of extended operation (PEO), as follows:

1. The applicant shall implement those new programs and enhancements to existing programs no later than 6 months prior to the PEO.

2. The applicant shall complete those activities by the 6-month date before the PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.

The applicant shall notify the NRC in writing within 30 days after having accomplished item (b)1. above and include the status of those activities that have been or remain to be completed in item (b)2. above.

(c) Deleted

D. Exemptions from certain requirements of Appendices E and J to 10 CFR Part 50, are described in supplements to the SER. These include: (a) an exemption from the requirement of Section IV.F of Appendix E that a full participation emergency planning exercise be conducted within one year before issuance of the first operating license for full power and prior to operation above five percent of rated power (Section 13.3 of SSER #6); and (b) an exemption from the requirement of Paragraph III.C.2(b) of Appendix J, the testing of the main steam isolation valves at the peak calculated containment pressure associated with the design basis accident (Section 6.2.7 of SSER #5). These exemptions are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest. Therefore, these exemptions are hereby granted pursuant to 10 CFR 50.12. With the granting of these exemptions, the facility will operate, to the extent authorized herein, in conformity with the application, as amended, the provisions of the Act, and the rules and regulations of the Commission.

E. The licensee shall fully implement and maintain in effect all provisions of the Commission-approved physical security, training and qualification, and safeguards contingency plans including amendments made pursuant to provisions of the Miscellaneous Amendments and Search Requirements revisions to 10 CFR 73.55 (51 FR 27817 and 27822) and to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The plans, which contain Safeguards Information protected under 10 CFR 73.21, are entitled: "Fermi 2 Physical Security Plan, Security Training and Qualification Plan, and

4.0 DESIGN FEATURES

4.1 Site Location

The Fermi 2 site is located on the western shore of Lake Erie in Frenchtown Township, Monroe County, Michigan, approximately 8 miles east-northeast of the city of Monroe, Michigan.

4.2 Reactor Core

4.2.1 Fuel Assemblies

The reactor shall contain 764 fuel assemblies. Each assembly shall consist of a matrix of Zircalloy fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO_2) as fuel material and water rods. 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 NRC staff approved codes and methods and have been shown by tests or analyses to comply with all 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 Rod Assemblies

The reactor core shall contain 185 cruciform shaped control rod assemblies. The control material shall be boron carbide and/or hafnium metal as approved by the NRC.

4.3 Fuel Storage

4.3.1 Criticality

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

a. Fuel assemblies having a maximum k-infinity of 1.30 in the normal reactor core configuration at cold conditions;

(continued)

4.0 DESIGN FEATURES

4.3 Fuel Storage (continued)

b. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 9.1 of the UFSAR; and

c. The following nominal center to center distances between fuel assemblies placed in the various storage rack types, as applicable

Spacing (inches)	Rack Type
6.22	High density storage racks that contain BORALCAN™ as the neutron absorbing material
6.23	High density storage racks that contain Boral as the neutron absorbing material

4.3.2 Drainage

The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 660 ft 11.5 inches.

4.3.3 Capacity

The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 3590 fuel assemblies.

5.5 Programs and Manuals

5.5.12 Primary Containment Leakage Rate Testing Program (continued)

e. The provisions of SR 3.0.2 do not apply to the test frequencies in the Primary Containment Leakage Rate Testing Program.

f. The provisions of SR 3.0.3 are applicable to the Primary Containment Leakage Rate Testing Program.

5.5.13 Not Used

5.5.14 Control Room Envelope Habitability Program

A Control Room Envelope (CRE) Habitability Program shall be established and implemented to ensure that CRE habitability is maintained such that, with an OPERABLE Control Room Emergency Filtration (CREF) System, CRE occupants can control the reactor safely under normal conditions and maintain it in a safe condition following a radiological event, hazardous chemical release, or a smoke challenge. The program shall ensure that adequate radiation protection is provided to permit access and occupancy of the CRE under design basis accident (DBA) conditions without personnel receiving radiation exposures in excess of 5 rem total effective dose equivalent (TEDE) for the duration of the accident. The program shall include the following elements:

a. The definition of the CRE and the CRE boundary.

b. Requirements for maintaining the CRE boundary in its design condition including configuration control and preventive maintenance.

c. Requirements for (i) determining the unfiltered air inleakage past the CRE boundary into the CRE in accordance with the testing methods and at the frequencies specified in Sections C.1 and C.2 of Regulatory Guide 1.197, “Demonstrating Control Room Envelope Integrity at Nuclear Power Reactors,” Revision 0, May 2003, and (ii) assessing CRE habitability at the Frequencies specified in Sections C.1 and C.2 of Regulatory Guide 1.197, Revision 0.

(continued)

ENCLOSURE 2

NON-PROPRIETARY SAFETY EVALUATION FOR

AMENDMENT NO. 220 TO RENEWED FACILITY OPERATING LICENSE NO. NPF-43

DTE ELECTRIC COMPANY

FERMI 2

DOCKET NO. 50-341

Proprietary information pursuant to Section 2.390 of Title 10 of the *Code of Federal Regulations* has been redacted from this document.

Redacted information is identified by blank space enclosed within [[double brackets]].

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION FOR

AMENDMENT NO. 220 TO RENEWED FACILITY OPERATING LICENSE NO. NPF-43

DTE ELECTRIC COMPANY

FERMI 2

DOCKET NO. 50-341

1.0 INTRODUCTION

By application dated September 5, 2019 (Reference 1), as supplemented by letters dated July 30, 2020 (Reference 2) and August 24, 2020 (Reference 3), DTE Electric Company (DTE, the licensee) requested changes to the license and technical specifications (TSs) for Fermi 2.

The Fermi 2 Renewed Facility Operating License No. NPF-43, issued on December 15, 2016, contains License Condition 2.C.(26)(c) regarding the spent fuel pool (SFP) storage racks containing the neutron absorbing material (NAM) Boraflex. This license condition requires that the licensee replace those racks containing Boraflex with racks containing Boral so that the Boraflex in the SFP will not be required to perform a neutron absorption function. The application requests, as an alternative to this rack replacement, the use of neutron absorbing inserts (i.e., NETCO SNAP-IN® rack inserts) in the racks containing Boraflex. To allow for the use of neutron absorbing inserts in these racks, the application requests to revise TS 4.3, "Fuel Storage," and TS 5.5, "Programs and Manuals," and to delete License Condition 2.C.(26)(c).

The supplemental letters dated July 30 and August 24, 2020, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the U.S. Nuclear Regulatory Commission (NRC, the Commission) staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on January 7, 2020 (85 FR 731). Although the supplemental letter dated July 30, 2020 included an additional proposed change to the TSs, this change has already been approved by Amendment No. 141, dated January 25, 2001 (Reference 4) and, therefore, the proposed change did not expand the scope of the application as originally noticed, but would simply reflect the current configuration of Fermi 2.

2.0 REGULATORY EVALUATION

2.1 Regulatory Requirements

The regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion (GDC) 61, "Fuel storage and handling and radioactivity control," state, in part, that, "These systems shall be designed (1) with a capability to permit appropriate periodic inspection and testing of components important to safety" and the regulations in GDC 62, "Prevention of criticality in fuel storage and handling," state that, "Criticality in the fuel storage and handling system shall be prevented by physical systems or processes, preferably by use of geometrically safe configurations."

The regulations in 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," Section V, "Instructions, Procedures, and Drawings," state, in part, that, "Activities affecting quality shall be prescribed by documented instructions, procedures, or drawings, of a type appropriate to the circumstances…."

The regulations in 10 CFR 50.68, "Criticality accident requirements," state, in part, that each holder of an operating license shall comply with either 10 CFR 70.24, "Criticality accident requirements," or 10 CFR 50.68(b). DTE has not elected to comply with 10 CFR 50.68(b) and, therefore, must comply with 10 CFR 70.24. Fermi 2 was granted an exemption to 10 CFR 70.24 on June 2, 1998 (Reference 5). The 10 CFR 70.24 exemption remains the Fermi 2 licensing basis for new and spent fuel storage.

The regulations in 10 CFR 50.36, "Technical specifications," contain the requirements for the content of TSs. The regulations in 10 CFR 50.36(b) require TSs to be derived from the analyses and evaluation included in the safety analysis report and amendments thereto. In accordance with 10 CFR 50.36(c)(2), "Limiting conditions for operation," limiting conditions for operation (LCOs) are the lowest functional capability or performance levels of equipment required for safe operation of the facility. In accordance with 10 CFR 50.36(c)(3), "Surveillance requirements," surveillance requirements (SRs) are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the LCOs will be met. The regulations in 10 CFR 50.36(c)(4), "Design features," require that the TSs include design features of the facility such as materials of construction and geometric arrangements, which, if altered or modified, would have a significant effect on safety. The regulations in 10 CFR 50.36(c)(5), "Administrative Controls," relate to provisions relating to organization and management, procedures, recordkeeping, review and audit, and reporting necessary to assure operation of the facility in a safe manner.

2.2 Regulatory Guidance

The relevant regulatory guidance documents used to assist the NRC staff in its review of compliance with the regulatory requirements listed in Section 2.1 are listed below.

NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR [Light-Water Reactor] Edition," (SRP) Section 9.1.1, "Criticality Safety of Fresh and Spent Fuel Storage and Handling," and Section 9.1.2, "New and Spent Fuel Storage" (References 6 and 7, respectively), provide guidance regarding the specific acceptance criteria and review procedures to ensure that proposed changes satisfy the requirements in 10 CFR 50.68 and GDCs 61 and 62.

SRP Section 18.0, "Human Factors Engineering" (Reference 8), discusses the processes for evaluating operator actions and identifies specific areas of review that are needed for successful integration of human characteristics and capabilities into nuclear power plant design.

NUREG-0711, "Human Factors Engineering Program Review Model" (Reference 9), provides acceptance criteria for a human factors engineering design process.

Nuclear Energy Institute (NEI) 16-03-A, “Guidance for Monitoring of Fixed Neutron Absorbers in Spent Fuel Pools” (Reference 10), provides guidance regarding appropriate monitoring programs for NAM. The NRC staff verified by letter dated October 5, 2017 (Reference 11), that this guidance is acceptable for referencing in licensing applications for nuclear power plants to the extent specified and under the limitations delineated.

The NRC staff issued a memorandum dated August 19, 1998 (Reference 12), also known as the “Kopp Memo,” containing staff guidance for performing the review of SFP nuclear criticality safety (NCS) analyses. This guidance supports determining compliance with GDC 62 and the guidance in SRP Sections 9.1.1 and 9.1.2. The principal objective of this guidance was to clarify and document staff positions that may have been incompletely or ambiguously stated in previously issued safety evaluation reports or other staff documents. A second purpose was to state staff positions on several strategies used in SFP NCS analyses at that time.

NRC Division of Safety Systems Interim Staff Guidance (DSS-ISG)-2010-01, “Staff Guidance Regarding the Nuclear Criticality Safety Analysis for Spent Fuel Pools” (Reference 13), provides updated guidance to the NRC staff reviewer to address the increased complexity of recent SFP NCS analyses and operations. This ISG is intended to reiterate existing guidance, clarify ambiguity in existing guidance, and identify lessons learned based on past submittals. Like the Kopp memo, this guidance supports determining compliance with GDC 62 and the guidance in SRP Sections 9.1.1 and 9.1.2.

2.3 Method of Review

This safety evaluation (SE) involves a review of the data provided by the licensee to demonstrate that if the Fermi 2 TS requirements, as amended by the licensee’s proposed changes, are satisfied, then compliance with the relevant NRC requirements for SFP subcriticality (discussed in Section 2.1) will be assured. The review was performed consistent with the guidance discussed in Section 2.2. The NRC staff notes that while NUREG-0800, Section 9.1.2 is applicable, it is not concerned directly with fuel storage criticality safety considerations and, therefore, NUREG-0800, Section 9.1.1 contains the primary guidance for reviewing the proposed changes.

2.4 Description of the Proposed Changes

The licensee proposed to delete License Condition 2.C.(26)(c) and to revise TS 4.3 and TS 5.5.

The licensee proposed to revise TS 4.3, as follows (deletions in double strike-out; additions in double underline).

4.3 Fuel Storage

4.3.1 Criticality

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

a. Fuel assemblies having a maximum k-infinity of ~~1.31~~ 1.30 in the normal reactor core configuration at cold conditions;

b. K_{eff} [k-effective] $\leq$ 0.95 if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 9.1 of the UFSAR

[Updated Final Safety Analysis Report]; and

c. The following nominal center to center distances between fuel assemblies placed in the various storage rack types, as applicable

Spacing (inches)	Rack Type
6.22	High density storage racks that contain ~~Boraflex~~ BORALCAN™ as the neutron absorbing material
6.23	High density storage racks that contain Boral as the neutron absorbing material
~~11.9 x 6.6~~	~~Low density storage racks~~
~~10.5~~	~~Defective fuel assembly storage rack~~

These revisions would reduce the maximum in-core k_{eff} at standard cold core geometry (SCCG) from 1.31 to 1.30 as determined by the NCS analysis in Enclosure 4 of Reference 1. They would also credit BORALCAN™ as the NAM in the high-density storage racks. Finally, they would delete the design features referencing low-density and defective fuel assembly storage racks because these fuel assembly storage racks have been removed in accordance with the previously approved Amendment No. 141.

In Reference 2, DTE proposed an additional revision to TS 4.3. Specifically, DTE proposed to revise TS 4.3.3, as follows (deletions in double strike-out; additions in double underline).

4.3.3 Capacity

The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than ~~4608~~ 3590 fuel assemblies.

This revision would reduce the SFP capacity from 4608 fuel assemblies to 3590 fuel assemblies. This change has already been approved by Amendment No. 141 and, therefore, the proposed revision would simply reflect the current configuration of Fermi 2.

Finally, the licensee proposed to revise TS 5.5, as follows (deletions in double strike-out; additions in double underline).

5.5.13 ~~High Density Spent Fuel Racks~~

~~A program shall be provided, for the high density storage racks containing Boraflex as the neutron absorber, which will ensure that any unanticipated degradation of the Boraflex will be detected and will not compromise the integrity of the racks.~~ Not Used

TS 5.5.13 was related to a program to detect unanticipated degradation of Boraflex as a NAM. Since Boraflex would no longer be credited as a NAM in the high-density storage racks, TS 5.5.13 would be changed to state “Not Used.”

Section 3.0 of this SE contains the NRC staff's technical evaluation of the adequacy of the SFP NCS analysis used as the basis for the proposed license and TS changes and to demonstrate compliance with the NRC's subcriticality requirements.

3.0 TECHNICAL EVALUATION

3.1 Background

The Fermi 2 Renewed Facility Operating License No. NPF-43, issued on December 15, 2016, contains License Condition 2.C.(26)(c), which requires DTE to discontinue reliance on Boraflex to perform a neutron absorption function by fully implementing the Boraflex rack replacement approved by the NRC in Amendment No. 141. In addition to the replacement of Boraflex racks with Boral racks, Amendment No. 141 approved the removal of low-density and defective fuel assembly storage racks and the installation of additional Boral racks. Upon full implementation of Amendment No. 141, the Fermi 2 SFP would have had a total capacity of 4608 fuel assemblies. However, DTE did not fully implement Amendment No. 141. DTE had planned to replace the Boraflex racks with Boral racks in a series of three campaigns. The first two campaigns, which had been completed by the time of the submittal of Reference 1, involved the removal of low-density and defective fuel assembly storage racks. The third campaign, which involved the replacement of the high-density Boraflex racks with high-density Boral racks, has not been completed. Using the changes proposed in Reference 1 (i.e., the deletion of License Condition 2.C.(26)(c) and the revision of TS 4.3 and TS 5.5), DTE would forego the third campaign and instead use NETCO-SNAP-IN® neutron absorbing inserts for criticality control in the existing Boraflex racks.

Enclosure 4 of Reference 1 provides a summary of the NCS analysis for the Fermi 2 spent fuel storage racks. It describes the methodology and analytical models used in the NCS analysis to show that the Boraflex spent fuel storage racks' maximum k_{eff} will be no greater than 0.95 if flooded with unborated water. No credit is taken for borated water. It also references a benchmarking evaluation performed for the MCNP-05P and TGBLA06 codes used in the analysis, to demonstrate the applicability of the codes to geometries and compositions being analyzed and to determine the code bias and uncertainty. The NRC has previously approved the use of this code package for similar SFP NCS analyses involving the use of NETCO-SNAP-IN® neutron absorbing inserts for other facilities (e.g., River Bend Station, Unit 1 (River Bend) Amendment No. 201 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19357A009)).

The use of NETCO-SNAP-IN® neutron absorbing inserts as a replacement for the Boraflex in serving the neutron absorption function for criticality control is being proposed because Boraflex is known to have severe degradation issues. The licensee would install the inserts in every Boraflex storage cell to qualify all cells for storage.

The Fermi 2 SFP currently utilizes two types of SFP storage racks. The first type was supplied by Joseph Oat Corporation and utilizes Boraflex as the NAM. The second type was supplied by Holtec International and utilizes Boral as the NAM. There are 13 Boraflex racks and 9 Boral racks. The pitch of the Boraflex and Boral racks are 6.22 and 6.23 inches, respectively. No changes are being proposed to the Boral racks. Boraflex NAM has a long history of degradation due to dissolution and loss of ^{10}B. This has been a safety-significant concern in a number of facilities that has led to the submission of amendments for those facilities to, like the current

Fermi 2 submittal, credit another NAM in the NCS analysis to meet the requirements of 10 CFR 50.68 and GDC 62.

The changes proposed by Reference 1 would allow the licensee to credit NETCO-SNAP-IN® neutron absorbing inserts in the Fermi 2 NCS analysis in place of Boraflex. These inserts are a homogenous mixture of boron carbide and aluminum. They are fashioned by bending a thin sheet of the insert material into a chevron shape with a bend angle slightly greater than 90 degrees. This allows the insert to hold itself in place inside an SFP storage cell by a retention force. The insert spans the entire height of the SFP storage cell. The NETCO-SNAP-IN® neutron absorbing inserts would be installed in the Boraflex racks oriented such that the north and west sides of every cell containing an insert would have a wing of the insert. This orientation would place a wing/sheet of the insert between every fuel assembly in the Boraflex racks. Since cells would only contain one NETCO-SNAP-IN® neutron absorbing insert, the south and west peripheral border of the Boraflex racks would not have a wing/sheet of the inserts; however, there are no storage racks that are adjacent to the south and west peripheral border of the Boraflex racks.

The NETCO-SNAP-IN® neutron absorbing inserts would be held in place by their own retention force. Drag testing and insert relaxation has been analyzed to ensure that it is highly unlikely that rack inserts will be inadvertently removed during SFP operations. Based on lessons learned from other facilities, the licensee also placed administrative controls on the orientation of the assemblies such that the channel fasteners will not be oriented in the direction of the rack insert. A channel fastener was responsible for the inadvertent removal of an insert at LaSalle County Station (LaSalle). The licensee has accounted for a missing insert in its NCS analysis to bound incidents such as the inadvertent removal of an insert and to ensure that the limits in the TSs are not exceeded.

The SFP NCS analysis considers three types of fuels: legacy, GE14, and GNF3. The licensee determined GNF3 fuel to be bounding in the NCS analysis. Because the SCCG k_{eff} limit in TS 4.3 is proposed to be reduced from 1.31 to 1.30, there was the possibility that existing fuel would exceed the new lower limit. In Reference 2, the licensee confirmed that Fermi 2 currently has no fuel assemblies with an SCCG k_{eff} above 1.30.

3.2 SFP NCS Analysis Methods

The methods used for the NCS analysis for fuel in the Fermi 2 SFP are described in Section 3.0 of Enclosure 4 of Reference 1. The licensee used NEI 12-16, "Guidance for Performing Criticality Analyses of Fuel Storage at Light-Water Reactor Power Plants" (Reference 14), as guidance for this analysis. The Fermi 2 SFP NCS analysis utilizes an MCNP-05P/TGBLA06 code package, which has been previously approved in a similar SFP NCS analysis involving NETCO-SNAP-IN® neutron absorbing inserts for Peach Bottom Atomic Power Station, Units 2 and 3 (Peach Bottom) (ADAMS Accession No. ML13114A929), among others. The area of applicability for the benchmarking analyses was verified to be applicable to the Fermi 2 SFP.

3.2.1 Computational Methods

Two computational methods were used in the SFP NCS analysis. The GNF lattice design code TGBLA06 was used to calculate the maximum SCCG, uncontrolled peak in-core k_{eff} values. Due to the presence of burnable absorbers, the maximum k_{eff} fuel bundle will have some degree of burnup. The burned fuel compositions were then imported into MCNP-05P, the GNF proprietary version of MCNP, to obtain the fuel storage rack k_{eff} values. The TBGLA06 code uses the ENDF/B-V neutron cross section library.

MCNP requires the user to input values for the following parameters that may have a significant effect on the statistics of the final results: number of histories per cycle, number of cycles skipped before averaging, and total number of cycles. The licensee confirmed that all calculations converged using appropriate checks.

Based on the use of acceptable inputs and appropriate convergence checks to ensure that an accurate k_{eff} is determined, the NRC staff finds that the computational methods used for the SFP NCS analysis are acceptable.

3.2.2 Computer Code Validation

The SFP NCS analysis utilizes the highest in-core k_{eff} at SCCG. Due to integral burnable absorbers such as gadolinia, this point does not occur at the beginning of life. It is necessary to consider the validation of computer codes and data used to calculate burned fuel compositions and the computer code data that utilize the burned fuel compositions to calculate k_{eff} for systems with burned fuel. The purpose of the criticality code validation is to ensure that appropriate code bias and bias uncertainty are determined for use in the criticality evaluation. DSS-ISG-2010-01 references NUREG/CR-6698, “Guide for Validation of Nuclear Criticality Safety Calculational Methodology” (Reference 15), which states, in part, that:

> In general, the critical experiments selected for inclusion in the validation must be representative of the types of materials, conditions, and operating parameters found in the actual operations to be modeled using the calculation method. A sufficient number of experiments with varying experimental parameters should be selected for inclusion in the validation to ensure as a wide an area of applicability as feasible and statistically significant results.

The NRC staff used NUREG/CR-6698 as guidance for its review of the computer code validation methodology provided in the application. The basic elements of validation are outlined in NUREG/CR-6698, including identification of operating conditions and parameter ranges to be validated, selection of critical benchmarks, modeling of benchmarks, statistical analysis of results, and determination of the area of applicability (AOA).

The licensee validated the code by comparing the calculated k_{eff} values with the measured k_{eff} values of a set of critical experiments. The critical experiments should result in an AOA that bound all parameters found in the Fermi 2 SFP. **[[**

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The licensee identified the applicable operating conditions for the validation **[[**

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Based on its review of the validation database and its applicability to the compositions, geometries, and methodologies used in the licensee's SFP NCS analysis, the NRC staff finds that the code validation was acceptable and that all identified biases and uncertainties were propagated appropriately.

3.2.3 Trend Analysis

As part of the statistical analysis of the results of the SFP NCS analysis, the licensee provided trending analysis between the ratio of calculated k_{eff} to measured k_{eff} of the critical experiments to the parameters found in Table 4 of Enclosure 4 of Reference 1. The purpose of a trend analysis is to determine if any adverse trending is identified in the pool of experiments. Adverse trending may bring the accuracy of the NCS methodology into question.

The licensee utilized two methods to determine if there was any trending between the parameters: (1) the linear correlation coefficient (r_2) of a linear regression fitted equation in the form of y(x)=a+bx and (2) a chi squared test. In both cases, the data showed no significant trending.

Based on a review of the trend analysis, the NRC staff finds that the trend analysis is acceptable.

Based on the above, the NRC staff finds that the SFP NCS analysis methods are acceptable.

3.3 <u>SFP NCS Analysis</u>

3.3.1 SFP Water Temperature

The NRC guidance provided in the Kopp memo states that the NCS analysis should be done at the temperature corresponding to the highest reactivity. **[[**

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3.3.2 SFP Storage Rack Models

The licensee used a 2D infinite SFP storage rack array to conservatively estimate the reactivity of the system. Every fuel assembly position contains the maximum reactivity design basis fuel assembly as determined in Section 5.3 of Enclosure 4 of Reference 1. This analysis does not credit Boraflex as a neutron absorbing material and, therefore, the licensee chose to model the Boraflex inside the storage rack as water. This substitution of materials is acceptable because the wrappers around the Boraflex do not necessarily provide a watertight seal. The dimensions and uncertainties of the storage racks can be found in Table 10 of Enclosure 4 of Reference 1.

The positioning of the NETCO-SNAP-IN® inserts was chosen to neutronically separate the fuel assemblies in the Boraflex racks from those in the Boral racks. The inserts are positioned such that the insert wings occupy the north and west sides of each storage cell. The inserts span the entire height of the fuel assembly. The purpose of the rack inserts is to absorb neutrons, which is accomplished by the boron carbide in the inserts. The rack inserts are modeled such that the boron areal density is 0.0157 g ^{10}B/cm^2. This is equal to the minimum acceptable boron areal density. The use of the minimum boron areal density does not result in any margin for uncertainty. However, all rack inserts are sampled as manufactured to ensure that the boron areal density is greater than 0.0157 g ^{10}B/cm^2. To guarantee this, the boron areal density, as measured, must be greater than 0.0157 g ^{10}B/cm^2 plus a measuring uncertainty of 3σ. This ensures that 99.7 percent of all rack inserts meet the criterion.

3.3.2.1 SFP Storage Rack Model Manufacturing Tolerances and Uncertainties

The manufacturing tolerances of the storage racks and rack inserts are found in Table 10 of Enclosure 4 of Reference 1. The manufacturing tolerances of the storage racks can contribute to SFP reactivity. According to the Kopp Memo, the determination of the maximum k_{eff} should consider either: (1) a worst-case combination with mechanical and material conditions set to maximize k_{eff} or (2) a sensitivity study of the reactivity effects of tolerance variations. In Section 5.6.1 of Enclosure 4 of Reference 1, the licensee stated the parameters that were varied to account for manufacturing tolerances. The parameters were varied by at least 2σ.

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]] The licensee also conservatively modeled the insert with a minimum wing length.

The NRC staff finds the treatment of the storage rack tolerances and uncertainties acceptable based on the following discussion. Only positive reactivity contributions are considered in the calculation of Δk_{bias}. This results in a conservative value of Δk_{bias}. The rack insert is modeled using the minimum boron areal density and minimum wing length, resulting in a conservative estimate of the negative reactivity contribution of the insert.

3.3.2.2 SFP Storage Rack Interfaces

There are two types of SFP storage racks in the Fermi 2 SFP—13 Boraflex racks and 9 Boral racks. There is also a dry cask storage pad and two fuel-preparation machines. The licensee does not explicitly model the interface between the Boraflex racks and the Boral racks or other equipment. The analysis assumed that the fuel assemblies in the Boraflex racks and the Boral racks are neutronically isolated from each other. However, the two different rack types are not sufficiently distant from each other where the distance alone would be enough to provide neutronic isolation. In response to an NRC staff request for additional information (RAI), the license explained that its assumption of the racks being neutronically isolated was actually based on there being two sheets of NAM between the rack types—one wing/sheet from a NETCO-SNAP-IN® insert in the Boraflex racks and one Boral sheet in the Boral racks. The NRC staff notes that even two sheets of NAM between the fuel assemblies is insufficient to conclude that the fuel assemblies would be neutronically isolated. However, since the analysis considers an infinite array where there is only one sheet of NAM between the fuel assemblies, the analysis bounds the rack type interface that has two sheets of NAM.

The licensee stated that the fuel-preparation machines are more than 12 inches from the Boraflex racks and that, therefore, there are enough neutron mean free paths to conclude that there is negligible neutronic interactions between the machines and the storage rack.

Based on the above, the NRC staff finds that the NCS analysis is acceptable with respect to SFP storage rack models.

3.3.3 Fuel Assembly Models

3.3.3.1 Bounding Fuel Assembly Design

The Fermi 2 SFP may store GE14, GNF3, and legacy fuel types previously used in Fermi 2. The Fermi 2 SFP NCS analysis evaluated the different lattice designs, with some fuel assemblies having multiple lattice designs. The analysis includes an analysis to determine the most limiting lattice from the fuel designs and then used that limiting lattice in the remainder of the analysis. The analysis used the 'rack efficiency' method of evaluating the lattices. The rack efficiency is defined as the ratio of the in-rack k_{eff} to the peak in-core k_{eff}. The fuel assembly with the highest rack efficiency at the proposed TS limiting SCCG is determined to be the limiting lattice. The NRC previously approved this method for determining the limiting lattice in River Bend Amendment No. 201 (ADAMS Accession No. ML19357A009). Because the Fermi 2 analysis determined its limiting lattice consistent with a previously approved method, the NRC staff finds it acceptable.

3.3.3.2 Fuel Assembly Manufacturing Tolerances and Uncertainties

According to the Kopp Memo, the determination of the maximum k_{eff} should consider either: (1) a worst-case combination with mechanical and material conditions set to maximize k_{eff} or (2) a sensitivity study of the reactivity effects of tolerance variations. In its analysis, the licensee selection option 2 and performed a sensitivity study of 50 different lattice types found in Table 11 of Enclosure 4 of Reference 1. The selected lattice was used in the MCNP-05P/TGBLA06 code package with no further mechanical tolerances accounted for. The licensee also performed depletion bias cases where the design basis fuel lattice was depleted under varying conditions found in Section 5.5.1 of Enclosure 4 of Reference 1. Additional tolerances were considered in a tolerance study in which fuel assembly design parameters were varied by at least 2σ. The parameters that were varied can be found in Section 5.6.1 of Enclosure 4 of Reference 1.

The NRC staff finds the treatment associated with the lattice design and depletion calculations acceptable based on the following discussion. The licensee performed a sensitivity study to find the most reactive fuel lattice. The licensee performed depletion calculations under varying conditions and only included positive reactivity contributions in the bias calculation. Therefore, the calculation of Δk_{bias} is conservative. The licensee performed a tolerance study on the fuel assembly design parameters to calculate $\Delta k_{tolerance}$ and also only included positive reactivity contributions.

3.3.3.3 Spent Fuel Characterization

The highest reactivity of a boiling-water reactor fuel assembly occurs with some degree of burnup due to burnable poisons in the assembly. Therefore, it is necessary to account for the treatment of burned fuel in the SFP. The licensee performed depletion calculations in TGBLA06 with parameters set to maximize burned fuel reactivity. Additionally, the TGLBLA06-defined lumped fission products are conservatively ignored in the in-rack k_{eff} calculations in MCNP-05P. The NRC staff notes that the licensee also did not include the effects of Xe-135 but does not necessarily consider this to be a conservative estimate. Xe-135 has a half-life of 9.2 hours; therefore, after several days it is reasonable to assume that no Xe-135 is present in the spent fuel. The time needed to transport fuel from the reactor core to the SFP may be enough to account for this decay time. Therefore, the NRC staff finds that not including the effects of Xe-135 reflects reality and is not necessarily a conservative approach.

The NRC staff finds the characterization of spent fuel in the NCS analysis acceptable because the analysis is conservative and accounts for varying depletion conditions.

3.3.3.4 Integral Burnable Absorbers

The fuel types stored in the Fermi 2 SFP utilize gadolinia poison to help control reactivity and peaking within fuel assemblies. The concentration and position of gadolinia loading can have a significant impact on the reactivity of the assembly. The licensee does credit gadolinia loading in the NCS analysis. **[[**

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The NRC staff finds the treatment of integral burnable absorbers in the NCS analysis acceptable based on the following discussion. **[**

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Based on the above, the NRC staff finds that the NCS analysis is acceptable with respect to fuel assembly models.

3.3.4 Analysis of Normal and Abnormal Conditions

The licensee considered the following normal and abnormal conditions:

- **[[**

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- Dropped or damaged fuel
- Abnormal positioning of a fuel assembly outside the fuel storage rack
- Missing inserts on SFP storage rack periphery
- Missing rack insert
- Rack sliding
- Loss of spent fuel cooling

The aforementioned normal and abnormal conditions contributed to the Δk_{bias}. Consistent with the rest of the analysis, only positive contributions to reactivity that are the largest for their respective term are considered **[[**

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The licensee analyzed credible normal scenarios, such as **[[**
]], in determining the most reactive configuration. The results of this analysis are found in Table 12 of Enclosure 4 of Reference 1. An additional normal scenario considered by the licensee was **[[**

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The dropped or damaged fuel assembly abnormal condition assumes that a bundle is dropped and that the pellets are released, filling empty spaces in the SFP storage cell. The licensee modeled this condition **[[**

]] comes to rest horizontally on top of the SFP storage rack. The licensee did not model this scenario given the following justification. The minimum separation of the fissile material between the dropped bundle and the stored fuel assemblies will be at least 12 inches. This provides enough neutron mean free paths to preclude neutron interactions that increase k_{eff}.

The licensee considered abnormal positioning of a fuel assembly outside of the fuel storage rack. There are numerous locations in which it is feasible for a bundle to be misplaced. The licensee determined that the most reactive position was **[[**

]]. The model for the misplaced bundle is shown in Figure 11 of Enclosure 4 of Reference 1. To find the most reactive position, **[[**
]]. The most reactive position is shown in the figure. **[[**

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The licensee considered the possibility of a non-conservative estimate of k_{eff} due to the lack of inserts along the rack periphery. **[[**

]]. The results of this analysis are shown in Table 13 of Enclosure 4 of Refence 1. **[[**
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The licensee considered a missing insert condition. This analysis is necessary due to the possibility of inadvertent removal of an insert during fuel assembly movement and insert removal for periodic inspections.

The licensee considered the effects of rack sliding. The licensee stated that the nominal model is infinite in extent with no inter-module gaps; therefore, all racks are close fitting and in the highest reactivity configuration. As previously noted, the Boraflex/Boral rack interface has two NAM wing/sheets between the fuel assemblies instead of one NAM wing/sheet as modeled in the infinite models. Therefore, sliding of the Boraflex/Boral racks at their interface is bounded by the infinite model of the individual rack designs.

Lastly, the licensee considered the effects of loss of spent fuel cooling. **[[**

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The NRC staff finds that the licensee's evaluation of the normal and abnormal conditions considered all positive reactivity impacts. Therefore, the calculation of Δk_{bias} is acceptable.

3.3.5 Disposition of Non-Conservatisms

Several potential non-conservative assumptions were identified as part of the NRC staff review of the application.

In choosing the design basis lattice, the results in Table 11 of Enclosure 4 of Reference 1 **[[**

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A potential non-conservatism is the inclusion of gadolinia loading in the NCS analysis. While the selected design basis lattice corresponds to the most reactive lattice, **[[**

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Additionally, the NETCO-SNAP-IN® rack inserts are only modeled as ^{10}B. This accounts for the neutron absorption capability of the inserts but does not account for the moderation capability. The inserts are a homogenous mixture of boron carbide and aluminum. Carbon is a potential neutron moderator with a low absorption cross-section. This may correspond to an unanalyzed positive reactivity contribution. Despite this, the NRC staff finds the material modeling of the rack inserts acceptable based on the following discussion. Carbon is not nearly as effective as a moderator as hydrogen as the moderation capability of an element depends on the mass number of the element. Boron carbide accounts for 23 volume percent of the rack inserts, therefore carbon accounts for roughly 4 to 5 volume percent. There is significantly less carbon compared to hydrogen in a single storage cell and, therefore, the staff finds that the moderation capability of carbon is negligible compared to hydrogen in water.

Based on the above and given the significant margin of the k_{max}(95/95) to the limit, the NRC staff finds the potential non-conservatisms in the licensee's NCS analysis acceptable.

3.4 Rack Insert Monitoring Program

3.4.1 Description of the Monitoring Program

The licensee proposed a program to monitor the condition of the NETCO SNAP-IN® neutron absorbing inserts. The program would consist of activities to monitor physical properties of the material, perform periodic neutron attenuation testing, and observe the inserts for wear. The licensee stated that if an abnormal condition was identified and confirmed it would be entered into the Fermi 2 Corrective Action Program for disposition.

The licensee's long-term coupon monitoring program would conduct periodic tests on different types of coupons from two coupon 'trees.' The coupon trees would be placed into the Fermi 2 SFP prior to the first installation of the NETCO SNAP-IN® neutron absorbing inserts and would be maintained in the SFP for as long as the NETCO SNAP-IN® neutron absorbing inserts continue to be used. All of the coupons would be manufactured to the same material specifications as the inserts. The coupons in the SFP would be used to test various properties, including potential changes to the $_{10}$B areal density (AD) and for signs of corrosion. Additionally, the coupon trees would be placed in locations in order to maximize dose and temperature exposure, to the extent possible.

Initially, one each of the bend, galvanic, and general coupons would be pulled every 5 years. However, after 10 years of satisfactory performance, the licensee would pull two bend and general coupons every 10 years instead. The licensee stated that with good performance, the inspection frequency could be extended but would not exceed the frequencies found in UFSAR Section B.1.27 and NEI 16-03-A. Based on these testing frequencies, the licensee stated that enough coupons would be installed to last for 80 years. Because of this, coupons would not need to be re-inserted into the SFP after removal.

In addition to the coupon testing proposed by the licensee, rack inserts would be periodically inspected. The inserts would be inspected both visually (for physical deformities such as bubbling, pitting, cracking, flaking, etc.) via camera and by periodic removal for testing for wear due to fuel movements. The removed inserts would not be re-inserted into the SFP. Spare inserts would be held to replace the removed inserts. As described in Reference 2, response to NRR-NCSG-RAI-01, these spare inserts would be kept in environmental conditions that are intended to preclude degradation of the material. The licensee provided proposed testing intervals for these tests and stated that with good performance, the test intervals could be extended but would not exceed the frequencies in UFSAR Section B.1.27 and NEI 16-03-A. Additionally, the licensee stated that there would be enough spare inserts to last for 80 years of testing such that no inserts would need to be re-inserted.

3.4.2 NRC Staff Evaluation of the Monitoring Program

The NRC staff reviewed the application as it pertains to the NAM that the licensee proposes to use for criticality control as well as to the associated NAM monitoring program. The staff finds the use of the NETCO SNAP-IN® neutron absorbing inserts acceptable as these inserts utilize the Rio-Tinto-Alcan BORALCAN™ composite material. The use of this NAM has been previously reviewed and approved by the staff for Peach Bottom, LaSalle (ADAMS Accession

No. ML110250051), and Quad Cities Nuclear Power Station (Quad Cities) (ADAMS Accession No. ML14346A306), among others. These approvals document the compatibility of the NAM with the SFP environment.

The NAM monitoring program includes the use of coupons that will be placed in the Fermi 2 SFP on coupon trees. The NRC staff finds this aspect of the monitoring program acceptable because: (1) the licensee will have enough coupons to last for the life of the SFP racks; (2) the coupon trees will be placed in a location of the SFP that will maximize the dose and temperature exposure of the coupons; (3) coupons will be tested once every 5 years for the first 10 years of use and then every 10 years given satisfactory performance; (4) the coupon testing will include a measurement of the $_{10}$B AD; (5) test coupons must meet or exceed the minimum $_{10}$B AD (0.0157 g/cm^2) with measurement uncertainty subtracted from the measured value; (6) coupon results are monitored and trended; and (7) full length inserts will be inspected visually via camera and will be removed at least once every 10 years for inspections to determine the condition of the inserts.

3.4.3 The Monitoring Program UFSAR and TS Requirements

License Condition 2.C.(26)(a) of the Fermi 2 Renewed Facility Operating License No. NPF-43 requires the licensee to incorporate the information in the license renewal application UFSAR supplement into the plant UFSAR. In order to satisfy this license condition, in part, the licensee incorporated the "Neutron-Absorbing Material Monitoring Program" into Section B.1.27 of the Fermi 2 UFSAR. This section of the UFSAR describes the monitoring program in general terms and isn't specific to a NAM. As part of the implementation of this application, if approved, the licensee stated that "UFSAR Section B.1.27 will be updated to specifically include the Rio-Tinto-Alcan BORALCAN™ composite material in the list of example materials to which the program applies." The licensee also stated that it would revise this UFSAR section to specifically state that program activities for the BORALCAN™ composite material will be consistent with the guidance in NEI 16-03-A. Additionally, the licensee stated that UFSAR Section 3.1.2.6.3 would be revised to describe the BORALCAN™ composite material as being relied upon to conform with GDC 62.

TS 5.5.13 only applies to the SFP storage racks that contain Boraflex as the NAM. Therefore, the licensee proposed to change this TS to state "Not Used." The licensee did not propose to replace this TS with new TS requirements related to programs to monitor either Boral or the NETCO SNAP-IN® neutron absorbing inserts because the relevant licensing requirements will already be incorporated into the Fermi 2 UFSAR as per License Condition 2.C.(26)(a).

The licensee also stated that License Condition 2.C.(26)(c) would no longer be required if the application were approved because using the NETCO SNAP-IN® neutron absorbing inserts would satisfy the intent of the license condition that the licensee not rely on Boraflex to perform a neutron absorption function.

3.4.4 NRC Staff Evaluation of the Monitoring Program UFSAR and TS Requirements

The NRC staff reviewed the proposed changes to License Condition 2.C.(26)(c), TS 5.5.13, and the Fermi 2 UFSAR.

The NRC staff finds that the proposed changes to UFSAR Sections 3.1.2.6.3 and B.1.27 provide reasonable assurance that, in conjunction with the proposed NAM monitoring program evaluated above, the condition of the NAM will continue to be monitored so that it can perform its safety function. The proposed change to UFSAR Section 3.1.2.6.3 is appropriate because it updates the UFSAR to specify that the new NAM inserts are credited to meet GDC 62. The proposed change to UFSAR Section B.1.27 is appropriate because it includes the new NAM inserts as a material to which the monitoring program applies and it specifies that NAM monitoring program activities will conform with the guidance in NEI 16-03-A. This is acceptable to the NRC staff because the referenced topical report is previously approved staff guidance for developing a NAM monitoring program and includes that the licensee measure the $_{10}$B AD of its NAM on a specified frequency. As explained above, the licensee meets this guidance by measuring the $_{10}$B AD of NAM coupons at intervals that will not exceed 10 years.

The NRC staff finds that the proposed change to TS 5.5.13 is acceptable because the TS only applies to the Boraflex NAM, which will no longer be credited for criticality control if the application is implemented. Additionally, because the relevant licensing requirements will already be incorporated into the Fermi 2 UFSAR as per License Condition 2.C.(26)(a), the staff has reasonable assurance that the NAM monitoring program will be able to ensure that the NAM performs its safety function without replacing this TS with new TS requirements related to programs to monitor either Boral or the NETCO SNAP-IN® neutron absorbing inserts.

The NRC staff finds that the proposed deletion of License Condition 2.C.(26)(c) is acceptable because once a more robust NAM is used to perform the neutron absorption function instead of Boraflex, the intent of the license condition is satisfied. As written, the license condition states that the Boraflex will be replaced with the Boral NAM. However, the licensee proposed to use the BORALCAN™ composite material in NETCO SNAP-IN® neutron absorbing inserts instead of Boral. The staff finds this acceptable because the BORALCAN™ composite material has previously been found acceptable for use in other SFPs. Additionally, the staff has previously found that this material is chemically compatible with the SFP environment and that, in conjunction with an appropriate monitoring program, as discussed in Section 3.3 above, there is reasonable assurance that it will perform its safety function.

3.4.5 Conclusion

The NRC staff reviewed the licensee's proposed insert monitoring program and determined that it will provide reasonable assurance that the licensee will be able to detect degradation of the neutron absorbing material before its ability to perform its intended safety function is impacted. Additionally, the staff reviewed the information provided regarding material compatibility with the SFP environment, as well as the BORALCAN™ monitoring program. The staff has reasonable assurance that the NETCO SNAP-IN® neutron absorbing inserts will be chemically compatible with the SFP environment. On this basis, the staff concludes that the proposed addition of a SFP neutron absorber monitoring program, the contents of the program, and the use of NETCO SNAP-IN® neutron absorbing inserts in the SFP meet the applicable requirements of 10 CFR 70.24 and GDCs 61 and 62 and are, therefore, acceptable.

3.5 <u>Human Factors Evaluation</u>

3.5.1 Operating Experience Review

The application references several instances of NETCO SNAP-IN® neutron absorbing inserts being approved for use at other sites, specifically, LaSalle, Peach Bottom, Quad Cities, and Palo Verde Nuclear Generating Station (ADAMS Accession No. ML15336A087).

Section 3.4.1 of Reference 1 discusses operating experience from LaSalle regarding the potential for an insert to be inadvertently removed. In that instance, the LaSalle licensee determined the cause of the inadvertent removal to be a channel fastener inadvertently coming in contact with the insert. To reduce the potential for occurrence of a similar type event at Fermi 2, the licensee stated that it would administratively control insert and channel fastener orientation. According to the licensee, procedures will ensure that fuel assemblies are oriented with the channel fastener at the opposite corner from the inserts when placing a fuel assembly into an SFP storage rack cell with an insert.

NRC Staff Evaluation:

NUREG-0711, Section 3, "Operating Experience Review," states, in part, that an applicant's operating experience review should include information about human factors issues experienced at predecessor plants or with highly similar systems. The licensee conducted an operating experience review consistent with this guidance. It identified cases of other plants using NETCO SNAP-IN® neutron absorbing inserts and addressed issues previously experienced by these plants with the use of these components. The licensee plans to implement administrative controls that will help to mitigate the recognized potential issues. The NRC staff finds this treatment to be acceptable because the mitigating actions proposed by the licensee are expected to address the issues identified from relevant operating experience.

3.5.2 Task Analysis and Procedure Development

The licensee discussed administrative controls that will be used to prevent potential issues, including the potential misorientation of an insert during installation. Based on prior operating experience at LaSalle (discussed earlier in this evaluation), there is a known potential for an installed insert to be inadvertently removed during subsequent fuel movement if that insert is not oriented properly in relation to a channel faster. As discussed in Section 3.4.1 of Reference 1, the licensee plans to ensure proper installation configuration through the use of established procedures. Furthermore, Section 3.7.1 of Reference 1 discusses the fact that these installation procedures will include the requirement for the installation of inserts to be verified, to confirm correct insert orientation. Based on this verification, the licensee does not consider misorientation of an insert to be a credible scenario. The licensee stated that, "[i]f an insert is identified as misoriented, the condition would be corrected" and that the "interim period where an insert was misoriented would be bounded by the case of a missing insert, which is explicitly addressed in the criticality safety analysis."

Additionally, the licensee considered the possibility of more than one insert missing and determined that this possibility was adequately controlled through administrative controls. In Reference 2, in response to an NRC staff RAI, the licensee stated that "the Fermi 2 plant procedure that establishes spent fuel pool storage rack management guidelines will be revised to ensure that no more than one rack insert is missing from any fuel storage rack at any one time."

In Reference 1, the licensee discussed its plans to eliminate the currently required task of monitoring degradation in storage racks containing Boraflex. The licensee stated that the elimination of this task was justified by the fact that "the Boraflex will no longer be credited to perform a neutron absorption function. Future degradation of the Boraflex will not impact the criticality safety analysis." Thus, there is no adverse impact on safety from eliminating this required task.

NRC Staff Evaluation:

Although the licensee did not provide a description of a formal task analysis in its application, it is clear from the submittal that the licensee has considered error prevention during insert installation in developing administrative controls for this installation. Proper installation will further serve to prevent potential errors during fuel movement, which have been known to occur at other plants.

The licensee plans to utilize standard human performance techniques, such as independent verification and control of processes using established procedures, to prevent potential errors. Furthermore, the licensee has accounted for the possible failure of these controls by considering the total absence of one insert as the bounding case in the NCS analysis.

The NRC staff finds that the licensee's consideration of important tasks associated with the proposed installation and use of neutron-absorbing inserts is sufficient. The proposed plan for error prevention and mitigation is thorough and it incorporates several barriers to ensure that insert misalignment or inadvertent removal of an insert during subsequent fuel movement will not occur.

Furthermore, the licensee's plan to discontinue the currently required task of monitoring the degradation of storage racks containing Boraflex is appropriate based on the fact that, with the approval of the application, the Boraflex will no longer be relied upon to ensure that criticality limits are not exceeded.

Based on the licensee's thorough consideration of important tasks associated with the installation and use of neutron-absorbing inserts and its plans to develop procedures necessary to safely perform the associated tasks, the NRC staff finds the licensee's consideration of these program elements to be acceptable.

3.5.3 Licensee Staff Training and Qualification

The licensee's application did not include a detailed discussion of the training and qualification of the staff that will be performing the installation of the neutron-absorbing insert. However, the application did discuss how information supplied by vendors has been used to inform the development of certain procedures. For instance, Section 3.3.1 of Reference 1 discussed the use of NETCO procedures as part of the data collection and processing for insert coupon testing. Additional vendor-supplied information is expected to inform the development of materials that will be used to train personnel regarding the installation of the neutron-absorbing inserts. Specifically, Enclosure 8 of Reference 1 includes a discussion, provided by NETCO, of the installation of the inserts and the tools used for this installation.

NRC Staff Evaluation:

Although the licensee did not provide a detailed discussion of the training and qualification of the staff that will be installing inserts, there is reasonable assurance that the licensee will adequately address these elements in its administration of the proposed license amendment. The licensee's implementation of its established training and quality assurance programs provides reasonable assurance that the training of qualified staff personnel will ensure that they are able to install and verify the proper installation configuration of the inserts.

Furthermore, there is reasonable assurance that vendor-supplied information will be utilized, as necessary, for the development of the licensee's insert installation procedures and for the training of the staff personnel that will use those procedures. The information provided by NETCO, such as that included in Enclosure 8 of Reference 1, is expected to inform any necessary training materials.

Based on the fact that the licensee will be required to implement its existing programs in the development of training to ensure that qualified staff are able to properly install the neutron-absorbing inserts, and based on the fact that the qualification of any vendor staff involved in the installation will be verified through the licensee's quality assurance program, the NRC staff finds the licensee's consideration of these program elements to be acceptable.

3.5.4 Design Implementation

Section 3.1.4 of Reference 1 discusses activities that (at the time of submittal) had already occurred or were planned. These activities were developed to demonstrate in both a "clean pool" testing environment and the actual Fermi 2 SFP that the inserts could be installed in the spent fuel storage racks. These activities included the installation of "prototype" inserts. Following the implementation of the license amendment, these prototype inserts will remain in the SFP as part of the set of actual inserts.

NRC Staff Evaluation:

The NRC staff determined that the completion of the planned demonstration and testing activities described in the application will adequately serve to demonstrate the capability of qualified staff/technicians to install inserts using the methods/procedures developed. This testing will also adequately serve to demonstrate the ability to safely implement the tools associated with installation activities. This includes demonstration of the integration of installation-specific tools (such as the NETCO installation tool) with existing plant equipment (such as the refuel bridge auxiliary hoist) and the capability of plant equipment to handle the associated loads.

Based on the licensee's plans to demonstrate that insert design is adequate to allow qualified staff to effectively and safely install the inserts in the spent fuel storage racks, the NRC staff finds the licensee's consideration of this program element to be acceptable.

3.5.5 Conclusion

The NRC staff reviewed information regarding the licensee's plans to install and utilize neutron-absorbing inserts in spent fuel storage racks. In accordance with NRC guidance addressing human factors considerations, the staff determined that the licensee has taken steps necessary to address the applicable human factors program elements. On this basis, the staff concludes that the processes and procedures developed and implemented by the licensee will meet the applicable requirements of GDC 62 and 10 CFR Part 50, Appendix B, Section V. Based on the determination that the licensee will adequately meet the applicable regulatory requirements, the staff finds the proposed license amendment to be acceptable.

3.6 Conclusion

Based on the above, the NRC staff determined that there is reasonable assurance that the Fermi 2 SFP, and the proposed conforming changes to License Condition 2.C.(26)(c) and the Fermi 2 UFSAR, meet the applicable regulatory requirements in GDCs 61 and 62 and 10 CFR 70.24. The June 2, 1998, exemption to 10 CFR 70.24 continues to be the Fermi 2 licensing basis for new and spent fuel storage.

Additionally, the NRC staff determined that the proposed TSs would continue to be based on the analyses and evaluation included in the UFSAR and amendments thereto, in accordance with 10 CFR 50.36(b). The NRC staff determined that the TSs, as amended, would continue to require the lowest functional capability or performance levels of equipment required for safe operation of the facility, in accordance with 10 CFR 50.36(c)(2), and contain requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the LCOs will be met, in accordance with 10 CFR 50.36(c)(3). The NRC staff also determined that the proposed TSs will continue to include required design features of the facility such as materials of construction and geometric arrangements, which, if altered or modified, would have a significant effect on safety, in accordance with 10 CFR 50.36(c)(4), and provisions relating to organization and management, procedures, recordkeeping, review and audit, and reporting necessary to assure operation of the facility in a safe manner, in accordance with 10 CFR 50.36(c)(5).

Therefore, the NRC staff concludes that the proposed changes are acceptable.

4.0 FINAL NO SIGNIFICANT HAZARDS CONSIDERATION

The NRC staff's proposed no significant hazards consideration determination was published in the *Federal Register* on January 7, 2020 (85 FR 731). By submittal dated March 9, 2020, Citizens' Resistance at Fermi 2 (CRAFT) requested a hearing on this application (ADAMS Accession No. ML20071G500). On July 7, 2020, the Atomic Safety and Licensing Board (Board) denied CRAFT's hearing request (ADAMS Accession No. ML20189A065). On August 3, 2020, CRAFT appealed the Board's decision to the Commission (ADAMS Accession No. ML20216A458). On February 18, 2021, the Commission upheld the Board's decision (ADAMS Accession No. ML21049A207).

Under the Atomic Energy Act of 1954, as amended, and the NRC's regulations, the NRC staff may issue and make an amendment immediately effective, notwithstanding the pendency before the Commission of a request for a hearing from any person, in advance of the holding and completion of any required hearing, where it has made a final determination that no significant hazards consideration is involved.

The NRC's regulations in 10 CFR 50.92(c) state that the NRC may make a final determination, under the procedures in 10 CFR 50.91, that a license amendment involves no significant hazards consideration if operation of the facility, in accordance with the amendment, would not: (1) involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety.

As required by 10 CFR 50.91(a), the licensee provided its analysis of the issue of no significant hazards consideration, which is presented below:

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

   Response: No.

   The proposed change revises the Renewed Facility Operating License and Technical Specifications to reflect installation of NETCO SNAP-IN® rack inserts in SFP storage rack cells. The changes are necessary to ensure that, without credit for Boraflex as a neutron absorbing material as required by the License Renewal License Condition, the effective neutron multiplication factor, k-effective, is less than or equal to 0.95, if the spent fuel pool (SFP) is fully flooded with unborated water. Since the proposed changes pertain only to the SFP, only those accidents that are related to movement and storage of fuel assemblies in the SFP could potentially be affected by the proposed changes.

   The installation of NETCO SNAP-IN® rack inserts and their credit in the criticality safety analysis does not result in a significant increase in the probability of an accident previously analyzed because there are no changes in the manner in which spent fuel is handled, moved, or stored in the rack cells. The probability that a fuel assembly would be dropped is unchanged by the installation of the NETCO SNAP-IN® rack inserts and their credit in the criticality safety analysis. These events involve failures of administrative controls, human performance, and equipment failures that are unaffected by the type of neutron absorbing material utilized in the SFP racks.

   The installation of NETCO SNAP-IN® rack inserts and their credit in the criticality safety analysis does not result in a significant increase in the consequences of an accident previously analyzed because there is no change to the fuel assemblies that provide the source term used in calculating the radiological consequences of a fuel handling accident. In addition, consistent with the current design, only one fuel assembly will be moved at a time. Thus, the consequences of dropping an insert with tooling or a fuel assembly onto any other fuel assembly or other structure remain bounded by the previously analyzed fuel handling accident. The proposed changes do not impact the effectiveness of the other engineered design features, such as isolation systems, that limit the dose consequences of a fuel handling accident.

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

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

   Response: No.

   Onsite storage of spent fuel assemblies in the Fermi 2 SFP is a normal activity for which Fermi 2 has been designed and licensed. As part of assuring that this normal activity can be performed without endangering the public health and safety, the ability to safely accommodate different possible accidents in the SFP have been previously analyzed. These analyses address accidents such as radiological releases due to dropping a fuel assembly; and potential inadvertent criticality due to misloading a fuel assembly. The proposed SFP storage configuration utilizing the NETCO SNAP-IN® rack inserts does not change the method of fuel movement or spent fuel storage and does not create the potential for a new accident. The proposed changes also allow for the continued use of SFP storage rack cells with Boraflex within those SFP storage rack cells; however, no credit is taken for Boraflex as a neutron absorbing material.

The rack inserts are passive devices. These devices, when inside a SFP storage rack cell, perform the same function as the previously licensed Boraflex neutron absorber panels in that cell. The NETCO SNAP-IN® rack inserts do not add any limiting structural loads or adversely affect the removal of decay heat from the assemblies. No change in total heat load in the spent fuel pool is being made. The insert devices will be monitored to ensure they maintain their design function over the life of the spent fuel pool. The existing fuel handling accident, which assumes the drop of a fuel assembly and refueling mast, bounds the drop of a rack insert and associated tools. This proposed change does not create the possibility of misloading an assembly into a SFP storage rack cell. Inadvertent removal of an insert, although largely precluded by design and administrative controls, does not challenge subcriticality requirements as explicitly demonstrated by the criticality safety analysis.

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 amendment involve a significant reduction in a margin of safety?

Response: No.

The NETCO SNAP-IN® rack inserts are being installed to maintain the margin of safety in the SFP criticality safety analysis. The NETCO SNAP-IN® rack inserts, once approved and installed, will replace the existing Boraflex as the credited neutron absorber for controlling spent fuel pool reactivity, even though the Boraflex material will remain in place.

Fermi 2 TS 4.3, “Fuel Storage,” Specification 4.3.1.b requires the SFP storage racks to maintain the effective neutron multiplication factor, k-effective, less than or equal to 0.95 when fully flooded with unborated water, which includes an allowance for uncertainties. Therefore, for SFP criticality safety considerations, the required safety margin is 5 percent.

The proposed changes ensure, as verified by the new criticality safety analysis, that k-effective continues to be less than or equal to 0.95, thus preserving the required safety margin of 5 percent.

In addition, the radiological consequences of a dropped fuel assembly, considering the installed NETCO SNAP-IN® rack inserts, remain unchanged as the anticipated fuel damage due to a fuel handling accident is unaffected by the addition of the inserts in the SFP storage cells. The proposed changes also do not increase the capacity of the SFP.

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

The NRC staff reviewed the licensee's no significant hazards consideration determination. Based on this review and on the staff's evaluation of the underlying application as discussed above, the NRC staff concludes that the three standards of 10 CFR 50.92(c) are satisfied. Therefore, the NRC staff has made a final determination that no significant hazards consideration is involved for the proposed amendment and that the amendment should be issued as allowed by the criteria contained in 10 CFR 50.91.

5.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Michigan State official was notified of the proposed issuance of the amendment on November 27, 2020. The State official had no comments.

6.0 ENVIRONMENTAL CONSIDERATION

The amendment changes requirements with respect to the installation or use of facility components located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration and there has been no public comment on such finding (85 FR 731). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

7.0 CONCLUSION

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

8.0 REFERENCES

1. Fessler, Paul, DTE Electric Company, letter to NRC, "License Amendment Request to Revise Technical Specifications to Utilize Neutron Absorbing Inserts in Criticality Safety Analysis for Fermi 2 Spent Fuel Storage Racks," September 5, 2019 (ADAMS Accession No. ML19248C679).

2. Dietrich, Peter, DTE Electric Company, letter to NRC, "Response to Request for Additional Information Regarding License Amendment Request to Revise Technical Specifications to Utilize Neutron Absorbing Inserts in Criticality Safety Analysis for Fermi 2 Spent Fuel Storage Racks," July 30, 2020 (ADAMS Accession No. ML20212B303).

3. Dietrich, Peter, DTE Electric Company, letter to NRC, "Response to Request for Additional Information Regarding Licensing Amendment Request to Revise Technical Specifications to Utilize Neutron Absorbing Inserts in Criticality Safety Analysis for Fermi 2 Spent Fuel Storage Racks," August 24, 2020 (ADAMS Accession No. ML20237F291).

4. Lamb, John G., NRC, letter to William T. O'Connor, Jr., Detroit Edison Company, "Fermi 2 – Issuance of Amendment Re: Spent Fuel Pool Rerack," January 25, 2001 (ADAMS Accession No. ML010310205).

5. Kugler, Andrew J., NRC, letter to Douglas R. Gipson, Detroit Edison Company, "Fermi 2 - Issuance of Exemption from the Requirements of 10 CFR 70.24," June 2, 1998 (ADAMS Accession No. ML020730461).

6. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," Section 9.1.1, "Criticality Safety of Fresh and Spent Fuel Storage and Handling," Revision 3, March 2007 (ADAMS Accession No. ML070570006).

7. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," Section 9.1.2, "New and Spent Fuel Storage," Revision 4, March 2007 (ADAMS Accession No. ML070550057).

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10. Nuclear Energy Institute, NEI 16-03-A, "Guidance for Monitoring of Fixed Neutron Absorbers in Spent Fuel Pools," Revision 0, May 2017 (ADAMS Accession No. ML17263A133).

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12. Kopp, Laurence, Sr., NRC, memo to Timothy Collins, NRC, "Guidance on the Regulatory Requirements for Criticality Analysis of Fuel Storage at Light-Water Reactor Power Plants," August 19, 1998 (ADAMS Accession No. ML003728001).

13. Division of Safety Systems Interim Staff Guidance DSS-ISG-2010-01, "Staff Guidance Regarding the Nuclear Criticality Safety Analysis for Spent Fuel Pools," Revision 0, October 13, 2011 (ADAMS Accession No. ML110620086).

14. Nuclear Energy Institute, NEI 12-16, "Guidance for Performing Criticality Analyses of Fuel Storage at Light-Water Reactor Power Plants," Revision 2, January 2017 (ADAMS Accession No. ML17009A343).

15. NUREG/CR-6698, "Guide for Validation of Nuclear Criticality Safety Calculational Methodology," January 2001 (ADAMS Accession No. ML050250061).

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Date of Issuance: May 24, 2021

SUBJECT: FERMI 2 - ISSUANCE OF AMENDMENT NO. 220 RE: REVISION TO TECHNICAL SPECIFICATIONS TO UTILIZE NEUTRON ABSORBING INSERTS IN CRITICALITY SAFETY ANALYSIS FOR SPENT FUEL POOL STORAGE RACKS (EPID L-2019-LLA-0199) DATED MAY 24, 2021

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ADAMS Accession Nos.:
ML21029A249 (Package);
ML21029A191 (Proprietary);
ML21029A254 (Non-Proprietary)

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