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

February 17, 2012

Mr. Jack M. Davis
Senior Vice President and Chief Nuclear Officer
Detroit Edison Company
Fermi 2 - 210 NOC
6400 North Dixie Highway
Newport, MI 48166

SUBJECT: FERMI 2 – EVALUATION OF APPLICABLE 10-YEAR INTERVAL INSERVICE INSPECTION RELIEF REQUEST – USE OF BOILING WATER REACTOR VESSEL AND INTERNALS PROJECT (BWRVIP) GUIDELINES IN LIEU OF SPECIFIC ASME CODE REQUIREMENTS (TAC NO. ME6765)

Dear Mr. Davis:

By letter dated July 28, 2011, supplemented by letters dated October 26, 2011 and January 11, 2012, Detroit Edison Energy (the licensee) submitted its third 10-year interval inservice inspection (ISI) program plan relief request for the reactor vessel internals (RVI) components at Fermi, Unit 2. The licensee proposed to use Boiling Water Reactor Vessel and Internals Project (BWRVIP) guidelines as an alternative to certain requirements of Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) for ISI of RVI components.

The Nuclear Regulatory Commission (NRC) staff has completed its review of the licensee's submittal. The NRC staff concludes that the alternative proposed by the licensee will ensure that the integrity of the RVI components is maintained with an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the licensee's proposed alternative for the RVI components at Fermi, Unit 2 is authorized for the third 10-year inspection interval.

All other requirements of the ASME Code, Section XI for which this alternative has not been specifically requested remain applicable, including third party review by the Authorized Nuclear Inservice Inspector. Any component that is not included in this request for alternative will continue to be inspected in accordance with the ASME Code, Section XI requirements.

In case of any further questions or comments, please contact Project Manager, Mahesh Chawla at Mahesh.chawla@nrc.gov or (301) 415-8371.

Sincerely,

Shawn Williams

Shawn A. Williams, Chief
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-341

Enclosure: Safety Evaluation

cc w/encl: Distribution via ListServ

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

FOR APPLICABLE 10-YEAR INTERVAL INSERVICE INSPECTION

RELIEF REQUEST FOR USE OF BOILING WATER REACTOR VESSEL INTERNALS

PROGRAM GUIDELINES IN LIEU OF SPECIFIC ASME CODE REQUIREMENTS

FERMI, UNIT 2

DOCKET NO. 50-341

1.0 INTRODUCTION

By letter dated July 28, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML112101480), supplemented by letters dated October 26, 2011 (ADAMS Accession No. ML112991389), and January 11, 2012 (ADAMS Accession No. ML120120278), Detroit Edison Energy (the licensee) submitted its third 10-year interval inservice inspection (ISI) program plan relief request for the reactor vessel internals (RVI) components at Fermi, Unit 2. The licensee proposed to use Boiling Water Reactor Vessel and Internals Project (BWRVIP) guidelines as an alternative to certain requirements of Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) for ISI of RVI components.

2.0 REGULATORY REQUIREMENTS

The ISI of ASME Code Class 1, 2, and 3 components is performed in accordance with Section XI of the ASME Code as required by Title 10 *Code of Federal Regulations* (10 CFR) 50.55a(g), except where specific relief has been granted by the Nuclear Regulatory Commission (NRC) pursuant to 10 CFR 50.55a(g)(6)(i). It is stated in 10 CFR 50.55a(a)(3) that alternatives to the requirements of 10 CFR 50.55a(g) may be used, when authorized by the NRC if: (i) the proposed alternatives would provide an acceptable level of quality and safety or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for ISI of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that ISI examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and

addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b), twelve months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The applicable ASME Code of record for the third 10-year ISI interval for Fermi, Unit 2 is ASME Code, Section XI, 2001 Edition, through 2003 Addenda.

3.0 TECHNICAL EVALUATION

3.1 LICENCEE'S EVALUATION

The Components for Which an Alternative is Requested

In its submittal dated July 28, 2011, the licensee included an alternative inspection program for the following ASME Code, Section XI, Class 1, Examination Categories that are applicable to the RVI components at Fermi, Unit 2.

> ASME Code, Section XI, Class 1, Examination Categories B-N-1 and B-N-2, Code Item Numbers B13.10, Vessel Interior, B13.20, Interior Attachments within Beltline Region, B13.30, Interior Attachments Beyond Beltline Region, and B13.40, Core Support Structure.

Examination Requirements From Which an Alternative is Requested

ASME Code, Section XI requires the visual examination (VT) of certain RVI components. These examinations are included in Table IWB-2500-1, Categories B-N-1 and B-N-2, and identified with the following item numbers:

- B13.10 - Examine accessible areas of the RV interior each period using a technique which meets the requirements for a VT-3 examination, as defined in paragraph IWA-2213 of the ASME Code, Section XI.

- B13.20 - Examine interior attachment welds within the beltline region each interval using a technique which meets the requirements for a VT-1 examination as defined in paragraph IWA-2211 of the ASME Code, Section XI.

- B13.30 - Examine interior attachment welds beyond the beltline region each interval using a technique which meets the requirements for a VT-3 examination, as defined in paragraph IWA-2213 of the ASME Code, Section XI.

- B13.40 - Examine surfaces of the core support structure each interval using a technique which meets the requirements for a VT-3 examination, as defined in paragraph IWA-2213 of the ASME Code, Section XI.

These examinations are performed to assess the structural integrity of the RVI components.

Licensee's Basis for Requesting an Alternative and Justification for Granting Relief

The licensee stated that the alternative inspections (described below) will maintain an adequate level of quality and safety of the affected welds and components and will not adversely impact

the health and safety of the public. As part of its justification for the relief, the licensee stated that BWR RVI components are now being examined in accordance with BWRVIP guidelines. The BWRVIP has established a reporting protocol for the examination results and deviations. These guidelines have been written to address the examination of safety significant RVI components using appropriate methods and reexamination frequencies. The licensee also noted that the NRC has agreed with the BWRVIP approach, in principle, and has issued safety evaluations (SEs) for these guidelines. [Note: "in principle" means that, for some reports, final SEs have been written, but the final BWRVIP acceptance reports which incorporate these SEs for some of the reports may not have been issued]. Relief from examinations in Table IWB-2500-1 of the ASME Code are requested pursuant to 10 CFR 50.55a(a)(3)(i).

Alternative Examination

In lieu of the requirements of the 2001 Edition and 2003 Addenda of the ASME Code, Section XI, the licensee proposed to examine the Fermi, Unit 2 RVI components in accordance with BWRVIP Guideline requirements. The particular guidelines that are applicable to the various RVI components are:

- BWRVIP-03NP, "BWR Vessel and Internals Project, BWR Vessel Internals Project, Reactor Pressure Vessel and Internal Examination Guidelines" (ADAMS Accession No. ML092580272)
- BWRVIP-14NP-A "BWR Vessel and Internals Project, BWR Evaluation of Crack Growth in BWR Stainless Steel RPV Internals," (ADAMS Accession No. ML101880724)
- BWRVIP-18-A, "BWR Vessel and Internals Project, BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines" (Proprietary information, not publicly available)
- BWRVIP-25, "BWR Vessel and Internals Project, BWR Core Plate Inspection and Flaw Evaluation Guidelines" (Proprietary information, not publicly available)
- BWRVIP-26-A, "BWR Vessel and Internals Project, BWR Top Guide Inspection and Flaw Evaluation Guidelines" (Proprietary information, not publicly available)
- BWRVIP-27-A, "BWR Vessel and Internals Project, BWR Standby Liquid Control System/Core Plate ΔP Inspection and Flaw Evaluation Guidelines" (ADAMS Accession No. ML041700446)
- BWRVIP-38, "BWR Vessel and Internals Project, BWR Shroud Support Inspection and Flaw Evaluation Guidelines" (Proprietary information, not publicly available)
- BWRVIP-41, "BWR Vessel and Internals Project, BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines" (Proprietary information, not publicly available)
- BWRVIP-47-A, "BWR Vessel and Internals Project, BWR Lower Plenum Inspection and Flaw Evaluation Guidelines" (Proprietary information, not publicly available)
- BWRVIP-48-A, "BWR Vessel and Internals Project, BWR Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines" (Proprietary information, not publicly available)
- BWRVIP-76NP, "BWR Vessel and Internals Project, BWR Core Shroud Inspection and Flaw Evaluation Guidelines" (ADAMS Accession No. ML003688790)
- BWRVIP-94NP, "BWR Vessel and Internals Project, Program Implementation Guide" (ADAMS Accession No. ML11271A058)
- BWRVIP-100NP-A, "BWR Vessel and Internals Project, BWR Updated Assessment of Fracture Toughness of Irradiated Stainless Steel for BWR Core Shroud" (ADAMS

Accession No. ML080110645)

- BWRVIP-139NP-A, "BWR Vessel and Internals Project, Steam Dryer Inspection and Flaw Evaluation Guidelines," (ADAMS Accession No. ML101270123)
- BWRVIP-183NP "BWR Vessel and Internals Project, Top Guide Grid Beam Inspection and Flaw Evaluation Guidelines," (ADAMS Accession No. ML080220433)

The licensee made a statement that any deviation from the aforementioned BWRVIP guidelines for the duration (third 10-year ISI interval) of proposed alternative will be communicated to the staff per the BWRVIP deviation process. At Fermi, Unit 2, the only deviation from the BWRVIP guidelines is associated with the inspection of the core plate bolting.

Irradiated stainless steel RVI components, especially, core shroud welds exposed to a neutron fluence value which exceeds the threshold limit are susceptible to loss of fracture toughness. In that context, the licensee stated that it would use the reduced fracture toughness values as specified in BWRVIP-100NP-A for its flaw evaluation of the cracked core shroud welds. In Enclosure 1 of the July 28, 2011 submittal, the licensee provided a comparison of the required ASME Code, Section XI, Category B-N-1 and B-N-2 examination requirements with the above current BWRVIP Guideline requirements that are applicable to the Fermi, Unit 2. In Enclosure 2, of the July 28, 2011 submittal the licensee provided, as an example, additional information regarding the BWRVIP inspection requirements for the following welds of the RVI components and their subcomponents representing each of the aforementioned ASME Code, Section XI, category/item numbers (Item Numbers B13.10, B13.20, B13.30, and B13.40).

Core Spray
Jet Pump
Core Shroud
Core Shroud Support and Core Support Structure
Top Guide
Interior Attachment Welds

In Enclosure 3 of the July 28, 2011 submittal, the licensee provided inspection history of the following RVI components: core shroud, core spray piping, top guide, core plate, stand-by-liquid system, jet pump assembly, control rod guide tube assembly, stub tube, in-core housing, instrumentation penetrations, vessel inside diameter brackets, and steam dryers. In Enclosure 3, the licensee also provided information with respect to the extent of active aging degradation that was observed in the aforementioned components and addressed the appropriate corrective actions that were taken to mitigate the aging degradation in the RVI components.

The licensee stated that these examples demonstrated that the inspection techniques that are recommended by the BWRVIP inspection guidelines are superior to the inspection techniques mandated by the ASME Code, Section XI, ISI program. Additionally, these examples confirmed that the BWRVIP inspection guidelines require more frequent inspections of the RVI components than the corresponding ASME Code, Section XI, ISI program. The licensee claimed that by implementing the BWRVIP inspection guidelines the aging degradation of the RVI components can be identified in a timely manner so that proper corrective action can be taken to restore the integrity of the applicable RVI components. Therefore, the licensee concluded that implementation of the BWRVIP inspection guidelines for the Fermi, Unit 2 RVI components would provide an acceptable level of quality and safety.

3.2 STAFF EVALUATION

The NRC staff reviewed the information provided by the licensee in its submittal dated July 28, 2011, which included technical bases for its proposed alternative to the ASME Code, Section XI, ISI requirements for the RVI components at Fermi, Unit 2. The staff reviewed the status of each of the referenced BWRVIP guidance documents and found all of the referenced BWRVIP reports to be acceptable. The staff did, however, identify some issues which required additional clarification by the licensee. The following paragraphs address the staff's requests for additional information (RAIs), the licensee's responses, and the staff's evaluation of the RAIs.

In response to RAI #1, by a letter October 26, 2011, the licensee stated that it provided inspection requirements and inspection frequencies for the RVI components at Fermi, Unit 2 similar to those addressed in the Exelon submittal (ADAMS Accession Number ML071140082) which was accepted by the staff. Table 1 in Enclosure 1, and the information in Enclosures 2 and 3 provide detailed examples of the inspections of the RVI components at Fermi, Unit 2. After further review, the staff finds the response acceptable because the licensee adequately addressed the inspection results, inspection methods used, and frequency of inspections. Therefore, the staff considers that its concern related to RAI #1 is resolved.

In response to RAI #2, by a letter October 26, 2011, the licensee stated that it developed an RVI inspection program which complies with the BWRVIP-94NP, "BWR Vessel and Internals Project, Program Implementation Guide" (ADAMS Accession No. ML11271A058). The licensee further stated that revised versions of the BWRVIP guidelines will be implemented only after they are approved by the staff. The staff finds this response acceptable because at the Fermi, Unit 2, the licensee's implementation of the BWRVIP inspection guidelines is consistent with the BWRVIP Implementation Guidelines. Therefore, staff considers that its concern related to RAI #2 is resolved.

In response to RAI #3, in its letter dated October 26, 2011, the licensee acknowledged that there are furnace sensitized stainless steel attachment welds which included guide rod brackets, steam dryer support lugs, core spray piping brackets, feed water brackets, surveillance brackets and, jet pump brackets at Fermi, Unit 2. These components were inspected as per their relevant BWRVIP reports and thus far, no cracking was observed. The inspection techniques and the frequency of inspections of some of these components exceed the ASME Code, Section XI requirements. The licensee reiterated that it did not perform additional augmented inspections on these components. Absence of cracking in the furnace sensitized RVI components is a good indication that thus far, there is no active aging degradation in these components. The implementation of the inspection criteria addressed in the applicable BWRVIP reports would be adequate in identifying any active aging degradation that could occur in the future in these components. Therefore, the staff determined that this issue is adequately resolved.

Based on the review of the Enclosure 3 in the July 28, 2011 submittal, the staff noted that the licensee was complying with the inspection guidelines addressed in BWRVIP-139NP-A, "BWR Vessel and Internals Project, Steam Dryer Inspection and Flaw Evaluation Guidelines," (ADAMS Accession No. ML101270123) and the BWRVIP-26-A, and the BWRVIP-183, "BWRVIP Top

Guide Beam Inspection and Flaw Evaluation Guidelines," (ADAMS Accession No. ML080220433) reports related to *Steam Dryer Inspection and Flaw Evaluation Guidelines*, and the BWRVIP reports related to the *Top Guide Grid Beam Inspection and Flaw Evaluation Guidelines*, for managing aging degradation in steam dryer and top guide components, respectively. Since these reports include adequate inspection guidelines, the staff determined that adoption of these inspection guidelines for the aforementioned RVI components would effectively enable the licensee to identify any active aging degradation in a timely manner. Therefore, the issue related to RAI #4 is adequately resolved.

In response to RAI #5, the licensee, by a letter dated October 26, 2011, stated that it implemented the inspection guidelines which were originally a part of the NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive (CRD) Return Line Nozzle Cracking." In addition, it implemented inspection program addressed in GE-NE-523-A71-0594-A, Revision 1, (proprietary information, not publicly available). Per these reports, the licensee performed ultrasonic testing on the CRD return line nozzle and feedwater nozzle. The licensee further stated that frequent inspections of the sparger hole nozzles showed no active aging degradation. Based on the response, the staff concludes that by implementing the inspections addressed in the aforementioned reports, the licensee would be able to adequately manage the aging degradation in the subject components. Therefore, this issue is adequately resolved.

In response to the staff's RAI #6, the licensee by a letter dated October 26, 2011, stated that Fermi, Unit 2 does not have a core shroud support leg weld (H12), and, therefore, the H12 weld was not included in Table 1 of the Enclosure 1 of the submittal dated July 28, 2011. The staff accepts this response and its concern related to RAI #6 is resolved.

Regarding the inspection of the core plate components, in its response to RAIs # 7 and 8, by letter dated October 26, 2011, the licensee stated that it did implement inspection guidelines specified in the BWRVIP report related to the core plate components at Fermi, Unit 2. The licensee further stated that, due to limited accessibility, core plate bolts were not inspected, hence, a deviation disposition was filed with the BWRVIP. Since Fermi, Unit 2 does not have wedges, the deviation disposition included an analysis which demonstrated that adverse displacement of the core plate would not occur due to cracking and loss of preload in the core plate bolts. Since the core plate bolts are not being inspected at Fermi, Unit 2 due to access issues, the staff requested that the licensee submit a plant-specific analysis to the staff for review and approval.

By letter dated January 11, 2012, the licensee submitted an analysis related to the core bolts to the staff for review. A cursory review of the fracture mechanics (FM) analysis provided in the January 11, 2012 letter indicated that the FM results support the relief request until the end of the ISI interval, which is equivalent to 30 years of operation. This determination is based on (1) the conservative assumption of having a 360° circumferential flaw of depth equal to the thread depth after an operation of 5 years, (2) the use of the 95 percentile crack growth rate as documented in BWRVIP-14NP-A "BWR Vessel and Internals Project, BWR Evaluation of Crack Growth in BWR Stainless Steel RPV Internals," (ADAMS Accession No. ML101880724), (3) the significant margin shown in the calculated results – loss of 0.12 percent of the preload in 60 years, (4) the industry and plant-specific operating experience showing no failures and degradation of bolts through extensive VT-3 examinations and one EVT-1 examination, and (5) a generic analysis showing only 80 percent of the bolts are necessary to resist loads during faulted conditions. Approving bases (3) to (5) also support the staff's determination to delay a

thorough review of the generic or plant-specific FM analysis beyond this ISI interval. This analysis is applicable only to this relief request and as such, it is valid only for the third ISI interval.

The staff reviewed the summary report on the inspections of the core shroud horizontal welds which were addressed in Enclosure 3 of the July 28, 2011 submittal and noted that these inspections were consistent with guidelines addressed in the BWRVIP report related to core shroud component, and thus far, no cracking was observed in these welds. In response to RAI #9, dated October 26, 2011, the licensee stated that a plant-specific analysis would be performed for the welds that would be exposed to a fluence value exceeding the threshold limits for irradiation-assisted stress corrosion cracking and neutron embrittlement. The staff expects that the plant-specific analysis would comply with the guidelines provided in the BWRVIP reports related to core shroud component. With respect to monitoring the aging degradation in H8 and H9 welds, consistent with the staff's RAI #9, the licensee agreed to include H8 and H9 welds in Table 1 of the July 28, 2011 submittal. After the review of the July 28, 2011 submittal, and the October 26, 2011 response, the staff determined that the licensee was adequately managing the aging degradation in the core shroud component and that the inspection criteria implemented for these welds were consistent with the BWRVIP-76NP report. Therefore, this issue is adequately resolved.

Since Alloy 182 welds are susceptible to intergranular stress corrosion cracking (IGSCC), the staff, in a letter dated September 12, 2011 (ADAMS Accession No. ML11255A080), in RAI #10, requested the licensee to provide information regarding the inspections and their results associated with the Alloy 182 welds at Fermi, Unit 2. In its response dated October 26, 2011, the licensee stated that Alloy 182 weld metal was used for the following RVI components: integral attachment welds, access hole covers (AHC), jet pump diffuser/adapter and H7 shroud welds. Previous inspections of these components did not reveal any indications with the exception of the AHC weld at the zero degree location. As a part of its monitoring program, the licensee conducted subsequent inspections on the AHC weld and thus far, the crack growth seems to have stabilized. However, the licensee stated that it would continue to perform re-inspections of the AHC welds, and based on future inspection results the re-inspection frequency would be established. The staff accepts this response because: (a) the licensee conducted routine inspections that are consistent with the relevant BWRVIP guidelines for the Alloy 182 welds; (b) the licensee effectively demonstrated its capability in monitoring and trending of the IGSCC in AHC welds, and, (c) the licensee implemented an adequate corrective action program which would ensure that the aging effects due to IGSCC are adequately managed for the Alloy 182 welds. Therefore, the issue related to RAI #10 is adequately resolved, and is considered closed.

Consistent with the determination that was made in the staff's SEs which approved each of the cited BWRVIP reports the BWRVIP inspection requirements (as supplemented by the staff-approved inspection guidelines for the feedwater nozzle and sparger welds), the licensee's proposed alternative will identify aging degradation of the RVI components in a timely manner. Therefore, the staff has concluded that the implementation of the inspection requirements specified in the licensee's proposed alternative will ensure that the integrity of the RVI components will be maintained with an acceptable level of quality and safety.

Therefore, based on the information in the licensee's submittals dated July 28, 2011, and October 26, 2011, the staff has confirmed that the licensee's proposed alternative is consistent

with the technical bases documented in the staff-approved inspection guidelines for the feedwater nozzle and sparger welds and the BWRVIP reports cited in Sections 3.0 and 4.0 of this SE.

4.0 CONCLUSION

Based on the information provided in the licensee's submittals, the staff concludes that the alternative proposed by the licensee will ensure that the integrity of the RVI components is maintained with an acceptable level of quality and safety.

Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the licensee's proposed alternative for the RVI components at Fermi, Unit 2 is authorized for the third 10-year inspection interval. All other requirements of the ASME Code, Section XI for which this alternative has not been specifically requested remain applicable, including third party review by the Authorized Nuclear Inservice Inspector. Any component that is not included in this request for alternative will continue to be inspected in accordance with the ASME Code, Section XI requirements.

Principal Contributor: Ganesh Cheruvenki, NRR

Date: February 17, 2012

In case of any further questions or comments, please contact Project Manager, Mahesh Chawla at Mahesh.chawla@nrc.gov or (301) 415-8371.

Sincerely,

/RA/

Shawn A. Williams, Chief
Plant Licensing Branch III-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-341

Enclosure: Safety Evaluation

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