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

March 7, 2018

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

SUBJECT: FERMI 2 – RELIEF FROM THE REQUIREMENTS OF THE ASME OM CODE (CAC NO. MG0119; EPID L-2017-LLR-0082)

Dear Mr. Polson:

By letter dated August 15, 2017, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17228A080) DTE Energy Company, (DTE or the licensee) submitted a request to the U.S. Nuclear Regulatory Commission (NRC) for the use of alternatives to certain American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, 2001 Edition with 2003 Addenda requirements at Fermi 2.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(2), the licensee requested to use an alternative on the basis that complying with the specified requirement would result in hardship or unusual difficulty. The proposed alternative would allow the licensee to use ASME Code Case N-513-4, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping Section XI, Division 1," for the evaluation and temporary acceptance of flaws in moderate energy Class 2 and 3 piping in lieu of specified ASME Code requirements.

The NRC staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that the proposed alternative provides reasonable assurance of structural integrity of the subject components and that complying ASME Code, Section XI, would result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2).

Therefore, the NRC staff authorizes the use of the licensee's proposed alternative described in the licensee's letter dated August 15, 2017, at Fermi, Unit 2, for the remainder of third 10-year ISI interval which is scheduled to end May 1, 2019, or until such time as the NRC approves Code Case N-513-4 for general use through revision of NRC RG 1.147 or other NRC document.

All other requirements of the ASME Code, Section XI, for which relief has not been specifically requested and authorized by NRC staff remain applicable, including a third party review by the Authorized Nuclear In-service Inspector. The NRC staff notes that approval of this alternative does not imply or infer NRC approval of ASME Code Case N-513-4 for generic use.

If you have any questions, please contact the Project Manager, Sujata Goetz at 301-415-8004 or via e-mail at Sujata.Goetz@nrc.gov.

Sincerely,

David J. Wrona, Chief
Plant Licensing Branch III
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-341

Enclosure:
Safety Evaluation

cc w/encl: ListServ

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST REGARDING PROPOSED ALTERNATIVE

TO UTILIZE ASME CODE CASE N-513-4

FERMI, UNIT 2

DTE ELECTRIC COMPANY

DOCKET NO. 50-341

1.0 INTRODUCTION

By letter dated August 15, 2017, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17228A080) DTE Energy Company, (DTE or the licensee) submitted a request to the U.S. Nuclear Regulatory Commission (NRC) for the use of alternatives to certain American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, 2001 Edition with 2003 Addenda at Fermi 2.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(2), the licensee requested to use an alternative on the basis that complying with the specified requirement would result in hardship or unusual difficulty. The proposed alternative would allow the licensee to use ASME Code Case N-513-4, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping Section XI, Division 1," for the evaluation and temporary acceptance of flaws in moderate energy Class 2 and 3 piping in lieu of specified ASME Code requirements.

2.0 REGULATORY EVALUATION

The licensee proposed an alternative to the acceptance standards of ASME Code, Section XI, Articles IWC-3000 and IWD-3000. Article IWC-3000 requires inservice inspection (ISI) of Class 2 pressure-retaining components and article IWD-3000 requires ISI of Class 3 pressure-retaining components.

Regulation 10 CFR 50.55a(g)(4), "Inservice inspection standards requirements for operating plants," states, in part, that ASME Code Class 1, 2, and 3 components (including supports) meet the requirements, except the design and access provisions and the pre-service examination requirements, set forth in the ASME Code, Section XI, of the ASME Code.

Regulation 10 CFR 50.55a(z), "Alternatives to codes and standards requirements," states, in part, that alternatives to the requirements of paragraph (g) of 10 CFR 50.55a may be used, when authorized by the NRC, if the licensee demonstrates that: (1) the proposed alternative

provides an acceptable level of quality and safety, or (2) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Based on the above, and subject to the following technical evaluation, the NRC staff finds that regulatory authority exists for the licensee to request the use of an alternative and the NRC to authorize the proposed alternative.

3.0 TECHNICAL EVALUATION

3.1 The Licensee's Alternative Request

The affected components are Code Class 2 and 3 moderate energy piping systems, within the scope of Code Case N-513-4, whose maximum operating temperature does not exceed 200 degrees Fahrenheit (°F) and whose operating pressure does not exceed 275 pounds per square inch gauge (psig). Examination Category is C-H and D-B (Pressure Retaining Components), and Item Nos. C7.10 and D2.10.

ASME Code, Section XI, Articles IWC-3120 and IWC-3130, require that flaws exceeding the defined acceptance criteria be corrected by repair or replacement activities or evaluated and accepted by analytical evaluation. ASME Code, Section XI, IWD-3120(b), requires that components exceeding the acceptance standards of IWD-3400 be subject to supplemental examination, or to a repair/replacement activity.

The licensee stated that ASME Code Case N-513-3, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping Section XI, Division 1," currently approved for use in Regulatory Guide (RG) 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 17, contains limitations regarding the evaluation of flaws in certain locations of moderate energy piping components. Many of these limitations have been addressed in Code Case N-513-4. The NRC has not approved generic use of ASME Code Case N-513-4. Under current ASME Code requirements, moderately degraded piping could require a plant shutdown within the required action statement timeframes to repair observed degradation. The licensee stated that the resulting dose accrual and plant risk would fail to provide a compensating increase in levels of quality or safety when the degraded condition is demonstrated to retain adequate margin for component functionality.

Licensee's Proposed Alternative and Basis for Use

The licensees proposed alternative, pursuant to 10 CFR 50.55a(z)(2), is to use ASME Code Case N-513-4 for the evaluation and temporary acceptance of flaws in moderate energy Class 2 and 3 piping in lieu of specified ASME Code, Section XI, requirements. In addition to the requirements of the code case, the licensee's proposed alternative includes the determination of an allowable leakage rate by dividing the critical leakage rate by a safety factor of four.

The licensee stated that limitations in Code Case N-513-3, related to its use on piping components such as elbows, bent pipe, reducers, expanders, branch tees, and external tubing or piping attached to heat exchangers, have been addressed in Code Case N-513-4. The licensee provided a high level overview of the differences between Code Case N-513-3 and Code Case N-513-4 as listed below:

1. Code Case N-513-4 revised the maximum allowable time of use from no longer than 26 months to the next refueling outage.

2. Code Case N-513-4 added applicability to piping elbows, bent pipe, reducers, expanders, and branch tees where the flaw is located more than $(R_0t)^{1/2}$ (where R_0 is the outside pipe radius and t is the evaluation wall thickness) from the centerline of the attaching circumferential piping weld.

3. Code Case N-513-4 expanded the use to external tubing or piping attached to heat exchangers.

4. Code Case N-513-4 limits the use to liquid systems.

5. Code Case N-513-4 clarifies treatment of Service Level load combinations.

6. Code Case N-513-4 addresses treatment of flaws in austenitic pipe flux welds.

7. Code Case N-513-4 requires minimum wall thickness acceptance criteria to consider longitudinal stress in addition to hoop stress.

8. Code Case N-513-4 makes other minor editorial changes to improve the clarity of the Code Case.

A document comparing the significant changes between Code Case N-513-4 and NRC approved Code Case N-513-3 was prepared by ASME Code and provided to the NRC in an Exelon fleet-wide relief request (RR) dated January 28, 2016 (ADAMS Accession No. ML16029A003). Attachment 4, "Technical Basis for Proposed Fourth Revision to ASME Code Case N-513," of the Exelon RR was subsequently approved. The licensee stated that the technical information in the Exelon RR, Attachment 4, dated January 28, 2016, is applicable to Fermi 2's use of Code Case N-513-4.

The licensee stated in its letter dated August 15, 2017, that the effects of leakage may impact the operability determination or the plant flooding analyses specified in paragraph 1(f) of Code Case N-513-4. For a leaking flaw, the licensee stated that the allowable leakage rate will be determined by dividing the critical leakage rate by a safety factor of four. The critical leakage rate is determined as the limiting leakage rate that can be tolerated and may be based on the allowable loss of inventory or the maximum leakage that can be tolerated relative to room flooding, among others. The licensee contends that applying a safety factor of four to the critical leakage rate provides quantitative measurable limits which ensure the operability of the system and early identification of issues that could erode defense-in-depth and lead to adverse consequences.

The licensee stated that the application of Code Case N-513-4, along with leakage limits, will maintain acceptable structural and leakage integrity while minimizing plant risk and personnel radiation exposure as compared to repairing instances of degradation in certain components under the current criteria.

Hardship Justification

The licensee stated that under current ASME Code requirements, moderately degraded piping could require a plant shutdown within the required action statement timeframes to repair

observed degradation. The resulting dose accrual and plant risk would fail to provide a compensating increase in levels of quality or safety when the degraded condition is demonstrated to retain adequate margin for component functionality. The licensee contends that its proposed alternative will maintain acceptable structural and leakage integrity while minimizing plant risk and personnel radiation exposure as compared to repairing instances of degradation in certain components under the current criteria.

Duration of Proposed Alternative

The licensee stated in its letter dated August 15, 2017, that the duration of the proposed alternative at Fermi 2 is the third 10-year ISI interval which began on May 2, 2009, and is scheduled to end on May 1, 2019, or until the NRC publishes Code Case N-513-4 in RG 1.147 or other document.

3.2 NRC Staff Evaluation

Many requirements specified in Code Case N-513-4 are not discussed in this safety evaluation, but they should not be considered as less important. As part of the NRC-approved proposed alternative, all requirements in the code case including any exceptions or restrictions that are approved in this SE, must be followed.

The NRC staff evaluated the adequacy of the proposed alternative in maintaining the structural integrity of piping components identified in Code Case N-513-4. Code Case N-513-3, which is conditionally approved for use in RG 1.147, provides alternative evaluation criteria for temporary acceptance of flaws, including through-wall flaws, in moderate energy Class 2 and 3 piping. However, Code Case N-513-3 contains limitations that the licensee considers restrictive and could result in an unnecessary plant shutdown. Code Case N-513-3 is limited to straight pipe with provisions for flaws that extend for a short distance, at the pipe to fitting weld, into the fitting. Evaluation criteria for flaws in elbows, bent pipe, reducers, expanders, branch tees, and heat exchangers are not included within the scope of Code Case N-513-3; however, Code Case N-513-4 addresses these limitations. Given that the previous revision of Code Case N-513 is conditionally approved for use in RG 1.147, Revision 17, the staff focused its review on the differences between Code Case N-513-3 and N-513-4.

The NRC staff evaluated the following significant changes that were made in Code Case N-513-4:

(1) Code Case N-513-4 revised the temporary acceptance period;

(2) Code Case N-513-4 added flaw evaluation criteria for elbows, bent pipe, reducers/expanders, and branch tees;

(3) Code Case N-513-4 expanded the applicability to heat exchanger tubing or piping;

(4) Code Case N-513-4 is limited for use in liquid systems;

(5) Code Case N-513-4 clarifies treatment of Service Level load combinations;

(6) Code Case N-513-4 revised treatment of flaws in austenitic pipe flux welds;

(7) Code Case N-513-4 revised minimum wall thickness acceptance criteria to consider longitudinal stress in addition to hoop stress;

(8) Code Case N-513-4 revised leakage monitoring requirements.

In addition to the evaluating the significant changes between N-513 and N-513-4 listed above, the NRC staff also evaluated the licensee's proposed hardship justification.

(1) Temporary Acceptance Period

Code Case N-513-3 specifies a temporary acceptance period of a maximum of 26 months and is accepted for use in RG 1.147, Revision 17, with the condition, "The repair or replacement activity temporarily deferred under the provisions of this Code Case shall be performed during the next scheduled outage." Code Case N-513-4 includes wording that limits the use of the code case to the next refueling outage. The NRC staff finds that Code Case N-513-4 appropriately addresses the temporary acceptance period and is, therefore, acceptable.

(2) Flaw Evaluation Criteria for Elbows, Bent Pipe, Reducers/Expanders, and Branch Tees

Evaluation and acceptance criteria have been added to Code Case N-513-4 for flaws in elbows, bent pipe, reducers, expanders, and branch tees using a simplified approach which is based on the Second International Piping Integrity Research Group (IPIRG-2) program reported in NUREG/CR-6444 BMI-2192, "Fracture Behavior of Circumferentially Surface-cracked Elbows," March 1996.

The flaw evaluation methodology approach in Code Case N-513-4 for piping components is conducted as if in straight pipe by scaling hoop and axial stresses using ASME Code piping design code stress indices and stress intensification factors to account for the stress variations caused by the geometric differences. Equations used in the code case are consistent with the piping design by rule approach in ASME Code, Section III, NC/ND-3600. NUREG/CR-6444 shows that this approach is conservative for calculating stresses used in flaw evaluations in piping elbows and bent pipe. The code case also applies this methodology to reducers, expanders, and branch tees.

The NRC staff finds that the flaw evaluation and acceptance criteria in Code Case N-513-4 for elbows, bent pipe, reducers, expanders, and branch tees is acceptable because the flaw evaluation methods in the code case are consistent with ASME Code Section XI, Section III, design by rule approach and provides a conservative approach as confirmed by comparing the failure moments predicted using this approach to the measured failure moments from the elbow tests for through-wall circumferential flaws conducted as part of the IPIRG-2 program. The purpose of the IPIRG-2 program was to develop data to verify fracture analyses for cracked pipes and fittings subjected to dynamic/cyclic load histories typical of seismic events. The results from the program indicated that the restraint of pressure induced bending for small diameter pipe and the effect of weld residual stresses on thin walled pipe at low stresses were significant technical factors for leak-before-break analyses.

(3) Flaw Evaluation in Heat Exchanger Tubing or Piping

Code Case N-513-4 has been revised to include heat exchanger external tubing or piping provided that the flaw is characterized in accordance with Section 2(a) of the code case and

leakage is monitored. Section 2(a) requires that the flaw geometry be characterized by volumetric inspection or physical measurement.

The NRC staff determined that the flaw evaluation criteria in Code Case N-513-4 for straight or bent piping, as appropriate, can be applied to heat exchanger external tubing or piping. The staff determined the methods for evaluating flaws in straight pipes are acceptable since they are currently allowed in Code Case N-513-3. For bent pipes, the acceptability is described in Code Case N-513-4. Therefore, the NRC staff finds inclusion of heat exchanger external tubing or piping in the code case to be acceptable because only heat exchanger tubing flaws that are accessible for characterization and leakage monitoring may be evaluated in accordance with the code case and the code case provides acceptable methods for the evaluation of flaws.

(4) Limit Use to Liquid Systems

Use of Code Case N-513-4 is specifically limited to liquid systems. The NRC staff finds this change acceptable since Code Case N-513 is not intended to apply to air or other compressible fluid systems.

(5) Treatment of Service Load Combinations

Although previously implied in Code Cases N-513-3, modifications in Code Case N-513-4 now make clear that all service load combinations must be considered in flaw evaluations to determine the most limiting condition. Therefore, the NRC staff finds this change acceptable.

(6) Treatment of Flaws in Austenitic Pipe Flux Welds

Paragraph 3.1, "Planar Flaws in Straight Pipes," Section (b) of Code Case N-513-4 contains modifications which include a reference to ASME Code, Section XI, Appendix C, C-6320, to address flaws in austenitic stainless steel pipe flux welds. The ASME Code, Section XI, Appendix C, Article C-6000, permits the use of elastic plastic fracture mechanics criteria in lieu of limit load criteria to analyze flaws in stainless steel pipe flux welds. Equation 1 of the Code Case N-513-4 was also revised to be consistent with ASME Code, Section XI, Appendix C, C-6320, so the equation can be used for flaws in austenitic stainless steel pipe flux welds. The NRC staff finds this acceptable because the modification to the code case now includes the appropriate methods for the evaluation of stainless steel pipe flux welds in accordance with ASME Code, Section XI.

(7) Minimum Wall Thickness Acceptance Criteria to Consider Longitudinal Stress

Although it is unlikely that a minimum wall thickness calculated based on the longitudinal stress would be limiting when compared to a minimum wall thickness calculated based on hoop stress, Code Case N-513-4 includes revisions that require consideration of longitudinal stress in the calculation of minimum wall thickness. Previous versions of the code case only required the use of hoop stress. The NRC staff finds this acceptable because it will ensure that the more limiting of the longitudinal or hoop stress is used to determine minimum wall thickness.

(8) Leakage Monitoring for Through-Wall Flaws

Code Case N-513-3 required through-wall leakage to be observed by daily walkdowns to confirm the analysis conditions used in the evaluation remain valid. Code Case N-513-4 modifies this requirement by continuing to require that leakage be monitored daily but now

allows other techniques to be used to monitor leakage such as using visual equipment or leakage detection systems to determine if leakage rates are changing. The NRC staff finds this change acceptable because the code case continues to require through-wall leaks to be monitored daily and the expanded allowable monitoring methods should have no adverse impact.

Code Case N-513-3, Paragraph 1(d), states "The provisions of this Case demonstrate the integrity of the item and not the consequences of leakage. It is the responsibility of the Owner to demonstrate system operability considering effects of leakage." Code Case N-513-4 modified the last sentence, now located in Paragraph (f), to state, "It is the responsibility of the Owner to consider effects of leakage in demonstrating system operability and performing plant flooding analyses."

Code Case N-513-3 and N-513-4 do not specify a maximum leakage rate. However the licensee is proposing to limit the leakage by proposing that the allowable leakage rate will be determined by dividing the critical leakage rate by a safety factor of four. The critical leakage rate is determined as the limiting leakage rate that can be tolerated and may be based on the allowable loss of inventory or the maximum leakage that can be tolerated relative to room flooding, among others. The licensee contends that applying a safety factor of four to the critical leakage rate, provides quantitative measurable limits which ensure the operability of the system and early identification of issues that could erode defense-in-depth and lead to adverse consequences.

The NRC staff finds that the licensee's approach of applying a safety factor of four to the critical leakage rate is acceptable because it will provide sufficient time for corrective measures to be taken before significant increases in leakage erode defense-in-depth which could lead to adverse consequences.

Hardship Justification

The NRC staff finds that performing a plant shutdown to repair the subject piping would cycle the unit and increase the potential of an unnecessary transient, resulting in undue hardship. Additionally, performing ASME Code repair/replacements during normal operation would place the plant at higher safety risk than warranted by taking safety related components out of service that are capable of performing their intended function. Therefore, the NRC staff determined that compliance with the specified ASME Code repair requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Summary

The NRC staff finds that the proposed alternative will provide reasonable assurance of the structural integrity because: (1) Code Case N-513-4 addresses the NRC condition in RG 1.147 for Revision 3 of the code case; (2) flaw evaluations in component types added to Revision 4 of the code case are based on acceptable methodologies; and (3) the method for determining the allowable leakage rate is adequate to provide early identification of a significant increase in leakage. In addition, complying with ASME Code, Section XI, requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

4.0 CONCLUSION

As set forth above, the NRC staff determined that the proposed alternative provides reasonable assurance of structural integrity of the subject components and that complying with Articles IWC-3120, IWC-3130, IWD-3120(b), and IWD-3400 of the ASME Code, Section XI, would result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2).

Therefore, the NRC staff authorizes the use of the licensee's proposed alternative described in the licensee's August 15, 2017, letter at Fermi 2 for the remainder of third 10-year ISI interval which is scheduled to end May 1, 2019, or until such time as the NRC approves Code Case N-513-4 for general use through revision of RG 1.147 or other NRC document.

All other requirements of the ASME Code, Section XI, for which relief has not been specifically requested and authorized by NRC staff remain applicable, including a third-party review by the Authorized Nuclear In-service Inspector. The NRC staff notes that approval of this alternative does not imply or infer NRC approval of ASME Code Case N-513-4 for generic use.

Principal Contributor: Robert Davis, NRR/DMLR/MPHB

Date of issuance: March 7, 2018

SUBJECT: Fermi 2 – RELIEF FROM THE REQUIREMENTS OF THE ASME OM Code (CAC NO. MG0119; EPID L-2017-LLR-0082) DATED MARCH 7, 2018

DISTRIBUTION:
PUBLIC
RidsACRS_MailCTR Resource
RidsNrrDorlLpl3 Resource
RidsNrrDeResource
RidsNrrLASRohrer Resource
RidsNrrPMFermi2 Resource
RidsRgn3MailCenter Resource

ADAMS Accession No. ML18003A210

OFFICE	NRR/DORL/LPL3/PM	NRR/DORL/LPL3/LA	NRR/DE/MPHB	NRR/DORL/LPL3/BC
NAME	SGoetz	SRohrer	DAlley	DWrona
DATE	1/16/18	1/4/18	12/21/17	3/7/18

OFFICIAL RECORD COPY