



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

January 10, 2020

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 RELIEF RE: PROPOSED ALTERNATIVE REQUEST  
NOS. PRR-001 AND PRR-004 ASSOCIATED WITH FOURTH TEN YEAR  
INTERVAL PUMP INSERVICE TESTING PROGRAM (EPID L-2019-LLR-0038  
AND EPID L-2019-LLR-0041)

Dear Mr. Dietrich:

By letter dated March 27, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19086A284), DTE Electric Company (DTE, the licensee) submitted relief request (RRs) Nos. PRR-001, PRR-002, PRR-003 and PRR-004, to the U.S. Nuclear Regulatory Commission (NRC) for the use of alternatives to the American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code), at Fermi-2 associated with the fourth 10-year interval pump inservice testing (IST) program. By letter dated June 27, 2019 (ADAMS Accession No. ML19171A357), the NRC staff authorized the proposed alternatives associated with RRs PRR-002 and PRR-003.

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(2), the licensee requested to use the proposed alternative in RR PRR-001 on the basis that the ASME OM Code requirements present an undue hardship without a compensating increase in the level of quality or safety.

Further, pursuant to 10 CFR 50.55a(z)(1), the licensee requested to use the proposed alternative in RR PRR-004 on the basis that the proposed alternative will provide an acceptable level of quality and safety. During NRC staff review of RR PRR-004, the NRC staff noted that the request will be reviewed in accordance with 10 CFR 50.55a(z)(2) on the basis that the ASME OM Code requirements present an undue hardship without a compensating increase in the level of quality or safety.

The NRC staff determined that for RRs PRR-001 and PRR-004 for Fermi 2, the proposed alternatives provide reasonable assurance that the residual heat removal and core spray pumps, respectively for reliefs PRR-001 and PRR-004 and listed in Tables 1 and 2, included in the enclosed safety evaluation, are operationally ready. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2) for RRs PRR-001 and PRR-004. Therefore, the NRC staff authorizes the use of the alternative RRs PRR-001 and PRR-004 for Fermi 2 for the fourth 10-year IST program interval, which begins on February 17, 2020, and is scheduled to end on February 16, 2030.

All other ASME OM Code requirements for which relief was not specifically requested and approved in the subject requests remain applicable.

If you have any questions, please contact the project manager, Booma Venkataraman, at (301) 415-2934 or Booma.Venkataraman@nrc.gov.

Sincerely,

***/RA Scott P. Wall for***

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

Docket Nos. 50-341

Enclosure:  
Safety Evaluation

cc: Listserv



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO RELIEF REQUESTS NO. PRR-001 AND PRR-004 FOR

FOURTH 10-YEAR INTERVAL INSERVICE TESTING PROGRAM

DTE ELECTRIC COMPANY

FERMI 2

DOCKET NO. 50-341

1.0 INTRODUCTION

By letter dated March 27, 2019 (Agencywide Documents and Access Management System (ADAMS) Accession No. ML19086A284), DTE Electric Company, (DTE, the licensee), submitted alternatives to the requirements of the American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code), associated with pump inservice testing (IST) 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 the proposed alternative in relief request (RR) PRR-001 on the basis that the ASME OM Code requirements present an undue hardship without a compensating increase in the level of quality or safety.

Further, pursuant to 10 CFR 50.55a(z)(1), the licensee requested to use the proposed alternative in RR PRR-004 on the basis that the proposed alternative will provide an acceptable level of quality and safety. During NRC staff review of RR PRR-004, the NRC staff noted that the request will be reviewed in accordance with 10 CFR 50.55a(z)(2) on the basis that the ASME OM Code requirements present an undue hardship without a compensating increase in the level of quality or safety.

2.0 REGULATORY EVALUATION

10 CFR 50.55a(f), states, in part, that IST of certain ASME Code Class 1, 2, and 3 pumps and valves be performed in accordance with the specified ASME OM Code and applicable addenda incorporated by reference in the regulations.

10 CFR 50.55a(z) states that alternatives to the requirements of paragraph (f) of 10 CFR 50.55a may be used, when authorized by the NRC, if the licensee demonstrates: (1) the proposed alternatives would provide 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.

Enclosure

### 3.0 TECHNICAL EVALUATION

#### 3.1 Licensee's Request for Alternative, RR PRR-001

##### ASME Code Requirements

The licensee requested an alternative to the pump testing requirements of the ASME OM Code.

Table ISTB-5121-1, "Centrifugal Pump Test Criteria," requires that for Group A and comprehensive tests, the vibration alert range for pumps (speed  $\geq 600$  revolutions per minute (rpm)) shall be from  $>0.325$  to  $0.700$  inches per second (ips).

ISTB-6200, "Corrective Action," (a) "Alert Range," states, "If measured test parameter values fall within the alert range of Table ISTB-5121-1, Table ISTB-5221-1, Table ISTB-5321-1, or Table ISTB-5321-2, as applicable, the frequency of testing as specified in para. ISTB-3400 shall be doubled until the cause of the deviation is determined and condition is corrected, or an analysis of the pump is performed in accordance with subparagraph. ISTB-6200(c)."

##### ASME Code Components Affected

The licensee requested to use the proposed alternative described below for the residual heat removal (RHR) pumps listed in Table 1.

Table 1

Component	Description	ASME Code Class	ASME OM Group	Type	Synchronous Motor Speed (RPM)
E1102C002A	RHR Pump A	2	A	Centrifugal	1800
E1102C002B	RHR Pump B	2	A	Centrifugal	1800
E1102C002C	RHR Pump C	2	A	Centrifugal	1800
E1102C002D	RHR Pump D	2	A	Centrifugal	1800

##### Duration of the Alternative

The Fermi 2 fourth 10-year IST program interval begins on February 17, 2020, and is scheduled to end on February 16, 2030.

##### Applicable Code Edition

The applicable ASME OM Code edition for the Fermi 2 fourth 10-year IST program interval is the 2012 Edition.

##### Reason for Request

The RHR pump motors have experienced high vibration levels since the pumps were installed. It was determined that the vibration was caused by hydraulic disturbances in the piping. Attempts were made to stiffen the RHR pump structure, but they only transferred energy to the piping. Vibration data shows no significant degrading trends since 2002. Differential pressure data for the pumps shows no evidence of pump degradation. Spectral data has been collected

and does not indicate any problem with bearings or the rotating elements. The RHR pump A motor was replaced during refueling RF12 outage, and vibration data for the new motor showed only a slight reduction compared to the old motor.

#### Licensee's Proposed Alternative

The licensee proposes to use a vibration alert limit of 0.415 ips instead of the ASME OM Code required limit of 0.325 ips for the RHR pumps. This alternative is requested for the IST of RHR pumps when vibration measurements are required, or any other time vibrations are recorded to determine pump acceptability (i.e., post-maintenance testing, other periodic testing, etc.).

The licensee stated that proposed alternative alert criteria values are reasonable as they represent an alternative method that still meets the intended function of monitoring the pump for degradation over time while keeping the required action level unchanged. The proposed values encompass all of the historical spiking values, which would eliminate the unnecessary actions associated with exceeding ASME OM Code alert limits due to spiking. However, the more accurate moving average value for these pumps would typically still be within the original ASME OM Code alert value of 0.325 ips at a point where any spiking in the data due to the high flow-induced broadband noise would exceed the proposed 0.415 ips alert limit. Therefore, corrective actions triggered by exceeding the 0.415 ips alert value would be taken at a point commensurate with the intent of the ASME OM Code guidance.

The Fermi 2 vibration specialist routinely performs a spectral analysis on all data recorded during RHR pump IST. This analysis is in addition to the quantitative rendering of total vibration values recorded in the IST procedures. The routine spectral analysis provides additional confidence in the ability to detect degradation at an early stage.

Additionally, each RHR pump motor is also covered by various preventive and predictive maintenance (PM and PdM) activities, which include:

- 10-year detailed motor condition inspection/refurbishment PM
- Oil sampling and analysis every 92 days
- Annual motor PM including phase to phase winding tests, insulation checks and exterior cleaning every 3 years

This maintenance and testing regime in addition to trending of IST data provides for early identification and analysis of any degradation.

#### NRC Staff Evaluation of the Alternative

The ASME OM Code requires that when the overall pump vibration measurement in any one measured direction exceeds 0.325 ips, the pump shall be declared in the alert range and the testing doubled until the cause of the deviation is determined and the condition is corrected, or an analysis of the pump is performed in accordance with ISTB-6200(c). Although a pump is considered operable while in the alert range, increased vibration at this level may be an indication of degradation which would warrant further investigation. However, if a particular pump has been determined to be in good operating condition and has a historical record of vibration in specific measured directions being measured in the alert range, then it would be appropriate to adjust the alert level to take this into consideration. Requiring more frequent

testing under these conditions is considered a hardship because the reason for the high vibration is understood and is known not to be indicative of pump degradation.

To accept pump vibration at a higher level than the ASME OM Code-required alert range absolute limits, the licensee addressed the following:

- (1) review vibration history to verify that pumps were operated at this level of vibration for a significant amount of time with justification of "spikes" in test data;
- (2) require a vibration expert verify that the vibration levels of the pumps are acceptable;
- (3) attempt to lower the vibration level through modifications to the pumps or the system and structures of the pumps; and,
- (4) perform spectral analysis to identify all contributors to the vibration level.

In its alternative request, the licensee provided this information, and its evaluation of these four key elements for the RHR pumps. In addition, the NRC staff noted that the licensee has submitted sufficient vibration history to verify that the pumps have operated at this vibration level for a significant period of time with no adverse impacts on performance. The licensee has described attempts to reduce vibration and has demonstrated that the cause of the vibration appears to be dependent on the piping and support configuration rather than the condition of the pumps. Spectral analysis of the pump-driver system was performed to identify all contributors to vibration levels. Based on the above evaluation and the provided historical pump vibration data, the NRC staff concluded that these are not indicative of degraded pump performance.

Each RHR pump motor is also covered by various PM and PdM activities. This maintenance and testing regime, in addition to trending of IST data, provides for early identification and analysis of any degradation and ensures that the RHR pumps are operationally ready.

The licensee has proposed to raise the vibration alert range for all four RHR pumps. The NRC staff reviewed the historical vibration information for the four RHR pumps and noted that the vibration parameters cited in the alternative request for RHR pumps A, B, C, and D do exceed the 0.325 ips alert limit. The analysis and evaluation that the licensee has performed provides reasonable assurance of operational readiness. Additionally, the proposed alternative alert limit of 0.415 ips is below the required action limit of 0.700 ips and the licensee has demonstrated that these pumps have a normal operational history at this vibration level with no adverse consequences.

The NRC staff authorized a similar alternative request for the licensee's current (third) 10-year IST program interval.

### 3.2 Licensee's Request for Alternative, RR PRR-004

#### ASME Code Requirements

The licensee requested an alternative to the pump testing requirements of the ASME OM Code. ISTB-3300, "Reference Values," describes how reference values shall be obtained for a pump. ISTB-5122, "Group B Test Procedure," describes how to conduct a Group B test for a pump.

### ASME Code Components

The licensee has requested to use the proposed alternative described below for the pumps listed in Table 2.

Table 2

Pump ID	Pump Description	ASME Code Class	ASME OM Pump Group	Type	Synchronous Motor Speed (RPM)
E2101C001A	Division 1 Core Spray (CS) Pump A	2	B	Centrifugal	3600
E2101C001B	Division 2 CS Pump B	2	B	Centrifugal	3600
E2101C001C	Division 1 CS Pump C	2	B	Centrifugal	3600
E2101C001D	Division 2 CS Pump D	2	B	Centrifugal	3600

### Duration of the Alternative

The Fermi 2 fourth 10-year IST program interval begins on February 17, 2020, and is scheduled to end on February 16, 2030.

### Applicable ASME Code Edition

The applicable ASME OM Code edition for the Fermi 2 fourth 10-year IST program interval is the 2012 Edition.

### Reason for Request

The ASME OM Code requires that pumps be tested individually in order to detect degradation. The Group B test cannot be performed on individual CS pumps due to motor-operated valve motor start limitations, potential valve cavitation, and the additional time required to perform the tests in conjunction with the technical specification (TS) surveillance, which would challenge the limiting condition for operation.

### Licensee's Proposed Alternative

During the quarterly Group B test, both pumps in each division will be tested as a single unit. Since both pumps are run in parallel, acceptance criteria for differential pressure have been established, which are more restrictive than the criteria given in Table ISTB-5121-1 for centrifugal pumps. The following additional limitations on acceptance criteria will be used to assure that any degradation in performance is detected and corrected in a timely manner.

1. To enhance the ability to detect the equivalent of one pump's degradation the following acceptance criteria will be utilized, which are more stringent than ISTB limits.
2. Acceptable  $\Delta P$  Range –  $0.94P_r$  to  $1.06P_r$ .
3. Alert Range –  $0.92P_r$  to  $< 0.94P_r$ .
4. Required Action Range – Low  $< 0.92P_r$  and High  $> 1.06P_r$ .

5. Where  $P_r$  is the differential pressure reference value.
6. If the hydraulic performance of a CS division enters the Alert Range for any reason other than instruments out of calibration, both pumps in that division will be individually evaluated (e.g., perform motor diagnostics, evaluate vibration data, etc.) in order to determine which pump(s) in the division has degraded. The testing frequency will be doubled until the cause of the deviation is determined and the condition is corrected.
7. If the hydraulic performance of a CS division exceeds the Required Action ranges for any reason, the CS division will be declared inoperable. Appropriate inspections, tests, and repairs will be completed prior to returning the division to service.
8. New reference curves will be established, or the current curves verified after either pump in the division has been repaired, replaced, or serviced.
9. The valve internals and gearing for the CS test line isolation valves (E2150F015 A & B) were changed in 2015, which allows for single pump testing during the biennial comprehensive pump test (CPT). This test will also help detect small levels of degradation that may not be as easily noticed during the Quarterly Group B test.
10. Measuring and test equipment (M&TE) for pressure will meet the ASME OM Code requirements for a CPT ( $\pm 0.5$  percent).
11. Vibration data will continue to be taken on each individual pump using the acceptance criteria established in ASME OM Code 2012 Edition (Table ISTB-5121-1). A single Alert criterion and a single Required Action criterion will be used over the range of the pump curve.
12. Normalization to a reference flow will be used to improve the effectiveness of trending.

#### NRC Staff Evaluation of the Alternative

Section ISTB of the ASME OM Code requires that pumps must be tested individually to detect a deviation in hydraulic and mechanical performance at points of operation readily duplicated during subsequent tests. These points of operation, referred to as reference points, are the baseline points from which the acceptance criteria are established. When maintenance on a pump has the potential to affect an individual reference value or a set of reference values, new reference values must be established. If the deviation in hydraulic performance of an individual centrifugal pump falls within the required action range, the pump is declared inoperable until the cause of the deviation is determined, the condition corrected, or an analysis of the pump is performed.

The CS system at Fermi 2 is a unique design which includes two divisions with two pumps in each division. If one of the two pumps in either division is declared inoperable, then that division is inoperable. There are no functions of the CS system for single pump operation in either division. The CS system also includes a test line that is used to perform the Group B test for both pumps in each division simultaneously while the plant is at power. Both pumps are required to operate in order to achieve the TS flow rate specified in Surveillance



Requirement (SR) 3.5.1.8 of  $\geq 5725$  gallons per minute at a system head corresponding to a reactor pressure of  $\geq 100$  pounds per square inch gauge.

The design of the CS system at Fermi 2 is such that each train is capable of being tested at substantial flow conditions for the CPT, but it is a hardship to test each pump in the train individually for the quarterly Group B test because the motor-operated valve in the test flow loop has motor start limitations and potential cavitation issues. Also, the TS surveillance test is done at the same time as the Group B test (not simultaneously). Conducting both tests at the same time challenges the LCO time. The NRC staff concludes that operation of the CS system pumps individually for testing is, therefore, a hardship within the limitations of the current system design. Because of this, the NRC staff reviewed the alternative request in accordance with 10 CFR 50.55a(z)(2) on the basis that the ASME OM Code requirements present an undue hardship without a compensating increase in the level of quality or safety.

As stated above, the licensee proposed the following limitations on acceptance criteria when performing the Group B test for the CS pumps:

- Use pressure instruments with  $\pm 0.5$  percent accuracy instead of the ASME OM Code allowed accuracy of  $\pm 2$  percent.
- Perform vibration measurements for individual pumps using the acceptance criteria stated in Table ISTB-5121-1. A single Alert criterion and a single Required Action criterion will be used over the range of the pump curve. The ASME OM Code does not require vibration measurements for Group B tests.
- Tighten the differential pressure Acceptable Range to  $0.94 P_r$  to  $1.06 P_r$  from the ASME OM Code range of  $0.90 P_r$  to  $1.10 P_r$ .
- Use an Alert Range for differential pressure of  $0.92 P_r$  to  $< 0.94 P_r$ . The ASME OM Code does not have an Alert Range for Group B tests. If the pumps enter the Alert Range, except for instruments out of calibration, they will be individually evaluated to determine which pump is degraded. The test frequency will be doubled until the cause of the degradation is determined and corrected, or an analysis of the pump is performed in accordance with ISTB-6200(c).
- Use a Required Action Range of Low  $< 0.92 P_r$  and High  $> 1.06 P_r$  instead of the ASME OM Code Required Action range of Low  $< 0.90 P_r$  and High  $> 1.10 P_r$ . If two pumps when tested enter the Required Action range, they will be declared inoperable, and appropriate inspections, tests, and repairs will be completed prior to returning them to service.
- Perform a CPT on each pump biennially.
- Establish new reference curves or verify the current reference curves after either pump in a division has been repaired, replaced, or serviced.
- Use normalization to a reference flow to improve the effectiveness of trending.

The licensee also stated that a modification was implemented in 2015 that changed the valve internals and actuator gearing for the CS test line isolation valves E2150F015A and B, which allows the biennial CPT to be performed for individual CS pumps.

The NRC staff finds that the additional limitations on the acceptance criteria for the Group B test are conservative as they are more stringent than the ASME OM Code Group B test requirements. Therefore, the NRC staff concludes that the proposed alternative of performing the CS pump Group B test with the pumps operated in parallel and the additional limitations proposed by the licensee provide reasonable assurance that any degradation in performance is detected and corrected in a timely manner, and the CS pumps will remain operationally ready.

The NRC staff authorized a similar alternative request for the licensee's current (third) 10-year IST program interval.

#### 4.0 CONCLUSION

As set forth above, the NRC staff determined that for alternative requests PRR-001 and PRR-004 for Fermi 2, the proposed alternatives provide reasonable assurance that the pumps listed in Tables 1 and 2, respectively, are operationally ready. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2) for RRs PRR-001 and PRR-004. Therefore, the NRC staff authorizes the use of the alternative requests for PRR-001 and PRR-004 for Fermi 2 for the fourth 10-year IST program interval, which begins on February 17, 2020, and is scheduled to end on February 16, 2030.

All other ASME OM Code requirements for which relief was not specifically requested and approved in the subject requests remain applicable.

Principal Contributor: Robert Wolfgang, NRR/DEX/EMIB

Date: January 10, 2020

SUBJECT: FERMI 2 - ISSUANCE OF RELIEF RE: PROPOSED ALTERNATIVE REQUEST NOS. PRR-01 AND PRR-04 ASSOCIATED WITH FOURTH TEN YEAR INTERVAL PUMP INSERVICE TESTING PROGRAM (EPID L-2019-LLR-0038 AND EPID L-2019-LLR-0041) DATED JANUARY 10, 2020

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