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

RELATED TO INSERVICE TESTING PROGRAM RELIEF REQUESTS

DETROIT EDISON COMPANY

FERMI UNIT 2

DOCKET NO. 50-341

1.0 INTRODUCTION

The Code of Federal Regulations, 10 CFR 50.55a, requires that inservice testing (IST) of certain ASME Code Class 1, 2, and 3 pumps and valves be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable addenda, except where relief has been requested and granted or proposed alternatives have been authorized by the Commission pursuant to 10 CFR 50.55a(f)(6)(i), (a)(3)(i), or (a)(3)(ii). In order to obtain authorization or relief, the licensee must demonstrate that: (1) conformance is impractical for its facility; (2) the proposed alternative provides an acceptable level of quality and safety; or (3) compliance would result in a hardship or unusual difficulty without a compensating increase in the level of quality and safety. Section 50.55a(f)(4)(iv) provides that inservice tests of pumps and valves may meet the requirements set forth in subsequent editions and addenda that are incorporated by reference in 10 CFR 50.55a(b), subject to the limitations and modifications listed, and subject to Commission approval. NRC guidance contained in Generic Letter (GL) 89-04, "Guidance on Developing Acceptable Inservice Testing Programs," provided alternatives to the Code requirements determined to be acceptable to the staff and authorized the use of the alternatives in Positions 1, 2, 6, 7, 9, and 10 provided the licensee follows the guidance delineated in the applicable position. When an alternative is proposed which is in accordance with GL 89-04 guidance and is documented in the IST program, no further evaluation is required; however, implementation of the alternative is subject to NRC inspection.

Section 50.55a authorizes the Commission to grant relief from ASME Code requirements or to approve proposed alternatives upon making the necessary findings. The NRC staff's findings with respect to granting or not granting the relief requested or authorizing the proposed alternative as part of the licensee's IST program are contained in this Safety Evaluation (SE).

The first ten-year interval for Fermi Unit 2 began January 23, 1988, and ends January 22, 1998. The current IST program is based on the requirements of the 1980 Edition through the winter 1981 addenda of the ASME Code.

2.0 BACKGROUND

2.1 Fermi IST Inspection and Subsequent Correspondence

During an IST inspection conducted at Fermi on January 23-27, 1995, the inspectors identified a number of relief requests which had not been previously reviewed by the NRC. They had been provided to the staff in a letter submitted by the licensee dated September 20, 1985. The relief requests in the letter include PR-6, PR-7, PR-8, VR-45, VR-46, VR-47, VR-48, VR-49, VR-50 and VR-51. The inspectors informed the licensee that the staff planned to evaluate the relief requests using the licensee's December 24, 1994, IST program submittal. This information is documented in Fermi Safety Issues Inspection Report Number 50-341/95002(DRS) dated February 10, 1995.

Subsequent to the inspection, the licensee revised Relief Requests PR-6, PR-7 and PR-8 in a letter dated July 14, 1995. In addition, the licensee submitted Revision 3, Change 9 of their IST program in a letter dated July 19, 1995, which included the following changes to the unreviewed relief requests: (1) VR-46, VR-47 and VR-49 had been revised; (2) VR-45 and VR-48 were revised to meet the requirements of GL 89-04, and (3) VR-50 was deleted from the licensee's IST program. Evaluations of relief requests PR-6-R1, PR-8-R1, VR-46-R5, VR-47-R1, VR-49-R3 and VR-51 are included in Sections 3 and 4 of this SE.

Inspection followup item (IFI) 341/95002-01(DRS) was generated to address the licensee's use of pump reference curves for Code compliance on all Fermi safety-related pumps without relief being either requested or approved. The licensee responded to this IFI in a letter dated April 7, 1995, committing to submit relief requests for the residual heat removal (RHR), high pressure coolant injection (HPCI), emergency equipment cooling water (EECW), diesel generator service water and the control center heating, ventilating and air conditioning (CCHVAC) chill water pumps. In addition, the licensee committed to submitting revised relief requests for the core spray and RHR service water pumps for review and approval by July 14, 1995. New Relief Request PR-11 which was included in the July 14, 1995, submittal proposed using pump reference curves for the EECW pumps. An evaluation of Relief Request PR-11 is included in Section 3.4.3 of this SE.

The July 14, 1995, submittal from the licensee requested interim relief to continue to test all safety-related pumps using reference curves with the exception of the standby liquid control pumps (which already use fixed reference values) and the core spray, RHR service water and EECW pumps until refueling outage 5. No formal relief request was included in the licensee's submittal. The staff conducted a conference call with the licensee on August 10, 1995, and the licensee committed to establish fixed reference values for these safety-related pumps at Fermi during their regular IST schedule. Because of the licensee's commitment, the interim relief request was not necessary. This is documented in a letter from the licensee dated August 31, 1995. The staff verified incorporation of fixed reference values for pumps in the Fermi IST program, with the exception of the standby liquid control, core spray, EECW and RHR service water pumps, in a phone conversation with the licensee on March 13, 1996.

2.2 Residual Heat Removal Service Water (RHRSW) Pump Testing

There are two divisions of RHRSW at Fermi with two pumps in each train. This system is similar to RHRSW systems at other boiling water reactors (BWRs) with the exception that the discharge path at Fermi is run to either cooling towers or the cold weather bypass. The Fermi Updated Final Safety Analysis Report (UFSAR) states that each pair of RHRSW pumps is capable of delivering 9000 gpm to the RHR heat exchangers and then to the cooling towers. These pumps are also capable of flooding the containment air space. In addition, division 2 of the RHRSW system is capable of backing up the RHR low pressure coolant injection (LPCI) mode at the rate of 3250 gpm. There are no specific Technical Specification (TS) surveillance requirements for the RHRSW pumps. There are four applicable limiting conditions of operation (LCO) action statements in the TS which are required to be entered depending on the specific combinations of RHRSW pumps or divisions declared inoperable.

Relief Request PR-7 was originally submitted in the September 20, 1985, letter. The basis for relief stated that TS 3.7.1.1 required the licensee to have two pumps operating in parallel and if one RHRSW pump was inoperable, then the division was declared inoperable. The licensee also stated that the stable flow range of the control valve in each RHRSW system was at approximately 5000 gpm which corresponded to the valve being throttled 3 to 8 percent open. This letter also stated that the RHRSW pumps experience runout at approximately 6000 gpm.

After the inspection in January 1995, the licensee submitted a revision to Relief Request PR-7 in a letter dated July 14, 1995. This letter stated that pump testing as required by the Code was impractical. The relief request stated that valve cavitation occurred if the division flow rate was throttled below 5250 gpm to the cooling towers or 5600 gpm when discharging to the cold weather bypass. The licensee classified the range of permissible range of test flow rates for individual pump testing as very restrictive.

The staff questioned the licensee's assertion that this testing was impractical. Specifically, TS action statement 3.7.1.1.a.2 allowed the plant to remain in operation for 7 days with one RHRSW pump in each division inoperable before the plant was required to be shut down. The TS action statement and the claims in the relief request appeared to conflict with each other. This was presented to the licensee in a conference call on October 27, 1995. Subsequent to this call, the licensee determined that there were no procedures to operate the RHRSW pumps individually in the event that the RHRSW system was required to operate while the plant was at power with one pump inoperable in either or both divisions of RHRSW. The licensee then produced an internal engineering memorandum dated March 15, 1983, that documented testing of the RHRSW division 1 under conditions of both two pump operation and single pump operation (this was later submitted to the NRC in a letter dated December 18, 1995). In a phone call on November 22, 1995, the licensee stated in response to questions from the staff that Fermi Operating Procedure 23.208, Revision 35, was recently revised to include operation of an RHRSW division with a single pump.

The March 15, 1983, memorandum stated that the flow control valve "successfully throttled the flow with both one and two pumps operating" at specific conditions. Minimum allowable flow rates depending on the discharge configuration were consistent with the values given in the July 14, 1995, letter. However, the memorandum states that the valve position is 15 percent open in all single pump cases and the maximum pump runout flow is 6500 gpm. The December 18, 1995, letter stated that the licensee was planning to perform a single pump test of the RHRSW system. In a letter dated February 2, 1996, the licensee stated that each RHRSW pump was tested using the flow limits in the engineering memorandum and "results indicated that each pump is capable of being operated in single pump operation at flows above the minimum flows specified." The letter stated that new pump testing would be in accordance with the Code requirements and Relief Request PR-7-R1 was being withdrawn. The licensee also stated in the February 2, 1996, letter that fixed reference values for the four RHRSW pumps would be developed and implemented by March 25, 1996.

3.0 PUMP RELIEF REQUESTS

3.1 Relief Request PR-6-R1

The licensee has requested relief from ASME Section XI, Paragraph IWP-1500 (Detection of Change), and ASME Section XI, Article 3000 (Inservice Test Procedures) for the four core spray pumps E2101C001A, E2101C001B, E2101C001C and E2101C001D. The licensee is requesting relief from two specific Code requirements: (1) Paragraph IWP-3100, Inservice Test Procedure; and (2) Paragraph IWP-3110, Reference Values. The licensee has proposed to test the two core spray pumps in each division in a parallel configuration and use reference curves to monitor degradation of the hydraulic performance of both pumps in each core spray division.

3.1.1 Licensee's Basis for Requesting Relief

The licensee states:

> Relief is requested to deviate from the Code in two areas:
>
> 1) To test both core spray pumps in a division in parallel. That is, both pumps are to be run together and treated as a single component. Differential pressure and developed head reference values represent a combined pump flow characteristic. Vibration data will continue to be monitored on each pump. Since both pumps are run in parallel, acceptance criteria for flow rate and differential pressure are set at more restrictive criteria than that provided in [ASME Section XI] Table IWP-3100-2.
>
> 2) For flow rate and differential pressure, a flow reference curve, rather than a single fixed value of differential pressure and corresponding flow, will be utilized. This

reference curve will be developed utilizing linear regression with four or more flow versus differential pressure data sets over a limited range of flow.

Each core spray division is designed to have two pumps operating in parallel in accordance with Technical Specifications Paragraph 3.5.1.a. If one pump is determined to be inoperable, then the division is declared inoperable. The system test line configuration is not designed to allow for single pump testing as system operation with a single pump is considered inoperable. It is designed only to accommodate full flow testing required by technical specification surveillance test requirements.

It is not practicable to run the core spray pumps one at a time in the test lineup configuration. The test line flow control valves are throttled approximately 13 percent open for division 1 and 9 percent open for division 2 to control two-pump test flow (pumps A and C are division 1, and pumps B and D are division 2). The existing flow control valves are not capable of throttling low enough (less than 5 percent open) to accommodate single pump operation without experiencing unstable operation, cavitation, and severe vibration.

Significant system modification would be required to enable testing of the core spray pumps in accordance with Code requirements. These modifications would be costly. They are costly both in terms of resources and increased radiation exposures during installation. Since the system performs adequately, there is little benefit, other than compliance with the Code, for installing any of them.

The use of pump reference curves is further necessitated by the fact that existing test line and flow control valves are oversized. The flow control valves are opened to a point in the span of travel in which small changes in valve position result in relatively large changes in flow rate. This would present an unnecessary challenge to both the equipment and the plant operators to attempt to return to a fixed reference value. The combined reference pump curves were developed using five to seven data points over a 600 gpm range of flows. The data was curve fitted using linear regression, which is a sensible method considering that the pump curve is essentially linear over this very small range.

A review of preservice test data and test results obtained prior to establishing the reference curves confirmed that the pumps were in good operating condition when the curves were developed. A review of the test data results obtained using the reference curves shows that the data is consistent and trendable. Additionally, the individual pump vibration data is extremely stable and indicates no signs of degradation on any of the core spray pumps. If invalid data were used to generate the pump reference curves, or if the curve fit was poor, the test results would be erratic, and 10 years

of historical performance demonstrate that this is not the case for the subject pumps.

As pump performance degrades, the actual combined two-pump performance curve will degrade in a manner similar to a single pump's performance curve. The only difference is that if only one pump in a combination curve for two identical pumps suffers a 10 percent degradation, then the combined two-pump curve would result in a 5 percent indicated degradation (assuming no degradation for the other pump). Therefore, the imposition of more restrictive limits than those contained in Table IWP-3100-2 assures that equivalent degradation detection sensitivity is achieved for two-pump testing versus single pump testing.

3.1.2 Alternate Testing

The licensee proposes:

1) For each core spray division, differential pressure and flow [are] being measured with both pumps running. A reference curve for pump performance monitoring has been developed over a range of 600 gpm (this represents only 8.5 percent of the total flow range) at flows which exceed the technical specifications minimum flow and discharge pressure requirements. This reference curve is being utilized to evaluate current pump performance for degradation.

2) In order to enhance the ability to detect the equivalent of one pump's degradation to the minimum acceptable level of performance per Table IWP-3100-2, the following acceptance criteria will be utilized, which are more stringent than Code limits:

Acceptable Range	Alert Range		Required Action Range	
ΔPr	Low Values	High Values	Low Values	High Values
0.965 to 1.02	0.95 to <0.965	>1.02 to 1.03	<0.95	>1.03

3.1.3 Evaluation

According to the Fermi UFSAR, Section 6.3.2.2.3, the core spray pumps have a safety function to protect the core in the event of a large break in the nuclear system if the feedwater pumps, the control rod drive pumps, the reactor core isolation cooling (RCIC) system and the HPCI system are unable to maintain the water level in the reactor pressure vessel. The core spray system at Fermi 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 core spray system for single pump operation in either division. The core spray system also includes a test line that is used to test both pumps in each

division simultaneously while the plant is at power. Both pumps are required to operate in order to achieve the TS surveillance flow rate specified in Section 4.5.1.b.1 of at least 6350 gpm against a test line pressure ≥270 psig. The ASME Section XI Code is intended to quantify the amount of degradation in individual safety-related components at nuclear power plants and set standards when corrective actions should be implemented. Monitoring is accomplished by performing periodic testing of specific components that fall within the scope of the plant's IST program. Since the Code specifically addresses components, testing of whole systems does not necessarily verify that all components within that system, which are included in the IST program, meet the Code requirements. When the design of a component or system makes it impractical to meet the Code requirements, the licensee may request relief from those specific requirements. The licensee may also propose alternatives to the Code requirements which may only be implemented after approval by the NRC.

3.1.3.1 Parallel Pump Testing

The licensee asserts that it is impractical to test any of the core spray pumps individually because the current test line flow control valves are oversized. In order to test these pumps individually, both flow control valves would need to be positioned less than 5 percent open during the pump test. According to industry data, conventional globe valve internal plugs, whether the plugs have flow characteristics of quick opening, linear or equal percentage curves, have very small percentages of their maximum flow rates at 5 percent stem travel. In addition, the licensee states that operation at this valve setting would be accompanied by unstable operation, cavitation and severe vibration. It would be an undue burden on the licensee if the system would have to be redesigned or major components replaced to perform single pump testing if there was a method currently available to monitor the hydraulic degradation of the core spray pumps with the existing system configuration.

The licensee has proposed to use their current methodology of testing both pumps in each division simultaneously to verify that the hydraulic performance of each pump meets the Code requirements. Parallel pump configurations are designed to increase the flow capacity of a system. For each core spray division with a minimum required TS flow rate of 6350 gpm at a test line pressure of ≥270 psig, and assuming that the core spray pumps at Fermi have identical hydraulic performance, each pump would have a minimum test flow rate of 3175 gpm. The Code lower required action range for centrifugal pumps is 90 percent of either the measured differential pressure or flow established when the pump was in good operating condition. Using the TS limit as an example, and assuming that differential pressure is the fixed reference value, if one of the two pumps in either division were to degrade to the Code required action range limit, its test flow rate would be 2857.5 gpm at the specified test line pressure. However, individual pump flow rates are not being measured in the core spray system at Fermi. Therefore, assuming no degradation in the other pump in the train, the measured flow rate would be 6032.5 gpm. This equates to a degradation in hydraulic system performance of 5 percent. This level of degradation would be acceptable if the Code requirements were applied to each two-pump system but would not be an accurate representation of the condition of the degraded pump.

To address this concern, the licensee has proposed to establish alert and required action range acceptance criteria which are twice as stringent as the Code requirements. The proposed criteria are conservative because they assume that degradation in hydraulic performance originates entirely from one of the two pumps in the tested division and are therefore acceptable. However, if the hydraulic performance of the division enters the required action range, then both pumps in that train must be individually verified to have acceptable performance, either through testing or inspection, or repaired prior to the train being returned to service (see Section 3.1.3.3 of this SE).

3.1.3.2 Pump Reference Values

The licensee has also requested relief from the requirements of IWP-3110 for determining reference values. The Code requires that pump differential pressure or flow reference values for pump inservice testing be established at points of operation readily duplicated during subsequent inservice tests. If pump flow is the selected reference value, the pump differential pressure will be used to verify compliance with the Code requirements. This data can also be used to trend the hydraulic performance of the pump to determine if there are potential problems with pump performance.

NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants," Section 5.2, allows the use of pump reference curves for systems where the impracticality of obtaining fixed reference values has been clearly demonstrated and provides a number of elements to develop and implement the reference curves. In addition, NUREG-1482, Section 5.3, provides guidance for the allowable variance from fixed reference values. A total tolerance of ±2 percent of the reference value is allowed without approval from the NRC. The licensee stated that fixed reference values cannot be used to test the core spray system trains because the test flow control valves are oversized and this creates an unnecessary challenge to operators to establish a fixed reference value. The licensee's position is justified considering the small percentage of valve stem travel required to produce the TS required flow rates. It would therefore be a burden on the licensee if the Code requirements were imposed.

The licensee has proposed to use a hydraulic performance curve for each core spray pump train to determine the hydraulic performance of the train. These curves are available for the core spray system. Fermi Surveillance Procedure 24.203.03 for the division 2 core spray pumps indicates that the range of the plotted curve values is 6600 gpm to 7200 gpm (±4.3 percent of 6900 gpm). The licensee has not discussed several elements referenced in NUREG-1482, Section 5.2, in this relief request. The licensee must ensure that these elements have been addressed in the development and implementation of the reference curves for the core spray pump trains and documented in their IST program. The proposed alternative provides a reasonable assurance of operational readiness because the licensee will be following established guidance provided in NUREG-1482.

3.1.3.3 Imposition of Additional Requirements

In considering the licensee's proposed alternate testing for this relief request, other portions of the Code must be addressed to ensure that potential hydraulic degradation is identified for an individual core spray pump. Specifically, provisions of Paragraphs IWP-3112, "Establishing an Additional Set of Reference Values," and IWP-3230(c), "Corrective Action," if enacted, could circumvent the determination of individual pump degradation. The corrective action requirements of IWP-3230(c) allow an analysis to be conducted to verify that the current test results do not impair pump operability and that the pump will still perform its function. It also allows the establishment of a new set of reference values after the analysis is concluded. However, in the core spray system at Fermi, no individual pump analysis could be conducted because the condition of each individual pump will not be known sufficiently to perform this analysis. In addition, the establishment of a new set of reference values, or a new pump reference curve, could not be performed because both pumps could not be verified to be in good operating condition unless they were first either inspected or individually tested. Therefore, the licensee is not allowed to use the provisions of Paragraphs IWP-3112 and IWP-3230(c) which permit analysis of data when the hydraulic performance of a pump train enters either the alert or required action range and subsequently establish additional reference values. The licensee is permitted to use the pump replacement and repair corrective action provisions of IWP-3230(c).

The licensee must revise this relief request to include the reference curves for each division of core spray that is currently included in the applicable surveillance procedures (such as Table 1 in Fermi Surveillance Procedure 24.203.03, Revision 25, Page 10, core spray loop B, reference test date 12-20-84). If during quarterly inservice testing the pump hydraulic performance is below either the alert or required action range for the low differential pressure values, the licensee shall apply the corrective action requirements of IWP-3230 except for the provision in IWP-3230(c) which allows analysis and addition of new reference values. New reference curves can be established only after both pumps have been individually verified to be in good operating condition. The relief request need not be resubmitted for approval if it is revised only to include a new reference curve. The licensee's proposed alternate testing for the core spray pumps, with the additional alternate requirements imposed here, provides a reasonable assurance of operational readiness because the more stringent hydraulic acceptance criteria and suspension of certain provisions of the Code will provide adequate assurance that an individual pump will not be allowed to degrade below the Code required action range without being detected.

3.1.4 Conclusion

Provisional relief is granted to perform parallel pump testing of each core spray pump train and to use reference curves to assess the performance of each parallel pump combination pursuant to 10 CFR 50.55a(f)(6)(i) based on the impracticality of performing the testing in accordance with the Code requirements, and in consideration of the burden on the licensee if the Code

requirements were imposed on the facility. The provisions applicable to this relief request are listed below.

1) If the hydraulic performance of one train enters the alert or required action range, then both pumps in that train must be individually verified to have acceptable performance, either through testing or inspection, or repaired prior to the train being returned to service.

2) All elements listed in NUREG-1482, Section 5.2, concerning development of pump reference curves should be addressed and documented in the licensee's IST program.

3) The licensee is not allowed to use the provisions of Paragraphs IWP-3112 and IWP-3230(c) that permit an analysis to be performed when the hydraulic performance of a pump train enters the alert or required action range and establish additional reference values.

4) This relief request must be revised to include the reference curves for each train of core spray that are currently included in the applicable surveillance procedures (such as Table 1 in Fermi Surveillance Procedure 24.203.03, Revision 25, Page 10, core spray loop B, reference test date 12-20-84). The relief request need not be resubmitted for approval if it is revised only to include a new reference curve; however, the new reference curve should be retained in facility files for inspection.

5) New reference curves for each core spray train can be established only after both pumps in the train have been verified individually to be in good operating condition.

3.2 Relief Request PR-8-R1

The licensee has requested relief from the ASME Section XI requirements related to the determination of pump vibration for RHR (residual heat removal) pumps E1102C002A, E1102C002B, E1102C002C and E1102C002D. The licensee has proposed to perform vibration testing of the RHR pumps at Fermi in accordance with the vibration requirements of ASME/ANSI Operations and Maintenance Standard, Part 6 (OM-6) with the exception of OM-6, Section 4.6.4(b).

3.2.1 Licensee's Basis for Requesting Relief

The licensee states:

> During preoperational testing, the vibration velocity measurements for the RHR pumps were high (0.19 to 0.27 ips [inches per second]) relative to the vibration velocity ranges given in Relief Request PR-1. Three of the four pumps fell into the alert range.

The preoperational vibration velocity measurements were part of a series of vibration tests which included vibration amplitude. The results of the tests are summarized in Detroit Edison Engineering Research Report 84D98-2 which concludes:

> "The vibration measurements which were taken during the preoperational test indicate that the pumps are operating in a satisfactory condition."

Given that the pumps are operating acceptably at the higher vibration velocities, a new set of vibration velocity ranges were developed with the assistance of the vendor as described in Detroit Edison Engineering Research Report 85D15-5, Revision 1.

Report 85D15-5 recommends the measurement of overall velocity (filter out), overall amplitude (filter out) and running speed amplitude (filter in). All three quantities will be measured at the pump bearing and compared to the ranges given in alternate testing.

Testing data over 10 years has revealed that the values for overall velocity have remained fairly constant and that the action levels recommended in report 85D15-5 are not conservative. Therefore, the vibration limits contained in ASME/ANSI OMa-1988, Part 6, Table 3 (ranges for test parameters) are being adopted as the vibration limits for overall velocity for the RHR pumps.

Relief is required for the use of the vibration limits without implementation of all of the requirements of OMa-1988, Part 6. Specifically, Detroit Edison does not intend at this time to implement Paragraph 4.6.4(b). This paragraph requires that on vertical line shaft pumps"...measurements shall be taken on the upper motor bearing housing in three orthogonal directions, one of which is the axial direction." The measurements will continue to be taken at the pump bearing. This is acceptable because the long-term hydraulic and vibrational test results indicate that all four pumps are performing acceptably and have displayed very little, if any degradation.

3.2.2 Alternate Testing

The licensee proposes:

> Pump vibration overall velocity, overall amplitude, and running speed amplitude measurements will be taken. The acceptable criteria for the readings will be as follows:

	Overall Velocity
Acceptable Range	≤0.325 in./sec
Alert Range	0.326 in./sec to 0.700 in./sec
Required Action Range	>0.700 in./sec

The ranges given in Table IWP-3100-2 for overall and running speed amplitude will be applied.

3.2.3 Evaluation

The licensee has requested to use the vibration requirements of OM-6 for the four Fermi RHR pumps. The current regulations (10 CFR 50.55a) endorse the 1989 edition of ASME Section XI. The 1989 edition of the Code provides that the rules for IST of valves may meet the requirements set forth in ASME/ANSI Operations and Maintenance Code, Part 6 (OM-6). Pursuant to 10 CFR 50.55a(f)(4)(iv), portions of editions or addenda may be used provided that all related requirements of the respective editions or addenda are met, and subject to Commission approval, and therefore, relief is not required for those inservice tests that are conducted in accordance with OM-6 or portions thereof. The related requirements for vibration testing are ISTB 4.6.1, 4.6.4, 5.2, and 6.1.

The licensee has requested to implement the requirements of OM-6 for the RHR pumps with the exception of paragraph 4.6.4(b) because the long-term hydraulic and vibrational test results indicate that all four pumps are performing acceptably and have displayed very little, if any degradation. However, past performance is not necessarily indicative of future vibration characteristics of any pump, including the RHR pumps at Fermi. In the change to the OM-6 Code, the working group concluded that more vibration directions should be included within the Code requirements to ensure that a significant change in measured vibration is not overlooked with time. The Code specifically states that axial vibration measurements on the pump thrust bearing must be measured. The licensee's proposed relief request is not an acceptable alternative to the OM-6 vibration requirements. In addition, the licensee has not presented a significant hardship or burden to the implementation of the Code requirements.

3.2.4 Conclusion

Using the vibration requirements of OM-6 for vibration testing of the RHR pumps is approved pursuant to 10 CFR 50.55a(f)(4)(iv) provided that all the related requirements of OM-6 listed in Section 3.2.3 of this SE are met. Implementation of the related requirements is subject to NRC inspection.

The requested relief to exclude the requirements of ISTB 4.6.4(b) from the licensee's vibration testing of the RHR pumps is denied. The licensee should apply all the vibration requirements of OM-6 to vibration testing of the RHR pumps.

3.3 Relief Request PR-11

The licensee has requested relief from the Code reference value requirements of ASME Section XI, Paragraph IWP-3110, for the emergency equipment cooling water (EECW) pumps P4400C001A and P4400C001B. The licensee has proposed to use pump reference curves to verify compliance with the Code pump hydraulic requirements.

3.3.1 Licensee's Basis for Requesting Relief

The licensee states:

> Relief is requested to deviate from the Code requirement for a fixed reference value for flow and differential pressure. For flow rate and differential pressure, a flow reference curve, rather than a single fixed value of differential pressure and corresponding flow, will be utilized. This reference curve will be developed utilizing linear regression with four or more flow versus differential pressure data sets over a limited range of flow.
>
> The use of pump reference curves is necessitated by the fact that both EECW Systems are tested by placing the EECW systems in operation and then restoring cooling water flow to the isolated (non-essential) loads (sump heat exchangers, containment penetration coolers, etc.). The test loop then consists of the Division 1 or Division 2 EECW Distribution with the non-essential loads restored for EECW Pumps P4400C001A and B, respectively. The system flow is then adjusted by throttling the manually operated pump discharge gate valve to obtain the desired flow rate. The division 1 Discharge Valve, P4400F004A, and the Division 2 Discharge Valve, P4400F004B, are normally Locked Open (LO) valves to allow maximum flow in the EECW mode. The ability to control flow with a manual gate valve is very limited, and it is difficult to always return to a precise flow. To require that Plant Operators test the system at such a fixed flow rate represents an undue hardship on Operators and an unnecessary challenge to the EECW system, since it requires a greater amount of time be spent in this abnormal lineup.
>
> A review of inservice test results obtained using the reference curves shows that the data is consistent and trendable. Additionally, the individual pump vibration data is extremely stable and indicates that pump performance has not degraded for either of the EECW Pumps. Had invalid data been used to generate the pump reference curves, or if the curve fit was poor, test results would be erratic, and this has not been the experience for these pumps.

3.3.2 Alternate Testing

The licensee proposes:

> The following acceptance criteria will be established for the emergency equipment cooling water pumps:
>
> For each EECW pump, differential pressure and flow is being measured over a narrow range of test flows. A reference curve for pump performance monitoring for each pump has been developed over a limited flow range. This reference curve is currently being used to evaluate pump performance for degradation.

3.3.3 Evaluation

The Code requires that pump differential pressure or flow reference values for pump inservice testing be established at points of operation readily duplicated during subsequent inservice tests. If pump flow is the selected reference value, the pump differential pressure will be used to verify compliance with the Code requirements. This data can also be used to trend the hydraulic performance of the pump to determine if there are potential problems with pump performance.

In order to establish reference flows for the EECW pumps at Fermi, manual gate valves which are left in the full open position and locked during power operation need to be unlocked and adjusted to establish the reference flow. The licensee states that this procedure is difficult because it places the EECW system in an abnormal lineup. Since a manual valve is being used to establish the flow, automatic reposition of the valve would not occur if the system were required to perform its safety function. There is therefore an undue burden on the licensee to perform the testing in accordance with the Code.

The licensee has proposed to use a reference curve for each pump to verify compliance with the Code requirements. NUREG-1482, Section 5.2, states pump curves are acceptable to use in place of fixed reference values provided the licensee justifies the impracticality of performing the testing. The licensee stated that the pump curves would be developed with four or more points over a narrow range. The licensee also states that vibration data for each pump are stable which implies that a single vibration value would apply to the pump vibration characteristics over the entire measured hydraulic range. The licensee has not addressed five of the seven elements referenced in NUREG-1482, Section 5.2. The licensee should ensure that these elements have been addressed in the development of the reference curves for the EECW pumps and documented in its IST program. The proposed alternative provides a reasonable assurance of operational readiness because the licensee will be following established guidance provided in NUREG-1482.

3.3.4 Conclusion

Relief is granted pursuant to 10 CFR 50.55a(f)(6)(i) to verify Code compliance of the hydraulic parameters of the EECW pumps by using pump reference curves based on the impracticality of performing testing in accordance with the Code requirements, and in consideration of the burden on the licensee if the Code requirements were imposed on the facility. The relief is granted with the provision that the elements listed in NUREG-1482, Section 5.2, are addressed and documented in the licensee's IST program.

4.0 VALVE RELIEF REQUESTS

4.1 Relief Request VR-46-R5

The licensee has requested relief from the analysis of leak rate requirements of ASME Section XI, Paragraph IWV-3426, for the 77 containment isolation valves (CIVs) listed in this relief request. The licensee has proposed to

test groups of CIVs associated with specific penetrations where it is impractical to individually leak test each valve in the group and assign permissible leakage rates for each valve group.

4.1.1 Licensee's Basis for Relief

The licensee states:

> Due to system configuration, the valves listed in Table VR-46-R5 cannot be individually leak tested. Table VR-46-R5 identifies the containment isolation valves which must be collectively leak tested in valve groups. This table also provides the corresponding primary containment penetration number and valve sizes.

4.1.2 Alternate Testing

The licensee proposes:

> The containment isolation valves listed in Table VR-46-R5 will be collectively leak tested according to their associated valve groups given in the table. The test leakage will be compared to the maximum leakage assigned to each group.
>
> If the test leakage exceeds the criteria given in IWV-3426, valves in the affected group will be evaluated on a valve by valve basis consistent with the requirements of IWV-3427(a). The valve most likely to be the leaker will be repaired first and the group retested. If the test leakage is within the criteria, no further testing will be performed. In accordance to the guidance contained in Generic Letter 89-04 Paragraph D and Attachment 1, Position 10, exception will be taken to the requirements contained in Section IWV-3427(b).

4.1.3 Evaluation

The valves identified in the licensee's submitted relief request have been designated as CIVs and have a safety function to isolate the containment during an accident. The Code requires that Category A valves be assigned specific leakage rates by the licensee and individually leak rate tested every 2 years. The licensee stated that the CIVs listed in this relief request cannot be tested individually. A review of drawings for a select number of valves referenced in this relief request indicate that there are no test connections or isolation valves available in the reviewed systems to facilitate individual leak rate testing. It would be an undue burden for the licensee to test these valves in accordance with the Code because the system would have to be redesigned or modified.

The licensee has proposed to test the containment isolation valves in groups corresponding to their respective containment penetration. Leakage rates have been assigned by the licensee to each penetration. If the leakage in a particular group exceeds the permissive value, the licensee would repair the valve that is most likely to be leaking and retest the group. The proposed

methodology is similar to the testing included in OM-10, Paragraphs 4.2.2.3(e) and 4.2.2.3(f). According to the guidance provided in NUREG-1482, Section 4.4.5, licensees may update their programs to the requirements of Paragraph 4.2.2.3 of OM-10.

The current regulations (10 CFR 50.55a) endorse the 1989 edition of ASME Section XI. The 1989 edition of the Code provides that the rules for IST of valves may meet the requirements set forth in ASME/ANSI Operations and Maintenance Code, Part 10 (OM-10). Pursuant to 10 CFR 50.55a(f)(4)(iv), portions of editions or addenda may be used provided that all related requirements of the respective editions or addenda are met, and subject to Commission approval, and therefore, relief is not required for those inservice tests that are conducted in accordance with OM-10 or portions thereof provided that the licensee meets all related requirements in Sections 4.2.2.1 and 4.2.2.3.

4.1.4 Conclusion

Leak rate testing of specific CIVs in groups is approved pursuant to 10 CFR 50.55a(f)(4)(iv) provided the licensee meets all related requirements of OM-10 which include Sections 4.2.2.1 and 4.2.2.3. Implementation of these requirements is subject to NRC inspection.

4.2 Relief Request VR-47-R2

The licensee has requested relief from the analysis of leak rate requirements of ASME Section XI, Paragraph IWV-3426, for the 14 CIVs listed in this relief request. The licensee has proposed to test groups of CIVs associated with specific penetrations where it is impractical to individually leak test each valve in the group and assign permissible leakage rates for each valve group.

4.2.1 Licensee's Basis for Relief

The licensee states:

> Due to system configuration, the containment isolation valves (CIVs) listed in Table VR-47-R2 [see licensee submittal dated July 19, 1995, page B-38] cannot be individually leak tested. Table VR-47-R2 gives the primary containment penetration corresponding to the containment isolation valves, the valve diameters and the maximum allowable leakage based on the leakage limits given in Technical Specification paragraph 3.6.1.2.e.
>
> According to the technical specification, the leakage shall be limited to one gpm times the number of valves per penetration, not to exceed three gpm per penetration. For the penetrations in Table VR-47-R2, the maximum penetration limit is three gpm (11355 ml/min). This limit is divided by the sum of the valve diameters for the penetration, and multiplied by the sum of the diameters of the valves tested in a penetration group to produce the maximum leakage for that group.

4.2.2 Alternate Testing

The licensee proposes:

> The containment isolation valves listed in Table VR-47-R2 will be leak tested according to the valve groups given in Table VR-47-R2. The test leakage will be compared to the maximum leakage assigned to each group.
>
> If the test leakage exceeds the criteria given in IWV-3426, valves in the affected group will be evaluated on a valve by valve basis consistent with the requirements of IWV-3427(a). The valve most likely to be the leaker will be repaired first and the group retested. If the test is within the criteria, no further testing will be performed. In accordance with the guidance contained in Generic Letter 89-04 Paragraph D and Attachment 1, Position 10, exception will be taken to the requirements contained in Section IWV-3427(b).

4.2.3 Evaluation

The valves identified in the licensee's submitted relief request have been designated as CIVs and have a safety function to isolate the containment during an accident. The Code requires that Category A valves be assigned specific leakage rates which are specified by the licensee and individually leak rate tested every 2 years. The licensee stated that the CIVs listed in this relief request cannot be tested individually. A review of drawings for a select number of valves referenced in this relief request indicate that there are no test connections or isolation valves available in the reviewed systems to facilitate individual leak rate testing. It would be an undue burden for the licensee to test these valves in accordance with the Code because the system would have to be redesigned or modified.

The licensee has proposed to test the containment isolation valves in groups corresponding to their respective containment penetration. Leakage rates have been assigned by the licensee to each penetration. If the leakage in a particular group exceeds the permissive value, the licensee would repair the valve that is most likely to be leaking and retest the group. The proposed methodology is similar to the testing included in OM-10, Paragraphs 4.2.2.3(e) and 4.2.2.3(f). According to the guidance provided in NUREG 1482, Section 4.4.5, licensees may update their programs to the requirements of Paragraph 4.2.2.3 of OM-10.

The current regulations (10 CFR 50.55a) endorse the 1989 edition of ASME Section XI. The 1989 edition of the Code provides that the rules for IST of valves may meet the requirements set forth in ASME/ANSI Operations and Maintenance Code, Part 10 (OM-10). Pursuant to 10 CFR 50.55a(f)(4)(iv), portions of editions or addenda may be used provided that all related requirements of the respective editions or addenda are met, and subject to Commission approval, and therefore, relief is not required for those inservice tests that are conducted in accordance with OM-10 or portions thereof provided

that the licensee meets all related requirements of Sections 4.2.2.1 and 4.2.2.3.

4.2.4 Conclusion

Leak rate testing of specific CIVs in groups is approved pursuant to 10 CFR 50.55a(f)(4)(iv) provided the licensee meets the related requirements of OM-10 which include Sections 4.2.2.1 and 4.2.2.3. Implementation of these requirements is subject to NRC inspection.

4.3 Relief Request VR-49-R3

The licensee has requested relief from the seat leakage measurement requirements of ASME Section XI, Paragraph IWV-3424, for the RHR system pressure isolation valves E1150F009 and E1150F608. These valves are on the suction line of the RHR pumps from the suction side of the "B" reactor recirculation loop and are located inside containment. The licensee has proposed to test these valves as a pair with the acceptance criteria described in TS Section 3.4.3.2.d of 1 gpm.

4.3.1 Licensee's Basis for Relief

The licensee states:

> Due to system configuration, the above pressure isolation valves cannot be individually leak tested. Both valves must be tested within the same test volume with pressure being applied in the accident direction for both valves.
>
> According to EF-2 Technical Specification Paragraph 3.4.3.2.d, the leakage shall be limited to one gpm (3785 ml/min) at a reactor coolant pressure 1045 ± 10 psig from any reactor coolant system pressure isolation valve.

4.3.2 Alternate Testing

The licensee proposes:

> Pressure isolation valves E1100F009 and E1100F608 will be leak tested together. The test leakage will be compared to a maximum leakage of 1 gpm (3785 ml/min).
>
> If the test leakage exceeds the 1 gpm limit as specified by Technical Specification Paragraph 3.4.3.2.d, the valves will be evaluated consistent with the requirements of IWV-3427(a). The valve most likely to be the leaker will be repaired first and both valves retested. If the test leakage is within 1 gpm, no further testing will be performed. In accordance with the guidance contained in Generic Letter 89-04 Paragraph D and Attachment 1, Position 10, exception will be taken to the requirements contained in Section IWV-3427(b).

4.3.3 Evaluation

The Code requires that category A valves, which are defined as valves that have specific seat leakage requirements, to be leak tested once every 2 years. Seat leakage through individual valves may be determined by either pressurizing the upstream side while measuring the leakage through a downstream test tap connection or measuring the feedrate between two valves. The valves addressed in this relief request are located inside containment and are arranged in parallel from the line leading from the suction piping of the "B" reactor recirculation loop to the isolation valve E1150F008 which is located outside of containment. A review of Fermi drawing 6M721-2083 shows that there are no test taps which would facilitate individual testing of the two valves inside containment and therefore testing in accordance with the requirements of the Code is impractical. It would be an undue burden for the licensee to leak rate test these valves individually because the system would have to be redesigned or modified.

The licensee has proposed to leak test these valves together and use the acceptance criteria provided in TS Section 3.4.3.2.d. The proposed testing provides reasonable assurance of operational readiness because the leakage criteria have been specified in the licensee's TS.

4.3.4 Conclusion

Relief is granted to leak test the RHR system pressure isolation valves E1150F009 and E1150F608 as a pair pursuant to 10 CFR 50.55a (f)(6)(i) based on the impracticality of performing testing in accordance with Code requirements, and in consideration of the burden on the licensee if the Code requirements were imposed on the facility.

4.4 Relief Request VR-51

The licensee is requesting relief from the power-operated valve requirements of ASME Section XI, Paragraph IWV-3413(b) for the diesel generator air-start system solenoid valves listed below. The licensee has proposed to demonstrate the required opening time of these solenoid valves by a successful start of each diesel generator on a 6-month frequency.

R30FA04A	R30FA04B	R30FA04C	R30FA04D
R30FA05A	R30FA05B	R30FA05C	R30FA05D

4.4.1 Licensee's Basis for Requesting Relief

The licensee states:

> It is impractical to apply the requirements of IWV-3413(b) to valves with very short stroke times (i.e. 2 seconds). Solenoid operated valves typically have full stroke times under one second. For these short stroke time valves, variances of 50 percent or more can occur in the measured times for reasons that are in no way related to valve performance; for example, operator reaction times. In this specific case verifying that the valve's stroke time satisfies

system operating requirements is sufficient to evaluate valve performance.

To satisfy the test frequency requirements would require additional diesel starts which would be detrimental to overall diesel operation and reliability.

4.4.2 Alternate Testing

The licensee proposes:

For the subject valves, a successful start of the diesel generator within the required Technical Specifications requirement of achieving speed and voltage level (Ref. Tech Spec. Paragraph 4.8.1.1.2.a.4) within 10 seconds, shall be sufficient to demonstrate that the 3-way solenoid valves have opened in the required time.

4.4.3 Evaluation

The Code requires that the diesel air-start solenoid valves be stroke timed every 3 months. These valves have a safety function to open in conjunction with the operation of their associated diesel generators. The diesel air start valves are solenoid valves which have stroke times usually under 2 seconds. The licensee stated in a phone conversation on March 13, 1996, that these valves are fully enclosed with no means to observe the position of the valve stem. Since these valve cannot be stroke timed by observation of valve position, either remotely or locally, it is impractical to measure the valve stroke times by conventional means. It would be an undue burden for the licensee to meet the Code requirements because these components would have to be either modified or replaced.

The licensee has proposed to credit a successful stroke time test of these valves by a successful start of the associated diesel within the TS time limit of 10 seconds. This start time surveillance limit, referenced in TS Section 4.8.1.1.2.a.4, is based on a test of each diesel generator every 6 months at ambient conditions. TS Table 4.8.1.1.2-1 indicates that the diesel generators are tested on a monthly frequency under different initial conditions. Since the Code test frequency for these valves is once every 3 months, it would appear that these valves can be tested at the Code frequency during this diesel test. The licensee must establish acceptance criteria for these valves during the monthly test that satisfy the Code quarterly test frequency requirements. Since these criteria must be established and procedures developed, an interim period of time should be given to the licensee to develop this testing. The proposed alternative to the Code requirements provides a reasonable assurance of operational readiness during the interim period because verification of valve stroke exercising is already established and being performed during the 6-month diesel start test.

4.4.4 Conclusion

The licensee's proposal to stroke time test the diesel generator air-start solenoid valves based on the start time of the diesel is granted pursuant to

10 CFR 50.55a(f)(6)(i) for an interim period of 1 year. During the interim period, the licensee must develop acceptance criteria to verify that these valves adequately stroke during the monthly diesel test which would satisfy the Code quarterly test frequency requirements.

5.0 ACTION ITEMS

5.1 In Relief Request PR-6-R1, provisional relief is granted to perform parallel pump testing of each core spray pump train and to use reference curves to assess the performance of each parallel pump combination. The licensee must incorporate the following provisions in its IST program or the applicable test procedures (See Section 3.1 of this SE).

1) If the hydraulic performance of one train enters the alert or required action range, then both pumps in that train must either be individually verified to have acceptable performance (through testing or inspection) or repaired prior to the train being returned to service.

2) All elements listed in NUREG-1482, Section 5.2, concerning development of pump reference curves must be addressed and documented in the licensee's IST program.

3) The licensee is not allowed to use the provisions of Paragraphs IWP-3112 and IWP-3230(c) that permit an analysis to be performed when the hydraulic performance of a pump train enters the alert or required action range and establish additional reference values.

4) This relief request must be revised to include the reference curves for each train of core spray that are currently included in the applicable surveillance procedures (such as Table 1 in Fermi Surveillance Procedure 24.203.03, Revision 25, Page 10, core spray loop B, reference test date 12-20-84). The relief request need not be resubmitted for approval if it is revised only to include a new reference curve; however, the new reference curve should be retained in facility files for inspection.

5) New reference curves for each core spray train can be established only after both pumps in the train have been verified individually to be in good operating condition.

5.2 In Relief Request PR-8-R1 the licensee appears to identify the four RHR pumps at Fermi as vertical line shaft pumps. RHR pumps at boiling water reactors are typically vertical centrifugal pumps. The two types of pumps are classified differently in OM-6 with more stringent acceptance criteria assigned to the vertical line shaft pumps. The licensee should resolve this discrepancy within its IST program and current and future program submittals as appropriate (See Section 3.2 of this SE).

5.3 The licensee should apply all vibration requirements of OM-6 to vibration testing of the RHR pumps (See Section 3.2 of this SE).

5.4 Relief Request PR-11 is granted for the EECW pumps with the provision that the elements listed in NUREG-1482, Section 5.2, are addressed and documented in the licensee's IST program (See Section 3.3 of this SE).

5.5 Approval was given in Relief Requests VR-46-R5 and VR-47-R2 to use later editions of the OM-10 Code to test groups of containment isolation valves associated with specific penetrations where it is impractical to individually leak test each valve in the group and assign permissible leakage rates for each valve group provided that the licensee meets all related requirements of Sections 4.2.2.1 and 4.2.2.3. Implementation of these requirements is subject to NRC inspection (See Sections 4.1 and 4.2 of this SE).

5.6 Interim relief is granted for Relief Request VR-51 for a period of 1 year to provide the licensee ample time to develop acceptance criteria which verify that the diesel air-start solenoid valves stroke during the monthly diesel test to satisfy the Code quarterly test frequency requirements (See Section 4.4 of this SE).

5.7 In the licensee's IST program submittal of July 19, 1995, the licensee states in Relief Request VR-45-R1 that these check valves cannot be partial-stroke exercised because the core spray pumps in each division are tested in parallel. Credit for a full-stroke test of a check valve requires that the flow through the check valve be known. Knowledge of only the total flow through multiple parallel lines is not a full-stroke test. However, since both pumps are running during the quarterly test, and if the division meets its hydraulic performance criteria, then the quarterly core spray test is a partial-stroke test of the core spray pump discharge check valves. The licensee should remove this reference from its IST program. In addition, the licensee should partial-stroke test the core spray discharge pump check valves after reassembly to meet the guidance in GL 89-04, Position 2.

6.0 CONCLUSION

The staff concludes that the relief requests as evaluated and modified by this SE will not compromise the reasonable assurance of operational readiness of the pumps and valves in question to perform their safety-related functions. Relief was granted for Relief Request VR-49-R3. Relief Requests PR-6-R1, PR-11, VR-46-R5 and VR-47-R2 were approved with provisions. Relief Request VR-51 was granted on an interim basis and Relief Request PR-8-R1 was partially approved. The staff has determined that approval of relief requests pursuant to 10 CFR 50.55a(f)(6)(i) or (f)(4)(iv) is authorized by law and will not endanger life or property, or the common defense and security and is otherwise

in the public interest. In making this determination, the staff has considered the impracticality of performing the required testing and the burden on the licensee if the requirements were imposed.

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