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DTE Energy

10 CFR 50.55a

November 3, 2009
NRC-09-0064

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington D C 20555-0001

Reference: Fermi 2
NRC Docket No. 50-341
NRC License No. NPF-43

Subject: Submittal of the Inservice Testing Program Relief Requests for Pumps and Valves- Third Ten-year Interval

Pursuant to 10 CFR 50.55a(a)(3), Detroit Edison hereby requests NRC approval of the following relief requests for the third ten-year interval of the Inservice Testing (IST) program at Fermi 2 which will start on February 17, 2010:

PRR-002, Relief to Allow Parallel Testing of Core Spray Pumps
PRR-003, Emergency Equipment Cooling Water Pumps Tested Using Pump Curves
PRR-004, Residual Heat Removal Pumps Vibration Alert Limits
PRR-005, Smooth Running Pump Vibration Acceptance Criteria
PRR-006, Service Water Pumps Suction Pressure Accuracy for the Comprehensive Pump Tests
PRR-007, Relief from Comprehensive Pump Testing for Centrifugal Pumps
PRR-009, Relief from Fixed Reference Value Testing
PRR-010, Relief from Comprehensive Pump Testing for Standby Liquid Control and Diesel Generator Fuel Oil Transfer Pumps
VRR-011, Relief for Test Frequency of Excess Flow Check Valves
VRR-012, Relief to Perform Position Indication Testing at Appendix J, Option B Frequency
VRR-013, Performance-Based Scheduling of Pressure Isolation Valve Leakage Tests

The enclosure to this letter provides details of these relief requests.

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Detroit Edison requests NRC approval of these relief requests in accordance with the following schedule to support planned testing for the third ten-year IST Interval.

Relief Requests	NRC Approval Requested By
PRR-002, PRR-003, PRR-006 and PRR-009	February 15, 2010
PRR-004, PRR-005, PRR-007 and PRR-010	June 11, 2010
VRR-011, VRR-012 and VRR-013	September 10, 2010

Should you have any questions or require additional information, please contact Mr. Rodney W. Johnson of my staff at (734) 586-5076.

Sincerely,

Joseph H. Plona

Enclosure

cc: NRC Project Manager
NRC Resident Office
Reactor Projects Chief, Branch 4, Region III
Regional Administrator, Region III
Supervisor, Electric Operators,
Michigan Public Service Commission

Enclosure to NRC-09-0064

Fermi 2 Docket No. 50-341
NRC License No. NPF-43

IST Relief Requests
for Third Ten Year Interval

10 CFR 50.55a Relief Request PRR-002

Relief to Allow Parallel Testing of Core Spray Pumps

Proposed Alternatives In Accordance with 10 CFR 50.55a(a)(3)

Alternative Provides Acceptable Level of Quality and Safety and Hardship or Unusual Difficulty Without Compensating Increase in Level of Quality or Safety

1. ASME Code Component(s) Affected

Pump	Name	Code Class	ISI Drawing
E2101C001A	Core Spray Pump A	2	6M721-5814
E2101C001B	Core Spray Pump B	2	6M721-5814
E2101C001C	Core Spray Pump C	2	6M721-5814
E2101C001D	Core Spray Pump D	2	6M721-5814

2. Applicable Code Edition and Addenda

ASME OM Code 2004 Edition, No Addenda

3. Applicable Code Requirement

Section ISTB-3400 Frequency of InService Tests

Section ISTB-5121 Group A Test Procedure

Section ISTB-5123 Comprehensive Test Procedure

4. Reason for Request

Pursuant to 10 CFR 50.55a, "Codes and Standards", paragraph (a)(3), interim relief is requested from ASME Code requirements in three specific areas:

- Pursuant to 10 CFR 50.55a, "Codes and Standards", paragraph (a)(3)(i), relief is requested from ASME OM Code ISTB to perform quarterly testing of both Core Spray Pumps in each Division in parallel. That is, both pumps are to be run together and treated as a single component. Relief has been previously granted to perform parallel pump testing in the first two ten year intervals. This relief is for an interim period (through the end of Refueling Outage 15) until system modifications can be completed. The basis of this relief is that the proposed alternative would provide an acceptable level of quality and safety.

- Pursuant to 10 CFR 50.55a, "Codes and Standards", paragraph (a)(3)(i), relief from the requirement of ASME OM Code ISTB-5121 is requested to utilize a flow reference curve, rather than a single fixed reference value for flow. This relief is for an interim period of four years from the start of the third 120 month interval. The basis of this relief is that the proposed alternative would provide an acceptable level of quality and safety.

- Pursuant to 10 CFR 50.55a, "Codes and Standards", paragraph (a)(3)(ii), one-time relief is requested from the requirement of ASME OM Code ISTB-3400 to perform a Comprehensive Pump Test (CPT) for the Core Spray Pumps biennially. Specifically, it is requested that the due date of February 17, 2012 for the performance of the first CPT on these pumps be extended beyond the end of Fermi 2 Refueling Outage 15, which at this time is currently scheduled to start on March 30, 2012 and end on April 30, 2012. The basis of this relief is that compliance with the specified requirement of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

5. Proposed Alternative and Basis for Use

The Fermi 2 Core Spray system test lines are designed such that pumps cannot be individually tested. These test lines and test valves are oversized. A modification plan is currently being finalized which will install several reducing orifices in each test line. This modification will allow for individual pump testing as well as providing more precise throttling capability.

Fermi 2 will continue to perform quarterly testing of both Core Spray Pumps in a Division in parallel until the test line modifications are completed.
Both pumps are to be run together and treated as a single component. This implies that differential pressure and developed head reference values represent a combined pump flow characteristic. 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 are being placed on the acceptance criteria to assure that any degradation in performance is detected and corrected in a timely manner:

1. In order 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:
   Acceptable DP Range - 0.94 to 1.06 ($\Delta P/\Delta P_r$)
   Alert Range - 0.92 to < 0.94
   Required Action Range - Low < 0.92 and High > 1.06
   Note: This represents the *least* restrictive criteria which will be used.

2. If the hydraulic performance of a CS division enters the Alert Range Low for any reason other than instruments out of calibration, both pumps in that division will be individually evaluated 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.

3. If the hydraulic performance of a CS division enters the Required Action Low 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.

10 CFR 50.55a Relief Request PRR-002

Relief to Allow Parallel Testing of Core Spray Pumps

The Core Spray (CS) System protects the reactor core in the event of a large break LOCA if the Feedwater, CRD, RCIC, HPCI, or RHR Systems are unable to maintain RPV water level. Each pump is capable of providing only 50% of the desired system flow. If one pump is determined to be inoperable, then the Division is declared inoperable. The current design of the system test line will only accommodate the full flow, two pump testing required by Technical Specifications Surveillance Test requirements. However, we will have continual monitoring of individual pumps for their vibration data.

It is not practicable to run the Core Spray Pumps one at a time in the current test lineup configuration. The test line flow control valves are throttled approximately 13% open (Division 1) and 9% open (Division 2) to control two pump test flow (Pumps A and C are in Division 1, and Pumps B and D are in Division 2). The existing flow control valves are not capable of throttling low enough (less than 5% open) to accommodate single pump operation without experiencing unstable operation, cavitation, and severe vibration. Significant damage to the test line valves occurred during attempts to throttle for single pump operation during plant initial startup testing.

<u>Fermi 2 will use a reference curve as a basis for variable reference points</u>. The use of pump reference curves is necessitated by the fact that the test line and flow control valves are oversized for single pump testing. 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. Thus, it presents 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 four to seven data points over a 600 gpm range of flows (approximately 4% of the operating range). The data was then fit to a differential pressure - flow curve using linear regression, which is an appropriate method considering that the pump curve is essentially linear over this very small range.

A review of preservice test data and inservice 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 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 such is not the case in over 20 years of testing experience with these pumps, thus validating data credibility.

A review of the historic test results shows that the data is consistent and trendable. The Core Spray pumps are standby system pumps and accumulate very few hours of run time per year. The individual pump vibration data indicates no signs of degradation on any of the Core Spray Pumps. Degradation is unlikely for such pumps constructed to high quality standards, with periodic maintenance / lubrication activities and very low lifetime run hours. Charts showing historic performance trends for each division pair of pumps are attached to this relief request. Those charts represent historic DP values normalized to a flow rate of 6600 gpm.

The use of a reference curve for Core Spray pump testing will continue until the planned modifications to the test line are completed. These modifications will provide enhanced throttling capability and allow for standard pump testing with a fixed reference value. Relief to use pump reference curves is requested for the first 4 years of the Third Ten Year Interval, which is one year beyond the anticipated date of completion of the modifications. The flow throttling ability will be assessed and determination made regarding the continued need for reference curves within the year following the modifications. If necessary, a revised relief request will be submitted at that time to allow for continued use of reference curves.

Fermi 2 will perform the first Comprehensive Pump Test on each of the Core Spray pumps within 3 years of the start of the third Ten Year IST Interval.
Significant system modifications are being pursued to enable testing of the Core Spray Pumps individually. These system modifications will be costly, both in terms of resources and radiation exposures during installation. It is the intent of this relief request to allow for the continued performance of parallel pump testing until such time as the system is capable of individual pump testing. The current schedule for the modifications provides for both divisions of Core Spray to be completed within 3 years of the start of the 3rd 10 year interval.

The quarterly testing of the Core Spray pumps is done at full flow conditions. Assuming equal performance, each pump is operating at a capacity of between 3,300 gpm and 3,600 gpm and discharge pressure greater than 270 psig during the tests. The CPT Design Accident Flowrate as described in ISTB-3300 for the Core Spray pumps is 3,175 gpm. The linear region of the pump curves is from approximately 1800 gpm to 3600 gpm, with a Best Efficiency Point (BEP) of 3100 gpm. This verifies that the historic quarterly testing has been performed at levels which would reveal any notable pump degradation.

In order to establish appropriate pump reference curves, the following elements of NUREG-1482 Revision 1, section 5.2, are addressed as follows:

1. The Core Spray pumps were known to be operating acceptably when the curve basis test data was recorded. The Division 1 pump(s), A and C, reference curve was revised based on data taken in November, 1993. The Division 2 pump(s), B and D, reference curve was developed based on preservice data taken in December, 1984 and has not been changed.

2. Flow and discharge pressure gauges meet the range and accuracy requirements of the Code.

3. The Division 1 curve is constructed with 7 points and the Division 2 curve with 4 points. The application of the curve, however, is limited to a 600 gpm range. This range is well within the accuracy limits of the respective linear equations as demonstrated by r values of > 0.99 in both cases.

4. The combined pump curve for each division is beyond the flat portion of that curve for all data.

5. The acceptance criteria is above the Technical Specifications minimum flow requirements and minimum discharge pressure required for each Core Spray division based on both pumps running.

6. Vibration levels for the four Core Spray Pumps have remained constant over many years of testing within the applicable flow ranges.

7. There have been no major repairs or replacements completed on the Core Spray pumps since preservice testing in 1984.

Because the Core Spray pumps in each Division are tested in parallel, the following additional limitations are being instituted to assure that any degradation in performance is detected and corrected in a timely manner:

8. In order to enhance the ability to detect the equivalent of one pump's degradation to the minimum acceptable level of performance, acceptance criteria will be utilized which are more restrictive than the Code limits.

9. If the hydraulic performance of a CS division enters the **Alert Range Low** or **Required Action Low** ranges for any reason other than instruments out of calibration, both pumps in that division will be individually evaluated to determine which pump(s) in the Division has degraded. Appropriate inspections, tests, and repairs will be completed prior to returning the Division to service.

10. Either new reference curves will be established or the current curves verified after either pump in the division has been repaired, replaced, or serviced as specified in Paragraph 4.4.

11. Performance trending of the Core Spray pumps will include normalization of the DP data to a fixed reference value. This eliminates the scatter within the DP data caused by test flow values above or below a nominal fixed reference flow. See Figures 1 and 2 for an example of this normalized trending.

NOTE: Revision of the pump curve Tables under this provision does not require NRC review.

6. Duration of Proposed Alternative

This proposed alternative will be utilized for the first 3 years, (through February 17th, 2013), of the 3rd 120 month interval. For the specific relief to use pump reference curves, the proposed alternative will be utilized for the first 4 years, (through February 17th, 2014), of the 3rd 120 month interval.

7. Precedents

- Wolf Creek obtained relief (Request 3PR-04) to extend the interval of Comprehensive Pump Testing to allow for planned system modifications. Reference Accession No. ML061930407 ; SER dated 8/4/2006

- Fermi 2 previously obtained relief (Request PRR-02) for parallel pump testing and use of pump reference curves. Reference Accession No. ML003684536 ; SER dated 2/17/2000

DIVISION 1 CORE SPRAY PUMPS PERFORMANCE CURVE AND ACCEPTANCE CRITERIA TABLE FOR PROCEDURE 24.203.02

$$\Delta P_r = 456.8592530 - 0.027306 Q_r$$

where: ΔP_r = Reference Differential Pressure, psi

Q_r = Reference Flow, gpm

Acceptable Range: $0.94\Delta P_r \leq \Delta P \leq 1.06\Delta P_r$

Alert Range Low: $0.92\Delta P_r \leq \Delta P < 0.94\Delta P_r$

Required Action Range: Low $\Delta P < 0.92\Delta P_r$
High $\Delta P > 1.06\Delta P_r$

Table 1 Core Spray Loop A E2101C001A&C

Flow gpm	Required Action Range Low psi	Alert Range Low psi	Acceptable Range ΔP psi	Required Action Range High psi
6600	<254.6	254.6 to <260.1	**260.1 to 290.4**	>290.4
6650	<253.3	253.3 to <258.8	**258.8 to 289.0**	>289.0
6700	<252.0	252.0 to <257.5	**257.5 to 287.6**	>287.6
6750	<250.8	250.8 to <256.2	**256.2 to 286.1**	>286.1
6800	<249.5	249.5 to <255.0	**255.0 to 284.7**	>284.7
6850	<248.3	248.3 to <253.7	**253.7 to 283.3**	>283.3
6900	<247.0	247.0 to <252.4	**252.4 to 281.8**	>281.8
6950	<245.8	245.8 to <251.1	**251.1 to 280.4**	>280.4
7000	<244.5	244.5 to <249.8	**249.8 to 279.0**	>279.0
7050	<243.3	243.3 to <248.5	**248.5 to 277.5**	>277.5
7100	<242.0	242.0 to <247.3	**247.3 to 276.1**	>276.1
7150	<240.7	240.7 to <246.0	**246.0 to 274.7**	>274.7
7200	<239.5	239.5 to <244.7	**244.7 to 273.2**	>273.2

DIVISION 2 CORE SPRAY PUMPS PERFORMANCE CURVE AND ACCEPTANCE CRITERIA TABLE FOR PROCEDURE 24.203.03

$$\Delta P_r = 444.50000 - 0.02500 Q_r$$

where: ΔP_r = Reference Differential Pressure, psi

Q_r = Reference Flow, gpm

Acceptable Range: $0.94\Delta P_r \leq \Delta P \leq 1.06\Delta P_r$

Alert Range Low: $0.92\Delta P_r \leq \Delta P < 0.94\Delta P_r$

Required Action Range: Low $\Delta P < 0.92\Delta P_r$
High $\Delta P > 1.06\Delta P_r$

Table 1 Core Spray Loop B E2101C001B&D

Flow gpm	Required Action Range Low psi	Alert Range Low psi	Acceptable Range ΔP psi	Required Action Range High psi
6600	<257.1	257.1 to <262.8	**262.8 to 296.1**	>296.1
6650	<256.0	256.0 to <261.6	**261.6 to 294.8**	>294.8
6700	<254.8	254.8 to <260.4	**260.4 to 293.5**	>293.5
6750	<253.7	253.7 to <259.3	**259.3 to 292.2**	>292.2
6800	<252.6	252.6 to <258.1	**258.1 to 290.9**	>290.9
6850	<251.4	251.4 to <256.9	**256.9 to 289.6**	>289.6
6900	<250.3	250.3 to <255.7	**255.7 to 288.3**	>288.3
6950	<249.1	249.1 to <254.6	**254.6 to 286.9**	>286.9
7000	<247.9	247.9 to <253.4	**253.4 to 285.5**	>285.5
7050	<246.8	246.8 to <252.2	**252.2 to 284.2**	>284.2
7100	<245.6	245.6 to <251.0	**251.0 to 282.9**	>282.9
7150	<244.5	244.5 to <249.9	**249.9 to 281.6**	>281.6
7200	<243.4	243.4 to <248.7	**248.7 to 280.3**	>280.3

FIGURE 1

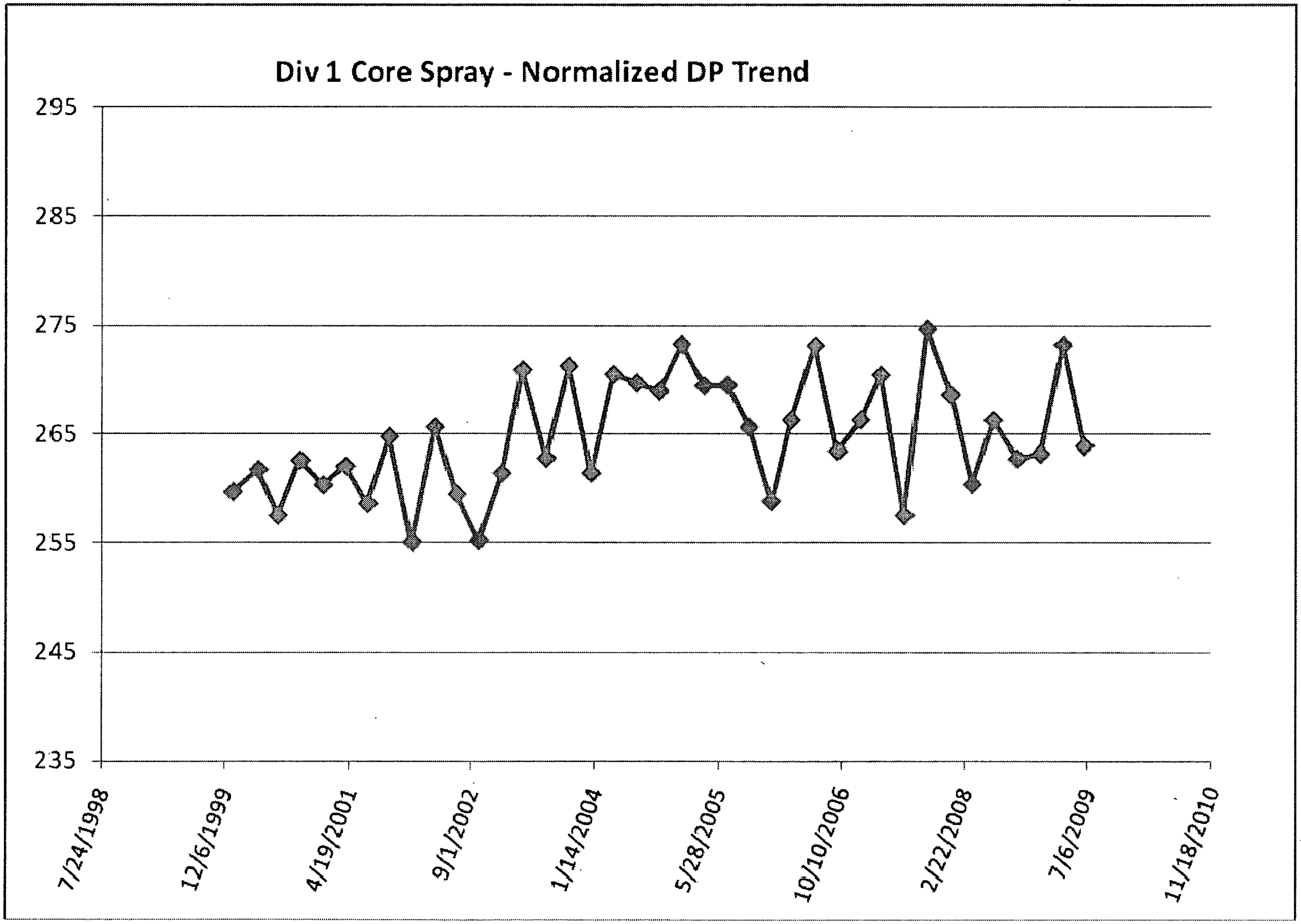
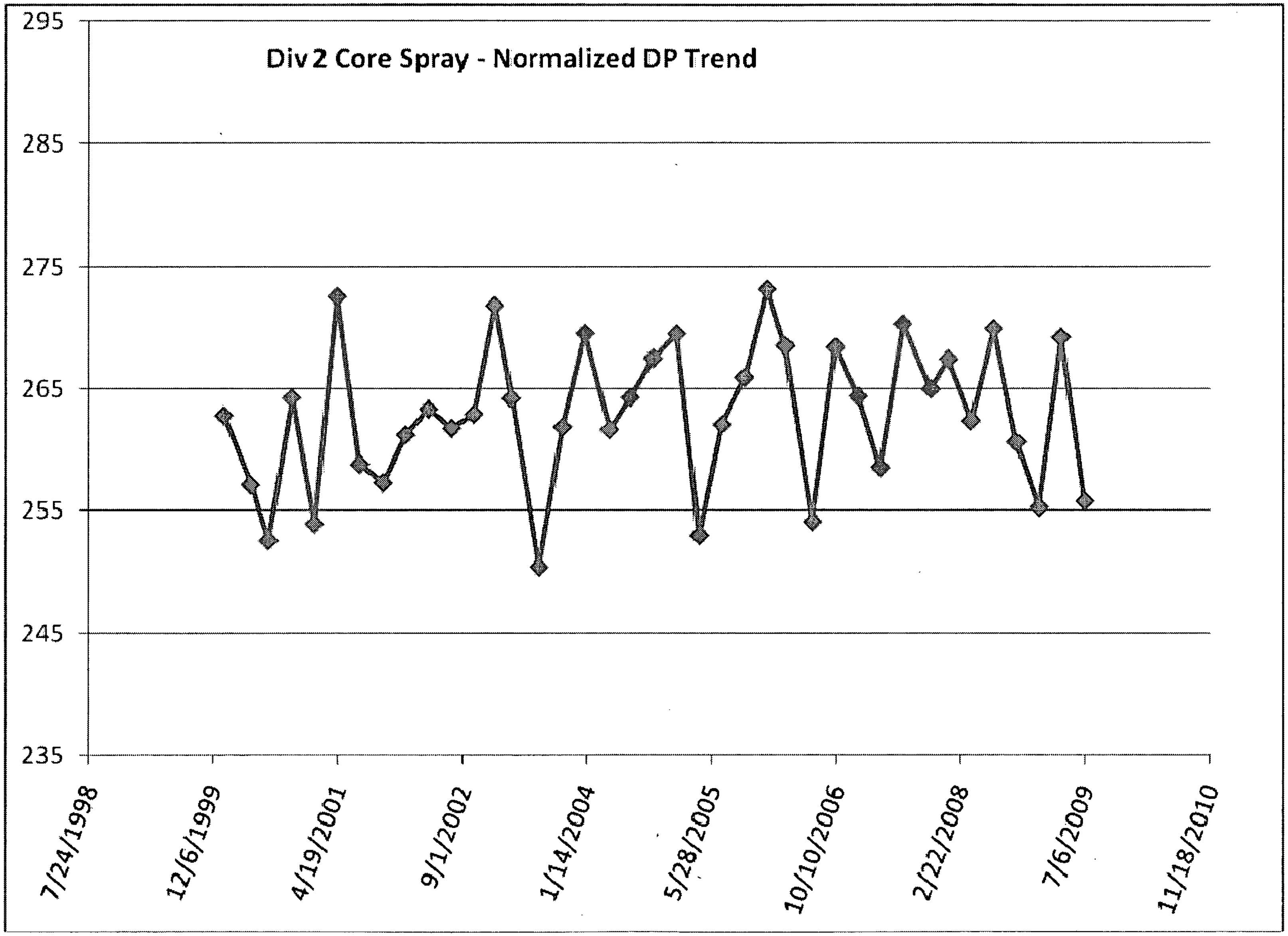

Div 1 Core Spray - Normalized DP Trend
295
285
275
265
255
245
235
7/24/1998
12/6/1999
4/19/2001
9/1/2002
1/14/2004
5/28/2005
10/10/2006
2/22/2008
7/6/2009
11/18/2010

FIGURE 2


Div 2 Core Spray - Normalized DP Trend
295
285
275
265
255
245
235
7/24/1998
12/6/1999
4/19/2001
9/1/2002
1/14/2004
5/28/2005
10/10/2006
2/22/2008
7/6/2009
11/18/2010

10 CFR 50.55a Relief Request PRR-003

Emergency Equipment Cooling Water Pumps Tested using Pump Curves

Proposed Alternative In Accordance with 10 CFR 50.55a(a)(3)(i)

Alternative Provides Acceptable Level of Quality and Safety

1. ASME Code Component(s) Affected

Pump	Name	Code Class	ISI Drawing
P4400C001A	Emergency Equipment Cooling Water (EECW) Pump A	3	6M721-5825-1
P4400C001B	Emergency Equipment Cooling Water (EECW) Pump B	3	6M721-5825-2

2. Applicable Code Edition and Addenda

ASME OM Code 2004 Edition, no Addenda

3. Applicable Code Requirement

ISTB-3300 and ISTB-5121 require that pump reference values be established at points of operation readily duplicated during subsequent tests. Acceptance criteria for subsequent tests are identified in Table ISTB-5121-1 based on the initial reference values.

4. Reason for Request

Pursuant to 10 CFR 50.55a, "Codes and Standards," paragraph (a)(3)(i), relief is requested to deviate from the Code requirement of ASME OM Code ISTB-3300 and ISTB-5121 for a fixed reference value for flow and differential pressure. The basis of the relief request is that the proposed alternative will provide an acceptable level of quality and safety.

The use of pump reference curves is necessitated by the difficulty in adjusting system test flow to the required value using the installed manual gate valve on the pump discharge. The ability to control flow using the installed manual gate valve is very limited, and it is difficult to always return to a precise flow value. Requiring Plant Operations to test the system at such a fixed flow rate represents an undue burden on the Operators and an unnecessary challenge to the EECW system, since it requires the system to remain in an abnormal lineup for a longer period of time. The significance of this is the diminished supply of cooling water available when compared to the normal line up. Using the pump curves also reduces the time that the system is inoperable during the surveillance.

5. Proposed Alternative and Basis for Use

EECW is essentially a fixed resistance system, with only coarse ability to adjust flow rates by isolating individual cooling load paths. Quarterly testing will be performed per ISTB-5121(c) and measured flow and differential pressure will be compared to their respective reference values. In situations where one or more non-essential cooling water branches are isolated for extended periods of time the test flow rate will be slightly lower than the typical quarterly test value. In this situation 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 and differential pressure data sets over a limited range of flow.

A review of historic inservice test results for the original pumps obtained using the reference curves shows that the data is consistent and trendable. Additionally, the individual pump vibration data was extremely stable and indicates that pump performance had 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 was not the experience with these pumps.

The EECW pumps were replaced in 2007 with slightly larger capacity models. Performance data was obtained at 8 separate flow points for Pump A and 9 points for Pump B to establish accurate reference curves.

Although the EECW pumps are classified as Group B pumps, Fermi 2 will perform typical quarterly testing using Group A pump requirements per ISTB-5121(c). The testing lineup will include one or two small bore non-essential cooling water branches isolated as a means to have some control over total system flow. These small branch lines are automatically isolated during system start and will be restored following the IST test data acquisition. If the "fixed" flow is slightly below the test criteria these loads may be unisolated individually to adjust system flow to within the test flow criteria. This testing methodology is intended to provide for enhanced degradation monitoring as compared to testing only against a reference curve.

Experience with this method over the past 2 years has shown that the system test flow variance near the reference flow is as follows:

Pump A: Ref Flow = 1862 gpm
Recorded test flows were:

1880	1894	1838	1855	1872	1874

Average deviation from 1862 gpm reference was 0.92%; Maximum deviation was 1.72%

Pump B: Ref Flow = 1730 gpm
Recorded test flows were:

1744	1753.3	1732	1760	1717	1702.6

Average deviation from 1730 gpm reference was 1.06%; Maximum deviation was 1.73%

For system scenarios where one or more cooling water branches must be isolated for extended periods (e.g., a leaking drywell cooler) the test flow may be reduced to below the fixed resistance test flow criteria. A differential pressure acceptance criteria curve has been established that covers the possible range of flow rate for each pump. The applicable tables and curve characteristics are attached to this relief request. In the specific allowed region of flow rates, the Q-P relationship is extremely linear, with R values greater than 0.996. All of the allowable test flow values are within a region of the pump curve greater than 80% of Design Accident Flow and with a well defined linear Q-P slope. Acceptance criterion for DP is established in 10 gpm increments, and the Required Action Low criterion is set conservatively at 0.91 versus the ISTB-5121-1 Table requirement of 0.90.

In establishing these pumps reference curves the elements of NUREG-1482 Revision 1 Section 5.2 are addressed as follows:

1. The EECW pumps were known to be operating acceptably when the pre-service test data was recorded. The Division 1 and 2 pumps were replaced during 2007 and reference curves were developed based on data taken following the new pump installations.

2. Flow instrumentation and the suction pressure and discharge pressure gauges meet the range and accuracy requirements for Comprehensive Pump Testing in Table ISTB-3510-1.

3. The Division 1 curve is constructed with 8 data points and the Division 2 curve with 9 points. The linear regression correlation quality for both curves was better than 0.996. The application of the curves is limited to 260 gpm and 280 gpm ranges for Divisions 1 and 2 respectively. This range is well within the accuracy limits of the respective linear equations. However, the variation in flow measurement during normal quarterly testing will be within a much smaller range, typically 50 - 60 gpm. The larger range of the curve is designed to provide for meaningful criteria in the rare conditions with substantial EECW loads isolated.

4. The test flow range for each division is well beyond the flat portion of that curve for all data.

5. The acceptance criteria are above the minimum acceptable full system flow limits as determined by Design Calculations.

Performance trending will utilize the normalization process described in Fermi 2 Technical Position 12. DP data will be normalized to the reference flow value to allow for a low scatter time-based trend analysis. Using this method for testing and analysis of the EECW pumps provides the ability to detect pump degradation. Acquisition of vibration data during each quarterly test enhances this ability.

6. Duration of Proposed Alternative

This proposed alternative will be utilized for the entire 3rd 120 month interval.

7. Precedents

The following plants obtained relief to utilize reference curves for pump testing and acceptance criteria

- Fermi 2 previously obtained relief (Request PRR-003) for testing using pump curves. Reference Accession No. ML003684536; SER dated 2/17/2000
- Prairie Island 2 obtained relief for testing using pump curves. Reference Accession No. 9508160303 ; SER dated 8/11/1995
- Davis Besse obtained relief for testing using pump curves. Reference Accession No. ML030790183 SER dated 1/23/2003

DIVISION 1 EECW PUMP PERFORMANCE CURVE AND ACCEPTANCE CRITERIA TABLE FOR PROCEDURE 24.207.08

$$\Delta P_r = 105.44 - 0.0156 Q_r$$

where: ΔP_r = Reference Differential Pressure, psi

Q_r = Reference Flow, gpm

Acceptable Range: $0.91\Delta P_r \leq \Delta P \leq 1.06\Delta P_r$

Required Action Range: Low $\Delta P < 0.91\Delta P_r$
High $\Delta P > 1.06\Delta P_r$

Note: The allowable minimum ΔP multiplier of 0.91 is more conservative than the 0.90 value required in Table ISTB-5100-1. This conservatism was added as an additional measure to account for the slight reduction in trendability associated with the use of a reference curve versus a fixed reference point.

Table 1 Div 1 EECW Pump P4400C001A Baseline Data   Reference IST Evaluation 08-014

Curve derivation is based on the following actual data points obtained 10/31/07 and 11/3/07 per WO 25129754 and 6/17/08 per WO 26291709				
Test Point	**Flow**	**DP**	Disch Press	Suct Press
1	**967**	**90.3**	122.3	32.0
2	**1124**	**87.7**	119.6	31.9
3	**1218**	**86.7**	118.5	31.8
4	**1525**	**81.8**	113.2	31.4
5	**1692**	**79.2**	110.5	31.3
6	**1823**	**76.9**	108.0	31.1
7	**1863**	**76.3**	107.4	31.1
8	**1894**	**75.9**	106.9	31.0

Emergency Equipment Cooling Water Pumps Tested using Pump Curves

Table 2 Div 1 EECW Pump P4400C001A Reference IST Evaluation 08-014

Linear regression derivation of DP and calculated DP criteria

Derivation and criteria table - Linear regression: y = -0.0156x + 105.44 where x = flow & y = DP [**R = 0.99962**] and criteria basis of -9% min DP / +6% max DP acceptance) Procedural test flow range is limited to 1550 - 1830 GPM

FLOW gpm	DP_{der}	DP_{min}	DP_{max}
1550	81.27	73.95	86.14
1560	81.11	73.80	85.97
1570	80.96	73.66	85.80
1580	80.80	73.52	85.64
1590	80.65	73.38	85.47
1600	80.49	73.24	85.31
1610	80.33	73.09	85.14
1620	80.18	72.95	84.98
1630	80.02	72.81	84.81
1640	79.87	72.67	84.65
1650	79.71	72.53	84.48
1660	79.55	72.39	84.32
1670	79.40	72.24	84.15
1680	79.24	72.10	83.99
1690	79.09	71.96	83.82
1700	78.93	71.82	83.66
1710	78.77	71.68	83.49
1720	78.62	71.53	83.32
1730	78.46	71.39	83.16
1740	78.31	71.25	82.99
1750	78.15	71.11	82.83
1760	77.99	70.97	82.66
1770	77.84	70.82	82.50
1780	77.68	70.68	82.33
1790	77.53	70.54	82.17
1800	77.37	70.40	82.00
1810	77.21	70.26	81.84
1820	77.06	70.11	81.67
1830	76.90	69.97	81.51

DIVISION 2 EECW PUMP PERFORMANCE CURVE AND ACCEPTANCE CRITERIA TABLE FOR PROCEDURE 24.207.08

$$\Delta P_r = 101.09 - 0.0149 Q_r$$

where: ΔP_r = Reference Differential Pressure, psi

Q_r = Reference Flow, gpm

Acceptable Range: $0.91\Delta P_r \leq \Delta P \leq 1.06\Delta P_r$

Required Action Range: Low $\Delta P < 0.91\Delta P_r$
High $\Delta P > 1.06\Delta P_r$

Note: The allowable minimum ΔP multiplier of 0.91 is more conservative than the 0.90 value required in Table ISTB-5100-1. This conservatism was added as an additional measure to account for the slight reduction in trendability associated with the use of a reference curve versus a fixed reference point.

Table 3 Div 2 EECW Pump P4400C001B Baseline Data Reference IST Evaluation 08-015

Curve derivation is based on the following actual data points obtained 10/23/07 and 10/25/07 per WO 25134233 (and 1/9/08 per TCN 11800)				
Test Point	**Flow**	**DP**	Disch Press	Suct Press
1	**990**	**86.2**	117.8	31.6
2	**1170**	**83.9**	115.4	31.5
3	**1448**	**79.4**	110.5	31.1
4	**1485**	**78.8**	109.9	31.1
5	**1495**	**79.6**	110.5	30.9
6	**1545**	**78.1**	109.4	31.3
7	**1615**	**77**	108.1	31.1
8	**1730**	**75.1**	106.2	31.1
9	**1753.3**	**75.2**	105.6	30.4

Table 4 Div 2 EECW Pump P4400C001B Reference IST Evaluation 08-015
Linear regression derivation of DP and calculated DP criteria

Derivation and criteria table - Linear regression: y = -0.0149x + 101.09 where x = flow & y = DP [**R = 0.99641**] and criteria basis of -9% min DP / +6% max DP acceptance)
Procedural test flow range is limited to 1450 - 1710 GPM

FLOW gpm	DP_{der}	DP_{min}	DP_{max}
1450	79.49	72.33	84.25
1460	79.34	72.20	84.10
1470	79.19	72.06	83.94
1480	79.04	71.92	83.78
1490	78.89	71.79	83.62
1500	78.74	71.65	83.46
1510	78.59	71.52	83.31
1520	78.44	71.38	83.15
1530	78.29	71.25	82.99
1540	78.14	71.11	82.83
1550	77.99	70.98	82.67
1560	77.84	70.84	82.52
1570	77.69	70.70	82.36
1580	77.54	70.57	82.20
1590	77.39	70.43	82.04
1600	77.24	70.30	81.89
1610	77.09	70.16	81.73
1620	76.94	70.03	81.57
1630	76.79	69.89	81.41
1640	76.64	69.76	81.25
1650	76.49	69.62	81.10
1660	76.34	69.48	80.94
1670	76.19	69.35	80.78
1680	76.04	69.21	80.62
1690	75.89	69.08	80.46
1700	75.74	68.94	80.31
1710	75.61	68.81	80.15

Relief Request PRR-004

Residual Heat Removal Pump Vibration Alert Limits

Proposed Alternative in Accordance with 10 CFR 50.55a(a)(3)(i)

Alternative Provides Acceptable Level of Quality and Safety

1. ASME Code Component(s) Affected

Pump	Name	Code Class	ISI Drawing
E1102C001A	Residual Heat Removal Pump A	2	6M721-5813-2
E1102C001B	Residual Heat Removal Pump B	2	6M721-5813-1
E1102C001C	Residual Heat Removal Pump C	2	6M721-5813-2
E1102C001D	Residual Heat Removal Pump D	2	6M721-5813-1

2. Applicable Code Edition and Addenda

ASME OM Code 2004 Edition, no Addenda

3. Applicable Code Requirement

ISTB Table ISTB-5121-1, "Centrifugal Pump Test Acceptance Criteria"

4. Reason for Request

Pursuant to 10 CFR 50.55a, "Codes and Standards," paragraph (a)(3)(i), relief is requested from the vibration criteria requirements of ASME OM Code ISTB Table ISTB-5121-1 during the Group A or biennial comprehensive pump test or any other time vibrations are taken to determine pump acceptability (i.e., post-maintenance testing, other periodic testing, etc.). The proposed alternative would provide an acceptable level of quality and safety.

Relief is requested from ISTB Table ISTB-5121-1 requirements to test the pump on an increased periodicity due to vibration levels exceeding the ISTB alert range absolute limit of 0.325 ips. This request is based on analysis of vibration and pump differential pressure data indicating that no pump degradation is taking place.

5. Proposed Alternative and Basis for Use

Fermi 2 is proposing to use an alternative vibration alert limit of 0.415 ips. This provides an alternative method that continues to meet the intended function of monitoring the pump for degradation over time while keeping the required action level unchanged.

Pump Testing Methodology

The RHR pumps at Fermi 2 are tested using a full flow recirculation test line back to the suppression pool each quarter. These pumps have a minimum flow line (per division) which is used only to protect the pump from overheating when pumping against a closed discharge valve. The mini-flow line isolation valve for each division is initially open when the pump is started, and flow is initially recirculated through the mini-flow line back to the suppression pool. Then, the full-flow test line isolation valve is throttled open to establish flow through the full-flow recirculation test line. The mini-flow line is then isolated automatically, and all flow remains through the full-flow test line for the IST test.

The RHR system is operated in the same manner and under the same conditions for each IST test, regardless of whether Fermi 2 is operating or shut down. Consequently, the pumps will experience the same potential for flow-induced, broad band vibration whenever they are tested, whether Fermi 2 is operating or shut down. As a result, this relief is requested for the inservice testing 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.).

NRC Staff Document NUREG/CP-0152

NRC Staff document NUREG/CP-0152, entitled "Proceedings of the Fourth NRC/ASME Symposium on Valve and Pump Testing," dated July 15-18, 1996, included a paper entitled Nuclear Power Plant Safety Related Pump Issues, by Joseph Colaccino of the NRC staff. That paper presented four key components that should be addressed in a relief request of this type to streamline the review process. These four key components are as follows:

I. The licensee should have sufficient vibration history from inservice testing which verifies that the pump has operated at this vibration level for a significant amount of time, with any "spikes" in the data justified.

II. The licensee should have consulted with the pump manufacturer or vibration expert about the level of vibration the pump is experiencing to determine if pump operation is acceptable.

III. The licensee should describe attempts to lower the vibration below the defined code absolute levels through modifications to the pump.

IV. The licensee should perform a spectral analysis of the pump-driver system to identify all contributors to the vibration levels.

The following is a discussion of how these four key components are addressed for this relief request.

I. Vibration History (Key Component No. 1)

A. Testing Methods and Code Requirements

Inconsistent and high vibration levels on the RHR pump motors has been a condition that has existed since original installation of these pumps in the 1970's. During preoperational testing in 1984, vibrations were measured in both displacement (mils) and velocity (ips) at three locations (horizontal inline with flowpath, horizontal perpendicular to flowpath and axial) on each motor bearing and on the pump bearing. The vibration signals were recorded at multiple pump flow velocities. The intention was to baseline the vibration data throughout the expected hydraulic use range and to see if hydraulic disturbances were responsible for the observed phenomena. The data showed conclusively that the motor was vibrating with randomly distributed bursts of energy at the natural frequency of the system, in the range of 9-14 Hz. Therefore, it was determined that the hydraulic disturbances found in the piping were the source of the energy.

The monitoring of multiple vibration points was not a requirement of Section XI of the ASME Code until the adoption of the O&M Standards/Codes. The Fermi 2 first interval IST Program (which began in 1983) was committed to the 1980 Edition, Winter 1981 Addenda of Section XI. Paragraph IWP-4510 of this code required that "at least one displacement vibration amplitude shall be read during each inservice test." This code was in effect at Fermi 2 until the start of the second ten-year interval, which began in Feb 2000. The Fermi 2 second interval IST Program was committed to the 1989 Edition of Section XI, which required multiple vibration points to be recorded during IST pump testing in accordance with the ASME/ANSI Operations and Maintenance Standard, Part 6, 1987 Edition with the 1988 Addenda.

However, at Fermi 2, the first and second ten-year interval IST Program Plans did include both vibration monitoring of multiple points and use of velocity measurement instead of displacement. This was a conservative testing regime based on expectations that this level of vibration monitoring would be beneficial in terms of early identification of degradation. Because of this, readily available data exists for two vibration points on each RHR pump from July 1984 to the present and on three motor vibration points from October 1996 to the present. Various analyses of this data are included in the figures provided with this relief request.

B. Review of Vibration History Data

RHR Pump IST vibration trend graphs (Figures 1-4 in this relief request), which include data from 2002 through the present, show essentially flat or slightly upward trends. These charts also show that vibration readings for all four pumps occasionally exceed the Code alert range criteria of 0.325 ips.

Differential Pressure trend graphs (Figures 7 - 10) illustrate differential pressure data dating back to 1990 for all four RHR pumps. This data clearly shows no discernible evidence of hydraulic degradation. Average run hours for each RHR pump per cycle is approximately 300-400. There is low likelihood that motors and pumps built and maintained to exacting nuclear quality standards will suffer significant wear-related degradation over a 20-30 year lifetime with such low average run times.

C. Review of "Spikes" in Vibration Data

In reviewing the long term trend data for vibration, which includes the code-required frequency ranges (one-third pump running speed to 1000 Hz.), random spikes were observed throughout the data that resulted in values above the alert range. Most of the vibration that is measured on the motor casing is due to excitation of the structural resonances of the motor/pump by turbulent flow. These structural resonances are poorly damped and can be easily excited. Many vertical pumps exhibit similar characteristics, and it is not necessarily problematic by itself. A problem occurs when a pump has a continuous forcing function whose frequency coincides with a resonance (i.e., running speed). The forcing function in this case is flow turbulence caused in large part by the 90 degree elbow in the piping just off the pump discharge. The flow through this area generates lateral broadband forces that excite the resonances in a non-continuous fashion.

This is why the amplitude swings so dramatically on the motor and to some degree on the pump casing. See Figure 5 for an example of a single point on RHR Pump C motor that clearly shows significant variation / spiking about a fairly constant mean. Figures 12 - 14 show frequency spectrum results for 3 recorded measurements of a single location (RHR Pump motor EA1) taken 1 minute apart. The total peak values which would be recorded for IST purposes were 0.303, 0.253 and 0.195. The system goes from brief periods of excitation to brief periods of no excitation. The discharge riser is also moving side to side from the same forces. Although the discharge piping configuration is less than optimum for this application, the design poses no threat to the long-term reliability of the pump, motor or the system piping.

As illustrated previously, there have been no significant degrading trends associated with vibration data for the past fifteen years. By analyzing this data using a moving average function (averaging of the last 8 data points), the trends are relatively steady, and without the spikes that the code-required data contains. This further supports the fact that the spikes in the original code data are due to the piping-induced, non-detrimental broadband vibration occurring in the one-third to one-half pump running speed range. These spikes may exceed Code alert criteria, which triggers the corrective action process and the need to increase the testing frequency. These Code compliance actions are not appropriate or necessary because the true nominal average of the particular vibration point may be anywhere from 40-60% below the individual spike value. The Code alert triggered response is not because of true degradation that warrants remedial action, but merely data fluctuation as illustrated on attached figures 12 thru 14.

II. Consultation - Pump Manufacturer/Vibration Expert (Key Component No. 2)

A. Expert Analysis of RHR Pump Vibration issue

Each RHR Pump motor is vertically mounted to the pump casing, with the piping entering/exiting the pump casing horizontally. Each 2000 horsepower motor is 8 ft.

tall and 42 in. diameter, weighing approximately 14,000 lbs. The vendor describes the upper motor thrust bearing as having a minimum expected life of 5 years [operation]. With a conservative assumption of 500 run hours per year and appropriate lubrication activities, these bearings should last over 80 years. The pump casing is mounted on a reinforced floor pad and is approximately 4 ft. high and 6 ft. diameter. The 24 in. suction piping enters the room level with the pump centerline but elbows horizontally 45 degrees 10 ft. from the pump center and then another 45 degrees 6 ft. from the pump. The 20 in. discharge pipe leaves the pump on nearly the same plane as the suction pipe but then elbows vertically 90 degrees at 6 ft. from pump center. Six feet up from this elbow is the pump discharge check valve and 3 ft. from the elbow is the 3 in. minimum flow piping connection. (See Figures 15 and 16 showing the pump suction and discharge piping isometrics)

Figure 17 shows the vibration monitoring points on the RHR motor/pump assembly. Points A1, A2, A3, C1 and C2 are the specified locations for InService Testing data.

ASME OM Code 2004 Section ISTB-6400 states "If the reference value of a particular parameter being measured or determined can be significantly influenced by other related conditions, then these conditions shall be analyzed[1] and documented in the record of tests (see ISTB-9000)." The footnote to "..analyzed", states "Vibration measurements of pumps may be foundation, driver, and piping dependent. Therefore, if initial readings are high and have no obvious relationship to the pump, then vibration measurements should be taken at the driver, at the foundation, and on the piping and analyzed to ensure that the reference vibration measurements are representative of the pump and that the measured vibration levels will not prevent the pump from fulfilling its function." This is exactly the case with the RHR pumps, where the flow noise significantly influences the vibration measurements of the pump and motor. The data for RHR Pump C was extensively analyzed and documented in IST Evaluation 97-042 by our on-site Level 3 Vibration Expert. Additionally, Engineering Research Report 85D15-5, Rev. 1, dated 1984, had identified the same resonant peaks in the other three RHR pumps.

This analysis identified a resonant frequency between 9 - 14 Hz. An impact test was also conducted with the pumps not running which again confirmed the 9-14 Hz resonant frequencies on the pumps. This resonance frequency, either alone or in combination with the running speed peak, occasionally results in the overall vibration amplitude exceeding the 0.325 in/sec Alert Range limit. Each structure has its own resonance frequency based on the mass and stiffness of the system. Minor changes in either of these two components will change the resonance frequency. A difference in piping and hanger design between the four RHR pumps is the cause for slight differences in the resonance frequency and therefore the vibration levels. The reason that the vibration levels change from run to run is that for a resonance frequency to "ring" it must be excited by some forcing function. In the RHR pumps this forcing function is flow noise, which causes a broad band forcing frequency that varies slightly during each run.

III. Attempts to Lower Vibration (Key Component No. 3)

As stated earlier, Engineering Research Report 85D15-5, Rev. 1, dated 1984, had identified these frequencies. At that time several attempts were made to stiffen the pump structure. These attempts only succeeded in transferring the energy to the piping. These supports were removed and the system returned to the previous configuration. When the upper motor bearing vibration data was added to the IST program and the data was found to be high, the shaft locking nut was checked along with the mounting bolts and hangers. No problems were identified. Additional vibration data was also collected and entered into a three-dimensional model (Figure 11) program. This program did not indicate any problems in either the pump or motor. Analysis of a high-resolution vibration spectrum shows the structural resonance and running speed peaks. These analyses indicate that the running speed spectral peaks remained unchanged while the resonant peak can change with each run. With the resonant frequency being a significant contributor in exceeding the alert vibration range there is little that can be done to the pump or rotating assembly (such as balancing or alignment) that will reduce this resonant vibration peak.

IV. Spectral Analysis (Key Component No. 4)

Spectral data indicates that the overall vibration levels (IST data) are primarily made up of the broad spectrum from 30 Hz up 100 Hz which undergoes random amplitudinal increases as a function of flow noise excitation. Spectral data does not indicate any problem with bearings or the rotating elements such as imbalance or misalignment. Uncoupled runs of the motors have shown very low vibration levels compared to pump running conditions. The overall peak amplitude value recorded for IST can vary by as much as 0.150 - 0.200 on readings taken a few seconds apart (Figures 12, 13 and 14). These noise-induced oscillations are neither consistent in amplitude or duration.

Basis for Code Alternative Alert Values

By this relief request Fermi 2 is proposing to increase the absolute alert limit for vibration from 0.325 in/sec to 0.415 in/sec for all four RHR pumps. The flow-induced broadband vibration occasionally causes the overall vibration value for these points to exceed 0.325 in/sec, resulting in the pumps being placed on increased test frequency. In late 2005 a single reading on RHR pump A exceeded Alert criteria. RHR pump A was placed on increased frequency and planning begun for motor replacement. The motor for RHR Pump A was replaced during RFO12 as corrective action due to exceeding the vibration alert. Initial examination of the replaced motor identified no evidence of degradation, and initial average vibration data for the new motor showed only a slight reduction compared to recent data on the old motor (Figure 6). This motor replacement was a high impact work item in the last refuel outage, incurring significant cost and dose Expert analyses and maintenance history reviews have shown that this flow-induced vibration has not resulted in noticeable degradation to the pump or motor. Additionally, the overall vibration levels, when dampened using moving-average technique, have remained essentially steady or risen only slightly over the past 15 years. Therefore, it has been demonstrated that doubling the test frequency and initiating corrective actions such as motor replacement under the current conditions does not provide additional assurance as to the condition of the pump and its ability to perform its safety function.

These new 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 Code Alert limits due to spiking. However, the more accurate moving average value for these pumps would typically still be within the original Code alert value of 0.325 in/sec at a point where any spiking in the data due to the high flow-induced broadband noise would exceed the requested 0.415 in/sec Alert limit. Therefore, corrective actions triggered by exceeding the 0.415 in/sec alert value would be taken at a point commensurate with the intent of the Code guidance.

The Fermi 2 Vibration Specialist routinely performs a spectral analysis on all data recorded during RHR pump inservice testing per procedure 47.000.02 "Mechanical Vibration Measurements for Trending". This analysis is in addition to the quantitative rendering of total vibration values recorded in the IST test procedures. The routine spectral analysis provides additional confidence in our ability to detect degradation at an early stage.

Each RHR Pump motor is also covered by various Preventive and Predictive Maintenance activities. These include:

- 10 year detailed motor condition inspection / refurb PM
- Thermography and analysis every 182 days
- Oil sampling and analysis every 92 days
- Annual motor PM including phase to phase winding tests, insulation checks and exterior cleaning

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

<u>Conclusions</u>

Several expert evaluations have documented that no internal pump or motor degradation is occurring due to the piping-induced vibration, which has been present since the pre-operational testing time period. The available vibration data over the past fifteen years and differential pressure data over nearly the past eleven years supports this fact. A maintenance history review and a review of thermography and oil analyses results further supports these conclusions.

Vibration data analysis clearly shows significant variations which are attributable to the external influence of the flow noise. These variations have frequently crossed the ASME Code Alert threshold of 0.325 in/sec and triggered unnecessary responses.

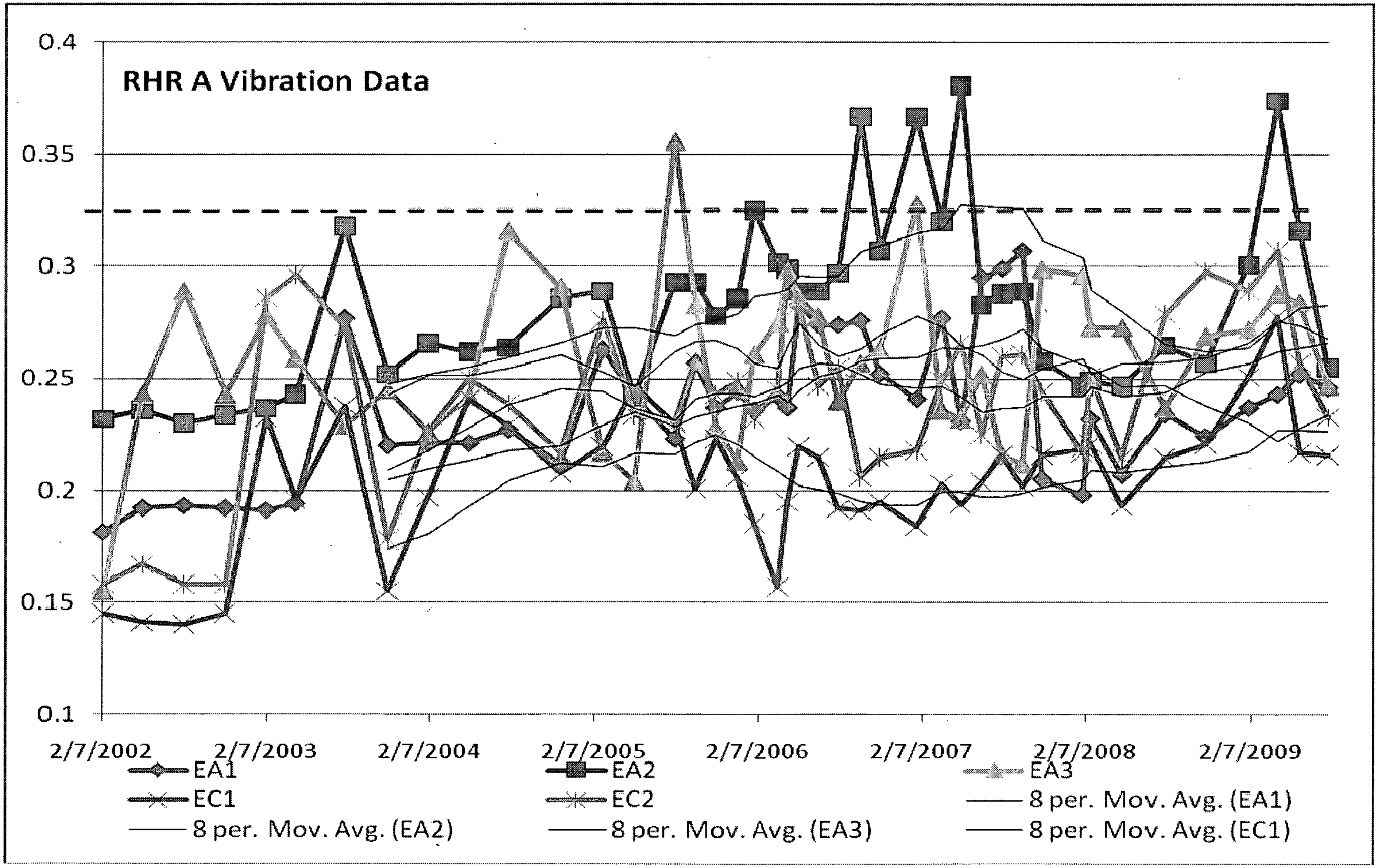
Based on this information, Fermi 2 concludes that doubling the test frequency and initiating costly corrective actions for the RHR pump motors at the 0.325 in/sec Code Alert limit does not provide additional information nor does it provide additional assurance as to the condition of the pumps and their ability to perform their safety function. Testing of these pumps on an increased frequency and performing the associated corrective actions places an unnecessary burden on Fermi 2 resources. Establishing an Alert limit of 0.415 in/sec provides for necessary margin above the normal and expected vibration levels encountered with these components to prevent exceeding the Alert limit due to the data fluctuations caused by the system flow induced noise.

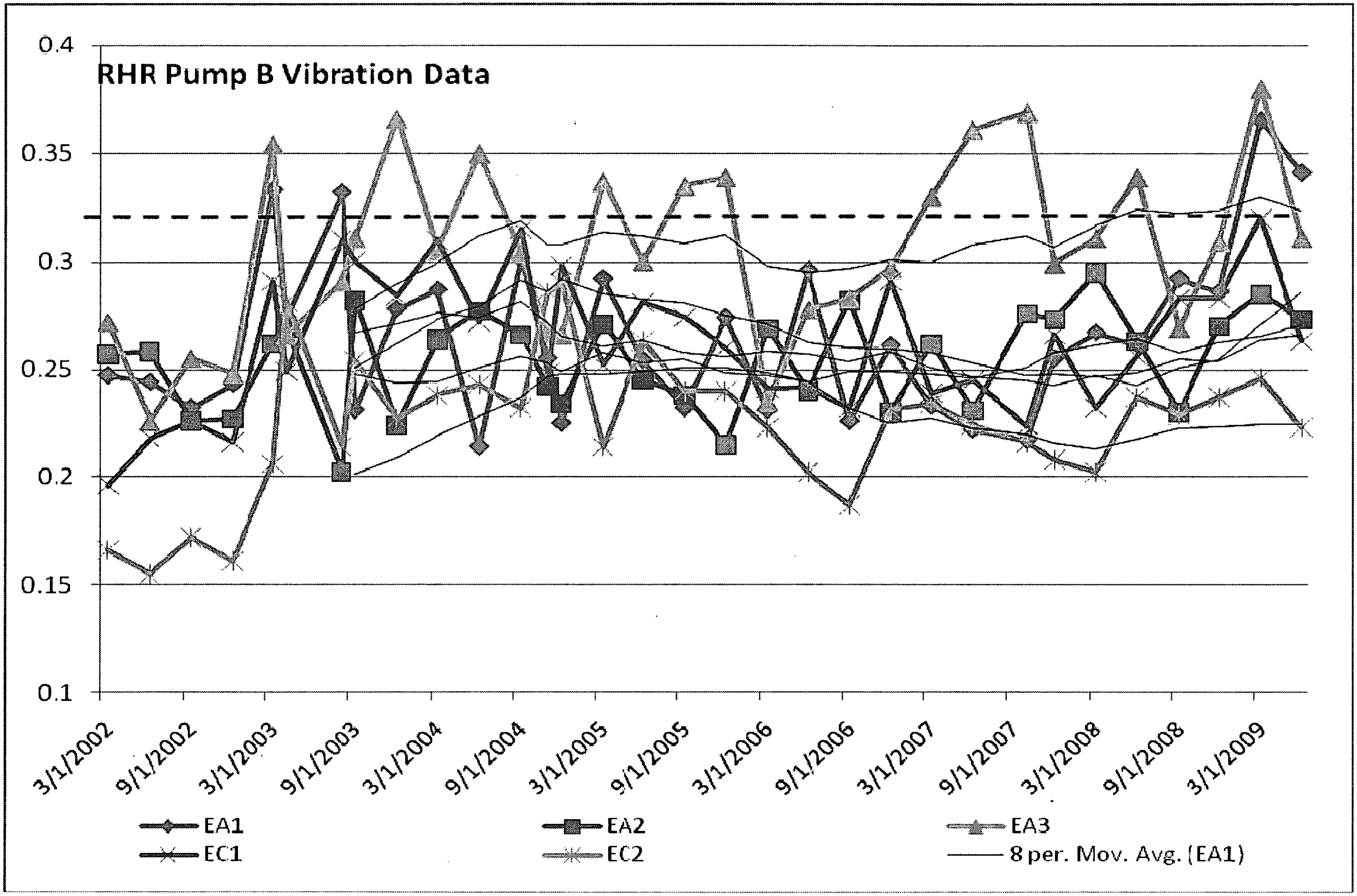
6. Duration of Proposed Alternative

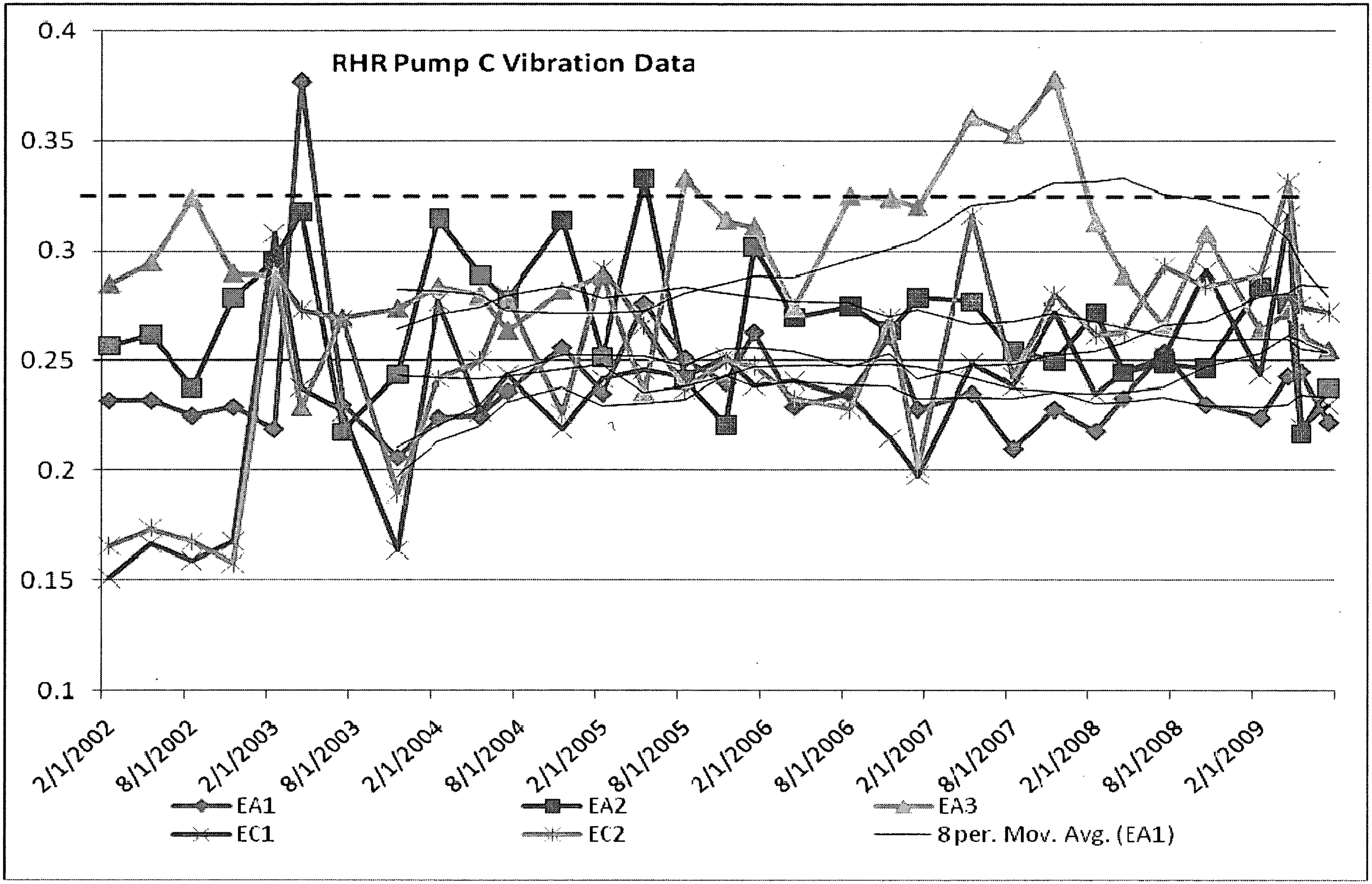
This proposed alternative will be used for the entire 3^{rd} 120 month interval

7. Precedents

- Byron Station Relief Request PR-2. Accession number ML020070381. Document date 2002-2-19
- Cooper Station Relief Request RP-07. Accession number ML061430021. Document date 2006-05-16
- Byron Station Relief Request PR-1. Accession number ML062230351. Document date 2006-09-07
- Fermi 2 Relief Request PRR-004. Accession number ML003684536. Document date 2000-02-17
- Cooper Station Relief Request RP-06. Accession number ML040560318. Document date 2004-02-25


RHR A Vibration Data
0.4
0.35
0.3
0.25
0.2
0.15
0.1
2/7/2002
2/7/2003
2/7/2004
2/7/2005
2/7/2006
2/7/2007
2/7/2008
2/7/2009
EA1
EA2
EA3
EC1
EC2
8 per. Mov. Avg. (EA1)
8 per. Mov. Avg. (EA2)
8 per. Mov. Avg. (EA3)
8 per. Mov. Avg. (EC1)


RHR Pump B Vibration Data
0.4
0.35
0.3
0.25
0.2
0.15
0.1
3/1/2002
9/1/2002
3/1/2003
9/1/2003
3/1/2004
9/1/2004
3/1/2005
9/1/2005
3/1/2006
9/1/2006
3/1/2007
9/1/2007
3/1/2008
9/1/2008
3/1/2009
EA1
EA2
EA3
EC1
EC2
8 per. Mov. Avg. (EA1)


RHR Pump C Vibration Data
0.4
0.35
0.3
0.25
0.2
0.15
0.1
2/1/2002
8/1/2002
2/1/2003
8/1/2003
2/1/2004
8/1/2004
2/1/2005
8/1/2005
2/1/2006
8/1/2006
2/1/2007
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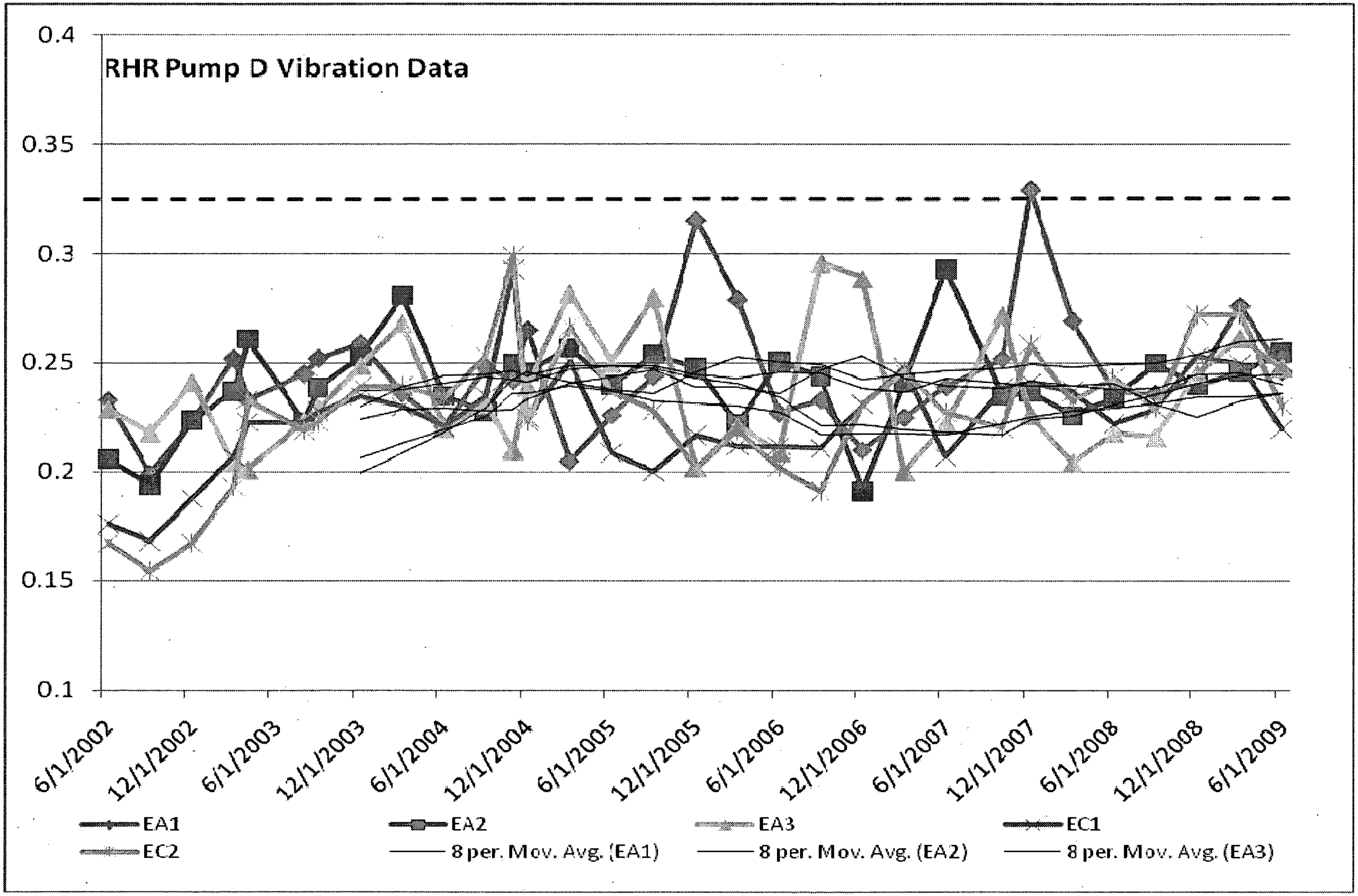
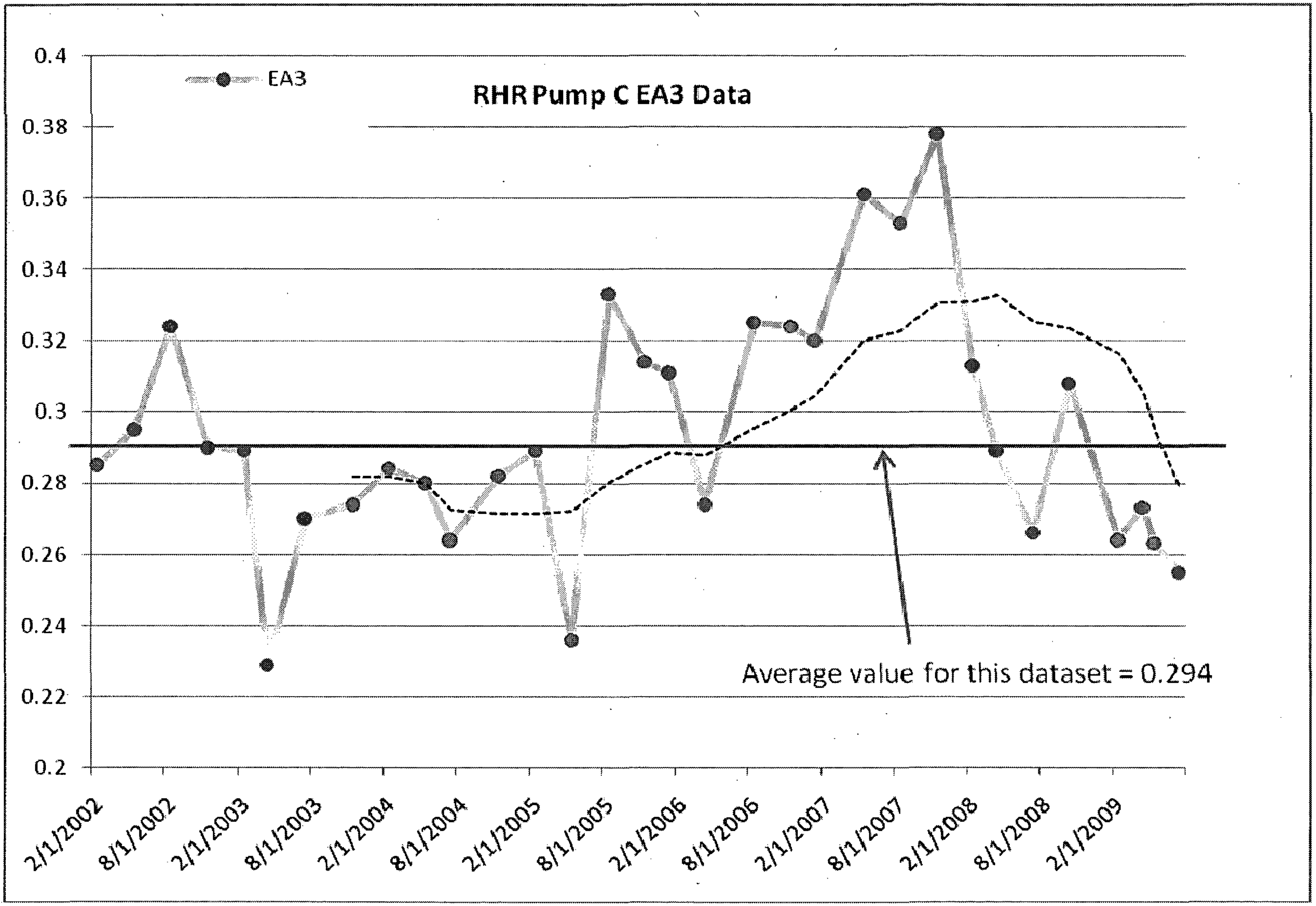
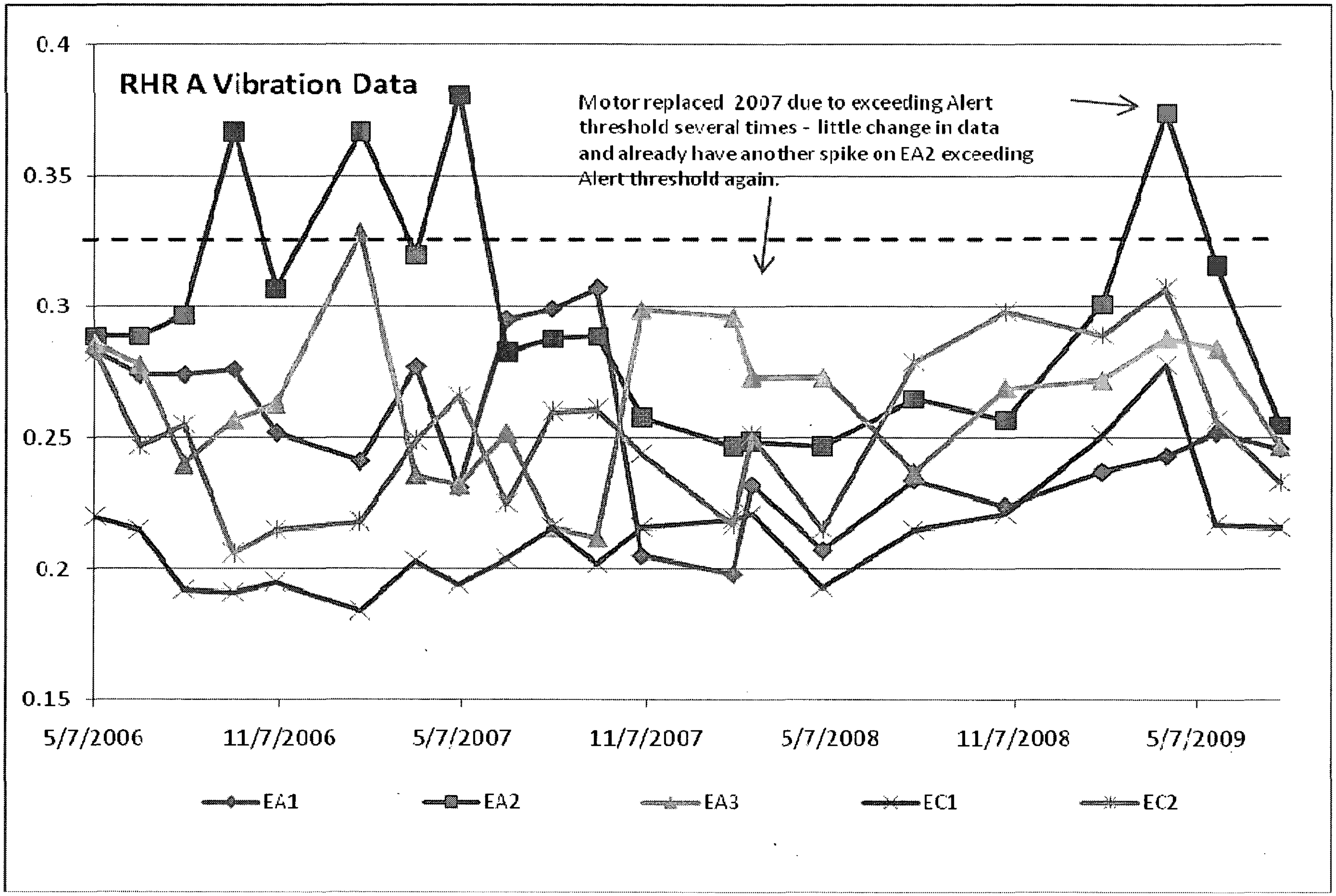
EC2
8 per. Mov. Avg. (EA1)


RHR Pump D Vibration Data
0.4
0.35
0.3
0.25
0.2
0.15
0.1
6/1/2002
12/1/2002
6/1/2003
12/1/2003
6/1/2004
12/1/2004
6/1/2005
12/1/2005
6/1/2006
12/1/2006
6/1/2007
12/1/2007
6/1/2008
12/1/2008
6/1/2009
EA1
EA2
EA3
EC1
EC2
8 per. Mov. Avg. (EA1)
8 per. Mov. Avg. (EA2)
8 per. Mov. Avg. (EA3)


RHR Pump C EA3 Data
EA3
0.4
0.38
0.36
0.34
0.32
0.3
0.28
0.26
0.24
0.22
0.2
2/1/2002
8/1/2002
2/1/2003
8/1/2003
2/1/2004
8/1/2004
2/1/2005
8/1/2005
2/1/2006
8/1/2006
2/1/2007
8/1/2007
2/1/2008
8/1/2008
2/1/2009
Average value for this dataset = 0.294


RHR A Vibration Data
Motor replaced 2007 due to exceeding Alert threshold several times - little change in data and already have another spike on EA2 exceeding Alert threshold again.
0.4
0.35
0.3
0.25
0.2
0.15
5/7/2006
11/7/2006
5/7/2007
11/7/2007
5/7/2008
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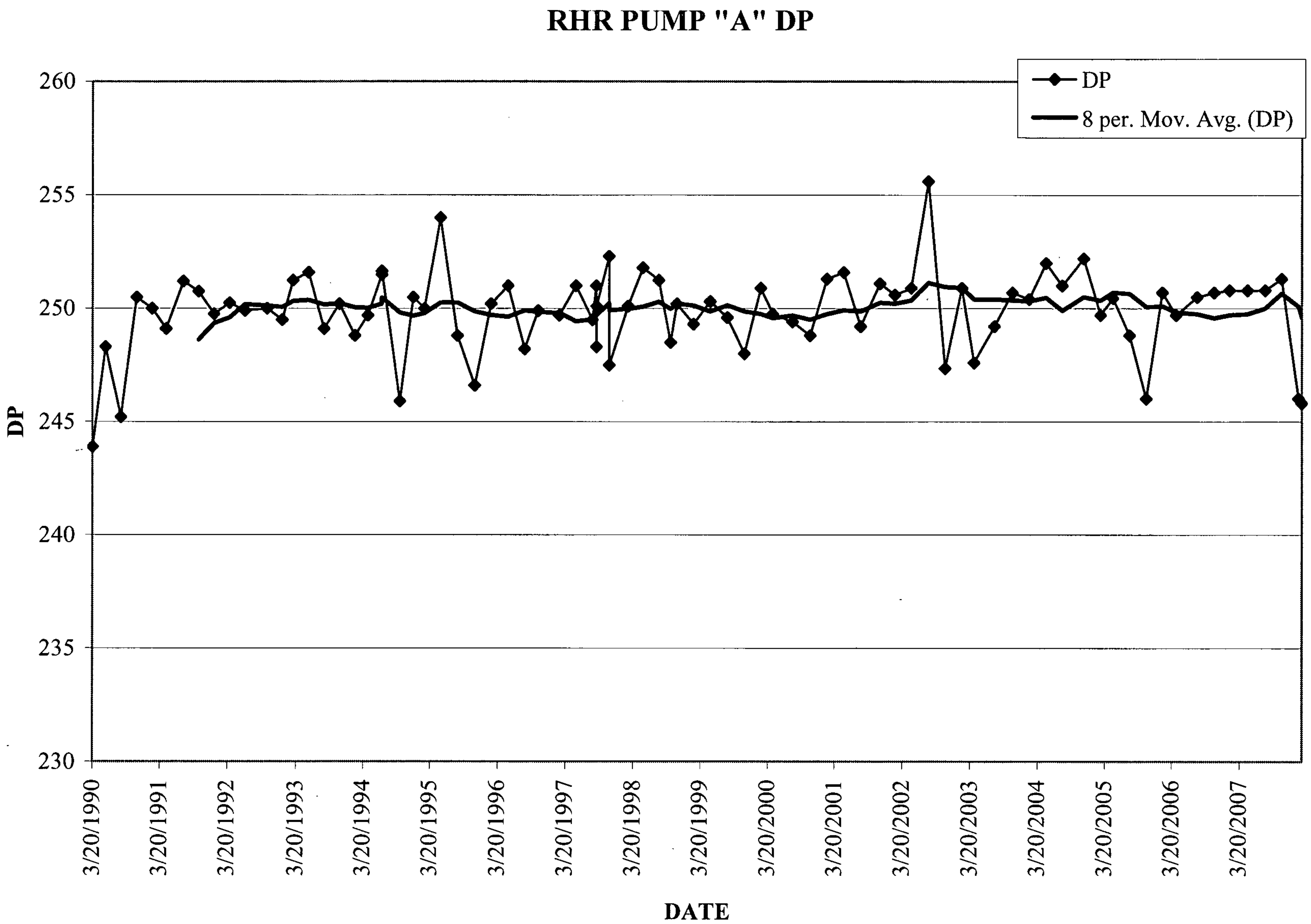
EA1
EA2
EA3
EC1
EC2


RHR PUMP "A" DP
DP
8 per. Mov. Avg. (DP)
260
255
250
245
240
235
230
3/20/1990
3/20/1991
3/20/1992
3/20/1993
3/20/1994
3/20/1995
3/20/1996
3/20/1997
3/20/1998
3/20/1999
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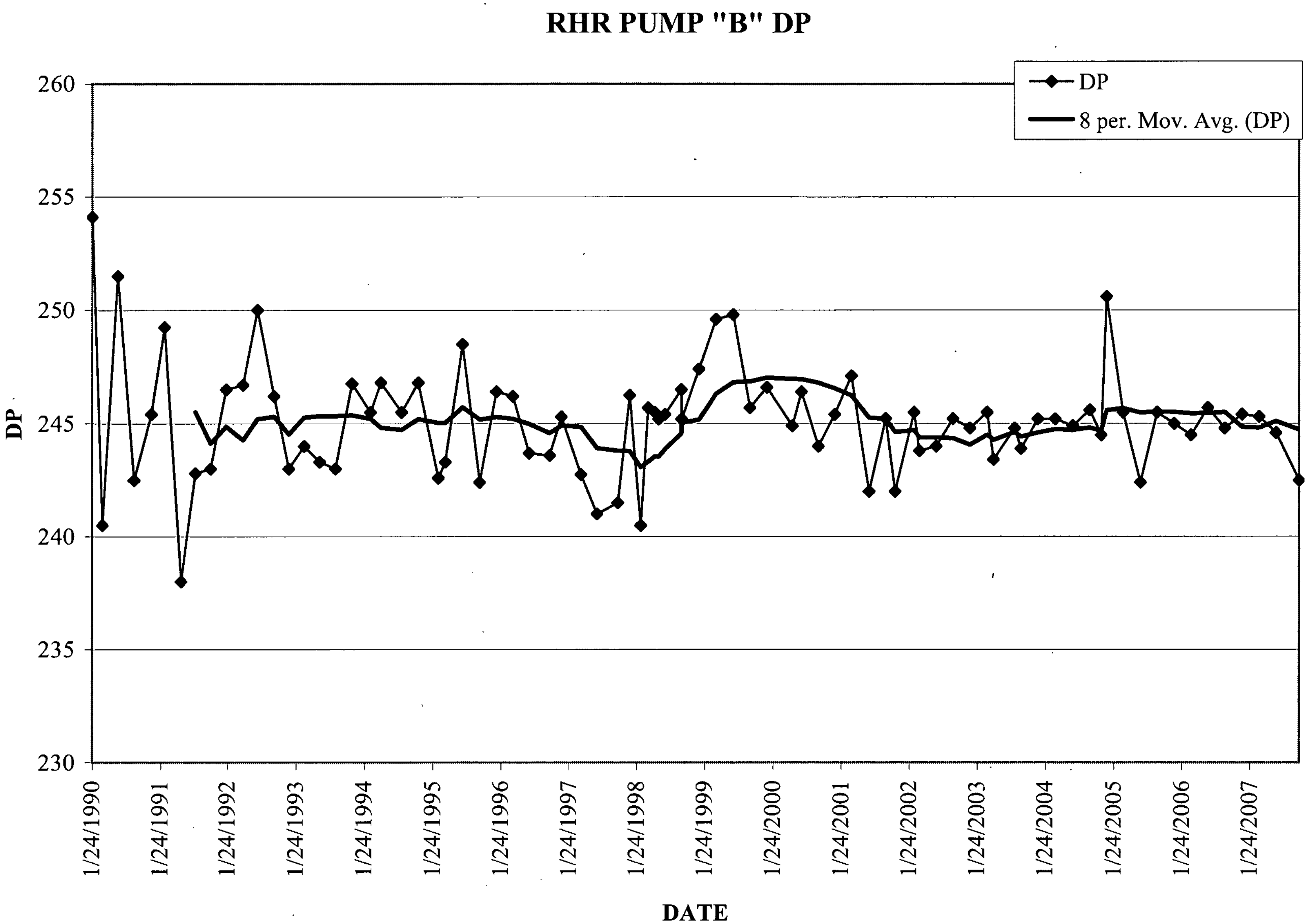
3/20/2006
3/20/2007
DATE


RHR PUMP "B" DP
DP
8 per. Mov. Avg. (DP)
260
255
250
245
240
235
230
DP
1/24/1990
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1/24/1992
1/24/1993
1/24/1994
1/24/1995
1/24/1996
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1/24/1998
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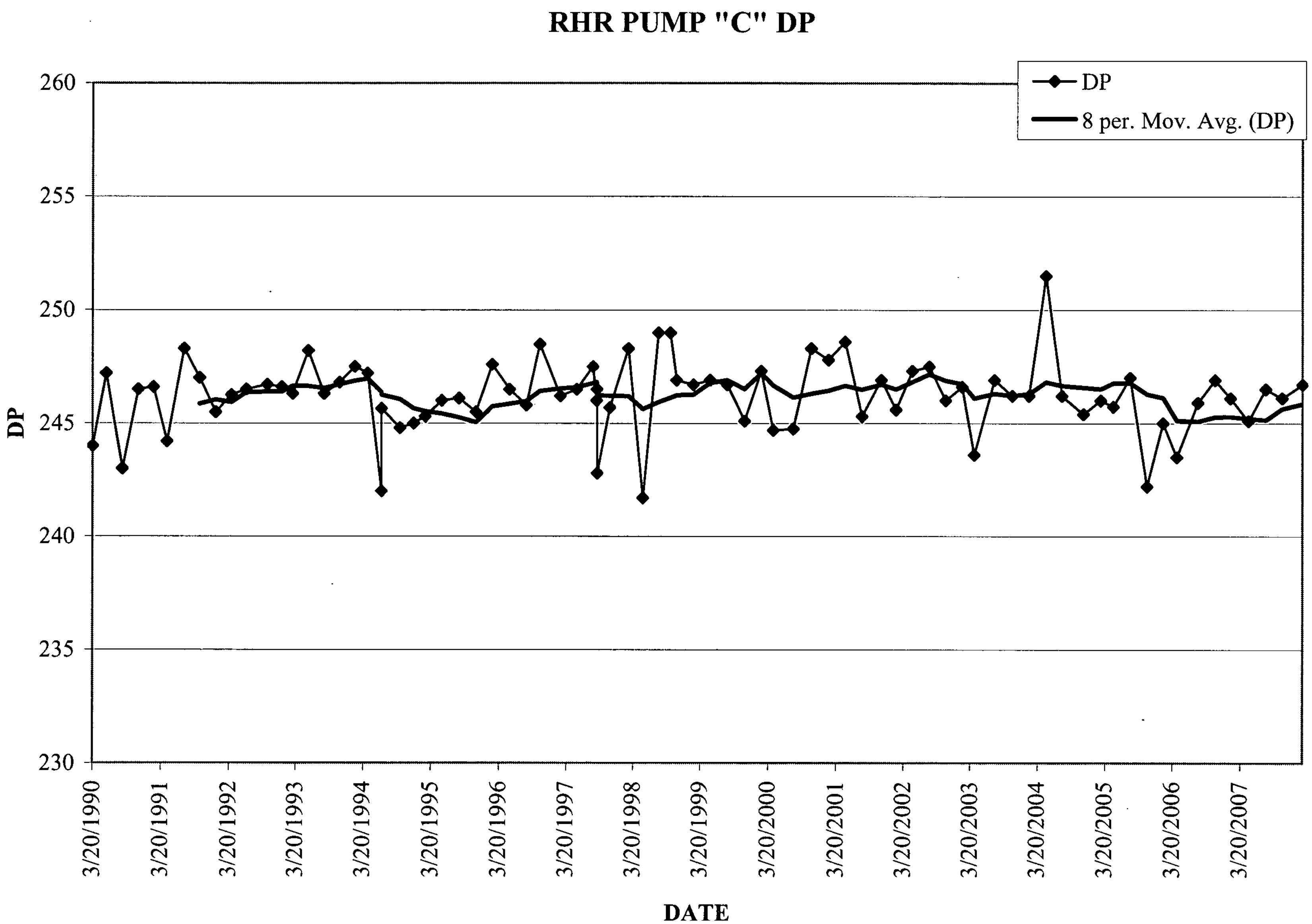
1/24/2006
1/24/2007
DATE


RHR PUMP "C" DP
DP
8 per. Mov. Avg. (DP)
260
255
250
245
240
235
230
DP
3/20/1990
3/20/1991
3/20/1992
3/20/1993
3/20/1994
3/20/1995
3/20/1996
3/20/1997
3/20/1998
3/20/1999
3/20/2000
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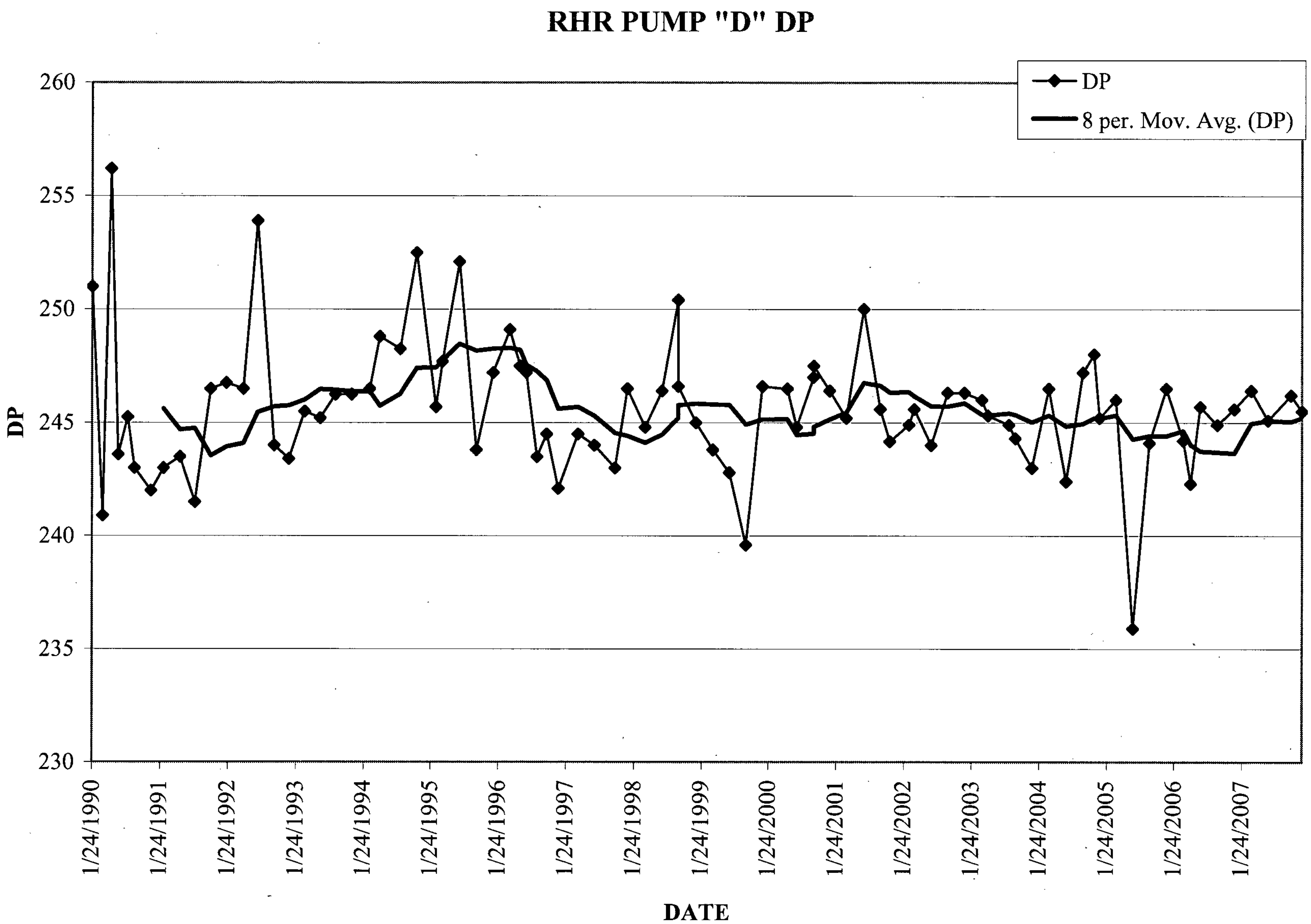
3/20/2006
3/20/2007
DATE


RHR PUMP "D" DP
DP
8 per. Mov. Avg. (DP)
260
255
250
245
240
235
230
DP
1/24/1990
1/24/1991
1/24/1992
1/24/1993
1/24/1994
1/24/1995
1/24/1996
1/24/1997
1/24/1998
1/24/1999
1/24/2000
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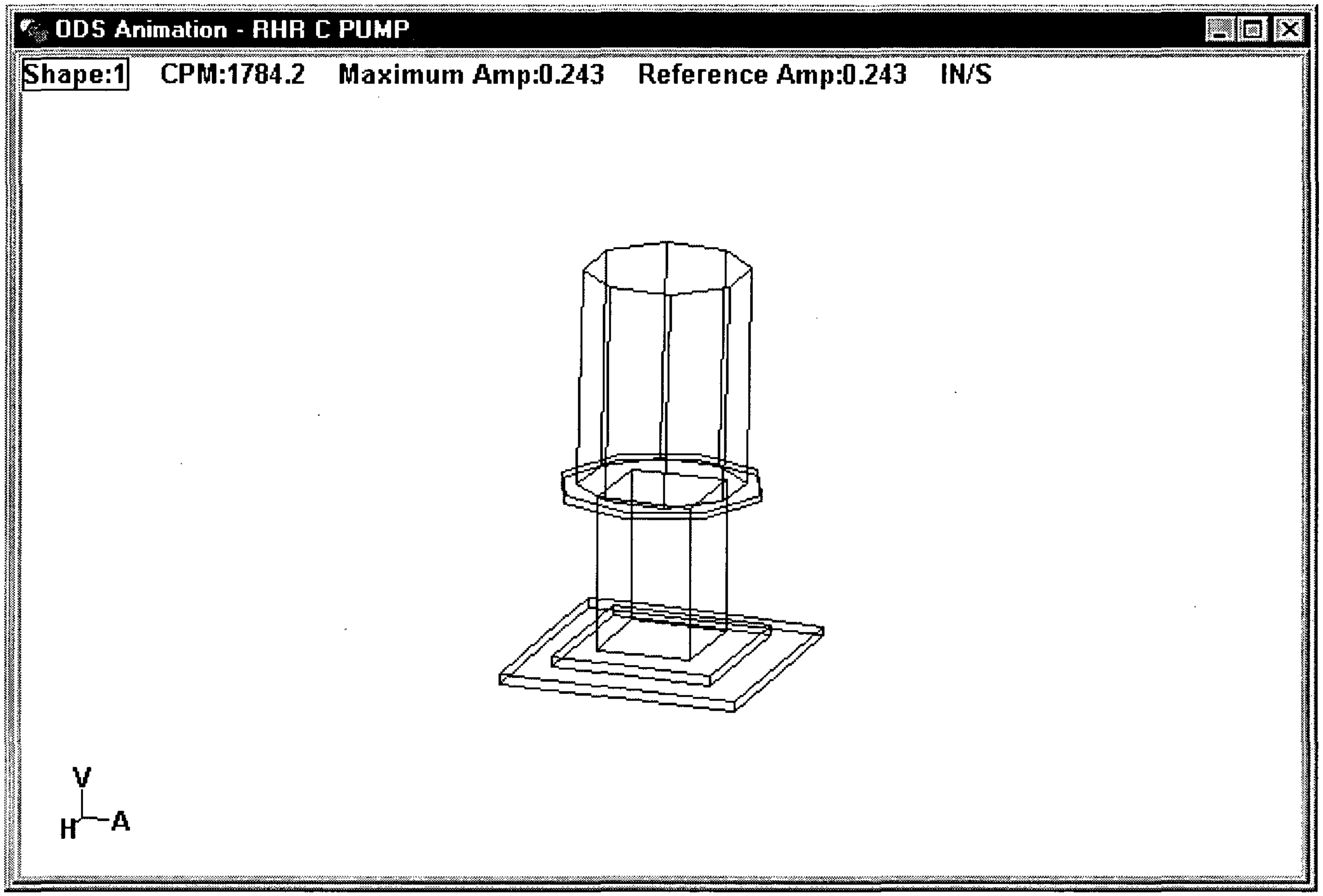
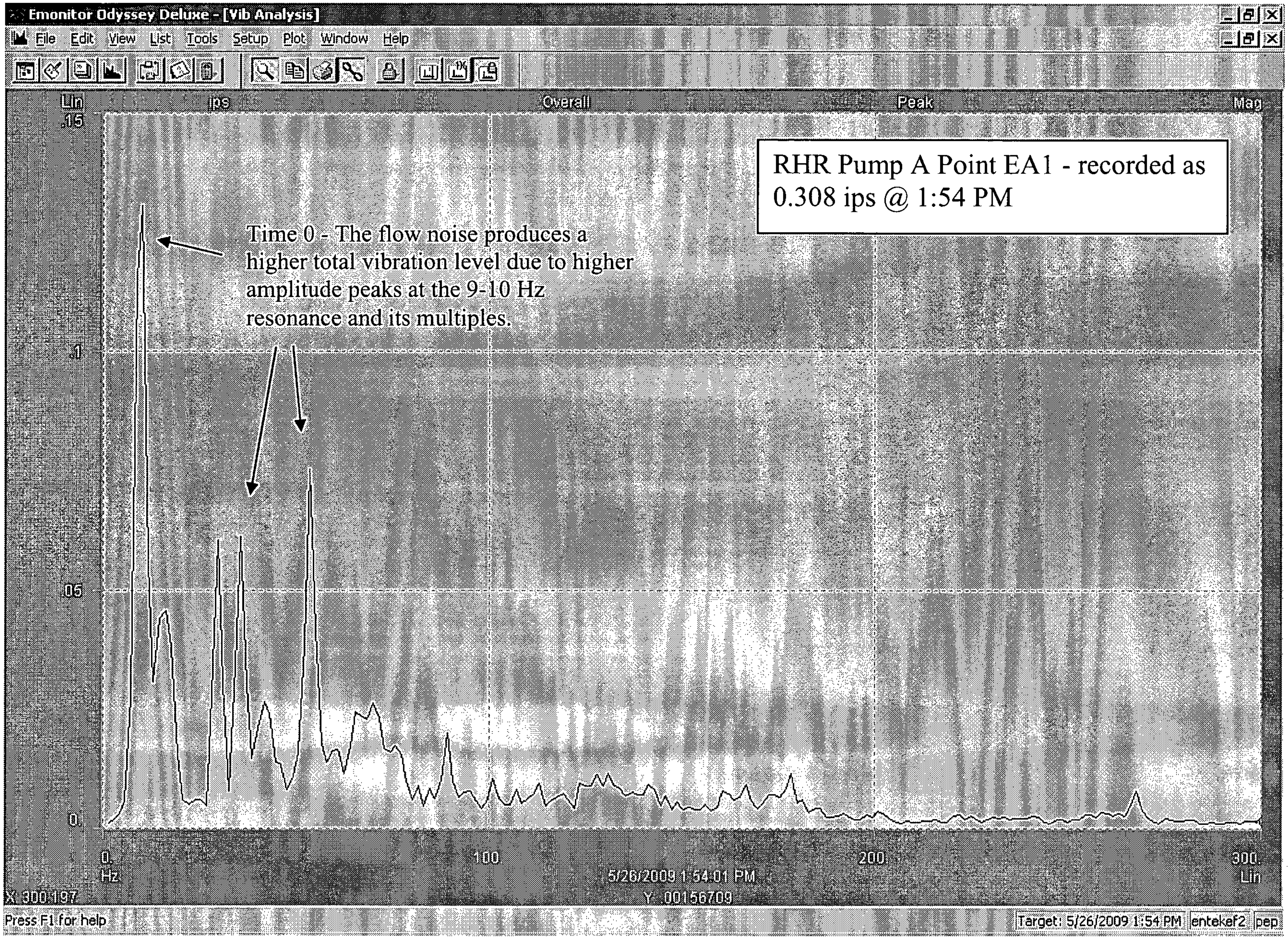
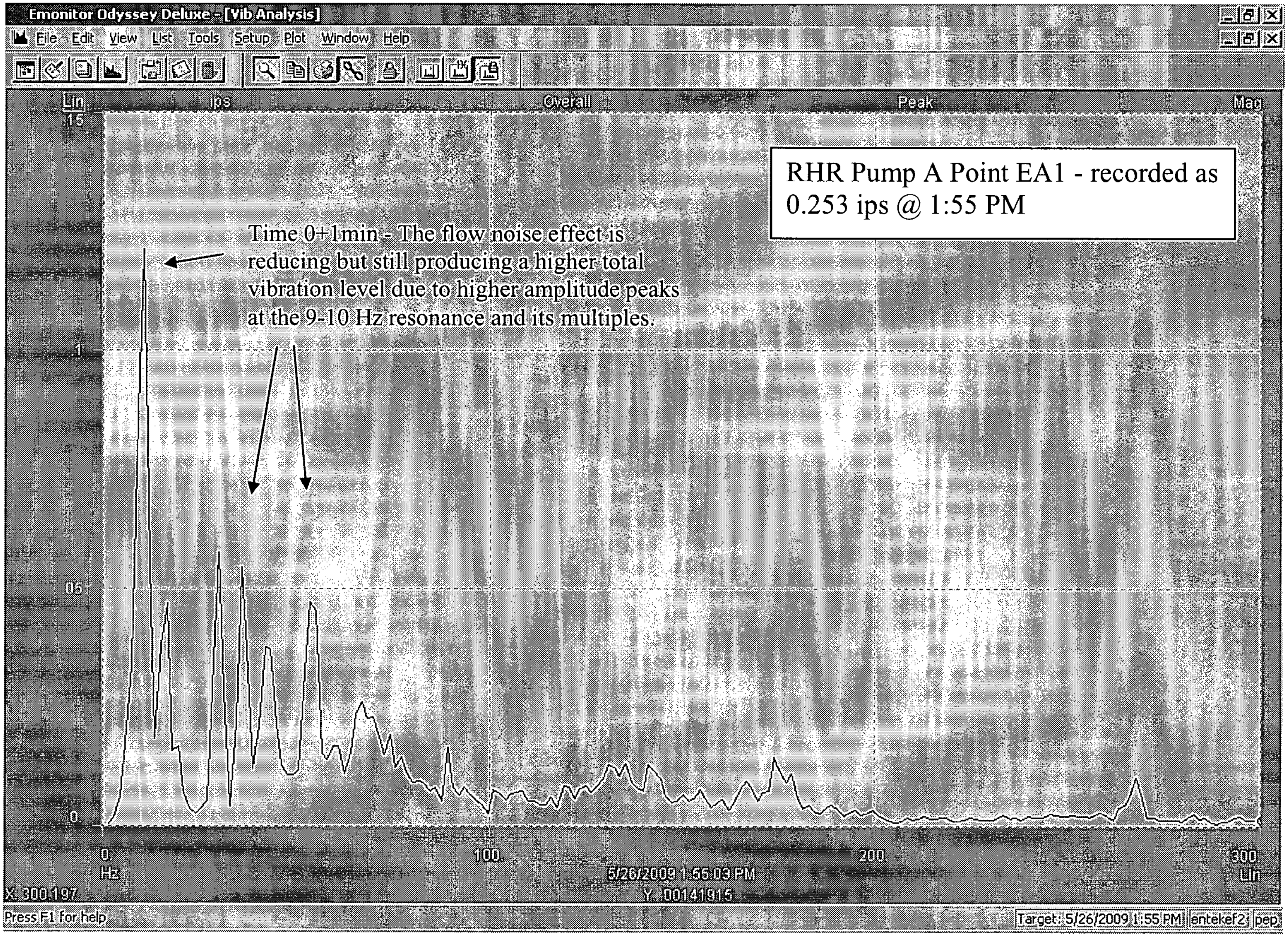
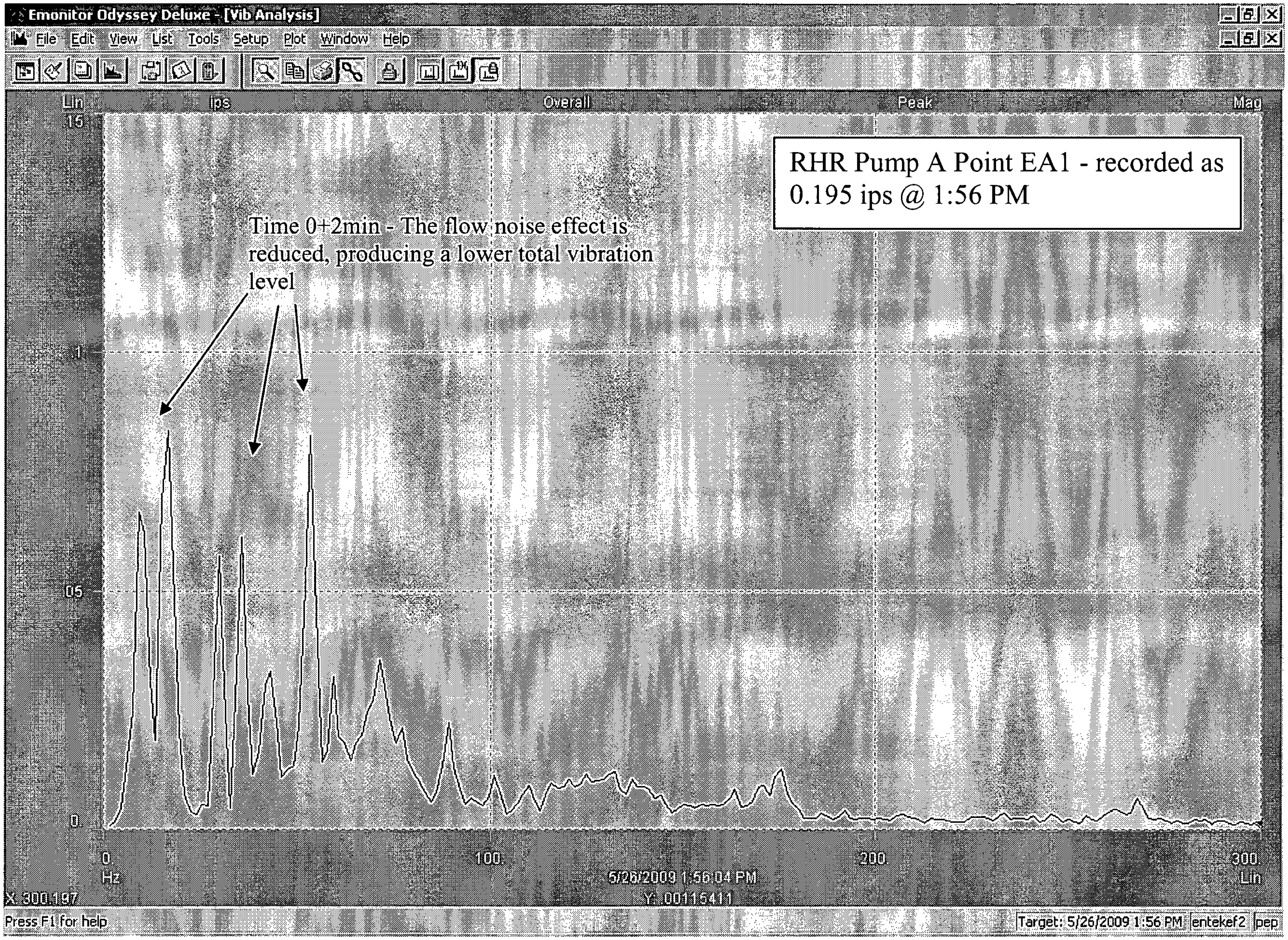
1/24/2005
1/24/2006
1/24/2007
DATE

3 Dimensional Model

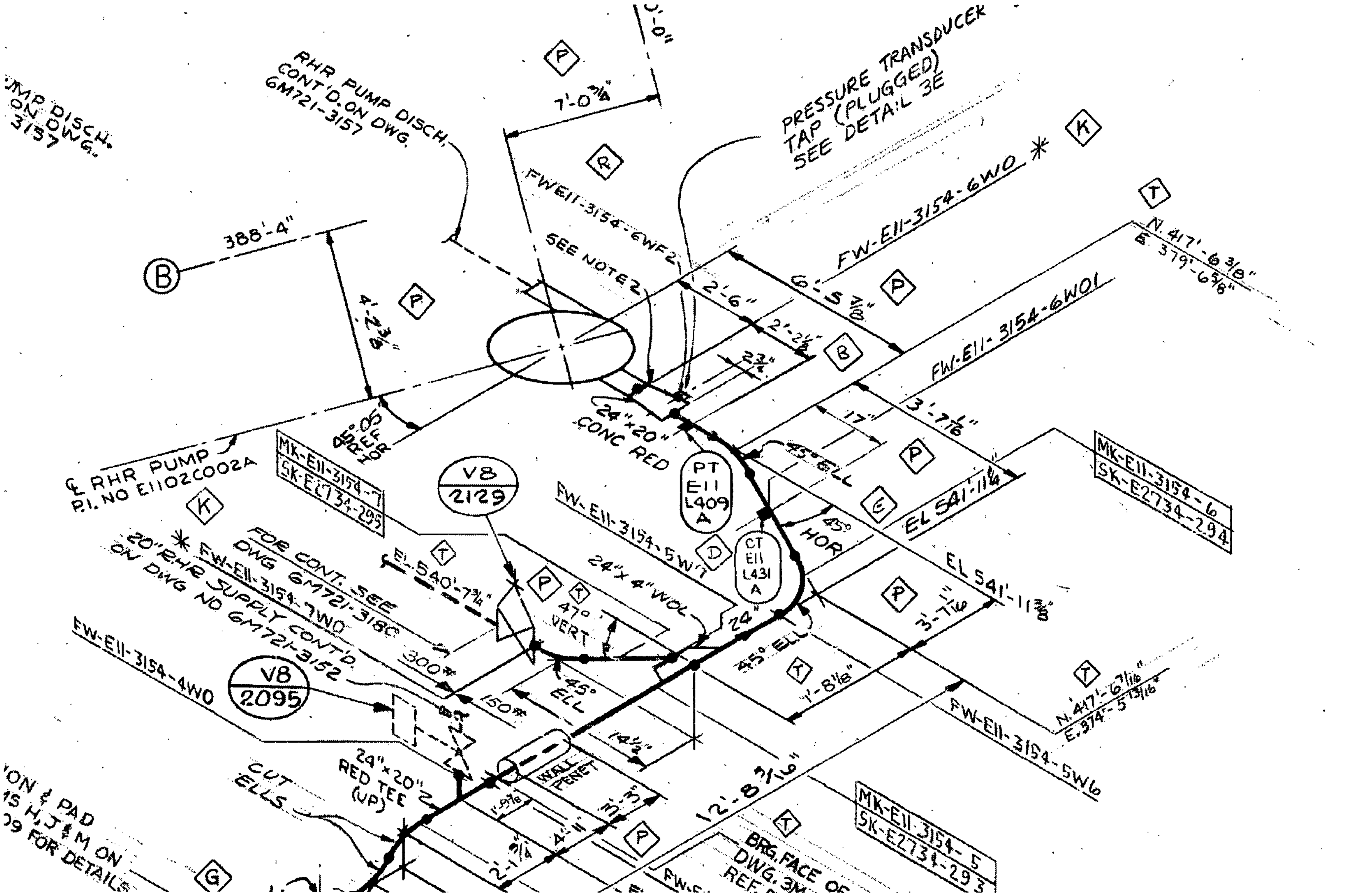



Emonitor Odyssey Deluxe - [Vib Analysis]
File Edit View List Tools Setup Plot Window Help
Lin
ips
Overall
Peak
Mag
.15
.1
.05
0.
RHR Pump A Point EA1 - recorded as 0.308 ips @ 1:54 PM
Time 0 - The flow noise produces a higher total vibration level due to higher amplitude peaks at the 9-10 Hz resonance and its multiples.
0.
Hz
100.
200.
300.
Lin
5/26/2009 1:54:01 PM
X: 300.197
Y: .00156709
Press F1 for help
Target: 5/26/2009 1:54 PM
entekef2
pep

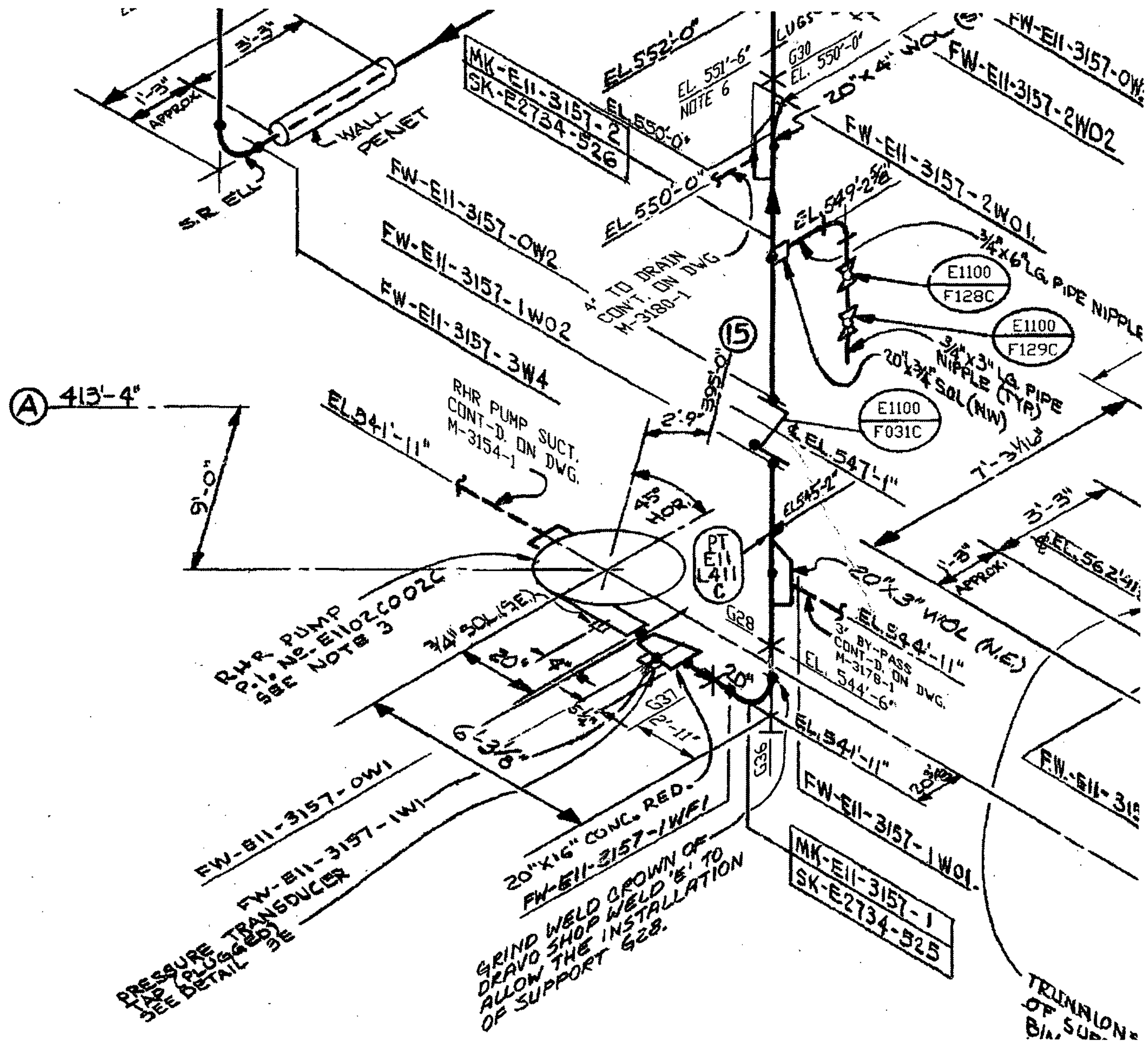

Emonitor Odyssey Deluxe - [Vib Analysis]
File Edit View List Tools Setup Plot Window Help
Lin
ips
Overall
Peak
Mag
RHR Pump A Point EA1 - recorded as 0.253 ips @ 1:55 PM
Time 0+1min - The flow noise effect is reducing but still producing a higher total vibration level due to higher amplitude peaks at the 9-10 Hz resonance and its multiples.
0.
Hz
100.
200.
300.
Lin
5/26/2009 1:55:03 PM
Press F1 for help
Target: 5/26/2009 1:55 PM


Emonitor Odyssey Deluxe - [Vib Analysis]
File Edit View List Tools Setup Plot Window Help
Lin
ips
Overall
Peak
Mag
RHR Pump A Point EA1 - recorded as 0.195 ips @ 1:56 PM
Time 0+2min - The flow noise effect is reduced, producing a lower total vibration level
.15
.1
.05
0.
0
Hz
100.
200.
300.
Lin
5/26/2009 1:56:04 PM
X: 300.197
Y: .00115411
Press F1 for help
Target: 5/26/2009 1:56 PM
entekef2
pep

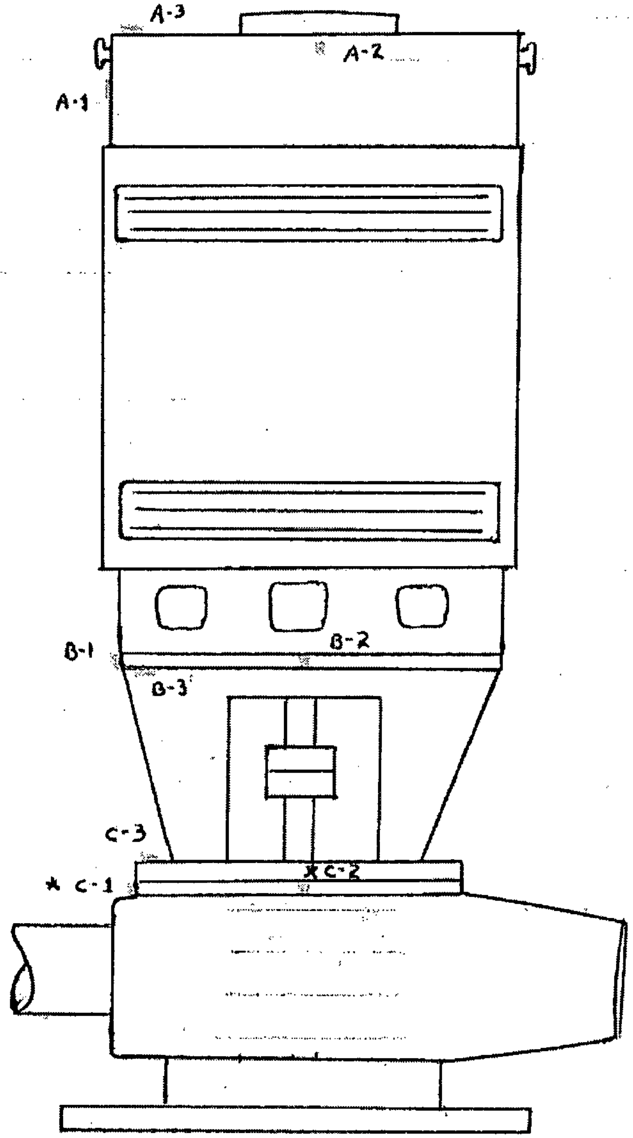
RHR PUMP A SUCTION PIPING ISOMETRIC



RHR PUMP C DISCHARGE PIPING ISOMETRIC



RHR PUMP AND MOTOR VIBRATION MONITORING POINTS



10 CFR 50.55a Relief Request PRR-005

Smooth Running Pump Vibration Acceptance Criteria

Proposed Alternative In Accordance with 10 CFR 50.55a(a)(3)(i)

Alternative Provides Acceptable Level of Quality and Safety

1. ASME Code Component(s) Affected

Pump ID	Pump Description	Code Class	OM Group (1)
E1151C001A	RHR Service Water Pump A	3	A
E1151C001B	RHR Service Water Pump B	3	A
E1151C001C	RHR Service Water Pump C	3	A
E1151C001D	RHR Service Water Pump D	3	A
P4400C001A	Emergency Equip Cooling Water Div 1 Pump	3	B
P4400C001B	Emergency Equip Cooling Water Div 2 Pump	3	B
P4400C002A	EECW Makeup Div 1 Pump	3	B
P4400C002B	EECW Makeup Div 2 Pump	3	B
P4500C002A	Emergency Equip Service Water South Pump	3	B
P4500C002B	Emergency Equip Service Water North Pump	3	B
R3000C001	EDG 11 Diesel Fuel Oil Xfer Pump A	3	B
R3000C002	EDG 12 Diesel Fuel Oil Xfer Pump A	3	B
R3000C003	EDG 11 Diesel Fuel Oil Xfer Pump B	3	B
R3000C004	EDG 12 Diesel Fuel Oil Xfer Pump B	3	B
R3000C009	EDG 13 Diesel Fuel Oil Xfer Pump A	3	B
R3000C010	EDG 14 Diesel Fuel Oil Xfer Pump A	3	B
R3000C011	EDG 13 Diesel Fuel Oil Xfer Pump B	3	B
R3000C012	EDG 14 Diesel Fuel Oil Xfer Pump B	3	B
R3001C005	EDG 11 DG Service Water Pump	3	B
R3001C006	EDG 12 DG Service Water Pump	3	B
R3001C007	EDG 13 DG Service Water Pump	3	B
R3001C008	EDG 14 DG Service Water Pump	3	B

Note 1 - All listed Group B pumps have quarterly testing which includes vibration measurement.

2. **Applicable Code Edition and Addenda**

ASME OM Code 2004 Edition, No Addenda

3. **Applicable Code Requirement**

This request for relief applies only to vibration testing. ISTB-3300 requires that vibration reference values be determined from the results of preservice testing or from the results of the first inservice test. Tables ISTB 5121-1 and ISTB-5221-1 establish ranges of acceptability of reference values. Specifically, the tables require the use of 2.5 and 6 times the reference values in determining acceptable ranges of vibration unless those calculated values exceed the absolute limits specified in the Tables. ISTB-6200 requires action to be taken based upon exceeding the ranges established in Tables ISTB 5121-1 and ISTB-5221-1.

4. **Reason for Request**

Pursuant to 10 CFR 50.55a, "Codes and Standards," paragraph (a)(3)(i), relief is requested to deviate from the requirement of ASME Code ISTB-3300, Tables ISTB 5121-1 and ISTB-5221-1, and ISTB 6200. The basis of the relief request is that the proposed alternative will provide an acceptable level of quality and safety.

The listed pumps have at least one vibration reference value (V_r) that is currently less than or equal to 0.04 inches per second (ips). Small values for V_r result in very small acceptable ranges for pump operation. The acceptable ranges are defined in Tables ISTB-5121-1 and ISTB 5221-1, as less than or equal to 2.5 V_r. Based on a small acceptable range, a smooth running pump could be subject to unnecessary corrective action.

5. **Proposed Alternative and Basis for Use**

To avoid unnecessary increased frequency testing or corrective actions on pumps which are performing satisfactorily and with very low baseline vibration, a minimum velocity measurement value (V_r) of 0.04 ips will be established for velocity reference values. This minimum value will be applied to individual vibration locations where the measured reference value is less than 0.04 ips and utilized in the calculation of acceptable ranges specified in Tables ISTB 5121-1 and ISTB-5221-1.

For very small reference values, hydraulic noise and instrumentation error can be a significant portion of the reading and therefore affect the repeatability of subsequent measurements. Also, experience gathered from the predictive maintenance program has shown that changes in vibration levels in the range of 0.04 ips are not typically indicative of degradation in pump or motor condition.

10 CFR 50.55a Relief Request PRR-005

Smooth Running Pump Vibration Acceptance Criteria

When new reference values are established per ISTB-3310, ISTB-3320 or ISTB-6200(c), the measured parameters will be evaluated for each location to determine if the provisions of this relief request remain applicable. If the measured V_r is greater than 0.04 ips, the requirements of ISTB-3300 will be applied. Conversely, if a measured V_r is less than or equal to 0.04 ips, a minimum value of 0.04 ips will be used for V_r for the pumps included in the list of pumps.

In addition to the requirements of ISTB, the pumps in the ASME Inservice Testing Program are included in the sites Preventive and Predictive Maintenance Program scope. The Predictive Maintenance Program currently employs predictive monitoring techniques such as vibration monitoring and analysis beyond that required by ISTB.

All data is collected currently utilizing an accurate data acquisition system, downloaded into the Vibration PdM Program software and then analyzed for vibration magnitude and discrete frequencies. Components exhibiting abnormal vibration trends would be subjected to more advanced diagnostics such as impact testing, thermography and detailed spectral analysis. Additional parameters typically monitored and trended are bearing temperature, oil sampling and analysis.

If the measured parameters are outside the normal operating range or are determined by analysis to be trending toward an unacceptable degraded state, appropriate actions are taken that may include:

- increased monitoring to establish rate of change,
- review of component specific information to identify cause, and
- removal of the pump from service to perform maintenance.

Preventive Maintenance Program coverage typically entails periodic inspections of seals, bearings and other wear-expectant components. PM intervals vary as a function of component risk importance, type of duty and operating experience.

All of the pumps in the IST Program will remain in the Preventive and Predictive Maintenance Program scope even if certain pumps have very low vibration readings and are considered to be smooth running pumps.

All of the listed pumps are in standby systems. These pumps are typically run only for testing or other short duration system operations. On average these pumps will see less than 150 operating hours per year. The RHRSW pumps are operated slightly more often, with average annual run hours of 500 - 600. Nearly all pump degradation mechanisms are directly proportional to operating hours and thus these pumps have a very low likelihood of service-related degradation.

The following is a listing of all the applicable pumps, their individual vibration monitoring points and the current reference vibration level at each point. The points applicable to this relief request are highlighted and italicized.

Smooth Running Pump Vibration Acceptance Criteria

Pump PIS	Exam	Baseline
E1151C001A	OVVEA1	0.057
E1151C001A	OVVEA2	0.109
E1151C001A	OVVEA3	0.061
E1151C001A	*OVVEC1*	*0.017*
E1151C001A	OVVEC2	0.048
E1151C001B	OVVEA1	0.155
E1151C001B	OVVEA2	0.195
E1151C001B	OVVEA3	0.057
E1151C001B	*OVVEC1*	*0.03*
E1151C001B	*OVVEC2*	*0.034*
E1151C001C	OVVEA1	0.21
E1151C001C	OVVEA2	0.217
E1151C001C	OVVEA3	0.109
E1151C001C	*OVVEC1*	*0.038*
E1151C001C	OVVEC2	0.053
E1151C001D	OVVEA1	0.1
E1151C001D	OVVEA2	0.119
E1151C001D	OVVEA3	0.081
E1151C001D	*OVVEC1*	*0.025*
E1151C001D	*OVVEC2*	*0.026*
P4400C001A	*OVVEC1*	*0.038*
P4400C001A	OVVEC2	0.048
P4400C001A	OVVED1	0.046
P4400C001A	*OVVED2*	*0.035*
P4400C001A	*OVVED3*	*0.036*
P4400C001B	OVVEC1	0.057
P4400C001B	OVVEC2	0.113
P4400C001B	*OVVED1*	*0.033*
P4400C001B	OVVED2	0.067
P4400C001B	OVVED3	0.047
P4400C002A	*OVVEC1*	*0.022*
P4400C002A	*OVVEC2*	*0.037*
P4400C002A	*OVVED1*	*0.019*
P4400C002A	*OVVED2*	*0.025*
P4400C002A	*OVVED3*	*0.019*
P4400C002B	*OVVEC1*	*0.029*
P4400C002B	*OVVEC2*	*0.024*
P4400C002B	*OVVED1*	*0.022*
P4400C002B	OVVED2	0.042
P4400C002B	*OVVED3*	*0.028*

Pump PIS	Exam	Baseline
P4500C002A	OVVEA1	0.05
P4500C002A	OVVEA2	0.067
P4500C002A	OVVEA3	0.044
P4500C002A	*OVVEC1*	*0.015*
P4500C002A	*OVVEC2*	*0.017*
P4500C002B	OVVEA1	0.041
P4500C002B	OVVEA2	0.077
P4500C002B	*OVVEA3*	*0.04*
P4500C002B	*OVVEC1*	*0.021*
P4500C002B	*OVVEC2*	*0.017*
R3000C001	*OVVEA3*	*0.021*
R3000C001	*OVVEC1*	*0.015*
R3000C001	*OVVEC2*	*0.018*
R3000C002	*OVVEA3*	*0.028*
R3000C002	*OVVEC1*	*0.021*
R3000C002	*OVVEC2*	*0.028*
R3000C003	*OVVEA3*	*0.02*
R3000C003	*OVVEC1*	*0.018*
R3000C003	*OVVEC2*	*0.02*
R3000C004	*OVVEA3*	*0.013*
R3000C004	OVVEC1	0.05
R3000C004	*OVVEC2*	*0.037*
R3000C009	*OVVEA3*	*0.034*
R3000C009	*OVVEC1*	*0.025*
R3000C009	*OVVEC2*	*0.027*
R3000C010	*OVVEA3*	*0.031*
R3000C010	*OVVEC1*	*0.04*
R3000C010	*OVVEC2*	*0.025*
R3000C011	*OVVEA3*	*0.027*
R3000C011	*OVVEC1*	*0.016*
R3000C011	OVVEC2	0.021
R3000C012	OVVEA3	0.048
R3000C012	*OVVEC1*	*0.03*
R3000C012	*OVVEC2*	*0.034*
R3001C005	OVVEA1	0.064
R3001C005	OVVEA2	0.072
R3001C005	*OVVEA3*	*0.025*
R3001C005	*OVVEC1*	*0.012*
R3001C005	*OVVEC2*	*0.02*

Smooth Running Pump Vibration Acceptance Criteria

Pump PIS	Exam	Baseline
R3001C006	OVVEA1	0.088
R3001C006	OVVEA2	0.067
R3001C006	*OVVEA3*	*0.026*
R3001C006	*OVVEC1*	*0.019*
R3001C006	*OVVEC2*	*0.022*
R3001C007	OVVEA1	0.084
R3001C007	OVVEA2	0.051
R3001C007	*OVVEA3*	*0.032*

Pump PIS	Exam	Baseline
R3001C007	*OVVEC1*	*0.023*
R3001C007	*OVVEC2*	*0.017*
R3001C008	*OVVEA1*	*0.035*
R3001C008	*OVVEA2*	*0.039*
R3001C008	*OVVEA3*	*0.013*
R3001C008	*OVVEC1*	*0.009*
R3001C008	*OVVEC2*	*0.005*

Pumps with a measured reference value at or below 0.04 ips for a specific vibration measurement location shall have subsequent test results for that location compared to an acceptable range based on 0.04 ips. This will result in a minimum alert range of 0.100 ips and required action range of 0.240 ips. In addition to the Code requirements, all pumps in the IST Program are included in and will remain in the Preventive and Predictive Maintenance Program scope regardless of their smooth running status.

All of the listed pumps are treated as Group A pumps. Vibration is measured and evaluated on a quarterly basis. This exceeds ASME Code requirements for Group B pumps.

In conclusion, using the provisions of this relief request as an alternative to the specific requirements of ISTB-3300, Tables ISTB 5121-1 and ISTB-5221-1, and ISTB 6200 will provide adequate indication of pump performance and continue to provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i) authorization to implement the proposed alternative is requested.

This is a new relief request for Fermi 2. NUREG 1482 Revision 1 Section 5.4 states that several plants have requested an alternative to the vibration acceptance criteria of Section ISTB for smooth-running, pumps, and the NRC has approved such requests. However, licensees with such approval must continue to assess the vibration data and monitor increases that may be indicative of a change.

6. Duration of Proposed Alternative

This proposed alternative will be utilized for the entire 3rd 120 month interval.

7. Precedents

- James A. Fitzpatrick Nuclear Power Plant - Relief Requests for the Fourth Interval Inservice Testing Program (TAC NOS. MD5396 through MD5404) SER dated 11/27/2007 (Request PRR-04)

- Beaver Valley Power Station, Unit Nos. 1 and 2 (BVPS-1 and 2) – Evaluation of Inservice Testing (IST) Pump Relief Request No. 8, Revisions 1K and 2I, Respectively (TAC NOS. MC3240 AND MC3241) SER dated 12/27/2004
- North Anna Power Station, Units 1 and 2 Re: Inservice Testing Program for Pump and Valves, Third Ten Year Interval Update (TAC Nos. MB2221 and MB2222); SER dated 1/28/2002

10 CFR 50.55a Relief Request PRR-006

Service Water Pumps Suction Pressure Accuracy for the Comprehensive Pump Tests

Proposed Alternative In Accordance with 10 CFR 50.55a(a)(3)(i)

Alternative Provides Acceptable Level of Quality and Safety

1. ASME Code Component(s) Affected

Pump No.	Description	ASME Class
E1151C001A	RHR Service Water Pump A	3
E1151C001B	RHR Service Water Pump B	3
E1151C001C	RHR Service Water Pump C	3
E1151C001D	RHR Service Water Pump D	3
P4500C002A	Emergency Equip Service Water South Pump	3
P4500C002B	Emergency Equip Service Water North Pump	3
R3001C005	EDG 11 DG Service Water Pump	3
R3001C006	EDG 12 DG Service Water Pump	3
R3001C007	EDG 13 DG Service Water Pump	3
R3001C008	EDG 14 DG Service Water Pump	3

2. Applicable Code Edition and Addenda

ASME OM Code 2004 Edition, no Addenda

3. Applicable Code Requirement

ISTB Table ISTB-3510-1 - Required Instrument Accuracy

4. Reason for Request

Pursuant to 10 CFR 50.55a, "Codes and Standards", paragraph (a)(3)(i), relief is requested from the requirement of ASME OM Code ISTB Table ISTB-3510-1. The basis of the relief request is that the proposed alternative would provide an acceptable level of quality and safety.

Table ISTB-3510-1 specifies the pressure instrument accuracy to be +/- 0.5 % during a comprehensive pump test. Due to the design of these pumps (vertical line shaft), the suction pressure (INLPR) is determined using measurement of RHR Reservoir level and correlation to suction lift pressure. The instrumentation for level measurement of the RHR Reservoir is calibrated to +/- 0.73% at full scale (+/- 0.22 ft @ 30 ft). The calibration cardinal point of 24 feet bounds readings obtained for pump surveillance testing. The accuracy at that cardinal point is +/- 0.92% (+/- 0.22 ft @ 24 ft.) The As Left tolerance at 24 feet for this instrument is 0.79%. These accuracy requirements represent highest obtainable for this type of instrumentation.

5. Proposed Alternative and Basis for Use

Fermi 2 proposes to perform the Quarterly testing of these pumps using the existing 0.92% accurate level instrumentation for determining suction pressure.

The objective of the service water pumps is to maintain cooling flow for the RHR Heat Exchangers, the EECW Heat Exchangers, and various Heat Exchangers on each Emergency Diesel Generator.

Each RHRSW Pump provides the motive force to move cooling water from the ultimate heat sink to the RHR heat exchanger and back to the ultimate heat sink. The RHRSW system function is to transfer heat rejected by the RHR heat exchanger.

Each EESW pump provides the motive force to provide cooling water to remove heat from the EECW system and transfer the heat load to the ultimate heat sink.

Each EDGSW Pump provides the motive force to provide cooling water to remove heat given off by the EDG lube oil cooler, inlet air cooler and the jacket coolant heat exchanger. Water is taken from and returned to the ultimate heat sink.

The RHRSW pumps are categorized as Group A since they are operated extensively during plant cold shutdown conditions as part of the Shutdown Cooling system and occasionally during power operations to support Torus Cooling Mode operations.

The EESW and DGSW pumps are categorized as Group B since they are in standby systems which are not operated routinely except for testing.

Differential pressure is determined by adding the suction lift pressure derived from RHR Reservoir level to the pump discharge pressure. Suction lift pressure is determined using a table relating RHR Reservoir level to suction lift in psi (a copy of this table is in each surveillance procedure).

The critical point accuracy of the existing level instrument is +/- 0.92% (for the 24' cardinal point). For the nominal INLPR pressure reading of 5.3 psi this equates to a maximum possible error of 5.3 x .0092 = 0.049 psi. For the comprehensive test of these pumps, the Code required accuracy for pressure is 0.5 %, or .027 psi at a measured INLPR of 5.3 psi. The difference between the permanently installed instrument accuracy and the Code required 0.5 % accuracy amounts to 0.022 psi.

Temporary Digital instrumentation is used to measure the discharge pressure (DISPR) of these pumps. The accuracy of the DISPR measurements is 0.5% of reading or better. For a bounding low DISPR reading of 32 psi the error would be 32 x .005 = 0.16 psi. Combining the INLPR error of 0.049 psi and the DISPR error of 0.16 psi using square root sum of the squares gives an overall error of +/- 0.167 psi for the DP value of 37.3 psid. This represents a 0.45% accuracy of the DP measurement.

The differential pressure parameter is affected primarily by the accuracy of the discharge pressure of the pumps. The suction lift pressure derived from RHR reservoir level has lower impact on the overall calculation of pump differential pressure. Using the installed 0.92% level instrument induces a maximum additional error of 0.022 psi. This is well within the 0.1 psi readability expectation for Operations when documenting the discharge pressure.

The RHR reservoir level transmitter is manufactured by Rosemount, with Model number 1151DP5E12. This instrument is a steel diaphragm style level instrument. The instrument loop calibration includes the transmitter, power supply and digital level indicator / recorder. The existing 0.73% of full scale reading accuracy already reflects very high accuracy requirements from the components in this loop.

In conclusion, Fermi 2 proposes to perform the Quarterly testing of these pumps using the existing 0.92% accurate level instrument for determining suction pressure. All other measurements and methods will meet the 0.5 % accuracy requirements for determining pump differential pressure. Use of this instrumentation and accuracy during quarterly testing supports the use of quarterly testing in lieu of Comprehensive Pump Testing as described in Fermi 2 Relief Request PRR-007 for Relief from Comprehensive Pump Testing for Centrifugal Pumps.

Using the provisions of this Relief Request as an alternative to the specific requirements of Table ISTB-3510-1 identified above will provide adequate indication of pump performance and continue
to provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i) Fermi 2 requests relief from the specific ISTB requirements identified in this request.

6. Duration of Proposed Alternative

This proposed alternative will be utilized for the entire 3rd 120 month interval.

7. Precedents

The following plants obtained similar relief for accuracy issues related to measurement of inlet/suction pressure. The basis argument of the low impact of suction pressure inaccuracy to the overall accuracy of the calculated DP value is the same.

- Keaunee Relief Request. Accession number 9707080332. SER date 6/30/1997.
- Fitzpatrick Relief Request. Accession number ML072910422. SER date 11/27/2007.
- McGuire Relief Request. Accession number ML052450257. SER date 9/6/2008.

10 CFR 50.55a Relief Request PRR-007

Relief from Comprehensive Pump Testing for Centrifugal Pumps

Proposed Alternative In Accordance with 10 CFR 50.55a(a)(3)(i)

Alternative Provides Acceptable Level of Quality and Safety

1. **ASME Code Component(s) Affected**

Pump No.	Description	ASME Class	Vertical Line Shaft Pump
E1102C002A	RHR Pump A	2	No
E1102C002B	RHR Pump B	2	No
E1102C002C	RHR Pump C	2	No
E1102C002D	RHR Pump D	2	No
E1151C001A	RHR Service Water Pump A	3	Yes
E1151C001B	RHR Service Water Pump B	3	Yes
E1151C001C	RHR Service Water Pump C	3	Yes
E1151C001D	RHR Service Water Pump D	3	Yes
E4101C001	High Pressure Injection Pump	2	No
P4400C001A	Emergency Equip Cooling Water Div 1 Pump	3	No
P4400C001B	Emergency Equip Cooling Water Div 2 Pump	3	No
P4500C002A	Emergency Equip Service Water South Pump	3	Yes
P4500C002B	Emergency Equip Service Water North Pump	3	Yes
R3001C005	EDG 11 DG Service Water Pump	3	Yes
R3001C006	EDG 12 DG Service Water Pump	3	Yes
R3001C007	EDG 13 DG Service Water Pump	3	Yes
R3001C008	EDG 14 DG Service Water Pump	3	Yes
T4100C040	South CCHVAC Chilled Water Pump	3	No
T4100C041	North CCHVAC Chilled Water Pump	3	No

2. **Applicable Code Edition and Addenda**

ASME OM Code 2004 Edition, No Addenda

3. **Applicable Code Requirement**

ISTB-5123 - Comprehensive Pump Testing for Centrifugal Pumps

ISTB-5223 - Comprehensive Pump Testing for Vertical Line Shaft Pumps

4. Reason for Request

Pursuant to 10 CFR 50.55a, "Codes and Standards", paragraph (a)(3)(i), relief is requested from the requirements of ASME OM Code ISTB -5123 and ISTB-5223. The basis of the relief request is that the proposed alternative would provide an acceptable level of quality and safety.

Table ISTB-3400-1 specifies a biennial frequency for Comprehensive Pump Testing (CPT) for Group A and Group B pumps. ISTB-5123 describes the specific requirements for performance of CPT for centrifugal pumps such as the RHR pumps. Performance of the biennial CPT on the RHR pumps, or the 18 other identified pumps are unnecessary since the existing quarterly pump tests are performed at sufficient flow rate to adequately monitor for pump degradation.

5. Proposed Alternative and Basis for Use

Fermi 2 proposes to perform the Quarterly Testing of these pumps individually at their existing test flow-rates or higher using 0.5 % accuracy requirements for determining pump differential pressure. Furthermore, Fermi 2 will utilize a maximum acceptable DP limit of 106% or lower for quarterly testing which is also consistent with planned Code changes applicable to CPT.

The NRC has issued Safety Evaluation Reports (SERs) that have defined "design flow" as the safety analysis required design accident flow for the system. Fermi 2 Technical Specification Surveillance Requirement (SR) 3.5.1.8 requires verification that RHR pumps can deliver a flow of ≥10,000 GPM. Per Design Calc DC-6034, LPCI design based on 2-pump operation requires a minimum single pump analyzed LOCA flow through the LPCI flow path of 11325 gpm. The present quarterly pump testing achieves at least 89% of the design accident flowrate for the RHR pumps, which meets the minimum requirement specified in ISTB-3300(e)(1). The RHR pump curves show a Best Efficiency Point of 10,000 gpm, therefore the existing IST test flowrate occurs in the region of linear flow to head relationship necessary to properly monitor for degradation. Table 1 of this relief request provides the similar data for the other 18 pumps listed in Part 1 above. The discussion above for RHR pumps is applicable to the other 18 pumps.

ASME Code Case OMN-18 will allow owners to perform a Group A test in lieu of the Comprehensive pump test if the Group A test is conducted at the comprehensive pump test flow rate using pressure instruments that meet the comprehensive pump test accuracy requirements (+/- 0.5% of full scale for analog gauges). The basis behind this change is that quarterly Group A pump testing performed at the comprehensive pump test flow rate is more effective in assessing the pumps' operational readiness, through trending, than a Group A test at lower flows in conjunction with a biennial CPT. Quarterly testing at CPT equivalent flow rates provides accurate data eight times as often as the CPT for trending purposes. This data is on a linear sloped portion of the pump curve where small changes in pump hydraulic performance are more easily detected. Therefore, when the actual CPT is identical to what would amount to a Group A test with the same instrumentation, there is no added value in performing a separate CPT with reduced required action limits.

In conclusion, using the provisions of this relief request as an alternative to the specific Comprehensive Pump Testing requirements of ISTB-5123 and ISTB-5223 will provide adequate indication of pump performance, permit early detection of component degradation, and continue to provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i) Fermi 2 requests relief from the specific ISTB requirements identified in this request.

6. Duration of Proposed Alternative

This proposed alternative will be utilized for the entire 3rd 120 month interval.

7. Precedents

- ASME has approved Code Case OMN-18 which will allow for the substitution of quarterly Group A pump testing in lieu of CPT. As a conservative exception to OMN-18, Fermi 2 will be imposing a tighter maximum DP acceptance criteria of 106% to quarterly testing.

8. Pump Test, Design and Best Efficiency Flow values

Table 1

Pump PIS	Quarterly Test flowrate (gpm)	Design Accident flowrate (gpm)[4]	Best Efficiency Point flowrate (gpm)
E1102C001A	10,200	11325	10000
E1102C001B	10,100	11325	10000
E1102C001C	10,100	11325	10000
E1102C001D	10,200	11325	10000
E1151C001A	5400	4500	5250
E1151C001B	5400	4500	5200
E1151C001C	5400	4500	5200
E1151C001D	5400	4500	5200
E4101C001A	5050	5000	6200 [1]
P4400C001A	1862	1740	2000 [2]
P4400C001B	1730	1688	2000 [2]
P4500C002A	1680	1350	1700
P4500C002B	1680	1350	1700
R3001C005	980	650	1000
R3001C006	980	650	1000
R3001C007	980	650	1000
R3001C008	980	650	1000
T4100C040	233	249	360 [3]
T4100C041	233	249	360 [3]

1 - Curve shows linear Q-P relationship from 4500 gpm - 8000 gpm (reference VMR4-3.2)
2 - Curve shows linear Q-P relationship from 1200 gpm - 2600 gpm (references C1-6858 and C1-6859)
3 - Curve shows linear Q-P relationship from 200 gpm - 420 gpm (reference VMB9-19)
4 - Notes for each system substantiating Design Accident Flow Rates as follows:

Notes identifying basis and validation information for Table 1

System	Design Basis Flow Rate notes
E1102	Tech Spec SR requires a minimum flow of 10000 gpm through test line. Per DC-6034, LPCI design based on 2-pump operation requires a minimum of 22,050 gpm delivered to the Rx vessel not including an assumed 600 gpm for core bypass. The minimum single pump analyzed LOCA flow through the LPCI flow path is therefore, 11325 gpm per pump, corresponding to 20 psig dome pressure (approx 415 ft TDH). Note that the test line is not designed to test at this high flow, but is instead limited based on the dual function of the line for torus cooling and the need to limit maximum flow through the RHR heat exchanger. Best Efficiency Point from R1-2540, R1-2541, R1-2542, R1-2543
E1151	Per DC-5803, Vol I minimum required head for testing establish based on RHRSW flow requirement to provide 8250 gpm or 4125 gpm per pump at a corresponding reservoir level of 575 ft ASL in operation against non-degraded EESW and DGSW backpressure. Best Efficiency Point (BEP) from P1-16731 (Pump A) IST Eval 84-10 (Pumps B-D)
P4400 Division 1	Per DC-6033 Vol VI DCD, 1740 gpm is minimum required flow under system test configuration (drywell and non-essential loads unisolated) with flow through "C" heat exchanger. Corresponding flow through "A" heat exchanger is 1682 gpm. Does not correspond to LOCA accident flow and head requirements with non-essential loads and drywell isolated, which requires minimum flow of 1000 gpm at a higher developed head. BEP based on C1-6858
P4400 Division 2	Per DC-6033 Vol VI DCD, 1688 gpm is minimum required flow under system test configuration (drywell and non-essential loads unisolated) with flow through "B" heat exchanger. Corresponding flow through "D" heat exchanger is 1675 gpm. Does not correspond to LOCA accident flow and head requirements with non-essential loads and drywell isolated, which requires minimum flow of 1000 gpm at a higher developed head. BEP based on C1-6859.
P4500	Per DC-5805, Vol I the minimum required head for testing established based on EESW flow requirement to provide 1350 gpm at a corresponding reservoir level of 575 ft ASL with a clean heat exchanger in operation against non-degraded RHRSW and DGSW backpressure. BEP from P1-16734
R3001	Per DC-5804, Vol I Minimum required head for testing establish based on DGSW flow requirement to provide 650 gpm at a corresponding reservoir level of 575 ft ASL in operation against non-degraded RHRSW and EESW backpressure. BEP from P1-16731.
T4100	Per DC-4322 Vol I, 249 gpm total minimum flow required: CCHVAC chiller requires 225 gpm with an additional 24 gpm pumped to support additional auxiliary cooling. Vendor manual VMB9-19 identifies the best efficiency point (79% eff) to be at 360 gpm.

10 CFR 50.55a Relief Request PRR-009

Relief from Fixed Reference Value Testing

Proposed Alternative In Accordance with 10 CFR 50.55a(a)(3)(i)

Alternative Provides Acceptable Level of Quality and Safety

1. **ASME Code Component(s) Affected**

Pump	Description	Code Class	OM Group
E1151C001A	RHR Service Water Pump A	3	A
E1151C001B	RHR Service Water Pump B	3	A
E1151C001C	RHR Service Water Pump C	3	A
E1151C001D	RHR Service Water Pump D	3	A
P4400C002A	Emergency Equip Cooling Water	3	B
P4400C002B	Emergency Equip Cooling Water	3	B
T4100C040	South CCHVAC Chilled Water	3	A
T4100C041	North CCHVAC Chilled Water	3	A

2. **Applicable Code Edition and Addenda**

ASME OM Code 2004 Edition and No Addenda

3. **Applicable Code Requirement**

ISTB-5121*(b)* and ISTB-5123*(b)* (for centrifugal pumps)

ISTB-5221*(b)* and ISTB-5223(*b*) (for vertical line shaft pumps)

These OM Code paragraphs contain the same statement: "The resistance of the system shall be varied until the flow rate equals the reference point. The differential pressure shall then be determined and compared to its reference value. Alternatively, the flow rate shall be varied until the differential pressure equals the reference point and the flow rate determined and compared to the reference flow rate value."

4. **Reason for Request**

Pursuant to 10 CFR 50.55a, "Codes and Standards", paragraph (a)(3)(i), relief is requested from the requirements of ASME OM Code ISTB-5121*(b)*, ISTB-5123*(b)*, ISTB-5221*(b)* and ISTB-5223(*b*). The basis of the relief request is that the proposed alternative would provide an acceptable level of quality and safety.

Fermi 2 has evaluated the ability to test the pumps in the IST Program and determined several cases where compliance with the Code and NUREG recommendations cannot be achieved. The characteristics of the affected piping system designs do not allow flow to be adjusted to an exact value. Some systems may not have valves designed for throttling or their throttling capabilities are too coarse (lack adequate "fine tuning" abilities) to control flow to an exact value. There may also be limitations in the instruments and controls of some systems that restrict the ability to set and maintain flow or differential pressure at an exact reference value.

5. **Proposed Alternative and Basis for Use**

Fermi 2 proposes to perform the quarterly Group A Pump Testing for the identified pumps will use the following "set parameter" reference value bands:

- For RHRSW pumps, a total tolerance inclusive of instrument accuracy of ±2.78%
- For EECW Makeup pumps, a total tolerance inclusive of instrument accuracy of ±3.0%
- For CCHVAC Chilled Water pumps a total tolerance inclusive of instrument accuracy of ±3.5%

Additionally, for the CCHVAC Chilled Water pumps, Fermi 2 will utilize a more conservative differential pressure acceptance criteria range of -8.0% to +6.0% for the quarterly Group A test.

The OM Code requires that subsequent inservice testing, after the establishment of reference values, that the flow rate or differential pressure be set to the exact reference value. The Code does not acknowledge the possibility that there may be limitations in the ability to do this. This issue is discussed in NUREG 1482 Revision 1, Section 5.3, "Allowable Variance from Reference Points and Fixed-Resistance Systems."

The NUREG discussion acknowledges that the Code does not allow for variance around a fixed reference value. It states: "The OM Code does not address the likelihood that it may not be possible to control a flow rate or differential pressure to an exact value." The NUREG concludes that when the Code specifies that the system resistance must be varied until the "set parameter" equals the corresponding reference value, it does not intend the "set parameter" to have an acceptable range as stated in the ISTB test acceptance criteria tables. The acceptance criteria ranges in these tables apply only to the parameter being determined after the resistance is varied.

The NUREG discussion stipulates that the reference value of the "set parameter" for certain pumps can only be achieved within a specified tolerance. It states: "...the allowed tolerance for setting the fixed parameter must be established for each case individually, including the accuracy of the instrument and the precision of its display." The "set parameter" may be adjusted "...as close as possible to the reference value during each test, rather than treating any variance in the value with a pump curve."

In NUREG-1482, the NRC recommendation section states: "The staff has determined that, if the design does not allow for establishing and maintaining flow at an exact value, achieving a steady flow rate or differential pressure at approximately the set value does not require relief for establishing pump curves." It further states that for Group A, Group B and

Comprehensive tests, a total tolerance of ±2 percent of the reference value for flow is allowed without prior NRC approval.

Residual Heat Removal Service Water (RHRSW)

These vertical line shaft pumps are tested at a flow rate of 5400 gpm. Testing is performed by throttling a large 24 inch motor operated globe valve to set flow to the specified reference value.

Flow adjustments using these valves (E1150F068A/B) are somewhat coarse and motor damage is possible with multiple start/stops. Test equipment has been substituted for the installed plant flow instrumentation to improve the accuracy of the system flow measurement. With the M&TE, total loop flow measurement accuracy is improved to 0.8 percent. However, with the limited throttling capabilities, a tolerance around the reference flow rate of 5400 gpm is needed. In an effort to achieve the reference value and yet not require excessive starts/stops of the throttle valve with the potential for motor damage, an optimum flow tolerance of ±100 gpm or approximately 1.85% has been determined. Combining this indicated flow tolerance with the instrumentation accuracy and rounding for readability yields a total tolerance around the "set parameter" reference value of 2.78%.

Emergency Equipment Cooling Water Makeup (EECW MU)
These centrifugal pumps are tested at a flow rate of 15 gpm. Testing is performed by throttling a 1 inch manual globe valve to set flow to the specified reference value. While flow adjustments using these manual valves are possible, with a low flow rate of 15 gpm, any small movement results in a significant flow change relative to the desired reference point. Test equipment has been substituted for the installed plant flow instrumentation to improve the accuracy of the system flow measurement. With the M&TE, total loop flow measurement accuracy is improved to 0.8 percent. However, with the low flow rate, a tolerance around the reference flow rate of 15 gpm is needed. In an effort to achieve the reference value and yet remain within a reasonable readable range for the operators to attempt to achieve, an optimum flow tolerance of ±0.3 gpm or 2.0% has been determined. Combining this indicated flow tolerance with the instrumentation accuracy and rounding for readability yields a total tolerance around the "set parameter" reference value of 3.0%.

CCHVAC Chilled Water
These centrifugal pumps are tested at a flow rate of 233 gpm. Testing is performed by throttling a 4 inch manual gate valve to set flow to the specified reference value. Flow adjustments using these valves are somewhat coarse as gate valves are not designed for use as throttle valves. Test equipment has been evaluated for use in lieu of the installed plant flow instrumentation to improve the accuracy of the system flow measurement, but has been determined to not be practical. The flow indicators are analog gauges locally mounted on the chiller skid. Limited access to the necessary transmitter pipe connections makes installation of M&TE for flow measurement not practical. The local flow indicators total loop flow measurement accuracy is 2.0%. With the limited throttling capabilities and less accurate plant instrumentation, a tolerance around the reference flow rate of 233 gpm is needed. In an effort to achieve the reference value and yet remain within a reasonable time frame for the

test performance, an optimum flow tolerance of ±3 gpm or approximately 1.3% has been determined. Combining this indicated flow tolerance with the instrumentation accuracy and rounding for readability yields a total tolerance around the "set parameter" reference value of 3.5%. Given this larger flow tolerance, Fermi 2 also proposes to adjust the differential pressure acceptance criteria as recommended in the guidance provided in section 5.3 of NUREG 1482. OM Code Table ISTB-5121-1 specifies a ±10% acceptance criteria range for quarterly Group A centrifugal pump testing. Fermi will instead use -8.0% and +6.0% for the differential pressure acceptance criteria range for the quarterly Group A test of these pumps.

In conclusion, the ability to detect degrading trends with these pumps is not diminished with the proposed changes. The RHRSW pumps are an example of this since they do actually degrade in a uniform manner over their 12-15 year lifetime. As of mid-2009, two of the four RHRSW pumps have been replaced with the remaining pump replacements scheduled for 2010. Close tracking of these pumps performance has been ongoing for several years to ensure optimum replacement scheduling. Long and short term trends were monitored. Short term trending involved DP normalization, which corrects DP readings for variances in flow above and below the reference. Long term trending is done using a moving average technique that also eliminates flow variance impacts. The other pumps cited in this request have exhibited no hydraulic degradation.

Using the provisions of this relief request as an alternative to the specific requirements of ISTB-5121, ISTB-5123 & ISTB-5221 will provide adequate indication of pump performance, permit detection of component degradation and continue to provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i) Fermi 2 requests relief from the specific ISTB requirements identified in this request.

6. Duration of Proposed Alternative

This proposed alternative will be utilized for the entire 3rd 120 month interval.

7. Precedents

- The issue of allowable variance for reference values is a current subject of discussion within ASME ISTB committee. The ISTB committee members are aware of recent NRC findings that reveal widespread misinterpretation of the NUREG-1482 guidance.

10 CFR 50.55a Relief Request PRR-010
Relief from Comprehensive Pump Testing for SLC and DGFOT Pumps

Proposed Alternative In Accordance with 10 CFR 50.55a(a)(3)(i)

Alternative Provides Acceptable Level of Quality and Safety

1. **Code Component(s) Affected**

Pump	Description	Code Class
C4103C001A	Standby Liquid Control Pump A	3
C4103C001B	Standby Liquid Control Pump B	3
R3000C001	EDG 11 Diesel Fuel Oil Transfer Pump A	3
R3000C002	EDG 12 Diesel Fuel Oil Transfer Pump A	3
R3000C003	EDG 11 Diesel Fuel Oil Transfer Pump B	3
R3000C004	EDG 12 Diesel Fuel Oil Transfer Pump B	3
R3000C005	EDG 13 Diesel Fuel Oil Transfer Pump A	3
R3000C006	EDG 14 Diesel Fuel Oil Transfer Pump A	3
R3000C007	EDG 13 Diesel Fuel Oil Transfer Pump B	3
R3000C008	EDG 14 Diesel Fuel Oil Transfer Pump B	3

2. **Applicable Code Edition and Addenda**

American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code) 2004 Edition, no Addenda

3. **Applicable Code Requirement**

ISTB-3400, "Frequency of Inservice Tests"

ISTB-5323, "Comprehensive Test Procedure"

4. **Reason for Request**

Pursuant to 10 CFR 50.55a, "Codes and Standards", paragraph (a)(3)(i), relief is requested from the requirements of ASME OM Code ISTB -5323 and ISTB-3400. The proposed alternative provides an acceptable level of quality and safety.

Each of these pumps will have a modified Group A test performed each quarter in place of the Group B quarterly test and the 2-yr Comprehensive pump test. Multi-point pre-service testing for positive displacement pumps is not required by the OM Code per

ISTB-5310. The Proposed Group A positive displacement pump test performed with vibration analysis will verify that the described pumps are operating acceptably and may be utilized as the post-maintenance test (pre-service test) following significant maintenance.

5. Proposed Alternative and Basis for Use

Fermi 2 will perform a modified Group A test each quarter in place of the Group B quarterly test and the 2-yr Comprehensive Pump Test (CPT) for these positive displacement pumps.

Standby Liquid Control (SLC) pumps
The SLC pumps function to pump a sodium pentaborate solution into the reactor if the reactor cannot be shut down or kept shut down with control rods.

Technical Specification 3.1.7.7 requires that each SLC system pump shall be capable of delivering greater than 41.2 gal/min, at a discharge pressure of greater than 1215 psig to be considered operable. This flow rate is based on the original system design requirement that a single standby liquid control pump be capable of shutting down the reactor from the most reactive condition at any time in core life and maintaining it subcritical during cooldown with all control rods withdrawn in the rated power pattern. The sodium pentaborate concentrations are controlled at levels which support the Technical Specifications flowrate plus a 25% design margin. This 25% margin is explicitly referenced in both T.S. B.3.1.7 and UFSAR section 4.5.2.4.3 and is therefore a required aspect of Fermi 2 licensing basis. In addition, the TS criterion for 41.2 gpm includes sufficient margin for instrument error.

The Standby Liquid Control pumps are categorized as Group B pumps since they are standby emergency pumps and are only operated for testing. They are horizontally-mounted reciprocating positive displacement pumps.

As an alternative to the Code requirement for performing a comprehensive pump test, each of these pumps will have a modified Group A test performed each quarter in place of the Group B quarterly test and the 2-yr Comprehensive pump test. The pumps will be operated at a reference discharge pressure (Pr) of 1230 +/-10 psig with pump flow rate (Q) measured and compared to its reference value. Deviations from the reference value will be compared to the required action and alert range requirements of Table ISTB-5321-2 for the Group A test, which is more stringent than the Group B testing that would normally be applied each quarter. In addition, mechanical vibration measurements will be recorded every quarter rather than only once every 2 years during the comprehensive pump test. Vibration measurements will be compared to the range requirements of Table ISTB-5321-2 for the Group A test. Corrective actions will be taken in accordance with ISTB-6200.

Permanently installed plant instrumentation will be used to determine flow rates. Portable pressure gauges and vibration instruments will be used for discharge pressure and mechanical vibration measurements. All instrumentation will meet the accuracy requirements for Comprehensive Pump Testing as listed in Table ISTB-3510-1.

The Standby Liquid Control pumps are tested at a reference discharge pressure of 1230 +/- 10psig. Per Table ISTB-5321-2, the required action range for the Group A flow measurement would be <0.93Qr and > 1.10Qr, with an alert range of 0.93Qr to < 0.95Qr. This is the same as the comprehensive test requirement with the exception that the CPT upper range limit is >1.03Qr. With typical values of approximately only 50 gpm, this upper limit for the comprehensive pump test would not encompass the normal data scatter associated with acceptable SLC pump operation. Therefore, Fermi 2 will monitor the flow of these pumps at the Group A test criteria each quarter as follows:

Acceptable Range	0.95 to 1.06 Qr
Alert Range	0.93 to <0.95 Qr
Required Action	<0.93 Qr or >1.06 Qr

Emergency Diesel Generator Fuel Oil Transfer Pumps

Each EDG has two associated Fuel Oil Transfer Pumps (DGFOT). In combination with the 550 gallon Fuel Oil Day tank, these pumps are capable individually of meeting design requirements for EDG fuel oil replenishment.

The DGFOT pumps are categorized as Group B pumps since they are standby emergency pumps and are only operated for testing. They are horizontally-mounted reciprocating positive displacement pumps.

As an alternative to the code requirement for performing a comprehensive pump test, each of these pumps will have a modified Group A test performed each quarter in place of the Group B quarterly test and the 2-yr Comprehensive pump test. The pumps will be operated at reference discharge pressures (Pr) of between 9.50 psig (Pump R3000C010) and 9.93 psig (R3000C004) with the allowable discharge pressure variation for each pump at +/- 0.05 psig. Pump flow rate (Q) is then measured and compared to its reference value. Deviations from the reference value will be compared to the required action and alert range requirements of Table ISTB-5321-2 for the Group A test, which is more stringent than the Group B testing that would normally be applied each quarter. In addition, mechanical vibration measurements will be recorded every quarter rather than only once every 2 years during the comprehensive pump test. Vibration measurements will be compared to the range requirements of Table ISTB-5321-2 for the Group A test. Corrective actions will be taken in accordance with ISTB-6200.

Permanently installed plant instrumentation will be used to determine flow rates. Portable pressure gauges and vibration instruments will be used for discharge pressure and mechanical vibration measurements. All instrumentation will meet the accuracy requirements for Comprehensive Pump Testing as listed in Table ISTB-3510-1.

Per Table ISTB-5321-2, the required action range for the Group A flow measurement would be <0.93Qr and > 1.10Qr, with an alert range of 0.93Qr to < 0.95Qr. This is the same as the comprehensive test requirement with the exception that the CPT upper range is >1.03Qr. With typical values of approximately only 7.6 gpm, this upper limit for the comprehensive pump test would not encompass the normal data scatter associated with acceptable DGFOT pump operation. Therefore, Fermi 2 will monitor the flow of these pumps at the Group A test criteria each quarter as follows:

Acceptable Range	0.95 to 1.06 Qr
Alert Range	0.93 to <0.95 Qr
Required Action	<0.93 Qr or >1.06 Qr

For the SLC and DGFOT pumps, Fermi 2 will evaluate all ranges against the design conditions to ensure that all procedural limits bound the more conservative of the design or ASME OM Code ranges delineated above.

In conclusion, this method of monitoring these pumps provides a level of testing that is an acceptable alternative to ASME CPT and is commensurate to the level of safety for these components. Performance of a substantial flow test each quarter will result in eight sets of data over a two-year period instead of the required one comprehensive test. Monitoring of vibration on these pumps every three months will result in eight sets of mechanical data versus the required one every two years.

Fermi 2 believes this testing regime provides an overall better assessment of pump mechanical and hydraulic health and will determine operational readiness on a quarterly frequency. Additionally, this Group A positive displacement pump test performed with vibrations will verify that the pump is operating acceptably and may be utilized as the post-maintenance test (preservice test) following significant maintenance. Multi-point preservice testing for positive displacement pumps is not required by the OM Code per ISTB-5310.

6. Duration of Proposed Alternative

This proposed alternative will be utilized for the entire 3rd 120 month interval.

7. Precedents

- ASME has approved Code Case OMN-18 which will allow for the substitution of quarterly Group A pump testing in lieu of CPT. As a conservative exception to OMN-18, Fermi 2 will be imposing a tighter maximum DP acceptance criteria of 106% to quarterly testing.

10 CFR 50.55a Request Number VRR-011

Relief for Test Frequency of Excess Flow Check Valves

Proposed Alternative In Accordance with 10 CFR 50.55a(a)(3)(i)

Alternative Provides Acceptable Level of Quality and Safety

1. **ASME Code Components affected:**

Valve PIS No.	Code Class	Category	ISI Drawing
B21F501A	1	A/C	6M721-5808-1
B21F501B	1	A/C	6M721-5808-1
B21F501C	1	A/C	6M721-5808-1
B21F501D	1	A/C	6M721-5808-1
B21F502A	1	A/C	6M721-5808-1
B21F502B	1	A/C	6M721-5808-1
B21F502C	1	A/C	6M721-5808-1
B21F502D	1	A/C	6M721-5808-1
B21F503A	1	A/C	6M721-5808-1
B21F503B	1	A/C	6M721-5808-1
B21F503C	1	A/C	6M721-5808-1
B21F503D	1	A/C	6M721-5808-1
B21F504A	1	A/C	6M721-5808-1
B21F504B	1	A/C	6M721-5808-1
B21F504C	1	A/C	6M721-5808-1
B21F504D	1	A/C	6M721-5808-1
B21F506	1	A/C	6M721-5808-2
B21F507	1	A/C	6M721-5808-2
B21F508	1	A/C	6M721-5808-2
B21F509	1	A/C	6M721-5808-2
B21F510	1	A/C	6M721-5808-2
B21F511	1	A/C	6M721-5808-2
B21F512	1	A/C	6M721-5808-2
B21F513A	1	A/C	6M721-5808-2
B21F513B	1	A/C	6M721-5808-2
B21F513C	1	A/C	6M721-5808-2
B21F513D	1	A/C	6M721-5808-2
B21F514A	1	A/C	6M721-5808-2
B21F514B	1	A/C	6M721-5808-2
B21F514C	1	A/C	6M721-5808-2
B21F514D	1	A/C	6M721-5808-2

Valve PIS No.	Code Class	Category	ISI Drawing
B21F515A	1	A/C	6M721-5808-2
B21F515B	1	A/C	6M721-5808-2
B21F515C	1	A/C	6M721-5808-2
B21F515D	1	A/C	6M721-5808-2
B21F515E	1	A/C	6M721-5808-2
B21F515F	1	A/C	6M721-5808-2
B21F515G	1	A/C	6M721-5808-2
B21F515H	1	A/C	6M721-5808-2
B21F515L	1	A/C	6M721-5808-2
B21F515M	1	A/C	6M721-5808-2
B21F515N	1	A/C	6M721-5808-2
B21F515P	1	A/C	6M721-5808-2
B21F515R	1	A/C	6M721-5808-2
B21F515S	1	A/C	6M721-5808-2
B21F515T	1	A/C	6M721-5808-2
B21F515U	1	A/C	6M721-5808-2
B21F516A	1	A/C	6M721-5808-2
B21F516B	1	A/C	6M721-5808-2
B21F516C	1	A/C	6M721-5808-2
B21F517A	1	A/C	6M721-5808-2
B21F517B	1	A/C	6M721-5808-2
B21F517C	1	A/C	6M721-5808-2
B21F517D	1	A/C	6M721-5808-2
B31F501A	1	A/C	6M721-5809
B31F501B	1	A/C	6M721-5809
B31F501C	1	A/C	6M721-5809
B31F501D	1	A/C	6M721-5809
B31F502A	1	A/C	6M721-5809
B31F502B	1	A/C	6M721-5809
B31F502C	1	A/C	6M721-5809
B31F502D	1	A/C	6M721-5809
B31F503A	1	A/C	6M721-5809
B31F503B	1	A/C	6M721-5809
B31F504A	1	A/C	6M721-5809
B31F504B	1	A/C	6M721-5809
B31F505A	1	A/C	6M721-5809
B31F505B	1	A/C	6M721-5809
B31F506A	1	A/C	6M721-5809
B31F506B	1	A/C	6M721-5809
B31F510A	1	A/C	6M721-5809

Valve PIS No.	Code Class	Category	ISI Drawing
B31F510B	1	A/C	6M721-5809
B31F511A	1	A/C	6M721-5809
B31F511B	1	A/C	6M721-5809
B31F512A	1	A/C	6M721-5809
B31F512B	1	A/C	6M721-5809
B31F515A	1	A/C	6M721-5809
B31F515B	1	A/C	6M721-5809
B31F516A	1	A/C	6M721-5809
B31F516B	1	A/C	6M721-5809
E21F500A	1	A/C	6M721-5814
E21F500B	1	A/C	6M721-5814
E41F500	1	A/C	6M721-5815
E41F501	1	A/C	6M721-5815
E41F502	1	A/C	6M721-5815
E41F503	1	A/C	6M721-5815
E51F503	1	A/C	6M721-5816
E51F504	1	A/C	6M721-5816
E51F505	1	A/C	6M721-5816
E51F506	1	A/C	6M721-5816
G33F583	1	A/C	6M721-5818
N21F539A	1	A/C	6M721-5821
N21F539B	1	A/C	6M721-5821

2. **Applicable Code Edition and Addenda:**

ASME OM Code 2004 Edition, No Addenda

3. **Applicable Code Requirement:**

ISTC-3522(c), "Category C Check Valves"

"If exercising is not practicable during operation at power and cold shutdown, it shall be performed during refueling outages."

ISTC- 3700, "Position Verification Testing"

"Valves with remote position indicators shall be observed locally at least once every 2 years to verify that valve operation is accurately indicated."

4. **Reason for Request**

Pursuant to 10 CFR 50.55a, "Codes and Standards", paragraph (a)(3), relief is requested from the requirements of ASME OM Code ISTC-3522(c) and ISTC-3700 for the subject valves.

The basis of the Relief Request is that the proposed alternative would provide an acceptable level of quality and safety.

Per Regulatory Guide 1.97, check valve remote position indication is excluded as a required parameter for evaluating containment isolation. The remote position indication is verified accurate at the same frequency as the exercise test prescribed in Technical Specification Surveillance Requirement 3.6.1.3.9.

The testing described above requires removal of the associated instrument or instruments from service. Since these instruments are in use during plant operation, removal of any of these instruments from service may cause a spurious signal, which could result in a plant trip or an unnecessary challenge to safety systems. Additionally, process liquid will be contaminated to some degree, requiring special measures to collect flow from the vented instrument side and also will contribute to an increase in personnel radiation exposure.

Testing on a cold shutdown frequency is impractical considering the large number of valves to be tested and the condition that reactor pressure greater than 500 psig is needed for testing. In this instance, considering the number of valves to be tested and the conditions required for testing, it is also a hardship to test all these valves during refueling outages.

The appropriate time for performing excess flow check valve test is during refueling outages in conjunction with vessel hydrostatic pressure testing. As a result of shortened outages, decay heat levels during hydrostatic pressure tests are higher than in the past. If the hydrostatic pressure test were extended to test all EFCVs, the vessel could require depressurization several times to avoid exceeding the maximum bulk coolant temperature limit. This is an evolution that challenges the reactor operators and thermally cycles the reactor vessel and should be avoided if possible. Also, based on past experience, excess flow check valve testing during hydrostatic pressure testing becomes an outage critical path activity and could possibly extend the outage if all EFCVs were to be tested during this time frame.

5. <u>Proposed alternative and basis for use</u>:

Functional testing with verification that flow is checked will be performed per Technical Specification 3.6.1.3.9 during refueling outages. Surveillance Requirement 3.6.1.3.9 allows a "representative sample" of Excess Flow Check Valves (EFCVs) to be tested every 18 months, such that each EFCV will be tested at least once every ten years (nominal). The six sample groups contain approximately 15 EFCVs each and are selected from different plant locations and operating conditions. The basis for this alternative is that testing a sample of EFCVs each refueling outage provides a level of safety and quality equivalent to that of the Code-required testing.

The EFCVs have position indication in the control room. Check valve remote position indication is excluded from Regulatory Guide 1.97 as a required parameter for evaluating containment isolation. The remote position indication will be verified accurate at the same frequency as the exercise test prescribed in Technical Specification Surveillance Requirement 3.6.1.3.9. Although inadvertent actuation of an EFCV during operation is highly unlikely due to the spring poppet design, Fermi 2 checks the EFCVs indications on a daily basis as part of the Operations Routines Checklist #26. Corrective Action documents are initiated for any EFCVs with abnormal position indication displays and repairs are scheduled for the next refueling outage.

Excess flow check valves are provided in each instrument process line that is part of the reactor coolant pressure boundary. The excess flow check valve is designed so that it will not close accidentally during normal operation, will close if a rupture of the instrument line occurs downstream of the valve, and can be reopened, when appropriate, after closure from a local panel. These valves have both local position indication and position indication in the control room.

The design and installation of the excess flow check valves at Fermi 2 follow the guidance of Regulatory Guide 1.11. As detailed in the Fermi 2 UFSAR, Detroit Edison has incorporated into the design of each excess flow check valve source line the equivalent of a 0.25-inch restricting orifice. This was done by either the installation of a 0.25-inch orifice, the tap size of the source line being a 0.25-inch or in the case of the Feedwater pressure-sensing lines, taking credit for an inboard containment isolation valve. Additionally, the design of each excess flow check valve contains an internal 0.25-inch main body orifice. The restrictions in the source lines of the excess flow check valves limit leakage, in case of a failure to close, to a level where the integrity and functional performance of secondary containment and associated safety systems are maintained. The coolant loss is well within the capabilities of the reactor coolant makeup system, and the potential offsite exposure is substantially below the guidelines of 10CFR100.

Excess flow check valves are required to be tested in accordance with ISTC-3522, which requires exercising check valves nominally every three months to the positions required to perform their safety functions. ISTC-3522(c) permits deferral of this requirement to every reactor refueling outage. Excess flow check valves are also required to be tested in accordance with ISTC-3700, which requires remote position indication verification at least once every 2 years.

The EFCVs are classified as ASME Code Category A/C and are also containment isolation valves. However, these valves are excluded from 10CFR50 Appendix J Type C leak rate testing, due to the size of the instrument lines and upstream orificing.

The excess flow check valve is a simple and reliable device. The major components are a poppet and spring. The spring holds the poppet open under static conditions. The valve will close upon sufficient differential pressure across the poppet. Functional testing of the valve is accomplished by venting the instrument side of the valve. The resultant increase in flow imposes a differential pressure across the poppet, which compresses the spring and decreases flow through the valve. System design does not include test taps upstream of the EFCV. For this reason, the EFCVs cannot be isolated and tested using a pressure source other than reactor pressure.

Industry experience as documented in GE Nuclear Energy topical report NEDO-32977-A, "Excess Flow Check Valve Testing Relaxation," indicates the EFCVs have a very low failure rate. The report indicates similarly that many reported test failures at other plants were related to test methodologies and not actual EFCV failures. The technology for testing these valves is simple and has been demonstrated effectively during the operating history of Fermi 2. Test history at Fermi 2 shows a very low failure rate and no evidence of common mode failure, which is consistent with the findings of NEDO-32977-A. The EFCVs at Fermi 2, consistent with the industry, have exhibited a high degree of reliability, availability, and provide an acceptable level of quality and safety.

In conclusion, the Fermi 2 Technical Specifications detail what frequency is required to maintain a high degree of reliability and availability, and provide an acceptable level of quality and safety. Therefore, Detroit Edison requests relief pursuant to 10CFR50.55a (a)(3)(i) to test excess flow check valves on a representative sample basis and at the frequency specified in Fermi 2 Technical Specifications Surveillance Requirements (SR) 3.6.1.3.9.

6. **Duration of proposed alternative:**

This proposed alternative will be utilized for the entire 3rd 120 month interval.

7. **Precedents:**

- Fermi 2 had similar relief approved for the 2nd Ten Year interval - VRR-011 (reference Accession No. ML003691487)

- Susquehanna Steam Electric Station Unit 2 - Safety Evaluation of Relief Requests for 2nd Ten Year Interval (reference Accession No. 9607150173)

- Nine Mile Point Nuclear Station - Safety Evaluation of Relief Requests for the Unit No. 1 Fourth 10-Year and Unit No. 2 Third 10-Year Pump and Valve Inservice Testing Program (TAC Nos. MD9202 AND MD9203) re-iterated approval of similar relief request GV-RR-08 for Nine Mile Point Unit 2. The alternative in GV-RR-08 was previously authorized by the NRC on September 17, 2001 (reference TAC No. MB1491).

10 CFR 50.55a Request Number VRR-012

Relief to perform Position Indication Testing at Appendix J Option B Frequency

Proposed Alternative In Accordance with 10 CFR 50.55a(a)(3)(i)

Alternative Provides Acceptable Level of Quality and Safety

1. ASME Code Component(s) Affected

Valve Number	Class	Cat	Function
C5100F002A	2	A	TIP Channel A Ball Valve
C5100F002B	2	A	TIP Channel B Ball Valve
C5100F002C	2	A	TIP Channel C Ball Valve
C5100F002D	2	A	TIP Channel D Ball Valve
C5100F002E	2	A	TIP Channel E Ball Valve
E11F412	2	A	RHR Div II Pri. Containment Monitoring Isolation Valve
E11F413	2	A	RHR Div II Pri. Containment Monitoring Isolation Valve
E11F414	2	A	RHR Div I Pri. Containment Monitoring Isolation Valve
E11F415	2	A	RHR Div I Pri. Containment Monitoring Isolation Valve
E41F400	2	A	Pri. Containment Monitoring (PCM) - Suppression Pool
E41F401	2	A	Pri. Containment Monitoring (PCM) - Suppression Pool
E41F402	2	A	Pri. Containment Monitoring (PCM) - Suppression Pool
E41F403	2	A	Pri. Containment Monitoring (PCM) - Suppression Pool
P34F401A	1	A	Post Accident Sampling (PAS) V13-7360
P34F401B	1	A	Post Accident Sampling (PAS) V13-7361
P34F403A	2	A	Post Accident Sampling (PAS) V13-7364
P34F403B	2	A	Post Accident Sampling (PAS) V13-7365
P34F404A	2	A	Post Accident Sampling (PAS) V13-7374
P34F404B	2	A	Post Accident Sampling (PAS) V13-7375
P34F405A	2	A	Post Accident Sampling (PAS) V13-7366
P34F405B	2	A	Post Accident Sampling (PAS) V13-7367
P34F406A	2	A	Post Accident Sampling (PAS) V13-7376
P34F406B	2	A	Post Accident Sampling (PAS) V13-7377
P34F407	2	A	Post Accident Sampling (PAS) V13-7368
P34F408	2	A	Post Accident Sampling (PAS) V13-7369
P34F409	2	A	Post Accident Sampling (PAS) V13-7378
P34F410	2	A	Post Accident Sampling (PAS) V13-7379
T50F412A	2	A	Pri. Containment Torus Level Monitoring Div 1
T50F412B	2	A	Pri. Containment Torus Level Monitoring Division 2
T50F450	2	A	Pri. Containment Radiation Monitoring System Inlet Isolation Valve
T50F451	2	A	Pri. Containment Radiation Monitoring System Outlet Isolation Valve
T50F458	2	A	Pri. Cont Atmospheric Monitoring (PCAM) Division 2 Penetration X-27F Remote Manual Solenoid Valve

2. **Applicable Code Edition and Addenda**

ASME OM Code 2004 Edition, no Addenda

3. **Applicable Code Requirement**

ISTC-3700 Position Verification Testing, states "Valves with remote position indicators shall be observed locally at least once every 2 years to verify that valve operation is accurately indicated."

4. **Reason for Request**

Pursuant to 10 CFR 50.55a, "Codes and Standards", paragraph (a)(3), relief is requested from the requirement of ASME OM Code ISTC-3700 for the subject valves. The proposed alternative will provide an acceptable level of quality and safety. Reducing the number of tests involving set-up of Leak Rate Monitors, tubing, etc. every two years will reduce overall dose.

Relief is requested from performing the position indication verification test (PIT) on a 2 year frequency. Position indication verification will be performed at a frequency commensurate with the 10CFR50 Appendix J, Option B test.

5. **Proposed Alternative and Basis for Use**

In accordance with ISTC-3700, where local observation is not possible, other indications shall be used to verify valve position. The method used at Fermi 2 is a pressure test using the local leakage rate testing equipment. This method involves pressurizing the containment penetration volume to approximately 55 psig, and verifying the penetration remains pressurized while the valve is indicating closed on the main control room board. The valve is then opened using the control switch in the main control room. A decrease in pressure is then verified along with valve position indicating open in the main control room. This method satisfies the requirement for position indication verification and ensures that the indicating system accurately reflects the valve position.

The subject valves are all categorized as A and are all containment isolation valves per the plant safety analysis. All of the subject valves have a safety function to close in order to isolate containment during a Loss of Coolant Accident (LOCA) when required.

Since these valves are containment isolation valves, they are each individually seat leakage testing in accordance with 10CFR50 Appendix J.

Each of the subject valves is a solenoid operated valve designed such that the position of the valve is not locally observable. The design of these valves is such that the coil position is internal to the valve body and not observable in either the energized or de-energized state. See Attachment 1 – Typical Solenoid Valve Arrangement, which is typical for the subject valves.

For the subject valves, Fermi 2 will perform the position indication verification in conjunction with the seat leakage test at a frequency in accordance with 10CFR50 Appendix J Option B. This interval may be adjusted to a frequency of testing commensurate with Option B of 10CFR50 Appendix J Type C leakage testing based on valve seat leakage performance.

Since each of these valves is seat leakage tested using local leakage rate testing equipment, the current leakage rate tests have been modified to also perform the position indication verification test at the same time. The individual valve being tested must have its system properly drained, vented, and aligned correctly prior to performing the seat leakage test or the position indication verification. This must be done every two years currently due solely to the Position Indication Test (PIT) 2 year interval requirement. Radiation exposure and Operations / Test personnel time/labor involved will be significantly reduced by performing the position indication verification test at the same interval as the Appendix J seat leakage test.

Additionally, each of these subject valves is exercised on a quarterly or refueling frequency and their stroke times measured and compared to the ASME OM Code acceptance criteria. By continuing this valve exercising and performance of the position indication verification and seat leakage test in accordance 10CFR50 Appendix J, an adequate assessment of valve health may be determined.

These solenoid-operated valves are also subject to Preventive Maintenance program coverage. Many of these SOVs are periodically replaced to satisfy EQ Program criteria. Any maintenance that is performed on these valves which might affect position indication will be followed by applicable PMT including PIT.

In 1996, Fermi 2 received a Safety Evaluation (Technical Specification Amendments 192/186) with approval to implement Option B of the 10CFR50 Appendix J Program. This program permits the extension of the Appendix J seat leakage testing to a frequency corresponding to the specific valve performance. Valves whose leakage test results indicate good performance may have their interval of testing increased based on these test results. The Fermi 2 program which implements Appendix J, Option B requires individual containment isolation valves to pass two successful seat leakage tests before it can be placed on extended seat leakage testing frequency. The majority of the listed valves are in good performer status, requiring a seat leakage test every 3 refuel outages.

In conclusion, the ability to detect degradation and ensure the operational readiness of the subject valves to perform their intended function is not jeopardized by performing the position indication verification test at the same frequency as specified by Option B. This frequency of testing provides reasonable assurance of the operational readiness of the subject valves and provides an acceptable level of quality and safety.

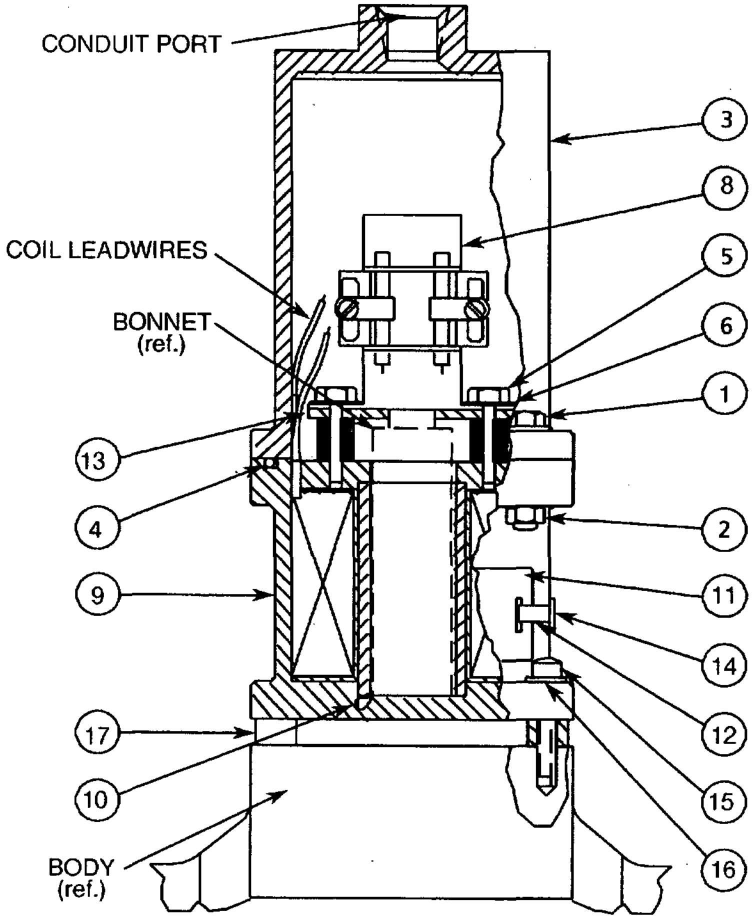
6. Duration of Proposed Alternative

This proposed alternative will be utilized for the entire 3rd 120 month interval.

7. Precedents

- Kewaunee VRR-05, Accession No. ML050380305, SER Date 3/4/2005.

Attachment 1 - Typical Solenoid Valve Arrangement



ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	Cover Bolts	10	Seal
2	Locknut	11	Nameplate
3	Cover	12	Strap
4	O-Ring	14	Buckle
5	Bolt	15	Bolt
6	Lockwasher	16	Lockwasher
8	Switch Block Assy.	17	Spacer
9	Coil Shell Assy.		

10 CFR 50.55a Relief Request VRR-013

Performance-Based Scheduling of PIV Leakage Tests

Proposed Alternative In Accordance with 10 CFR 50.55a(a)(3)(i)

Alternative Provides Acceptable Level of Quality and Safety

1. **ASME Code Component(s) Affected**

Valve No.	Description	Appendix J, Option B Air Tested	Code Class
E1100F050A	RHR Div. 1 Inbd Isolation Testable Check Valve	N	1
E1100F050B	RHR Div. 2 Inbd Isolation Testable Check Valve	N	1
E1150F008	RHR Div. 1 & 2 Shutdown Cooling Outboard Cont. Isol. Valve	Y	1
E1150F009	RHR Div. 1 & 2 Shutdown Cooling Inbd Cont. Isol. Valve	Y	1
E1150F015A	RHR Div. 1 Low Pressure Coolant Injection (LPCI) Inbd Isolation Valve	N	1
E1150F015B	RHR Div. 2 Low Pressure Coolant Injection (LPCI) Inbd Isolation Valve	N	1
E1150F608	RHR Shutdown Cooling Inbd Inlet Isolation Bypass Valve	Y	1
E2100F006A	Core Spray (CS) Div. 1 Inbd Primary Containment (PC) Check Valve	Y	1
E2100F006B	Core Spray (CS) Div. 2 Inbd Primary Containment (PC) Check Valve	Y	1
E2150F005A	Core Spray (CS) Div.1 Inbd Isolation Valve	Y	1
E2150F005B	Core Spray (CS) Div.2 Inbd Isolation Valve	Y	1
E4150F006	HPCI Main Pump Outlet to Feedwater Isolation Valve	Y	1
E4150F007	HPCI Main Pump Discharge Isolation Valve	N	2
E5150F012	Reactor Core Isolation Cooling (RCIC) Pump Discharge Isolation Valve	N	2
E5150F013	Reactor Core Isolation Cooling (RCIC) Pump Supply To Feedwater Header Isolation Valve	Y	1

2. **Applicable Code Edition and Addenda**

ASME OM Code 2004 Edition, no Addenda

3. **Applicable Code Requirement**

ISTB Table ISTC-3630 - Leakage Rate for other than Containment Isolation Valves

4. Reason for Request

Pursuant to 10 CFR 50.55a, "Codes and Standards", paragraph (a)(3), relief is requested from the requirement of ASME OM Code ISTC-3630(a). ISTC-3630(a) requires that leakage rate testing (water) for pressure isolation valves be performed at least once every 2 years. Recent historical data was used to identify that PIV testing alone each refuel outage incurs a total dose of approximately 400 mRem. The reason for this relief request is to reduce outage dose. The basis of this relief request is that the proposed alternative would provide an acceptable level of quality and safety.

5. Proposed Alternative and Basis for Use

Pressure Isolation Valves (PIVs) are not included in the scope for performance-based testing as provided for in 10CFR50 Appendix J, Option B. The concept behind the Option B alternative for containment isolation valves is that licensees should be allowed to adopt cost effective methods for complying with regulatory requirements. Additionally, NEI 94-01 describes the risk-informed basis for the extended test intervals under Option B. That justification shows that for valves which have demonstrated good performance by passing their leak rate tests (air) for two consecutive cycles, further failures appear to be governed by the random failure rate of the component. NEI 94-01 also presents the results of a comprehensive risk analysis, including the statement that "the risk impact associated with increasing [leakrate] test intervals is negligible (less than 0.1% of total risk)." The valves identified in this relief request are all in water applications. The PIV testing is performed with water pressurized to normal plant operating pressures. This relief request is intended to provide for a performance-based scheduling of PIV tests at Fermi 2. The reason for requesting this relief is dose reduction / ALARA. Assuming all of the PIVs remain classified as good performers the extended test intervals would provide for a savings of 800 mRem over a 4-1/2 year period.

NUREG 0933 Issue 105 discussed the need for PIV leak rate testing based primarily on three pre-1980 historical failures of applicable valves industry-wide. These failures all involved human errors in either operations or maintenance. None of these failures involved inservice equipment degradation. The performance of PIV leak rate testing provides assurance of acceptable seat leakage with the valve in a closed condition. Typical PIV testing does not identify functional problems which may inhibit the valves ability to re-position from open to closed. For check valves, such functional testing is accomplished per ASME OM Code ISTC-3522 and ISTC-3520. Power-operated valves are routinely full stroke tested per ASME OM Code to ensure their functional capabilities. At Fermi 2, these functional tests for PIVs are performed only at a Cold Shutdown or Refuel Outage frequency. Such testing is not performed online in order to prevent any possibility of an inadvertent Interfacing System Loss of Coolant Accident (ISLOCA) condition. The 18 month functional testing of the PIVs is adequate to identify any abnormal condition that might affect closure capability. Performance of the separate

18 month PIV leak rate testing does not contribute any additional assurance of functional capability, it only verifies the seat tightness of the closed valves.

Fermi 2 proposes to perform PIV testing at intervals ranging from every refuel to every third refuel. The specific interval for each valve would be a function of its performance and would be established in a manner consistent with the Containment Isolation valve (CIV) process under 10CFR50 Appendix J Option B. Nine of the 15 valves listed are also classified as CIVs and are leak rate tested with air at intervals determined by 10CFR50 Appendix J, Option B (hereto referred to as Option B). ISI Leak Rate Program guidance will be established such that if any of those 9 valves fail either their CIV test or their PIV test, the test interval for both tests will be reduced to every RFO until they can be re-classified as good performers per the Appendix J, Option B requirements.
The test intervals for the valves with a PIV-only function will be determined in the same manner as is done for CIV testing under Option B. That is, the test interval may be extended to every 3 RFO (not to exceed 6 years) upon completion of two consecutive periodic PIV tests with results within prescribed acceptance criteria. Any PIV test failure will require a return to the initial (every RFO) interval until good performance can again be established.

The primary basis for this relief request is the historically good performance of the PIVs. The only recorded PIV test failures at Fermi 2 were in fact determined to be a result of the test methodology and not due to seating surface condition of the valves. These failures occurred many years ago and, following test procedure enhancements, have not recurred. Several of the valves covered by this relief request have passed the as found PIV water test but experienced failures of as found CIV air leakage tests due to seat imperfections. There is general industry-wide consensus that CIV air-testing is a more challenging and accurate measurement of seat condition, and more likely to identify any seat condition degradation.

NUREG/CR-5928, "Final Report of the NRC-sponsored ISLOCA Research Program", evaluated the likelihood and potential severity of ISLOCA events in BWRs and PWRs. The BWR design used as a reference for this analysis was a BWR-4 with a Mark 1 containment. Fermi 2 was listed in Section 4.1 of this document as one of the applicable plants. The applicable BWR systems were individually analyzed and in each case this report concluded that the system was "...judged to not be an important consideration with respect to ISLOCA risk." Section 4.3 concluded the BWR portion of the analysis by saying "ISLOCA is not a risk concern for the BWR plant examined here."

The following statement is contained in the Fermi 2 PSA:
"...initiators related to the ECCS valve test and maintenance activities are the dominant contributors to the interfacing LOCA frequency, while hardware failure induced valve leakage accounted for only 0.3% of the overall interfacing system LOCA frequency. The mean values of frequencies associated with test and maintenance activities and hardware failures are 6.2E-7/yr and 2.0E-9/yr respectively."

This means that the actual act of testing these valves is a far higher ISLOCA initiation risk than actual valve leakage. Reducing the test frequency would actually reduce the likelihood of an ISLOCA. Assuming conservatively that a tripling of test interval per this relief correlates to a tripling of the hardware leakage factor, this still yields a value of only 6.0E-9/yr. That value is low enough to be considered an insignificant contributor to the overall ISLOCA frequency.

Summary of bases / rationale for this relief request:

- Performance-based PIV testing would yield a dose reduction of up to 800 mRem over a 4-1/2 year period.
- Performance of separate functional testing of PIVs every 18 months per ASME Code.
- Excellent historical performance results from PIV testing for all the applicable valves.
- Low likelihood of valve mispositioning during power operations (procedures, interlocks).
- Air testing versus water testing - degrading seat conditions are identified much sooner with air testing
- Relief valves in the low pressure piping - these relief valves may not provide ISLOCA mitigation for inadvertent PIV mispositioning (gross leakage) but their relief capacity can easily accommodate conservative PIV seat leakage rates.
- Alarms that identify high pressure to low pressure leakage - Operators are highly trained to recognize symptoms of a present or incipient ISLOCA and to take appropriate actions.

The intent of this relief request is simply to allow for a performance-based approach to the scheduling of PIV leakage testing. It has been shown that ISLOCA represents a small risk impact to BWRs such as Fermi 2. Fermi 2 PIVs have an excellent performance history in terms of seat leakage testing. The risks associated with extending the leakage test interval to a maximum of 3 refueling outages are extremely low. This relief will provide significant reductions in radiation dose.

6. Duration of Proposed Alternative

This proposed alternative will be utilized for the entire 3rd 120 month interval.

7. Precedents

- Previous adoption of the 10CFR50 Appendix J, Option B performance-driven test frequencies for Containment Isolation Valve leak rate testing. Recognition that valves with consistently good seat leakage test results are highly unlikely to degrade to unacceptable conditions within the longer test intervals.
- The relationship of PIV test historic performance to the likelihood of such degradation is fundamentally the same.