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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO THE INSERVICE TESTING PROGRAM

VERMONT YANKEE NUCLEAR POWER STATION

DOCKET NUMBER 50-271

1.0 INTRODUCTION

The *Code of Federal Regulations*, 10 CFR 50.55a, requires that inservice testing (IST) of certain American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 pumps and valves are performed in accordance with Section XI of the ASME *Boiler and Pressure Vessel Code* (the Code) and applicable addenda, except where alternatives have been authorized or relief has been requested by the licensee and granted by the Commission pursuant to Sections (a)(3)(i), (a)(3)(ii), or (f)(6)(i) of 10 CFR 50.55a. In proposing alternatives or requesting relief, the licensee must demonstrate that: (1) the proposed alternatives provide an acceptable level of quality and safety; (2) compliance would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety; or (3) conformance is impractical for i facility. Section 50.55a authorizes the Commission to approve alternatives and to grant relie' from ASME Code requirements upon making the necessary findings. Guidance related to the development and implementation of inservice testing (IST) programs is given in Generic Let.. (GL) 89-04, "Guidance on Developing Acceptable Inservice Testing Programs," issued April 3, 1989, and its Supplement 1 issued April 4, 1995. Additional guidance can be found in NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants," NUREG/CR-6396, "Examples, Clarifications, and Guidance on Preparing Requests for Relief from Pump and Valve Inservice Testing Requirements," and "Summary of Public Workshops Held in NRC Regions on Inspection Procedure 73756, 'Inservice Testing of Pumps and Valves,' and Answers to Panel Questions on Inservice Testing Issues."

The 1989 Edition of the ASME Code is the latest edition incorporated by reference in Paragraph (b) of Section 50.55a. Subsection IWP of the 1989 Edition, which gives the requirements for IST of pumps, references Part 6 of the American National Standards Institute/ASME *Operations and Maintenance Standards* (OM-6) as the rules for IST of pumps. OM-6 replaces specific requirements in previous editions of Section XI, Subsection IWP of the ASME Code.

2.0 BACKGROUND

By letter dated November 20, 1998, Vermont Yankee Nuclear Power Corporation (VY), the licensee, submitted two revised pump relief requests for the third 10-year interval for the Vermont Yankee Nuclear Power Station Inservice Testing (IST) Program. RR-P04, Revision 1 for the High Pressure Coolant Injection (HPCI) main (high pressure) pump and RR-P10, Revision 2 for the Reactor Core Isolation Cooling (RCIC) pump each request relief from the vibration velocity acceptance criteria specified in Table 3 of ASME/ANSI Operations and Maintenance (OM) Standards, Part 6, "Inservice Testing of Pumps in Light-Water Reactor

Power Plants." Specifically, each requests the use of an "alert range" that is less restrictive than that prescribed by OM-6 (at specified vibration data points) but commits to the use of full spectrum vibration analysis in lieu of the broad band vibration monitoring allowed by the Code.

The Vermont Yankee Nuclear Power Station IST program for the third 10-year interval began on September 1, 1993, and is scheduled to expire on August 31, 2003. The Vermont Yankee Nuclear Power Station IST program was developed to the 1989 Edition of Section XI, Division 1, of the ASME Boiler and Pressure Vessel Code. The 1989 Edition of the Code specifies that the rules for the inservice testing of pumps and valves are stated in the ASME/ANSI Operations and Maintenance (OM) Standards, Part 6, "Inservice Testing of Pumps in Light-Water Reactor Power Plants," Part 10, "Inservice Testing of Valves in Light-Water Reactor Power Plants," and OMa-1988 Addenda to the OM-1987 Edition. [Reference VY third 10-year IST program submittal dated November 30, 1992, and NRC SE dated September 3, 1993.]

3.0 HIGH PRESSURE COOLANT INJECTION PUMP RELIEF REQUEST RR-P04, REVISION 1

RR-P04 pertains to the ASME Code Class 2 High Pressure Coolant Injection (HPCI) main (high pressure) pump at Vermont Yankee Nuclear Power Station (P44-1A). The main pump has the safety function to operate in series with the booster pump (P44-1B) to provide: 1) adequate core cooling and reactor vessel depressurization following a small break loss of coolant accident, and 2) reactor pressure control during reactor shutdown and isolation.

The licensee requests relief from Section 5.2(d) of OM-6 for the HPCI pump. This section of the ASME Code requires that "Pressure, flow rate, and vibration (displacement or velocity) shall be determined and compared with corresponding reference values. All deviations from the reference values shall be compared with the limits given in Table 3 and corrective action taken as specified in para. 6.1."

Specifically, the licensee requests relief from the vibration velocity (V_v) acceptance criteria specified in Table 3 at the Main Pump Turbine Side Horizontal and Vertical Vibration Points 1-3, 0-3 and Main Pump Gearbox Side Horizontal Vibration Point 1-4. The remaining HP and Booster pump vibration points will be evaluated using OM-6 acceptance criteria. Relief request RR-P04 was previously approved by NRC in a safety evaluation dated September 3, 1993, in a format that could be interpreted to apply to all HP pump vibration points. The licensee now proposes to perform vibration spectrum monitoring quarterly, to delete the spectral resonance alarm criteria of 1.05 and 1.3 times the overall peak reference value (committed to in Rev. 0 of RR-P04), and lower the overall peak value acceptable range limit from 0.675 in/sec (approved in Rev. 0 of RR-P04) to 0.575 in/sec.

3.1 Licensee's Basis for Request

The licensee provided the following basis for the relief request:

> Relief is requested on the basis that the proposed alternatives would provide an acceptable level of quality and safety.

The HPCI pump has a notable history regarding analysis and resolution of high vibration issues. During the 1985 through1987 time frame, vibration consultants with specialized equipment were utilized to identify phase angles, natural and resonance frequencies, etc., providing a thorough analysis of existing conditions. The root cause of the higher vibration levels was determined to be a 2nd order acoustical resonance in the piping connecting the low pressure (LP) and high pressure (HP) pumps, and the presence of a structural resonance at the 2nd order in the horizontal direction on the HP pump.

These resonance conditions are design related and have existed since initial pump installation. The HPCI Booster pump impeller was modified in 1989, based on the consultant's recommendations to reduce the 2nd order vibration levels; however, the overall peak levels remained higher than the OM-6 Table 3a acceptable range of 0.325 in/second. Vermont Yankee concluded that these high levels did not indicate pump mechanical degradation and do not represent phenomena that could prevent the pump from performing its intended function. The NRC approved IST Program Relief Request RR-P04 in 1993 which permitted the overall peak vibration acceptable range to be expanded to 0.675 in/sec. At that time, Vermont Yankee additionally committed to evaluate the resonance peaks during each test and assigned limits of 1.05 and 1.3 times the overall peak reference value (V_r).

Regarding the approved relief request commitment to evaluate the resonance peaks, VY conservatively interprets "resonance peaks" to be the largest peak on the spectrum even though resonance only occurs when a natural frequency and forced frequency coincide. VY applies the resonance peak criteria to all peaks on the spectrum, the largest usually being the impeller vane pass frequency. Compliance with the VY-proposed spectral resonance alarm criteria of 1.05 and 1.3 times the overall peak reference value (V_r) results in a hardship without a compensating increase in the quality and safety of the plant. Specifically, spectral alarm bands are typically established to be more restrictive in the areas of bearing degradation and less restrictive in the impeller vane pass frequency region. Assignment of a single conservative spectral alarm limit for any large peak on the entire spectrum places the pump in the alert range when, for example, vane pass frequency varies by a small amount. The commitment to perform full spectrum vibration monitoring envelopes a review of all peaks in the spectrum for signs of degradation, including the resonance peaks. The VY commitment to assign a single spectral alarm limit adds little value to the vibration program and unjustifiably causes the pump test frequency to be doubled. Relief is requested to delete the conservative spectral alarm commitment. Additionally, VY has reviewed the overall peak values and determined that the acceptable range limit can be lowered from 0.675 to 0.575 in/sec. This lower acceptance value is the result of continuing efforts to reduce the vibration levels on this complex system (i.e., turbine, HP pump, gearbox, and booster pump combination).

3.2 Proposed Alternate Testing

The licensee proposed the following:

To allow for practicable vibration monitoring of the HPCI HP pump, alternate vibration acceptance criteria are required specifically for vibration points 1-3, 0-3 and 1-4. Full spectrum analysis will be performed during each quarterly test and the following criteria will be used:

Test Parameter	Acceptable Range	Alert Range	Required Action Range
V_v	≤2.5 V_r but not > 0.575 in/sec	> 2.5 V_r to and including 6 V_r but not > 0.70 in/sec	> 6 V_r or > 0.70 in/sec

The remaining HPCI HP and Booster pump vibration points are evaluated using OM-6 acceptance criteria.

3.3 Evaluation

Section 4.6.4 of OM-6 requires that "On centrifugal pumps, measurements shall be taken in a plane approximately perpendicular to the rotating shaft in two orthogonal directions on each accessible pump bearing housing. Measurement also shall be taken in the axial direction on each accessible pump thrust bearing housing." The licensee proposes to use the acceptance criteria specified in the table below for the Main Pump Turbine Side Horizontal and Vertical Vibration Points 1-3, 0-3 and Main Pump Gearbox Side Horizontal Vibration Point 1-4. The remaining HPCI HP and Booster pump vibration points will be evaluated using OM-6 acceptance criteria.

Test Parameter	Acceptable Range	Alert Range	Required Action Range
OM-6, V_v (≥ 600 rpm)	≤2.5 V_r	> 2.5 V_r to 6 V_r or >0.325 in/sec	> 6 V_r or >0.70 in/sec
RR-P04, V_v (Approved 9/3/93)	≤2.5 V_r but not > 0.675 in/sec	> 2.5 V_r to and including 6 V_r but not > 0.70 in/sec, resonance peaks ≥1.05 V_r	> 6 V_r or > 0.70 in/sec, resonance peaks ≥1.3 V_r
RR-P04, Rev. 1 Proposed V_v	≤2.5 V_r but not > 0.575 in/sec	> 2.5 V_r to and including 6 V_r but not > 0.70 in/sec (delete spectral alarm commitment)	> 6 V_r or > 0.70 in/sec (delete spectral alarm commitment)

The licensee requests permission to delete the spectral alarm commitment that was approved by the NRC as an alternative in the original version of RR-P04 (9/3/93 SE). The licensee contends that compliance with the VY-proposed spectral resonance alarm criteria of 1.05 and 1.3 times the overall peak reference value (V_r) results in a hardship without a compensating increase in the quality and safety of the plant. The licensee stated that their commitment to perform full spectrum vibration monitoring envelopes a review of all peaks in the spectrum for signs of degradation, including the resonance peaks. VY contends that their commitment to assign a single spectral alarm limit adds little value to the vibration program and unjustifiably causes the pump test frequency to be doubled (e.g., when the resonance peak at the impeller vane pass frequency exceeds 1.05 V_r). Based on VY's review of overall peak vibration values, the licensee has determined that the acceptable range limit can be lowered from 0.675 in/sec to 0.575 in/sec.

The licensee has performed extensive analysis of this pump installation and determined that the high vibration levels are due to effects of acoustical and structural resonance. These high levels do not indicate pump mechanical degradation and do not represent phenomena that could prevent the pump from performing its intended function. In addition, the licensee is continuing its efforts to reduce the vibration levels on this complex system (i.e., turbine, HP pump, gearbox, and booster pump combination).

The licensee's proposal to perform pump vibration spectrum analysis quarterly with a lower vibration acceptance criteria should result in corrective action being taken on a pump with significant degradation. A spectrum analysis measures a narrow vibration band width over a wide frequency range and indicates the frequency and magnitude of vibration peaks, which permits identification of specific problems with bearings and other pump mechanical

components. The spectrum analysis allows a more comprehensive evaluation of pump condition than the Code required wide range vibration measurements. Therefore, the proposal provides an acceptable level of quality and safety.

Deletion of the commitment to have an additional Alert Range of 1.05 V, to 1.3 V, and an additional Required Action Range of > 1.3 V, for the resonance peaks will not decrease the effectiveness of the licensee's pump vibration monitoring program in terms of its ability to detect pump degradation. This additional commitment could cause an unnecessary burden on the licensee particularly when "resonance peaks" are interpreted to be the largest peak on the spectrum even though resonance only occurs when a natural frequency and forced frequency coincide.

3.4 Conclusion

The licensee's proposed alternative to the Code requirement, described in Revision 1 to pump relief request RR-P04, is authorized pursuant to 50.55a(a)(3)(i) based on the determination that the proposed alternative provides an acceptable level of quality and safety.

4.0 REACTOR CORE ISOLATION COOLING PUMP RELIEF REQUEST RR-P10, REVISION 2

RR-P10, Revision 2 pertains to the ASME Code Class 2 Reactor Core Isolation Cooling (RCIC) pump at Vermont Yankee Nuclear Power Station (P47-1A). The RCIC pump is powered by a steam driven turbine and has a safety function to operate to provide makeup water to the reactor vessel during shutdown and isolation in order to prevent the release of radioactive materials to the environment as a result of inadequate core cooling. The system is designed to receive steam from the reactor vessel and function without AC power from normal supplies or the emergency diesel generators. The pump is a horizontal, multistage, centrifugal, double volute pump having five stages with four vanes on the first stage impeller and five vanes on the remaining four impellers, designed to provide a constant flow of 416 gpm at rated speed. The bearings are antifriction, rolling element type. The RCIC system at VY is designed and qualified for at least 12 hours of continuous or intermittent operation in support of core cooling following transient or accident events. Other plants using this pump design are Quad Cities, Monticello, and Pilgrim.

The licensee requests relief from Section 5.2(d) of OM-6 for the HPCI pump. This section of the ASME Code requires that "Pressure, flow rate, and vibration (displacement or velocity) shall be determined and compared with corresponding reference values. All deviations from the reference values shall be compared with the limits given in Table 3 and corrective action taken as specified in para. 6.1."

Specifically, the licensee requests relief from the Vibration Velocity (V_v) acceptance criteria specified in Table 3 for the Pump Outboard Bearing, Vertical Vibration Point 0-4. The remaining RCIC pump vibration points (i.e., the pump inboard bearing horizontal/vertical and the outboard bearing horizontal/axial points) will be evaluated using OM-6 acceptance criteria.

This relief request (RR-P10, Rev. 0) was previously submitted to the NRC on January 30, 1995, and was not authorized for long-term implementation. The relief request, at that time, requested a 0.5 in/sec acceptance range limit for all RCIC pump vibration points. By letter dated May 26, 1995, the NRC granted interim approval for a 1-year period and VY was requested to perform additional investigation and provide an enhanced justification. The interim relief request was never implemented by VY. The relief request was subsequently deleted (RR-P10, Rev. 1) from the IST Program with the issuance of revision 18.

4.1 Licensee's Basis for Request

The licensee provided the following basis for the relief request:

> Relief is requested on the basis that the proposed alternatives would provide an acceptable level of quality and safety.
>
> Past testing and analysis performed on the RCIC System by Vermont Yankee and independent vibration consultants in 1988 and 1997 confirms characteristic pump vibration levels in the outboard bearing vertical direction, at the high end of the acceptance range criteria stated in Table 3 of Part 6 of the Code. This testing and analysis meets the intent of Paragraph 4.3 and footnote 1 of Part 6 of the Code.
>
> The root causes of the higher vibration levels have been determined to be:
>
> a) Excitement in the outboard bearing support in the vertical direction at or near the fourth and fifth orders (vane pass frequency).
>
> b) The presence of a natural frequency at 320 Hz (19,200 cycles per minute) in the outboard bearing vertical direction.
>
> In the pump speed range of 4,000 to 4,500 RPM the fourth (267-300 Hz) and fifth (333-375 Hz) orders do not coincide with the 320 Hz natural frequency peak but are influenced by it. In general, the 4th order is more sensitive to resonance as pump speed and the corresponding 4th order vane pass frequency is increased toward the 320 Hz natural frequency. The 5th order is influenced somewhat less as speed is lowered, and the corresponding 5th order vane pass frequency is decreased toward the 320 Hz natural frequency.
>
> The analysis performed by a vibration consultant in 1988 documented that the 4th order peak value of 0.511 in/sec @ 4500 rpm dropped to .177 in/sec when speed was decreased to 4342 rpm. The recommendation at that time was to reduce the speed for surveillance testing. When the surveillance speed was lowered to approximately 4300 rpm, the overall peak vibration level in the outboard vertical direction remained in the area of 0.3 in/sec. A reference value of .316 in/sec was established with a 0.325 in/sec acceptable range limit. VY has operated the pump with this small acceptable range margin since March 2, 1990.

The analysis performed by the same vibration consultant in 1997 clearly documented the relationship of the natural frequency to the 4th and 5th order vane pass frequency using improved vibration technology. The excitement in the bearing support was also documented. The recommendation at that time was again to reduce the speed for surveillance testing if possible. If a speed reduction was not possible then changing the number of 1st stage impeller vanes and modifications to the outboard bearing support was recommended.

With only one vertical direction vibration point exceeding the OM-6 vibration criteria, it was determined that to pursue 1st stage impeller replacement or to perform the analysis to qualify a bearing support modification results in a hardship without a compensating increase in quality and safety of the plant. Spectrum analysis of the latest surveillance test data shows that the primary source of the vibration continues to coincide with vane pass frequency of the pump. Vane pass frequency is inherent in all pumps and normally does not present a problem unless it happens to excite resonant frequencies. The vane pass frequencies do not coincide exactly with the natural frequency; therefore, a full resonance condition does not exist. The identified vane pass frequencies are on the periphery of resonance excitement, thereby causing higher than expected vibration in the outboard vertical direction. This condition on the outboard bearing, in one direction, is not of a magnitude that would prevent the RCIC pump from performing its intended safety function.

Surveillance testing is currently performed to satisfy both Technical Specification and IST requirements using a reference speed of 4300 rpm. Preliminary design basis review information indicates that the speed will need to be increased to test the pump at a higher output to account for instrument uncertainty. Increasing the speed to the expected 4450 to 4500 rpm range produces an overall peak vibration between 0.433 and 0.460 in/sec as documented in the 1997 consultant report.

The resonance condition is design related and has existed since initial pump installation. Surveillance test documentation collected over a number of years demonstrates that no appreciable degradation has taken place. On February 18, 1990, the outboard bearing was replaced three times in an effort to demonstrate that a degraded bearing condition did not exist.

The pump vendor certified, in a September 14, 1998, memorandum, that the pump could be run at 0.575 in/sec and would not be expected to exhibit reduced reliability given the intermittent and short duration (< 24 hours) operation in support of core cooling following transient or accident events. Communication with the aforementioned plants identified that vibration levels of ≤ 0.2 in/sec are routinely experienced; however, it should be noted that their pump pedestals are approximately 1'-3" high while the VY RCIC pump pedestal is 3'-0" in height. With this understanding, a direct comparison between plants cannot be made since the foundation is dissimilar and natural frequencies are unique for each component and combination of components.

Although existing vibration levels in the RCIC pump outboard bearing vertical direction are at the high end of standard acceptance criteria, they are acceptable and reflect the unique operating characteristics of the VY RCIC pump. It has been concluded that there are no vibration concerns of a magnitude that would indicate pump degradation or prevent the pump from performing its intended function.

4.2 Proposed Alternate Testing

The licensee proposed the following:

To allow for practicable vibration monitoring of the RCIC pump, alternate vibration acceptance criteria are required. Full spectrum vibration monitoring will be performed during each quarterly test and the following criteria will be used for RCIC pump vibration point 0-4:

Test Parameter	Acceptable Range	Alert Range	Required Action Range
V_v	≤2.5 V_r but not > 0.575 in/sec	> 2.5 V_r to and including 6 V_r but not > 0.70 in/sec.	> 6 V_r or > 0.70 in/sec

4.3 Evaluation

The licensee stated that use of the vibration acceptance criteria contained in OM-6 has caused, and continues to cause, frequent entry into the Alert Range, requiring increased frequency testing for vibration point 0-4.

Section 4.6.4 of OM-6 requires that "On centrifugal pumps, measurements shall be taken in a plane approximately perpendicular to the rotating shaft in two orthogonal directions on each accessible pump bearing housing. Measurement also shall be taken in the axial direction on each accessible pump thrust bearing housing." Table 3a of OM-6 requires those pumps with vibration levels between 0.325 in/sec and 0.700 in/sec be classified in the "alert" range and that the testing frequency be doubled (from quarterly to every 6 weeks) until the cause of the vibration is determined and the condition corrected.

While not implemented by the licensee, the staff approved interim use of relaxed alert range (0.50 in/sec to 0.70 in/sec) in a safety evaluation to the licensee dated May 26, 1995. In that safety evaluation the staff stated that "During the interim period, the licensee should investigate methods to reduce current pump vibration levels; confirm that an analysis has been performed which demonstrates the pump is capable of continued operation at higher vibration levels (including contact with the pump manufacturer); and evaluate data on how the revised alert limit was derived. ...If the licensee has implemented a program for spectral analysis of the vibration signature of the pump, it would be beneficial to include such information in the alternative

testing section of the revised relief request." As discussed below, the licensee's revised relief request RR-P10, Rev. 2 is responsive to the concerns raised by the staff in the May 26, 1995, safety evaluation.

The licensee now proposes to use the acceptance criteria specified in the table below for the Pump Outboard Bearing, Vertical Vibration Point 0-4 (vibration levels between 0.575 in/sec and 0.700 in/sec will be classified in the "alert" range for this one vibration data point). The remaining RCIC pump vibration points (i.e., the pump inboard bearing horizontal/vertical and the outboard bearing horizontal/axial points) will be evaluated using OM-6 acceptance criteria.

Test Parameter	Acceptable Range	Alert Range	Required Action Range
OM-6, V_v (≥ 600 rpm)	≤2.5 V_r	> 2.5 V_r to 6 V_r or >0.325 in/sec	> 6 V_r or >0.70 in/sec
RR-P10, Rev. 2 Proposed V_v	≤2.5 V_r but not > 0.575 in/sec	> 2.5 V_r to and including 6 V_r but not > 0.70 in/sec	> 6 V_r or > 0.70 in/sec

The licensee states that "Past testing and analysis performed on the RCIC System by VY and independent vibration consultants in 1988 and 1997 confirms characteristic pump vibration levels in the outboard bearing vertical direction, at the high end of the acceptance range criteria stated in Table 3 of Part 6 of the Code. This testing and analysis meets the intent of Paragraph 4.3 and footnote 1 of Part 6 of the Code." Footnote 1 to Paragraph 4.3, "Reference Values" states:

> Vibration measurements of pumps may be foundation, driver, and piping dependent. Therefore, if initial vibration 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.

The licensee has performed extensive analysis of this pump installation and determined that the root cause of the high vibration levels are due to:

a) Excitement in the outboard bearing support in the vertical direction at or near the fourth and fifth orders (vane pass frequency),

b) The presence of a natural frequency at 320 Hz. (19,200 cycles per minute) in the outboard bearing vertical direction.

An analysis performed by a vibration consultant in 1988 documented that the 4th order peak value of 0.511 in/sec at 4500 rpm dropped to 0.177 in/sec when speed was decreased to

4342 rpm. The recommendation at that time was to reduce the speed for surveillance testing. A second analysis performed by the same vibration consultant in 1997 documented the relationship of the natural frequency to the 4th and 5th order vane pass frequency using improved vibration technology. The excitement in the bearing support was also documented. The vibration consultant's recommendation was again to reduce the speed for surveillance testing if possible. If a speed reduction was not possible then changing the number of 1st stage impeller vanes and modifications to the outboard bearing support was recommended. With only one vertical direction vibration point exceeding the OM-6 vibration criteria the licensee determined that to pursue 1st stage impeller replacement or to perform the analysis to qualify a bearing support modification would result in a hardship without a compensating increase in quality and safety of the plant.

Spectrum analysis of the latest surveillance test data shows that the primary source of the vibration continues to coincide with vane pass frequency of the pump. Vane pass frequency is inherent in all pumps and normally does not present a problem unless it happens to excite resonant frequencies. The vane pass frequencies do not coincide exactly with the natural frequency; therefore, full resonance (and hence potentially damaging) condition does not exist in this instance. The identified vane pass frequencies are on the periphery of resonance excitement, thereby causing higher than expected vibration in the outboard vertical direction. This condition on the outboard bearing, in one direction, is not of a magnitude that would prevent the RCIC pump from performing its intended safety function. This condition is design related and has existed since initial pump installation. Surveillance test documentation collected over a number of years demonstrates that no appreciable degradation has taken place.

The licensee stated that the pump vendor has certified, in a September 14, 1998, memorandum, that the pump could be run at 0.575 in/sec and would not be expected to exhibit reduced reliability given the intermittent and short duration (< 24 hours) operation in support of core cooling following transient or accident events. The licensee contacted BWR licensees with similar RCIC pumps and identified that vibration levels of ≤ 0.2 in/sec are routinely experienced; however, they noted that these other licensee's pump pedestals are approximately 1'-3" high while the VY RCIC pump pedestal is 3'-0" in height. Therefore, the licensee states that a direct comparison between plants cannot be made since the foundation is dissimilar and natural frequencies are unique for each component and combination of components.

The licensee's proposal to perform pump vibration spectrum analysis quarterly with a lower vibration acceptance criteria (as certified to be acceptable by the RCIC pump vendor) should result in corrective action being taken on a pump with significant degradation. A spectrum analysis measures a narrow vibration band width over a wide frequency range and indicates the frequency and magnitude of vibration peaks, which permits identification of specific problems with bearings and other pump mechanical components. The spectrum analysis allows a more comprehensive evaluation of pump condition than the Code required wide range vibration measurements. Therefore, the proposal provides an acceptable level of quality and safety.

4.4 Conclusion

The licensee's proposed alternative to the Code requirement, described in Revision 2 to pump relief request RR-P10, is authorized pursuant to 50.55a(a)(3)(i) based on the determination that the proposed alternative provides an acceptable level of quality and safety.

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