



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

June 3, 2010

Mr. Paul Freeman
Site Vice President
c/o Mr. Michael O'Keefe
NextEra Energy Seabrook, LLC
P.O. Box 300
Seabrook, NH 03874

SUBJECT: SEABROOK STATION, UNIT NO. 1 - RELIEF REQUEST FOR CONTAINMENT BUILDING SPRAY PUMP BEARING VIBRATION ALERT RANGE LIMIT, THIRD 10-YEAR INTERVAL (TAC NO. ME2416)

Dear Mr. Freeman:

By letter dated October 13, 2009 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML092890325), NextEra Energy Seabrook, LLC (the licensee), submitted a proposed alternative to the requirements of the American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code) for Seabrook Station, Unit No. 1 (Seabrook). These requirements pertain to the inservice testing requirements. The proposed alternative would increase the Vibration Alert Range Absolute Limit from 0.325 inches per second (ips) to 0.350 ips.

The Nuclear Regulatory Commission (NRC) staff has reviewed the licensee's analysis in support of the proposed alternative. The NRC staff concludes that the proposed alternative provides an acceptable level of quality and safety. The request is authorized for Seabrook pursuant to 10 CFR 50.55a(a)(3)(i) for the remainder of the third 10-year interval.

The NRC staffs' evaluation and conclusions are contained in the enclosed safety evaluation.

P. Freeman

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If you have any questions, please contact the Seabrook Project Manager, Mr. G. Edward Miller, at 301-415-2481.

Sincerely,

A handwritten signature in black ink, appearing to read "Harold K. Chernoff". The signature is fluid and cursive, with a long, sweeping line extending from the end of the name.

Harold K. Chernoff, Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-443

Enclosure: As stated

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

RELIEF REQUEST ASSOCIATED WITH

CONTAINMENT BUILDING SPRAY PUMP BEARING VIBRATION ALERT LIMIT

NEXTERA ENERGY SEABROOK, LLC

SEABROOK STATION, UNIT NO. 1

DOCKET NO. 50-443

1.0 INTRODUCTION

By letter dated October 13, 2009 (ML092890325), NextEra Energy Seabrook, LLC, the licensee, submitted alternative request PR-1 for the third 10-year inservice testing (IST) program interval. The licensee requested an alternative test plan in lieu of certain IST requirements of the 2004 Edition of the American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code). Specifically, the proposed alternative would increase the Vibration Alert Range Absolute Limit from 0.325 inches per second (ips) to 0.350 ips. The NextEra Energy Seabrook, LLC third 10-year IST interval commences on August 18, 2010, and ends on August 17, 2020.

2.0 REGULATORY EVALUATION

Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a(f), "Inservice Testing Requirements," requires, in part, that ASME Class 1, 2, and 3 components must meet the requirements of the ASME OM Code and applicable addenda, except where alternatives have been authorized pursuant to paragraphs (a)(3)(i) and (a)(3)(ii) of 10 CFR 50.55a.

In proposing alternatives, the licensee must demonstrate that the proposed alternatives provide an acceptable level of quality and safety or compliance would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Section 50.55a authorizes the NRC to approve alternatives to ASME OM Code requirements upon making necessary findings. NRC guidance contained in NUREG-1482, Revision 1, "Guidance for Inservice Testing at Nuclear Power Plants," provides alternatives to ASME Code requirements which are acceptable.

3.0 TECHNICAL EVALUATION

3.1 ASME Code Components Affected

CBS-P9A – Containment Building Spray Pump A
CBS-P9B – Containment Building Spray Pump B

3.2 ASME OM Code Requirements

Table ISTB-5121-1, Centrifugal Pumps Test Acceptance Criteria

ISTB-5121(e) and ISTB-5123(e)

All deviations from the reference values shall be compared with the ranges of Table ISTB-5121-1 and corrective action taken as specified in ISTB-6200. Vibration measurements shall be compared to both the relative and absolute criteria shown in the alert and required action ranges of Table ISTB-5121-1.

3.3 Proposed Alternative

The licensee stated that, due to resonance amplification, CBS-P9B pump bearing vibrations have exceeded the ISTB Table 5121-1 absolute limit and CBS-P9A pump bearing vibrations have approached the limit. The licensee is proposing to increase the Vibration Alert Range Absolute Limit from 0.325 inches per second (ips) to 0.350 ips

3.4 Licensee Basis for the Alternative

The licensee provided the following justification, in part, for the proposed alternative:

The ASME Code provides both a relative multiplier on the reference value, or an absolute limit. The lower of the relative multiplier or the absolute limit is used to define test acceptance criteria. The Code established that the absolute limit for the ALERT limit will be applied to all of the bearings. Based on the forcing function (e.g. pump casing resonance caused by the four vane impeller) being the same on both CBS-P-9-A and CBS-P-9-B, the absolute limit of 0.325 inches per second (ips) needs to be increased to 0.350 ips to provide test margin.

The cause of the vibration is well understood and is a result of our original pump design and the sizing of our re-circulation line. It is not the result of any material degradation from the original installation. An impeller design change would be required to obtain vibration test margin; however, this design change would not fix any material degradation or restore lost margin.

CBS pump design uses a wide, four-vane impeller that is susceptible to elevated vane pass vibration. This induced vibration amplitude, along with casing resonance near vane pass frequency, results in elevated overall vibration levels. There are no corrective actions to minimize this condition without replacing the pump impeller, or to modify the stiffness of the pump bearing housings. Implementing either of these design changes to prevent entering the Alert Range, would require extensive work and testing, with no improvement to equipment reliability.

Pump bearing housing resonance amplification results in testing challenges due to lack of any margin between our reference value and the ISTB Table 5121-1, Centrifugal Pump Tests Acceptance Criteria Alert Range absolute limit.

Exceeding the 0.325 ips Alert limit would result in additional testing. Reduced interval testing does not provide any compensating increase in the level of quality and safety. The pumps are infrequently run, on the order of 200 hours for an 18 month cycle.

Pump bearing resonance test results and vibration spectrum analysis are consistent with tests performed during initial plant startup (1986). These results identify that the casing resonance contributes to the overall vibration amplitude. Continued pump operation at these levels is acceptable. Additionally, high resolution vibration data analysis has not found any indications of bearing wear or degradation.

Seabrook Station has also recognized the impact of the Silica Removal Program that will periodically be using the CBS pumps to recirculate the RWST for removal of silica. The CBS pumps were considered Category B pumps during the Second [IST] Interval. The CBS pumps have already been classified as Category A pumps and now have vibration data taken on a quarterly basis. The increased frequency of testing will provide a larger more frequent sample of trend data to be used in analysis of the pumps performance.

Increasing the ISTB Table 5121-1 Alert Range Absolute Limit from 0.325 ips to 0.350 ips for all of the pump bearing limits on both 1-CBS-P-9-A and 1-CBS-P-9-B, will provide adequate margin for test repeatability.

The CBS pumps will be subject to additional testing, trending, and diagnostic analysis as required by the Seabrook Station Predictive Maintenance Program. This program employs predictive monitoring techniques that go beyond the vibration monitoring and analysis required by ISTB. These techniques also now include thermography and lube oil sampling and analysis.

3.5 NRC Staff Evaluation

Pursuant to 10 CFR 50.55a(f)(4)(ii), the Seabrook Station IST program will comply with the ASME OM Code, 2004 Edition. ASME OM Code, 2004 Edition, ISTB-5121(e), for Group A pump tests, and ISTB-5123(e), for Comprehensive Pump Tests, both require that all deviations from the reference values shall be compared with the ranges of Table ISTB-5121-1. ISTB-5121(e) and ISBE-5123(e) also require that vibration measurements shall be compared to both the relative and absolute criteria shown in the alert and required action ranges of Table ISTB-5121-1. For centrifugal pumps that operate above 600 revolutions per minute (rpm), the absolute value Alert Range is from 0.325 ips to 0.7 ips. CBS-P-9-A and CBS-P-9-B are both operated above 600 rpm.

The licensee has proposed a change to the ASME OM Code Table ISTB-5121-1, Centrifugal Pump Test Acceptance Criteria Alert Range Limits for its CBS Pumps CBS-P-9-A and CBS-P-9-B. Specifically, the licensee is requesting to increase the Alert Range Absolute limit from 0.325 ips to 0.350 ips for all bearings of the subject CBS pumps.

The CBS system is designed to remove the energy discharged to the containment following a loss-of-coolant accident or main steam line break to prevent the containment pressure from exceeding design pressure and to reduce and maintain containment temperature and pressure within acceptable limits. The CBS pumps are motor-driven, horizontal, Bingham-Willamette Type CD centrifugal pumps. The pump style is a double-suction, single-discharge, single stage pump and the impeller is configured with a wide, flat discharge vane exiting to the discharge diffuser. According to the pump vendor, the pump impeller design is no longer manufactured and its current replacement impeller has a modified vane exit passage to reduce vane pass excitation. Each train of the CBS system includes one, 100% capacity pump. These pumps can only be tested on a recirculation flow path which is sized for 1900 gpm, which is approximately 63% of the best efficiency point (BEP) Flow of 3000 gpm and approximately 68% of the required design flow of 2808 gpm.

The staff finds the licensee's proposal to increase the Alert Range Absolute lower limit from 0.325 ips to 0.350 ips for all bearings of the subject CBS pumps acceptable for the following reasons:

1. The pumps are susceptible to higher vibrations due to the necessary test conditions. The pumps are tested at approximately 63% of their BEP flow which increases pump internal recirculation flow. Pump internal recirculation flow increases the pump impeller vane pass vibration response.
2. The pumps are susceptible to higher vibration due to their design. The licensee's data analysis identified high pump vane pass spectral responses, and pump casing resonance testing identified that the pump has a resonance frequency similar to that of the pump vane pass. This condition results in increasing vibration amplitude that is responsible for most of the vibration magnitude. The pump vendor has evaluated this issue and agrees with the cause determination and with increasing the pump vibration limits.
3. The pumps have operated satisfactorily at these higher vibration levels since initial operation, including during the pre-operational test (1986). No unusual wear or degradation has been detected during testing or inspections due to this consistently elevated vibration. The licensee has been performing Vibration Spectral Analysis which detects pump bearing or motor bearing degrading trends and improper rotor balance or shaft rubs since at least 2003 with no indication of bearing wear or degradation.
4. The licensee has committed to continue the use of Condition Based Monitoring Techniques that have been used since at least 2003, including the use of Thermography, Lube Oil Sampling and Analysis, and Vibration Spectral Analysis which go beyond monitoring and analysis required by Subsection ISTB of the OM Code.

Furthermore, the licensee's proposed change meets the criteria as specified in NUREG/CP-0152, "Proceedings of the Fourth NRC/ASME Symposium on Value and Pump Testing." This NUREG gives four key components the staff must consider in evaluating such requests which are:

1. The licensee should have sufficient vibration history to verify the pump has operated at this level for a significant amount of time;
2. The licensee should have consulted with the pump manufacturer to determine if operation of the pump is acceptable;
3. The licensee should describe attempts to lower the vibration through modifications to the pump; and
4. The licensee should perform a spectral analysis of the pump-driver system to identify all contributors to the vibration levels. The licensee has consulted with the pump manufacturer to consider pump modifications to reduce or eliminate the vibration issue.

However, they have determined that there are no corrective actions to minimize this condition without replacing the pump impeller, or to modify the stiffness of the pump bearing housings. Implementing either of these design changes to prevent entering the Alert Range, would require extensive work and testing, with no improvement to equipment reliability.

Therefore, the staff finds that the slight increase of the vibration Alert Range will have an insignificant effect on the timely detection of pump degradation prior to component failure, especially since the "Required Action" level of 0.7 ips remains unchanged.

4.0 CONCLUSION

As set forth above, the NRC staff determines that the proposed alternative, PR-2, for CBS Pumps CBS-P9A and CBS-P9B, provides an acceptable level of quality and safety. Accordingly, the staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3)(i), and is in compliance with the ASME Code's requirements. All other ASME OM Code requirements for which relief was not specifically requested and approved, remain applicable. These proposed alternatives are authorized for the third 10-year IST interval, which commences on August 18, 2010, and ends on August 17, 2020.

Principal Contributor: R. Lake

Date: June 3, 2010

P. Freeman

- 2 -

If you have any questions, please contact the Seabrook Project Manager, Mr. G. Edward Miller, at 301-415-2481.

Sincerely,

/ra/

Harold K. Chernoff, Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-443

Enclosure: As stated

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