



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

September 25, 2017

Mr. Fadi Diya
Senior Vice President and
Chief Nuclear Officer
Union Electric Company
P.O. Box 620
Fulton, MO 65251

SUBJECT: CALLAWAY PLANT, UNIT NO. 1 – REQUEST FOR ALTERNATIVE NO. PR-07
FROM THE REQUIREMENTS OF THE ASME CODE FOR THE FOURTH
10-YEAR INSERVICE TESTING INTERVAL (CAC NO. MF9802)

Dear Mr. Diya:

By letter dated June 1, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17153A067), as supplemented by letter dated June 20, 2017 (ADAMS Accession No. ML17171A371), Union Electric Company, dba Ameren Missouri (the licensee) submitted a request to the U.S. Nuclear Regulatory Commission (NRC) for the use of an alternative to certain American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code) requirements at Callaway Plant, Unit No. 1 (Callaway).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(z)(1), the licensee requested to use the proposed alternative on the basis that the alternative provides an acceptable level of quality and safety.

The NRC staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(1). Therefore, the NRC authorizes the use of Alternative for Request No. PR-07 at Callaway for the remainder of the fourth 10-year inservice testing interval.

F. Diya

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If you have any questions, please contact the Project Manager, John Klos at 301-415-5136 or via e-mail at John.Klos@nrc.gov.

Sincerely,



Robert J. Pascarelli, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-483

Enclosure:
Safety Evaluation

cc w/encl: Distribution via Listserv



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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR ALTERNATIVE NO. PR-07 REGARDING

VIBRATION REFERENCE VALUES FOR VARIOUS PUMPS

UNION ELECTRIC COMPANY

CALLAWAY PLANT, UNIT NO. 1

DOCKET NO. 50-483

1.0 INTRODUCTION

By letter dated June 1, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17153A067), as supplemented by letter dated June 20, 2017 (ADAMS Accession No. ML17171A371), Union Electric Company, dba Ameren Missouri (the licensee) submitted a request to the U.S. Nuclear Regulatory Commission (NRC) for the use of an alternative to certain American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code) requirements at Callaway Plant, Unit No. 1 (Callaway). The licensee proposed an alternative to the method for establishing vibration reference values specified in ASME OM Code ISTB-3300, "Reference Values," for select pumps.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(z)(1), the licensee requested to use the proposed alternative on the basis that the alternative provides an acceptable level of quality and safety.

2.0 REGULATORY EVALUATION

The regulations in 10 CFR 50.55a(f), "Preservice and inservice testing requirements," require, in part, that inservice testing (IST) of certain ASME Code Class 1, 2, and 3 components must meet the requirements of the applicable ASME OM Code editions and addenda, except where alternatives have been authorized, pursuant to 10 CFR 50.55a(z)(1) or 10 CFR 50.55a(z)(2).

In proposing alternatives, a licensee must demonstrate that the proposed alternatives provide an acceptable level of quality and safety as outlined in 10 CFR 50.55a(z)(1), or compliance would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety as outlined in 10 CFR 50.55a(z)(2).

Based on the above and subject to the following technical evaluation, the NRC staff finds regulatory authority exists for the licensee to request, and the NRC to authorize the proposed alternative to the ASME OM Code, subject to the evaluation given below.

3.0 TECHNICAL EVALUATION

The fourth 10-year IST interval at Callaway began on December 20, 2014. The applicable ASME OM Code edition and addenda for the 10-year IST interval is the 2004 Edition through the 2006 Addenda.

3.1 The Licensee's Request for Alternative

Applicable Code Requirements

ASME OM Code ISTB-3300(f) requires that "All subsequent test results be compared to these initial reference values or to new reference values established in accordance with ISTB-3310, ISTB-3320, or ISTB-6200(c)."

For centrifugal pumps, ASME OM Code ISTB-5121(e), "Group A Test Procedure," and ISTB-5123(e), "Comprehensive Test Procedure," require that 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.

For vertical line shaft pumps, ASME OM Code paragraphs ISTB-5221(e), "Group A Test Procedure" and ISTB-5223(e), "Comprehensive Test Procedure," require that all deviations from the reference values shall be compared with the ranges of Table ISTB-5221-1 and corrective action taken as specified in ISTB-6200.

ASME Code Components Affected

Relief is requested for the following pumps, as stated in Table 1, "Callaway Plant Inservice Testing Program Pump Table," in its letter dated June 1, 2017.

Table 1: Pumps Effected by Request for Alternative No. PR-07

Pump Number	Description	Pump Type	ASME OM Code Category
PAL01A/B	Motor Driven Auxiliary Feedwater Pumps	Centrifugal	Group A
PBG02A/B	Chemical Volume And Control System Boric Acid Transfer Pumps	Centrifugal	Group A
PEF01A/B	Essential Service Water Pumps	Vertical Line Shaft	Group A
PEG01A/B/C/D	Component Cooling Water Pumps	Centrifugal	Group A
PEJ01A/B	Residual Heat Removal Pumps	Centrifugal	Group A
PAL02	Turbine Driven Auxiliary Feedwater Pump	Centrifugal	Group B
PBG05A/B	Centrifugal Charging Pumps	Centrifugal	Group B
PEM01A/B	Safety Injection Pumps	Centrifugal	Group B
PEN01A/B	Containment Spray Pumps	Centrifugal	Group B

Reason for Request

In its letter dated June 1, 2017, the licensee stated that:

Relief is being requested for establishing the vibration reference value (V_r) solely on the basis of the data collected during preservice or inservice testing for those

vibration points that have unusually low levels of vibration. This request applies only to values for V_r associated with vibration testing. Small values for V_r result in small acceptable ranges for pump operation. The acceptable range defined in Table ISTB-5121-1 and Table ISTB-5221-1 [for centrifugal pumps and vertical line shaft pumps, respectively] is less than or equal to $2.5V_r$. Based on such a small acceptable range, a smooth running pump (i.e., one that has a very low vibration reference value of ≤ 0.05 inches per second (ips)) could be subject to unnecessary corrective action caused by numerically small changes in vibration levels.

Proposed Alternative and Basis for Use

In its letter dated June 1, 2017, the licensee stated, in part, that:

For very small reference values, hydraulic noise and instrument error can be a significant portion of the vibration reading and could affect the repeatability of subsequent measurements. To avoid unnecessary corrective action, a minimum V_r of 0.05 ips is being established for velocity measurements. Pumps with a measured V_r less than or equal to 0.05 inches per second (ips) for a particular vibration measurement location shall have subsequent test results for that location compared to an acceptable range based on 0.05 ips.

When new reference values are established, the measured parameters will be evaluated for each location to determine if the provisions of this relief request still apply. If the measured V_r is greater than 0.05 ips, the requirements of ISTB-3300 will be applied [for the subject pumps]. Conversely, if the measured V_r is less than or equal to 0.05 ips, a minimum value of 0.05 ips will be used in determining the acceptable, alert, and required action ranges.

In addition to the requirements of ISTB, the pumps in the ASME Inservice Testing Program are included in the Callaway Predictive Maintenance Program. The Callaway Predictive Maintenance Program currently employs predictive monitoring techniques such as:

- vibration monitoring and analysis beyond that required by ISTB,
- oil sampling and analysis where applicable (e.g., for pumps with sufficiently large oil reservoirs).

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

It should be noted that all of the pumps in the IST Program will remain in the Callaway Predictive Maintenance Program even if certain pumps have very low vibration readings and are considered to be smooth running pumps...

3.2 NRC Staff Evaluation

The ASME OM Code requires that the vibration of all safety-related pumps be measured and compared with the vibration acceptance criteria as specified in Table ISTB-5121-1 and Table ISTB-5221-1 for centrifugal pumps and vertical line shaft pumps, respectively, to determine if the measured values are acceptable.

Table ISTB-5121-1 and Table ISTB-5221-1 show that, if during an inservice test, a vibration measurement exceeds 2.5 times the reference value V_r , previously established as required by ISTB-3300, the pump is considered to be in the alert range. The frequency of testing is then doubled in accordance with ISTB-6200 until the cause of the deviation is determined, the condition is corrected, and the vibration level returns to below the alert range. Pumps whose vibration is measured at greater than 6 times V_r , are considered to be in the required action range and must be declared inoperable until the cause of the deviation has been determined and the condition is corrected. Per ISTB-3300, the vibration reference values shall be established only when the pump is known to be operating acceptably.

For pumps whose vibration levels are an order of magnitude below the absolute vibration limits specified in Table ISTB-5121-1 and Table ISTB-5221-1, a relatively small increase in vibration magnitude may cause a pump to enter the alert or required action range even though the pump is operating acceptably. The pump may enter these ranges due to variations in flow, instrument accuracies, or other noise sources that would not be associated with degradation of the pump. Pumps that operate with these low vibration levels are typically referred to as "smooth running." Since the acceptable range for a "smooth running" pump is so small, the pump could be subjected to unnecessary corrective action due to entry into the alert or action ranges.

The NRC has previously authorized a minimum vibration level of 0.05 ips or less to be considered "smooth running" pumps at several nuclear plants. However, only monitoring vibration of "smooth running" pumps has been shown to be insufficient for determining pump degradation. At one particular plant, the NRC authorized a minimum reference value of 0.1 ips. A pump bearing at this plant experienced a significant degradation even though the pump vibration levels were below the minimum reference value in the approved alternative. The bearing degradation was discovered during predictive maintenance program activities.

The licensee's proposed alternative combines a minimum vibration value of 0.05 ips to be considered a "smooth running" pump with additional monitoring using a predictive maintenance program that includes vibration analysis beyond that required by ASME OM Code, as well as oil sampling and analysis, as applicable. The licensee notes in its alternative request that if any of the measured parameters, including predictive maintenance values, are outside of the normal operating range or are determined by analysis to be trending towards an unacceptable degraded state, appropriate actions will be taken. These actions include increased monitoring to establish a rate of change, review of component specific information to identify the cause of the condition, and removal of the pump from service to perform maintenance. The proposed alternative is consistent with the objectives of the IST, which is to monitor and correct degradation in safety-related components.

Based on the minimum vibration reference value of 0.05 ips noted in this request and the proposed predictive maintenance program, the NRC staff finds that the alert and required action limits specified in the request should address previously undetected pump problems and provide an adequate indication of pump performance. The licensee's predictive maintenance

program is designed to detect problems involving unacceptable mechanical conditions in advance of when a smooth running pump may reach the overall vibration alert or action limits.

This justification is consistent with the long held staff position described in NUREG-1482, Revision 2, "Guidelines for Inservice Testing at Nuclear Power Plants: Inservice Testing of Pumps and Valves and Inservice Examination and Testing of Dynamic Restraints (Snubbers) at Nuclear Power Plants" (ADAMS Accession No. ML13295A020), dated October 2013, concerning smooth running pumps. Specifically, NUREG-1482, Revision 2, Section 5.12, "Smooth-Running Pumps," states, in part, that:

A small increase in smooth-running pump vibration during the [ASME] OM Code-required IST causes the pump to exceed [ASME] OM Code vibration acceptance criteria, which normally results in unnecessary corrective action. The NRC has authorized alternative vibration acceptance criteria for smooth-running pumps on a case-by-case basis in accordance with 10 CFR 50.55a(a)(3)¹...

Alternative requests for smooth-running pumps should specify a minimum vibration reference value (≤ 0.05 inch per second), and these smooth-running pumps must be included in a predictive maintenance (PdM) program.

Therefore, the proposed alternative provides reasonable assurance that the subject pumps remain operationally ready and thus, the NRC finds that the proposed alternative will provide an acceptable level of quality and safety.

4.0 CONCLUSION

As set forth above, the NRC staff determines that the proposed alternative proposed by Request for Alternative No. PR-07 provides an acceptable level of quality and safety for the subject pumps at Callaway. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(1), and is in compliance with the ASME Code's requirements. Therefore, the NRC staff authorizes the use of Request for Alternative No. PR-07 at Callaway for the remainder of the fourth 10-year IST interval.

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

Principal Contributor: John Billerbeck

Date: September 25, 2017

¹ Retitled from paragraph 50.55a(a)(3)(i) to 50.55a(z)(1) by 79 FR 65776, dated November 5, 2014.

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DATED SEPTEMBER 25, 2017**

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**by memo dated*

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