



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

August 10, 2009

Vice President, Operations
Arkansas Nuclear One
Entergy Operations, Inc.
1448 S.R. 333
Russellville, AR 72802

SUBJECT: ARKANSAS NUCLEAR ONE - UNIT 2 – REQUEST FOR RELIEF FOR THE
FOURTH 10-YEAR INTERVAL INSERVICE TESTING PROGRAM, PRR-ANO2-
2009-1 (TAC NO. ME0921)

Dear Sir or Madam:

By letter dated March 20, as supplemented by letter dated May 21, 2009, Entergy Operations, Inc. (Entergy, the licensee), requested U.S. Nuclear Regulatory Commission (NRC) approval of Relief Request PRR-ANO2-2009-1 for the fourth 10-year inservice testing (IST) interval at Arkansas Nuclear One, Unit 2 (ANO-2). The licensee requested relief from certain IST requirements of the American Society of Mechanical Engineers Code for Operation and Maintenance of Nuclear Power Plants (ASME OM Code). Specifically, the licensee requested relief from the ASME OM Code pump categorization requirements for the low pressure safety injection (LPSI) pumps 2P-60A and 2P-60B. The proposed alternative involves classifying the LPSI pumps as Group A pumps during Modes 5-6 and Group B pumps during Modes 1-4.

The proposed alternative was requested pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(a)(3)(i). Based on the NRC staff's review, authorization of the proposed relief request is justified on the basis that it would provide an acceptable level of quality and safety for ANO-2's fourth 10-year IST interval.

All other ASME OM Code requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

The NRC staff's safety evaluation is enclosed.

Sincerely,

A handwritten signature in black ink, appearing to read "M. Markley".

Michael T. Markley, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-368

Enclosure:
Safety Evaluation

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

RELIEF REQUEST PRR-ANO2-2009-1 FOR THE
FOURTH 10-YEAR INSERVICE TESTING PROGRAM INTERVAL

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT 2

DOCKET NO. 50-368

1.0 INTRODUCTION

By letter dated March 20, 2009, and supplemented by letter dated May 21, 2009 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML090790382 and ML091410403), Entergy Operations, Inc. (Entergy, the licensee), submitted Relief Request PRR-ANO2-2009-1 for the fourth 10-year inservice testing (IST) interval at Arkansas Nuclear One, Unit 2 (ANO-2). With the request, the licensee requested relief from certain IST requirements of the American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code).

The licensee requested relief from the ASME OM Code pump categorization requirements for the low pressure safety injection (LPSI) pumps 2P-60A and 2P-60B. The proposed alternative involves classifying the LPSI pumps as Group A pumps during Modes 5-6 and Group B pumps during Modes 1-4.

The ANO-2 fourth 10-year IST interval will commence on March 26, 2010. The Code of record for the IST program is the 2004 Edition of the ASME OM Code.

2.0 REGULATORY EVALUATION

Section 50.55a, "Codes and standards," of Title 10 of the *Code of Federal Regulations* (10 CFR), requires that IST of certain ASME Code Class 1, 2, and 3 pumps and valves be performed at 120-month (10-year) IST program intervals in accordance with the specified ASME OM Code and applicable addenda incorporated by reference in the regulations, except where alternatives have been authorized or relief has been requested by the licensee and granted by the U.S. Nuclear Regulatory Commission (NRC) pursuant to paragraphs (a)(3)(i), (a)(3)(ii), or (f)(6)(i) of 10 CFR 50.55a. In accordance with 10 CFR 50.55a(f)(4)(ii), licensees are required to comply with the requirements of the latest edition and addenda of the ASME OM Code incorporated by reference in the regulations 12 months prior to the start of each

Enclosure

120-month IST program interval. In accordance with 10 CFR 50.55a(f)(4)(iv), IST of pumps and valves may meet the requirements set forth in subsequent editions and addenda that are incorporated by reference in 10 CFR 50.55a(b), subject to NRC approval. Portions of editions or addenda may be used provided that all related requirements of the respective editions and addenda are met. 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 the facility. Section 50.55a authorizes the NRC to approve alternatives and to grant relief from ASME OM Code requirements upon making necessary findings. NRC guidance contained in Generic Letter (GL) 89-04, "Guidance on Developing Acceptable Inservice Testing Programs," dated April 3, 1989, provides alternatives to Code requirements which are acceptable. Further guidance is given in GL 89-04, Supplement 1, dated April 4, 1989, and NUREG-1482, Revision 1, "Guidelines for Inservice Testing at Nuclear Power Plants," dated January 2005.

3.0 TECHNICAL EVALUATION

3.1 Code Requirements

In the ASME OM Code, Subsection ISTB, Paragraph ISTB-1300 requires that all IST pumps shall be categorized as either a Group A or Group B pump.

Paragraph ISTB-2000 defines Group A pumps as "pumps that are operated continuously or routinely during normal operation, cold shutdown, or refueling operations," and Group B pumps are defined as "pumps in standby systems that are not operated routinely except for testing."

Paragraph ISTB-1400(b) states that "a pump that meets both Group A and Group B pump definitions shall be categorized as a Group A pump."

3.2 Licensee's Basis for Requesting Relief

The ANO-2 LPSI pumps meet the categorization requirements of Group A pumps because they are operated routinely during plant shutdowns and refueling outages. These pumps also meet the requirements of Group B pumps because they are not operated, except for IST, during normal plant operations (reactor critical). ANO-2 requests an alternative, via 10 CFR 50.55a(a)(3)(i), to the requirements of ASME OM Code ISTB-1400(b). ANO-2 requests to test the LPSI pumps as Group B pumps during Modes 1-4 and Group A pumps during Modes 5-6.

The LPSI pumps are tested quarterly using the minimum recirculation flow path from each pump through an orificed line and back to the refueling water tank. The orificed line is the only flow path which upholds the train separation requirements during power operations. The orificed line has no installed instrumentation to measure flow during inservice testing, when the flow has been determined to be approximately 100 gallons per minute (gpm). This low-flow condition does not provide as accurate pump performance data as the comprehensive tests because of the flat nature of the pump curves at the low flow. The pump differential pressure, however, will be sensitive to significant changes in pump performance or suction/discharge flow blockage.

The LPSI pumps are also tested at full flow rate (4,250 to 4,350 gpm) during every refueling outage, as well as during planned and unplanned cold shutdown periods when plant conditions and circumstances permit. The comprehensive full-flow pump tests ensure monitoring of operational time-based pump degradation, whereas the quarterly Group B pump tests provide reasonable assurance of operational readiness of the LPSI pumps.

Vibration Measurements

ANO-2's third interval quarterly pump tests required pump vibration measurements. The minimum recirculation flow path does not permit the pumps to operate at their most efficient levels, resulting in recirculation flow noise. This recirculation flow noise causes overall vibration values that are two to three times higher than the full-flow comprehensive tests. These vibration readings have been subject to spectral analysis under the ANO-2 Predictive Maintenance Vibration Analysis program, which concluded that the recirculation flow noise is the major contributor to the high overall vibration readings.

The effects of low-flow operation on a centrifugal pump make the required broadband vibration readings during the current quarterly test of minimal value. Under the 2004 ASME OM Code, the licensee claims operational readiness of Group B pumps is reasonably assured without requiring quarterly vibration measurements.

Flow Measurements

The ASME OM code requires both flow and differential pressure measurements for Group A pumps on a quarterly basis. The ANO-2 LPSI pumps were not designed with flow indication on the minimum recirculation flow path; however, the cold shutdown flow path has flow instrumentation to satisfy Group A requirements. Modifying the minimum recirculation flow path would require a modification of the flow path piping, resulting in additional cost to ANO-2 without a comparative increase of the quality of the pump performance data. Monitoring pump differential pressure on a quarterly basis without indicated flow meets the monitoring requirements of the ASME OM code for Group B pump tests.

As Group B pumps, the 2-minute minimum pump run-time for quarterly tests is also eliminated. Eliminating the minimum pump run-time requirement and the requirement to record differential pressure and vibration levels is expected to slightly reduce the length of each pump test. This will help to reduce the cumulative run-time of each LPSI pump under low-flow conditions to support testing, with a commensurate reduction in potential pump wear.

Other Considerations

The ANO-2 LPSI pumps are contained in areas which contain radiation, contamination, and personnel hazards. This results in as low as reasonably achievable (ALARA) issues as well as contamination control issues. ANO-2 estimated that the additional dose accumulated by performing quarterly Group A pumps is between 24 and 48 millirem/year. Additionally, pump 2P-60B requires the use of a stepladder to obtain vibration readings. A worker must use both hands for the vibrations data collector to properly collect the data, preventing three-points-of-

body contact on the ladder. The lack of balance support during pump data collection could result in worker injury.

3.3 Licensee Proposed Alternative Testing

The licensee proposes to perform IST of the LPSI pumps in accordance with the 2004 Edition of the ASME OM Code Subsection ISTB, "Inservice Testing of Pumps in Light-Water Reactor Nuclear Power Plants," with the following modifications:

- The LPSI pumps will be tested as standby pumps (Group B) during Modes 1-4 and continuously operating pumps (Group A) during Modes 5-6.
- In Modes 5-6, the Comprehensive Pump Test (CPT) may be substituted for a quarterly Group A test that comes due during a mid-cycle cold shutdown period.

3.4 Evaluation

The licensee has proposed that the LPSI pumps be tested as standby pumps (Group B) during Modes 1-4 and as continuously operating pumps (Group A) during Modes 5-6. In Modes 5-6, the CPT may be substituted for a quarterly Group A test that comes due during a mid-cycle cold shutdown period as provided by the ASME OM Code, Subsection ISTB. ASME OM Code Paragraph ISTB-5000 states that when a Group A test is required, a CPT may be substituted.

ASME OM Code, Paragraph ISTB-2000, defines Group A pumps as "pumps that are operated continuously or routinely during normal operation, cold shutdown, or refueling operations;" and Group B pumps are defined as "pumps in standby systems that are not operated routinely except for testing." Based on these definitions, the LPSI pumps clearly meet the definition of Group B pumps during normal operation in Modes 1-4. In Modes 5-6, the LPSI pumps are used for shutdown cooling and meet the definition of Group A pumps. Paragraph ISTB-1400(b) states: "A pump that meets both Group A and Group B pump definitions shall be categorized as a Group A pump." This would normally cause the LPSI pumps to be classified as Group A and tested in accordance with ISTB-5221, ISTB-5222, and ISTB-5223. However, because of the inability to achieve a substantial flow rate in Modes 1-4, it is not possible to conduct a Group A test that would provide very much meaningful data to detect degradation due to the relatively flat profile of the pump curve and the higher vibration levels present at these near shut-off head flow conditions. The current vibration data provided by ANO-2 shows that the vibration levels during quarterly Group A testing are well within the acceptable range listed in Table ISTB-5221-1, "Vertical Line Shaft and Centrifugal Pumps Test Acceptance Criteria," of the ASME OM Code. Additionally, the LPSI pumps are standby pumps during Modes 1-4 and little degradation is expected with respect to hydraulic performance during the operational period when the pumps are idle. Therefore, a Group B test would provide adequate assurance of the operational readiness of the LPSI pumps, and imposing the Code requirements would not provide meaningful performance data to assess the operational readiness of the pumps.

The licensee stated that the minimum recirculation flow path does not contain flow instrumentation and the accuracy for the current portable flow instrumentation is +/- 5 percent. In order to achieve the +/- 2 percent flow accuracy required by the ASME OM code, the

minimum flow-path piping would need to increase in diameter, resulting in significant costs to ANO-2. In GL 89-04, Position 9, the NRC staff determined that,

In cases where flow can only be established through a non-instrumented minimum-flow path during quarterly pump testing, and a path exists at cold shutdowns or refueling outages to perform a test of the pump under full or substantial flow conditions, ... the increased interval is an acceptable alternative to the Code requirements.

Therefore, the proposed alternative testing of the LPSI pumps as Group B during Modes 1-4 and as Group A during Modes 5-6 is consistent with GL 89-04, Position 9, and provides reasonable assurance of operational readiness of the LPSI pumps.

The licensee stated that the LPSI pumps are located in areas which are both radiation areas and contamination areas. The NRC promotes ALARA principles and does not advocate unnecessary exposure to additional dose. Because the LPSI pumps move primary water, there is always a possibility of a "crud" burst and contamination inside of the room(s) containing the pumps. Therefore, the proposed alternative would uphold ALARA safety principles.

4.0 CONCLUSION

Based on the above evaluation, the NRC staff concludes that the licensee's proposed alternative testing of the LPSI pumps as Group B during Modes 1-4, and as Group A during Modes 5-6 is authorized pursuant to 10 CFR 50.55a(a)(3)(i), based on the alternative providing an acceptable level of quality and safety. The alternative is authorized for the fourth 10-year IST interval, which will commence on March 26, 2010.

All other ASME OM Code requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: M. Orenak

Date: August 10, 2009

The NRC staff's safety evaluation is enclosed.

Sincerely,

/RA by CFLyon for/

Michael T. Markley, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-368

Enclosure:
Safety Evaluation

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