



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 165 TO

FACILITY OPERATING LICENSE NO. NPF-6

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT NO. 2

DOCKET NO. 50-368

1.0 INTRODUCTION

By letter dated April 4, 1995, Entergy Operations Inc. submitted for staff review proposed technical specification (TS) changes to delete the requirements for inservice inspections (ISIs) of reactor coolant pump (RCP) flywheels at Arkansas Nuclear One, Units 1 and 2 (ANO-1 & 2). The licensee submitted the TS changes and a fracture mechanics analysis as a lead submittal from a group of Combustion Engineering Owners Group plants which includes Millstone, Unit 2, Palisades, St. Lucie, Units 1 and 2, and Waterford, Unit 3. The ISI for the ANO-2 RCP 2P32A flywheel was scheduled for refueling outage, 2R11, which will begin on September 22, 1995. The ISI for the ANO-1 RCP flywheel was scheduled for the 1996 refueling outage. The ANO plants have an 18-month fuel cycle.

After a preliminary review, we determined that the proposed TS changes with associated fracture mechanics analysis will require review beyond the September 1995 target date because of the generic implication of eliminating ISI requirements for the RCP flywheel. As an interim measure, by letter dated August 25, 1995, the licensee proposed to divide the TS change into two steps. The first step addresses the ISI of ANO-2 RCP 2P32A only. The proposed change to the ANO-2 TS adds a footnote to Surveillance Requirement 4.4.10.1. The footnote reads: "For reactor coolant pump 2P32A, the ultrasonic volumetric examination of the areas of higher stress concentration at the bore and keyway may be extended through the 2R12 refueling outage." This amendment addresses the ISI associated with ANO-2 refueling outage 2R12 and RCP 2P32A only. The second phase of the amendment, requesting deletion of RCP ISI altogether, is still under review and will be addressed at a later date. The August 25, 1995, letter did not change the original no significant hazards consideration determination.

2.0 DISCUSSION

10 CFR Part 50, Appendix A, General Design Criteria 4 (GDC 4), requires that structures, systems, and components important to safety be protected against

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the effects of missiles that might result from equipment failures. Regulatory Guide (RG) 1.14, Revision 1, Coolant Pump Flywheel Integrity, describes a method acceptable to the staff for implementing this requirement with regard to minimizing the potential for failure of the flywheels of RCPs. RG 1.14 states that, "If the flywheel of the reactor coolant pump is conservatively designed and made from suitable materials with closely controlled quality, if adequate design review of new configurations is provided, and if adequate inservice inspection is provided, the probability of a flywheel failure is sufficiently small that the consequences of failure need not be protected against." Regulatory Position C.4.b of RG 1.14 recommends ultrasonic volumetric examination of the areas of higher stress concentration at the bore and keyway at approximately 3-year intervals and a surface examination of all exposed surfaces and complete ultrasonic volumetric examination at approximately 10-year intervals. The inspections should be performed during the refueling or maintenance shutdown coinciding with the inservice inspection schedule as required by Section XI of the ASME Code.

The methods acceptable to the staff are stated in the RG 1.14, and include consideration of design and analysis, suitability of materials, quality of fabrication control, process verification, examination, testing and inservice inspections. The analysis and review of design, materials, and fabrication control are required to assure the flywheel is conservatively designed and fabricated to meet all of the operating conditions under which the plant was licensed. The flywheel spin test and examination is needed to verify the adequacy of the initial design, analysis, material selection and manufacturing processes. The inservice inspection is needed to assure that stress concentrations and fatigue have been adequately considered, and that flaw size and growth rate remain within the predicted acceptable limits for the service life of the flywheel assembly.

Surveillance Requirement 4.4.10.1 in the current ANO-2 TS states that "each RCP flywheel shall be inspected per the recommendations of Regulatory Position C.4.b of Regulatory Guide (RG) 1.14, Revision 1, August 1975."

3.0 EVALUATION

Entergy Operations and certain CE plant licensees, through the Combustion Engineering Owners Group (CEOG), contracted with Structural Integrity Associates Inc. (SIA), performed fracture mechanics analyses to justify elimination of the inspection requirements in the TS. SIA conducted an independent evaluation and analyses of flywheel integrity including plant-specific data from ANO, Units 1 & 2, St. Lucie, Units 1 & 2, Millstone, Unit 3, Palisades, and Waterford, Unit 3. The SIA analyses included a review of flywheel designs, materials, inspection results, stress and fracture mechanics analyses, and ASME Code allowable flaw sizes.

The ANO-2 flywheel assembly is the solid type with the disc shrunk-on and is keyed to the motor shaft. The flywheel material is made of A 533, Grade B, Class 1 steel plate which is a pressure vessel quality steel and vacuum improved. Since the beginning of commercial operation in 1980, ANO-2 has

followed the 3-year and 10-year inspection schedules as recommended in RG 1.14 and has completed volumetric and surface examinations of all four RCP flywheels. Ten separate inspections were completed on each flywheel. Based on these inspection results, the licensee did not identify any indications which present structural integrity concerns or conditions which could lead to the failure of a flywheel.

For the ANO-2 flywheels, the SIA analyses included a fatigue crack growth evaluation based on an assumed initial flaw of 0.25 inch, minimum material properties, applied stresses at various speed conditions, and 4000 shutdown and start cycles for the life of the plant. The minimum fracture toughness of the flywheel used in the analysis is 100 ksi√in. The normal motor speed is 900 rpm and the design overspeed is 1125 rpm. The LOCA overspeed is 2359 rpm. The SIA analyses results showed that the initial flaw would grow to 0.26 inch at the end of license. Based on the safety factors in IWB-3610 of the ASME Code, Section XI, SIA calculated an allowable flaw size of two inches for the normal operating condition and greater than two inches for the emergency and faulted condition.

4.0 TECHNICAL CONCLUSIONS

The staff finds that the licensee's proposed one-time extension of the ISI for the ANO-2 RCP 2P³2A flywheels to be acceptable based on the following determinations:

- 1) The ISI of Pump 2P32A has followed the inspection schedule of Regulatory Guide 1.14, and has shown no significant indications; and,
- 2) With the one-time extension, Pump 2P32A would not have an inspection for about six calendar years. Based on the licensee's fracture mechanics analysis, should a flaw develop during a 6-year period, it would not grow to exceed the allowable size at the end of the period.

5.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Arkansas State official was notified of the proposed issuance of the amendment. The State official had no comments.

6.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes surveillance requirements. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative

occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (60 FR 35069).

Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

7.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

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Date: September 22, 1995