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July 31, 2001

2CAN070107

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555

Subject: Arkansas Nuclear One – Unit 2
Docket No. 50-368
License No. NPF-6
Change to the ANO-2 Reactor Coolant Pump Flywheel Inspection Interval Surveillance Requirements

Gentlemen:

Attached please find the proposed change to modify the Arkansas Nuclear One, Unit 2 (ANO-2) Technical Specifications (TS) Surveillance Requirement (SR) 4.4.10.1. This SR requires performance of the reactor coolant pump (RCP) flywheel inspections in accordance with the recommendations of Regulatory Position C.4.b of Regulatory Guide (RG) 1.14, Revision 1, *Reactor Coolant Pump Flywheel Integrity* (August 1975). Paragraph (1) of Regulatory Position C.4.b requires an in-place ultrasonic volumetric examination of the areas of higher stress concentration at the bore and key way at approximately 3-year intervals. This examination is conducted during the refueling/maintenance outages coinciding with the inservice inspection schedule as required by Section XI of the ASME Code. ANO-2 proposes to extend the flywheel inspection interval defined above to 10 years. Structural Integrity Associates, Inc. prepared Topical Report SIR-94-080-A, Revision 1, *"Relaxation of Reactor Coolant Pump Flywheel Inspection Requirements,"* which provides the bases for the proposed change. The NRC reviewed and approved the topical report as referenced in a safety evaluation dated May 21, 1997 (0CNA059718).

The proposed change has been evaluated in accordance with 10CFR50.91(a)(1) using criteria in 10CFR50.92(c) and it has been determined that this change involves no significant hazards. The bases for these determinations are included in the attached submittal. A similar amendment has been approved for San Onofre Nuclear Generating Station and an amendment request is currently under NRC review for Millstone 2.

The proposed change does not introduce any new commitments. This change has been prepared to support the upcoming ANO-2 refueling outage scheduled in April 2002. Therefore, Entergy Operations requests NRC approval of the proposed change by the end of February 2002 with an effective date to be within 60 days of approval.

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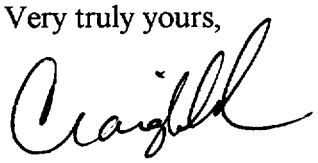
I declare under penalty of perjury that the foregoing is true and correct. Executed on July 31, 2001.

Very truly yours,



CGA/sab
Attachments

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ATTACHMENT

TO

2CAN070107

PROPOSED TECHNICAL SPECIFICATION

AND

RESPECTIVE SAFETY ANALYSES

IN THE MATTER OF AMENDING

LICENSE NO. NPF-6

ENTERGY OPERATIONS, INC.

DOCKET NO. 50-368

DESCRIPTION OF PROPOSED CHANGES

Arkansas Nuclear One, Unit 2 (ANO-2) Technical Specification (TS) Surveillance Requirement (SR) 4.4.10.1 states:

> In addition to the requirements of Specification 4.0.5, each Reactor Coolant Pump flywheel shall be inspected per the recommendations of Regulatory Position C.4.b of Regulatory Guide 1.14, Revision 1, August 1975.*
>
> *The ultrasonic volumetric examination of the areas of higher stress concentration at the bore and keyway of the flywheels for all four reactor coolant pumps may be extended through completion of the 2R13 refueling outage.

The proposed change will eliminate this SR and move it to Administrative Controls under Programs as a new section 6.5.7, "Reactor Coolant Pump Flywheel Inspection Program". The wording under this new flywheel inspection program will be revised to state:

> This program shall provide for the inspection of each reactor coolant pump flywheel per the recommendation of Regulatory Position C.4.b of Regulatory Guide 1.14, Revision 1, August 1975. The volumetric examination per Regulatory Position C.4.b.1 will be performed on approximately 10-year intervals.

In addition, the reference to SR 4.4.10.1 in the Limiting Condition for Operation for TS 3.4.10.1 is being removed.

BACKGROUND

The 10 CFR Part 50, Appendix A, General Design Criteria 4 (GDC 4) requires that nuclear power plant structures, systems, and components important to safety be protected against the effects of missiles that might result from equipment failures. The NRC has concluded that Regulatory Guide (RG) 1.14 "*Reactor Coolant Pump Flywheel Integrity*" describes an acceptable method of implementing GDC 4 with regard to minimizing the potential for failures of the flywheels of reactor coolant pump (RCP) motors. However, the flywheel inspections result in significant outage time, man-rem exposure and cost which may be minimized by use of a more carefully designed inspection program for the flywheels.

The ANO-2 TS SR 4.4.10.1 requires that each RCP flywheel be inspected in accordance with the recommendations of Regulatory Position C.4.b of RG 1.14, Revision 1, August 1975. This regulatory position specifies an in-plant 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 volumetric examination on an approximate 10 year intervals.

On April 4, 1995 (0CAN049504), Entergy Operations submitted a TS change request for Arkansas Nuclear One Unit 1 (ANO-1) and Unit 2 (ANO-2) which proposed deleting the requirements for inservice inspection (ISI) of the RCP flywheels. This TS change request was based on information contained in the topical report entitled, *"Relaxation of Reactor Coolant Pump Flywheel Inspection Requirements"* (SIR-94-080, Revision 1). The submittal for ANO served as a lead submittal for other Combustion Engineering Owners Group (CEOG) plants participating in the topical report development. Structural Integrity Associates, Inc. (SIA) prepared the topical report to provide a basis for complete elimination of the RCP flywheel inspections for the CEOG plants. While the topical report review was in progress, Entergy requested and received two one-time TS amendments permitting deferral of upcoming outage based flywheel inspections for ANO-2. The staff subsequently approved the topical report on May 21, 1997 (as SIR-94-080-A) concluding that the flywheel inspection period could be extended from the current 3 years to 10 years and that total elimination of flywheel inspections was not justified.

For the CEOG plants included in Topical Report SIR-94-080-A, Revision 1, the report concluded that:

- Inspections performed to date at these plants have not revealed the presence of any service-induced flaws. A survey of several other plants also revealed that service induced flaws has not been identified.
- Fatigue crack growth is the only degradation mechanism that affects service performance of the RCP flywheel. Analyses were performed that showed that fatigue crack growth is negligibly small even assuming a conservatively sized initial flaw.
- Flaw tolerance evaluations performed using conservative linear elastic fracture mechanics principles revealed that flywheels do not present a safety concern for current plant lives and for life extensions.

BASIS FOR PROPOSED CHANGE

The justification to extend the volumetric examination to 10 years is based on NRC's approval of Topical Report SIR-94-080-A, Revision 1. The NRC has granted ANO and other participating CE owners the ability to extend the critical inspection of the keyway and bore from 3 years to 10 years. However, in the NRC SE the staff requires that licensees seeking application of this report to their plants need to verify the reference temperature RT_{NDT} for their RCP flywheels. The SE also required that licensees with flywheels made of materials different than ASTM-A-533B and ASTM-A-508 justify the use of the K_{IC} vs. T- RT_{NDT} curve contained in Appendix A of Section XI of the ASME Code.

The original ANO-2 flywheel assemblies are of the solid type with the flywheel shrunk-on and keyed to the motor shaft. The flywheel material is ASTM A-533, Grade B, Class 1

steel plate, which is pressure vessel quality steel and is vacuum improved as discussed in Topical Report SIR-94-080-A, Rev. 1. Two different melts were used to fabricate the flywheels. For the first melt the nil ductility temperature determined for the drop weight test (ASTM E-208) was - 20°F. Charpy tests were not performed at NDT +60°F as required by ASME Code, Section III, NB-2330 to establish RT_{NDT}. However, Charpy tests were performed at +150°F and minimum impact energy obtained was 105 ft-lbs. with a minimum lateral expansion of 79 mils. For the second melt, the NDT was determined to be +10°F. The minimum Charpy value at 150°F was determined to be 63 ft-lbs. with a minimum lateral expansion of 50 mils.

Although the value of RT_{NDT} is not available, it is concluded that the value of NDT can be used in determining the fracture toughness of the flywheel based on the lower bound fracture toughness (K_{Ic}) curve in ASME Section XI, Appendix A, Figure A-4200-1. This curve is applicable to the material of the flywheel at ANO-2 since it was fabricated from SA-533, Grade B, Class 1 material. The operating temperature (T) of the flywheel is not less than 100°F and therefore (T-RT_{NDT}) is conservatively taken as 90°F using the more conservative NDT value of +10°F for the two melts. From the ASME Section XI curve, the value of K_{IC} is at least 180 ksi$\sqrt{in}$ for the flywheel at ANO-2. This value of K_{IC} is far greater than the value of 100 ksi$\sqrt{in}$ used in the topical report to determine the flaw tolerance of the flywheel at ANO-2. Therefore, it is concluded that the fracture toughness value of 100 ksi$\sqrt{in}$ used in the topical report for the evaluation of ANO-2 is conservative.

In addition, ANO-2 has installed a replacement RCP motor and flywheel, which is made of ASTM A-508, Class 5 material. The A-508 material was upgraded from the previous A-533 flywheel material having the following characteristics:

- The mechanical properties show that the A-508 material has a higher fracture toughness (K_{Id} =190 ksi$\sqrt{in}$ at 70°F).
- The A-508 material is a considerably tougher material in that the NDT is required to be less than -40°F with actual NDT being -76°F (using ASTM E208 per ASME NB-2321.1).
- The fracture toughness at the operating temperature is substantially greater than the A-533 material and the A-508 material is at the upper shelf energy level for normal operations.
- The Charpy test resulted in energy levels above 115 ft-lbs.

Therefore, based on the actual material types for ANO-2 flywheels and the resulting RT_{NDT} and fracture toughness values, ANO-2 flywheels are bounded by the analysis conclusions of Topical Report SIR-94-080-A and the NRC's associated safety evaluation. In addition, none of the volumetric examinations conducted at ANO-2 in accordance with R. G. 1.14 have identified any service induced flaws in the flywheels.

Regarding the proposed change to move the reactor coolant pump flywheel examination from the surveillance requirements to a new program section, it is based on the approach

and wording contained in NUREG-1432, Revision 2, *Standard Technical Specifications for Combustion Engineering Plants*. The wording proposed by Entergy Operations is consistent with the Standard TS in Section 5.5.7 of NUREG-1432 which generically specifies:

> "This program shall provide for the inspection of each reactor coolant pump flywheel per the recommendation of Regulatory Position C.4.b of Regulatory Guide 1.14, Revision 1, August 1975."

An additional sentence is being added to the program requirements, which states:

> "The volumetric examination per Position C.4.b.1 will be performed on a once per 10-year basis."

This specific change is consistent with Topical Report SIR-94-080-A, Revision 1 and the examination requirements of RG 1.14. Item 1 of Position C.4.b specifically requires that the RCP flywheels be volumetrically examined about every three years. Therefore, this sentence is being proposed which will supercede the three-year requirement.

The reference to SR 4.4.10.1 in the Limiting Condition for Operation for TS 3.4.10.1 is being removed since the only surveillance requirement associated with TS 3.4.10.1 was regarding the flywheel inspection. The proposed change does not impact the remainder of the LCO that ensures that structural integrity of ASME Code Class 1, 2, and 3 components is maintained.

DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

Energy Operations, Inc. is proposing that the Arkansas Nuclear One, Unit 2 (ANO-2) Operating License be amended to allow an extension of the current three year inspection interval of the reactor coolant pump flywheel volumetric examination to ten years. The request is based on a Topical Report SIR-94-080-A, Revision 1, *"Relaxation of Reactor Coolant Pump Flywheel Inspection Requirements"* prepared by Structural Integrity Associates, Inc. and approved by the NRC on May 21, 1997. The NRC Staff review of the topical report concluded that the extension of the examination interval to ten years was acceptable assuming specific material conditions are satisfied. ANO-2 has provided information demonstrating that these conditions are met. In addition, the flywheel inspection requirement wording has been moved to the Programs section of the technical specifications is consistent with NUREG-1432.

An evaluation of the proposed change has been performed in accordance with 10CFR50.91(a)(1) regarding no significant hazards considerations using the standards in 10CFR50.92(c). A discussion of these standards as they relate to this amendment request follows:

1. **Will operation of the facility in accordance with this proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?**

   Inspections of the reactor coolant pump (RCP) flywheels are conducted to detect a flaw in the flywheel prior to it becoming a missile that could damage other portions of the facility. The fracture mechanics analyses conducted as part of the NRC approved Topical Report SIR-94-080-A, Rev. 1, shows that a conservatively sized pre-existing crack will not grow to a flaw size necessary to create flywheel missiles with the current or extended life of the facility. This analysis conservatively assumes minimum material properties, maximum flywheel speed, location of the flaw in the highest stress area, and a number of startup and shutdown cycles higher than expected. Since a conservative flaw in the RCP flywheels will not grow to the allowable flaw size under large break LOCA conditions over the life of the plant, reducing the inspection frequency of the flywheels will not significantly increase the probability or consequences of an accident previously evaluated.

   The change to move the surveillance requirements for the RCP flywheels to the programs section of the technical specifications is administrative and has no impact on probability or consequences of an accident.

   Therefore, this change does not involve a significant increase in the probability or consequences of any accident previously evaluated.

2. **Will operation of the facility in accordance with this proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?**

   The proposed changes will not alter the plant configuration or require any new or unusual operator actions. They do not alter the way any structure, system, or component functions and do not alter the manner in which the plant is operated. These changes do not introduce any new failure modes.

   Therefore, this change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. **Will operation of the facility in accordance with this proposed change involve a significant reduction in a margin of safety?**

   The ANO-2 flywheels are made of either ASTM A-533, Grade B, Class 1 or A-508, Class 5 steel plate material, which is pressure vessel quality steel. These materials have high tensile and yield strength qualities. The operating temperature

of the flywheel is not less than 100°F and the RT_{NDT} value is below +10°F. Therefore, there is at least 90°F margin below the lowest temperature at which operating speed is achieved which is in accordance with Regulatory Guide 1.14, Rev. 1, *Reactor Coolant Pump Flywheel Integrity*. The fracture mechanics analyses conducted to support the extension of the inspection frequency from 3 to 10 years was performed with substantial conservatism built into the analyses. Even with this analytical conservatism, the results indicate that the flywheels have sufficient margin that there is only a negligible potential for gross failure of the flywheels.

Therefore, this change does not involve a significant reduction in the margin of safety.

Therefore, based on the reasoning presented above and the previous discussion of the amendment request, Entergy Operations has determined that the requested change does not involve a significant hazards consideration.

ENVIRONMENTAL IMPACT EVALUATION

Pursuant to 10CFR51.22(b), an evaluation of the proposed amendment has been performed to determine whether or not it meets the criteria for categorical exclusion set forth in 10CFR 51.22 (c) (9) of the regulations. The basis for this determination is as follows:

1. The proposed license amendment does not involve a significant hazards consideration as described previously in the evaluation.

2. This change does not result in a significant change or significant increase in the radiological doses for any Design Basis Accident. The proposed license amendment does not result in a significant change in the types or a significant increase in the amounts of any effluents that may be released off-site.

3. The proposed license amendment does not result in a significant increase to the individual or cumulative occupational radiation exposure because this change only modifies the inspection frequency of the ANO-2 RCP flywheels and does not physically modify the facility or change its radiological considerations. Conducting flywheel inspections on an approximate once per 10-year basis will serve to reduce occupational doses.

MARKUP OF CURRENT TECHNICAL SPECIFICATIONS

3/4.4.10 STRUCTURAL INTEGRITY

ASME CODE CLASS 1, 2 AND 3 COMPONENTS

LIMITING CONDITION FOR OPERATION

3.4.10.1 The structural integrity of ASME Code Class 1, 2 and 3 components shall be maintained ~~in accordance with Specification 4.4.10.1~~.

APPLICABILITY: ALL MODES

ACTION:

a. With the structural integrity of any ASME Code Class 1 component(s) not conforming to the above requirements, restore the structural integrity of the affected component(s) to within its limit or isolate the affected component(s) prior to increasing the Reactor Coolant System temperature more than 50°F above the minimum temperature required by NDT considerations.

b. With the structural integrity of any ASME Code Class 2 component(s) not conforming to the above requirements, restore the structural integrity of the affected component(s) to within its limit or isolate the affected component(s) prior to increasing the Reactor Coolant System temperature above 200°F.

c. With the structural integrity of any ASME Code Class 3 component(s) not conforming to the above requirements, restore the structural integrity of the affected component to within its limit or isolate the affected component from service.

SURVEILLANCE REQUIREMENTS

~~4.4.10.1 In addition to the requirements of Specification 4.0.5, each Reactor Coolant Pump flywheel shall be inspected per the recommendations of Regulatory Position C.4.b of Regulatory Guide 1.14, Revision 1, August 1975.*~~

~~* The ultrasonic volumetric examination of the areas of higher stress concentration at the bore and keyway of the flywheels for all four reactor coolant pumps may be extended through completion of the 2R13 refueling outage.~~

6.3 UNIT STAFF QUALIFICATIONS

6.3.1 Each member of the unit staff shall meet or exceed the minimum qualifications of ANSI N18.1-1971 for comparable positions, except for (1) the designated radiation protection manager, who shall meet or exceed the qualifications of Regulatory Guide 1.8, September 1975

6.4 DELETED

6.5 ~~DELETED~~ PROGRAMS

[6.5.1 through 6.5.6 will be used later.]

6.5.7 Reactor Coolant Pump Flywheel Inspection Program

This program shall provide for the inspection of each reactor coolant pump flywheel per the recommendation of Regulatory Position C.4.b of Regulatory Guide 1.14, Revision 1, August 1975. The volumetric examination per Regulatory Position C.4.b.1 will be performed on approximately 10-year intervals.