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10CFR2.201

July 17, 2000

OCAN070002

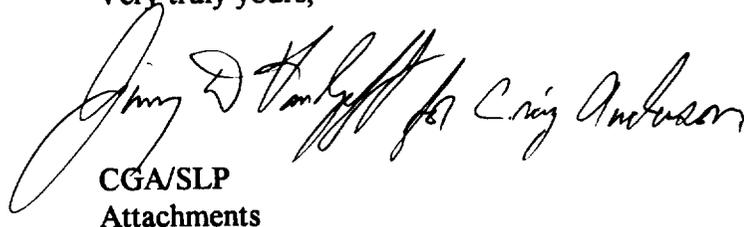
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Subject: Arkansas Nuclear One - Units 1 and 2
Docket No. 50-313 and 50-368
License No. DPR-51 and NPF-6
Response To Inspection Report
50-313/00-04; 50-368/00-04
EA 00-081

Gentlemen:

Pursuant to the provisions of 10CFR2.201, attached is the response to the Notice of Violation (NOV) regarding inadequate design control over changes made to the ANO-1 low pressure injection/decay heat removal (LPI/DHR) pump bearing housing material and the viscosity of the bearing lubricating oil. Should you have any questions or comments, please contact me.

Very truly yours,


CGA/SLP
Attachments

IEDI

U. S. NRC
July 17, 2000
OCAN070004

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NOTICE OF VIOLATION

During an NRC inspection completed March 30, 2000, a violation of NRC requirements was identified. In accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions," NUREG-1600, the violation is listed below:

10 CFR Part 50, Appendix B, Criterion III states, in part, that measures shall be established for the selection and review for suitability of application of materials, parts, equipment and processes that are essential to the safety-related functions of the structures, systems, and components.

Contrary to the above, as evidenced by the examples described below, the measures that were established for the selection and review for suitability of application of materials, parts, equipment and processes essential to the safety-related functions of the Unit 1 low pressure injection/decay heat removal pumps were not adequate.

1. In 1992, stainless steel bearing housings were installed to replace the original carbon steel housings. The housings had a greater coefficient of thermal expansion and a lower heat transfer coefficient than the original cast iron housings. The engineering evaluation completed for this design change failed to consider the greater thermal expansion of the new material and, as a result, did not identify the potential effect the change to the new material would have on pump internal clearances.
2. In September 1999, the bearing oil in the pumps was changed from ISO 22 to a higher viscosity oil, ISO 46. The engineering evaluation for this change in oil type failed to identify that the higher viscosity oil would increase the heat generation in the bearing and cause greater thermal expansion of the bearing race. As a result of this change, internal clearances became critical to the performance of the pumps. The engineering evaluation for the change in oil viscosity was not thorough and did not adequately consider the thermal characteristics of the lubricant and the resultant impact on the inboard bearing performance.
(01013)

This is a Severity Level III violation (Supplement I)

Response to Notice of Violation 50-313/004-01

(1) Reason for the violation:

As discussed in the pre-decisional enforcement conference held on May 8, 2000, replacement stainless steel housings were installed without adequately considering the entire range of potential cooling water temperatures supplied to the LPI/DHR pumps, and the viscosity of the bearing oil in both LPI/DHR pumps was changed without ensuring capability with specified service conditions.

The LPI/DHR pumps originally had cast iron bearing housings. These housings experienced flow reductions due to corrosion. In 1992, a modification was developed to change bearing housing material to stainless steel. This modification utilized a plant change process that is not as rigorous as the current process. The modification package was developed by Entergy Operations, with the manufacturing of the housing performed by the equipment vendor. The purchase specification did not provide detailed design specifications for the potential range of service conditions the pumps may experience. The vendor that supplied the stainless steel housings was not the original equipment manufacturer and did not have the original LPI/DHR pump specifications and analysis. This vendor supplied a Certificate of Conformance apparently without performing a rigorous evaluation. The root cause of this condition is an inadequate review of the design change. During development of this change, it was not recognized that the difference in thermal conductivity of the materials would result in reduction in clearances between the bearing outer race and housing for certain service water (SW) temperatures. This was due to an overall lack of understanding of the sliding radial bearing design.

In 1987, the oil in both LPI/DHR pumps was changed to a lower viscosity to more closely match the specifications contained in the vendor technical manual. In September 1999, the oil was changed back to the higher viscosity that had been used previously. Routine oil analysis had shown wear particles indicating long-term degradation of the thrust bearings. After discussions with the bearing manufacturer and consideration of recommended lubricants in the pump technical manual, a decision was made to use the higher viscosity oil. An engineering reply instead of a more formal engineering evaluation was utilized to document this change which resulted in higher bearing temperatures. The root cause of this condition is also an inadequate review of the design change. The bearing oil viscosity in both LPI/DHR pumps was changed without ensuring compatibility with specified service conditions.

(2) Corrective steps that have been taken and the results achieved:

A modification package was developed and installed on both pumps. This activity identified and verified proper critical dimensions, returned the inboard bearing housings to the original cast iron material, replaced the inboard bearings with those having larger internal clearances, increased the inside diameter of the inboard bearing housings to the upper half of the tolerance band, and installed provisions for measuring local oil temperature on the inboard bearing housing. An evaluation of lubrication requirements determined that the lower viscosity oil is adequate for the full range of expected operating conditions. Post-modification testing demonstrated operability of both pumps at the high and low ends of the range of potential SW temperatures and provided assurance that the pumps will function as required in any operational mode.

An operating experience report was issued to the industry on bearing and bearing temperature concerns.

The ANO lubrication program was revised to require an engineering evaluation instead of an engineering reply for lube oil changes. This change included the addition of a critical component checklist.

(3) Corrective steps that will be taken to avoid further violations:

Applicable engineering, operations, and maintenance personnel will be provided training on radial bearing design considerations by June 30, 2001.

Prior to August 19, 2000, processes will be revised and appropriate training provided to help ensure:

- Equipment modifications which do not change form, fit, or function of original equipment are consistent with the original design requirements
- Adequacy of original design specifications when specified
- When specifying equipment modifications, the entire operating range of the process system as well as support systems, such as cooling water, are included
- Engineers challenge vendor recommendations and ensure vendors understand equipment operating conditions
- Ample internal clearances exist when making changes to rotating equipment

Guidance on post modification testing will be strengthened by September 14, 2000, to ensure that, if reasonable, the testing covers the entire system operating range as well as support systems.

Prior to August 31, 2000, the vendor qualification program will be evaluated relative to restrictions when the vendors lack original equipment specifications and analysis.

Applicable LPI/DHR pump plant documentation (i.e., vendor technical manuals and drawings) will be updated to reflect current design requirements by September 14, 2000.

Safety system functional assessment guidance will be enhanced to improve component level design reviews by August 15, 2000.

(4) Date when full compliance will be achieved:

Full compliance was achieved on March 11, 2000, when post-modification testing demonstrated operability of both pumps at the high and low ends of the range of potential SW temperatures and provided assurance that the pumps will function as required in any operational mode.