UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA ST., N.W., SUITE 3100
ATLANTA, GEORGIA 30303

In Reply Refer To:
RII:JPO
50-491, 50-492
50-493, 50-488
50-489, 50-490

FEB 29 1980

IE:R A

Duke Power Company
ATTN: L. C. Dail, Vice President
Design Engineering
P. O. Box 33189
Charlotte, NC 28242

Gentlemen:

This Information Notice is provided as an early notification of a possible significant matter. It is expected that recipients will review the information for possible applicability to their facilities. No specific action or response is requested at this time. If further NRC evaluations so indicate, an IE Circular or Bulletin will be issued to recommend or request specific licensee actions. If you have questions regarding this matter, please contact the Director of the appropriate NRC Regional Office.

Sincerely,

James P. O'Reilly
Director

Enclosures:
1. IE Information Notice
No. 80-07
2. List of Recently Issued
IE Information Notices

cc w/encl:
J. T. Moore, Project Manager
Post Office Box 422
Gaffney, South Carolina 29340

SSINS No.: 6870
Accession No.:
7912190675

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

February 29, 1980

IE Information Notice No. 80-07

PUMP SHAFT FATIGUE CRACKING

On October 9, 1979, the Tennessee Valley Authority (TVA) reported to NRC that low-stress high-cycle fatigue cracks had been found in two non-safety-related feedwater pumps at their Browns Ferry BWR facility. One pump had been operated for approximately 20,000 hours and the other for approximately 28,000 hours. TVA indicated that excessive vibration had been experienced prior to detection of the cracks by ultrasonic and visual inspection. TVA also reported that catastrophic failure had been experienced with a boiler feed pump at their Paradise fossil unit. The TVA failed pump shafts were of type 414 stainless steel. TVA plans to replace the shafts with a type 17-4ph stainless steel.

A number of centrifugal charging/safety injection pump shaft failures have been reported since 1977. The pumps of interest are the dual purpose centrifugal pumps which are utilized for a normal charging function and in the safeguard mode are aligned for high pressure borated coolant injection. These pumps were procured by Westinghouse from the Pacific Pump Division of Dresser Industries. The pump shaft material was supplied to Pacific Pump by the Carpenter Technology Corporation.

Westinghouse and Pacific Pump have been conducting an on-going investigative program since 1977 to resolve the shaft failure problem. Results from the program suggested that the causes of the shaft failures could be related to shaft material deficiencies, design and/or abnormal operation of the centrifugal pumps.

Forty centrifugal charging/safety injection pump shafts fabricated from four heats of A276 type 414 stainless steel bar were air cooled and tempered at 1000°F. The above stated heat treating practice resulted in shafts with low toughness (Charpy "V" notch energies - Longitudinal 6-10 ft-lbs, transverse 2-3 ft-lbs).

Corrective actions taken to reduce the incidence of charging pump/safety injection pump shaft failure have included:

1. Replacement of the type 414 low toughness stainless steel material. Replacement material for the charging pump shafts is type 414 stainless steel, oil quenched and tempered at 1150-1200°F. Some of the air cooled shafts have been re-tempered at 1150°F.

2. Design modifications to the shaft to reduce stress raisers. The modifications included increasing the fillet radius in the split ring groove, increasing the thread root in the locknut section of the shaft and the use of formed cutting tools during fabrication.

3. A review of the operating history of the dual purpose centrifugal pumps indicate abnormal operation to be a potentially significant contributor to the early failure of the pump shafts. Abnormal operation includes any condition that results in partial or complete loss of fluid in the pump or continued operation under high vibration conditions caused by misalignment or other installation problems. Westinghouse Nuclear Service Division's Technical Bulletins 77-9, 78-1 Rev. 1 and 79-6 provide guidance for monitoring of and limits for pump vibration as well as guidance for pump operation and maintenance.

Ten additional Safety Injection Pumps manufactured by Pacific Pump were identified as having shafts with the same material and heat treatment as the failed charging/safety injection pump shafts. These ten additional pumps are of a different design and provide for medium pressure boron injection in the safeguard mode but do not function in normal operation.

Licensees are encouraged to review the materials utilized for and the design of shafts in safety-related pumps and non-safety-related pumps which could affect safety-related system performance. Particular attention should be paid to abnormal operating conditions which could induce high stress in the pump shafts, susceptibility of materials to crack initiation and growth, and the presence of stress raisers.

This Information Notice is provided as an early notification of a possible significant matter that is still under review by the NRC staff. It is expected that recipients will review the information for possible applicability to their facility. No specific action or response is requested at this time. If you have any questions regarding this matter, please contact the Director of the appropriate NRC Regional Office.

Enclosure

RECENTLY ISSUED
IE INFORMATION NOTICES

Information Notice No.	Subject	Date Issued	Issued To
80-07	Pump Shaft Fatigue Cracking	2/29/80	All holders of power reactor OLs and CPs
80-06	Notification of Significant Events	2/27/80	All holders of Reactor OLs and to near term OL applicants
80-05	Chloride Contamination of Safety Related Piping	2/8/80	All licensees of nuclear power reactor facilities and applicants and holders of nuclear power reactor CPs
80-04	BWR Fuel Exposure in Excess of Limits	2/4/80	All BWR's holding a power reactor OL or CP
80-03	Main Turbine Electro-Hydraulic Control System	1/31/80	All holders of power reactor OLs and CPs
80-02	8X8R Water Rod Lower End Plug Wear	1/25/80	All BWR Facilities holder power reactor OLs or CPs
80-01	Fuel Handling Events	1/4/80	All holders of power reactor OLs and CPs
79-37	Cracking in Low Pressure Turbine Discs	12/28/79	All power reactor OLs and CPs
79-36	Computer Code Defect in Stress Analysis of Piping Elbow	12/31/79	All power reactor OLs and CPs
79-35	Control of Maintenance and Essential Equipment	12/31/79	All power reactor facilities with an OL or CP
79-34	Inadequate Design of Safety-Related Heat Exchangers	12/27/79	All holders of power reactor OLs and CPs
79-33	Improper Closure of Primary Containment Access Hatches	12/21/79	All power reactor facilities holding OLs and CPs
79-32	Separation of Electrical Cables for HPCI and ADS	12/21/79	All power reactor facilities holding OLs and CPs