

Omaha Public Power District  
444 South 16th Street Mall  
Omaha, Nebraska 68102-2247  
402/636-2000

August 27, 1991  
LIC-91-232R

Mr. Robert D. Martin  
Regional Administrator  
U. S. Nuclear Regulatory Commission  
Region IV  
611 Ryan Plaza Drive, Suite 1000  
Arlington, TX 76011

Reference: Docket No. 50-285

Dear Mr. Martin:

SUBJECT: 10 CFR Part 21 Report Concerning the Failure of a Roll Pin

Omaha Public Power District (OPPD) has investigated the failure of a roll pin used on the diesel generator damper actuator and determined the failure to be reportable pursuant to 10 CFR Part 21. OPPD notified Messrs. J. P. Jaudon and W. M. McNeil of the Region IV office on August 23, 1991, of the attached information. Attached is information required pursuant to 10 CFR Part 21.21(b)(3).

If you have any questions, do not hesitate to contact me or members of my staff.

Sincerely,



W. G. Gates  
Division Manager  
Nuclear Operations

WGG/sel

Attachments

c: LeBoeuf, Lamb, Leiby & MacRae  
Dr. T. E. Murley, Director of Reactor Regulation (3)  
W. C. Walker, NRC Project Manager  
R. P. Mullikin, NRC Senior Resident Inspector  
Document Control Desk

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## INTRODUCTION

On July 11, 1991, at the Fort Calhoun Station Unit No. 1, during the performance of the monthly diesel generator surveillance test, diesel generator DG-2 was manually shutdown following a high jacket water temperature alarm. It was determined that the exhaust damper which allows air flow through the radiator did not open. Investigation revealed that a roll pin (used as a shear pin) on the damper actuator shaft, had failed, preventing the damper from opening. On July 18, 1991 the roll pin for the redundant diesel generator (DG-1) was removed, and a visible crack was discovered.

In response, the failed pin from DG-2, the pin from DG-1 which contained a visible crack, and a spare pin from the same manufacturing lot number were submitted to a metallurgical laboratory for analysis.

## NATURE OF DEFECT

The metallurgical analysis indicated that the chemical composition of the roll pins conformed to ASTM A682 Grade 1070 steel that had been quenched and tempered to produce a tempered martensitic micro-structure. The hardness of the steel, which ranged from 48-50 Rockwell C, was appropriate for the desired application.

A calculation of the shear strength of the roll pins obtained by utilizing the hardness to strength correlation found that the pins met the design shear requirements.

The fracture surfaces of the failures were found to be intergranular caused by phosphorus segregation at the grain boundaries. Phosphorus also created banded areas from which cracking originated. Both the failed and cracked roll pins were found to have cracking caused by the same embrittling mechanism. Since subsurface cracking was found in all three of the pins, including the unused pin, the cause of failure cannot be attributed to operating conditions or environments. It was determined that the failure of the pins was due to phosphorus segregation caused by an improper tempering heat treatment or manufacture of the steel during solidification of the ingot.

The final metallurgical report was received by OPPD on August 15, 1991. The report included discussion on the above failure mechanism of the pins, the material composition of the pins, the tests the pins were subjected to by the laboratory and the stated cause of failure.

## IDENTIFICATION OF SUPPLIER

The roll pins which failed were purchased under 10 CFR Part 21 and Part 50 Appendix B requirements in December 1988 under OPPD Purchase Order S040618 from:

Cardinal Industrial Products Corporation  
3873 W. Oquendo Road  
Las Vegas, Nevada 89118

The pins are specified as:

1/4 x 3 1/2 inch A682-77 Gr. 1070 Spring Pins, Lot 8733602-1

OPPD verbally notified Cardinal Industrial Products Corporation on August 16, 1991 informing Mr. D. Hathcock - Manager Quality Assurance of OPPD's intent to conduct an evaluation of the deviation to determine if the failure of these pins could create a substantial safety hazard pursuant to 10 CFR Part 21.

This evaluation concluded that the deviation in the roll pins could create a Engineering Analysis Request 91-040, substantial safety hazard and therefore the failure is being reported pursuant to 10 CFR Part 21. This determination was made on August 22, 1991 after review and evaluation of the final metallurgical report.

#### LOCATION OF COMPONENTS IN USE

An investigation is being conducted into the location of the remaining roll pins received under this purchase order. To date, no other roll pins from this purchase order have been found to be installed at Fort Calhoun Station.

#### CORRECTIVE ACTIONS TAKEN

As corrective action, both inlet and outlet dampers were opened on both diesel generators, and an emergency temporary modification was installed which blocked both exhaust dampers open.

Cardinal Industrial Products Corporation was contacted on August 23, 1991 concerning the final determination of OPPD's evaluation. Information concerning the specific metallurgical testing conducted for OPPD has been transmitted to Cardinal and five roll pins from the subject lot have been provided to Cardinal to conduct additional testing.