

U.S. NUCLEAR REGULATORY COMMISSION  
REGION III

Report No. 50-255/84-12(DRS)

Docket No. 50-255

License No. DPR-20

Licensee: Consumers Power Company  
212 West Michigan Avenue  
Jackson, MI 49201

Facility Name: Palisades Nuclear Generating Plant

Inspection At: Palisades Site, Covert, MI

Inspection Conducted: July 13, 1984

Inspector: *D. E. Jones*  
D. E. Jones

Date

7/24/84

Approved By: *D. H. Danielson*  
D. H. Danielson, Chief  
Materials & Process Section

Date

7/24/84

Inspection Summary

Inspection on July 13, 1984 (Report No. 84-12(DRS))

Areas Inspected: Routine announced inspection of follow-up of valve shaft inspection and replacement on main steam line isolation valves. This inspection involved a total of 7 inspector-hours onsite by 1 NRC inspector.  
Results: No items of noncompliance or deviations were identified.

## DETAILS

### 1. Persons Contacted

#### Consumers Powers Company (CPCo)

- \*R. W. Montross, Plant Manager
- \*D. G. Malone, Senior Engineer
- \*D. W. Rogers, Technical Engineer
- \*W. L. Ford, QA
- \*C. S. Kozup, Operations Superintendent
- \*R. A. Vincent, NAPO Administrator
- \*K. E. Osborne, Maintenance Superintendent
- B. A. Low, Maintenance Engineer

#### U.S. Nuclear Regulatory Commission

- \*B. L. Jorgenson, Senior Resident Inspector.

\*Denotes those present at the exit interview.

### 2. Potential Shaft Cracking Problem In Main Steam Line Isolation Valves

This inspection was initiated to review the adequacy of the testing and replacement of the main steam isolation valve shafts.

Discussions with Consumers Power Company personnel revealed the following:

In January 1984 both MSIV shafts were removed and inspected during repairs to the cover-to-body flanges. One shaft exhibited a linear indication on the limit switch end and both shafts were found to exhibit linear indications emanating from the activator end keyways.

A materials engineering analysis was performed by Consumers Power Company Laboratory Services Department, Metallurgy Division. The shafts were identified on the limit switch end as follows:

One shaft had "1-30501 H.T. 94788 AB" stamped on it. The second shaft had "22-30501 H.T. 94788 AB" on it.

Dye penetrant testing revealed a single crack in one shoulder-keyway region of shaft 1-30501. Additionally, a longitudinal split was revealed at the limit switch end of shaft 22-30501.

The shaft 22-30501 was sectioned at the cracked areas and the fracture surfaces were opened. The opened fracture surfaces were microscopically examined and photographed. Based upon the gross directional characteristics and color banding, it was felt that multiple torsional load transients propagated the shoulder-keyway cracks. The longitudinal crack at the limit-switch end also propagated in stages. In the absence of appreciable applied loads, it was believed that this longitudinal crack propagated due to thermal stresses periodically added to the residual circumferential stresses.

It was determined that due to "temper embrittlement" of the steel microstructure (during heat treatment) that the shafts had sufficient tensile and yield strengths, but low impact energy absorption properties.

Based upon recommendations, from CPCo Metallurgy Division, the mechanical design was changed as follows:

- a. The operating lever keyway profile was changed from full-depth to a modified keyway, to minimize the mechanical stress riser.
- b. The diametrical shoulder was moved  $\frac{1}{2}$ " away from the operating lever end to minimize the mechanical stress riser. A sleeve was added to restore the original shoulder position.
- c. The shoulder fillet radius was increased, to minimize the stress riser.
- d. Press fit of the keys was eliminated to lower the induced circumferential stresses.
- e. Locking nut torque was decreased to lower the induced longitudinal stresses.

The material was changed from ASTM-A276 Grade 410 Stainless steel to ASTM-A564 Grade 630 fully annealed 17-4 precipitation harding (PH) stainless steel.

Two new replacement shafts were obtained from Atwood-Morrill with the above mechanical and metallurgical changes and installed.

No items of noncompliance or deviations were identified.

### 3. Exit Interview

The inspector met with site representatives (denoted in Paragraph 1) at the conclusion of the inspection. The inspector summarized the scope and findings of the inspection noted in this report.