UNITED STATES
NUCLEAR REGULATORY COMMISSION
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OFFICE OF NUCLEAR REACTOR REGULATION

STAFF EVALUATION OF THE 25-YEAR TENDON SURVEILLANCE REPORT

CONSUMERS ENERGY COMPANY

PALISADES PLANT

DOCKET NO. 50-255

1.0 INTRODUCTION

Consumers Energy Company submitted the Palisades Plant 25-year tendon surveillance report on December 18, 1997. In the letter accompanying the report, the licensee committed to submit a post-surveillance regression analysis of prestressing tendon forces by February 27, 1998. The licensee provided the analysis by letter dated February 23, 1998. The licensee submitted additional information on September 25, 1998, in response to the staff's July 27, 1998, request.

This staff evaluation addresses the adequacy of the report and the regression analysis performed by the licensee.

2.0 EVALUATION

Precision Surveillance Corporation, as contractor for the licensee, performed the surveillance of the post-tensioning tendon system at the Palisades Plant. The contractor developed the surveillance report that was submitted to the NRC in the December 18, 1997, letter. The report indicated that the surveillance consisted of a number of separate inspections including: (1) sheathing filler inspection and chemical analysis, (2) tendon anchorage inspection, (3) tendon lift-off testing, (4) inspection and tensile test of wire samples removed from the detensioned tendons, and (5) resealing of tendons after all inspections were completed. The staff's review of the inspection procedures finds that the inspections were performed in accordance with the existing practice to comply with the plant's technical specification requirements.

The lift-off testing of the randomly-sampled tendons was performed as part of the surveillance. The lift-off testing gave the measured prestressing forces in the selected tendons. The licensee compared the measured prestressing forces against the predicted forces for these tendons as required by the technical specifications. The technical specifications also require the licensee to perform trending analysis based on the available measured prestressing forces, from all the surveillances. The trending analysis allows the licensee to ensure that the future trend of prestressing forces in the tendons will be above the predicted forces. The trending analysis is

ENCLOSURE

In performing the regression analysis, the licensee assumes that the regression curve is a straight line on a semi-log plot with the tendon force (y-axis) on a linear scale and the time (x-axis) on a logarithmic scale. This relationship is recommended by Regulatory Guide 1.35.1, "Determining Prestressing Forces for Inservice Inspection of Prestressed Concrete Containments," due to the known variation of time-dependent factors (i.e., creep of concrete and relaxation of prestressing steel). The staff therefore considers the licensee's assumption acceptable.

At each surveillance when the tendon forces were measured, the licensee considered an average of the measured tendon forces as representing the tendon forces in all the tendons in the population. Because of the small sample size (2 percent of the tendon population), the staff considers that this practice might not be representative of the actual variation in the tendon forces. The licensee should consider use of the individual measured forces in the regression analysis as discussed in Attachment 3 of NRC Information Notice (IN) 99-10, "Degradation of Prestressing Tendon Systems in Prestressed Concrete Containments," dated April 13, 1999.

The IN also discusses other issues (e.g., wire failures at Calvert Cliffs Nuclear Power Plant, tendon anchorage failures at Farley Nuclear Plant, and temperature effects on relaxation of prestressing steel). These issues may be relevant to the post-tensioning tendon system at Palisades. Thus, the staff recommends that the licensee take appropriate action if any of these findings are applicable to the post-tensioning tendon system at Palisades.

3.0 CONCLUSION

Based on the information provided in the report and in response to the staff's request for additional information, the staff concludes that the licensee is performing the tendon surveillance in accordance with the requirements of the plant's technical specifications. Due to the relevance of the issues described in IN 99-10 to the tendons at the Palisades Plant, the staff recommends that the licensee take appropriate actions to avoid similar problems.

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