WISCONSIN PUBLIC SERVICE CORPORATION

P.O. Box 1200, Green Bay, Wisconsin 54305

August 28, 1973

Dr. D. F. Knuth, Director
Directorate of Regulatory Operations
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Dr. Knuth:

Subject: Docket 50-305
Kewaunee Nuclear Power Plant
Main Steam Isolation Valves

Reference: Letter - Mr. E. W. James to Mr. F. E. Kruesi, dated January 5, 1973

The referenced letter stated that when resolution and corrective action was accomplished concerning the main steam isolation valve discs, a final report would be issued. We have at this time resolved the problem and this letter is intended to discuss the resolution and corrective action taken by Wisconsin Public Service. In addition to the valve disc problem we will discuss the addition of the rupture disc to the main steam isolation valve air cylinders.

Final Corrective Action

In the referenced letter we notified you that liquid penetrant tests of the main steam line isolation valve discs had revealed cracks and that the discs had been removed and sent out for further testing. The results of the analysis of the problem have been evaluated and the corrective action to be taken has been decided upon. The elastic plastic design of the valve allows for permanent deformation of the disc upon a spurious valve closure at full load steam flow conditions. To minimize the operational impact of establishing the cumulative effect of successive closures, new main steam line isolation valves will be installed at the first refueling outage. The new valves are of a design that will not depend upon plastic deformation for energy absorption.

Interim Corrective Action

In the interim, the original discs are being replaced with new discs, made of 410 stainless steel. The valves will be provided with new linkages which are compatible with the discs. The valves will be inspected and tested to assure that: a) no binding of the moving parts of the valve assembly has occurred; and b) the valve can fully perform its closure function. In the

event of a spurious or inadvertent valve closure above 50% of rated steam flow, the valve will be: a) disassembled to allow inspection of the disc, rockshaft and tail link; the inspection will consist of a dimensional check and an NDT examination of the components; and b) inspected to assure that the valve can fully perform its closure function.

Analysis - Interim Corrective Action

A very extensive stress analysis has shown that the disc, linkage and valve body will perform as required for the entire spectrum of valve closure incidents. Basic to the analysis was establishment of a disc design closure energy and time that was conservative with respect to the certainty of the values of the parameters involved in the calculation. Separate valve models were made for the analysis of isolation valve and check valve. In order to determine the flow parameters of the fluid passing through the valve, a blowdown computer program was used. The relevant equations required to determine the angular acceleration, angular velocity and angular position of the valve disc are incorporated into the program. Valve flow coefficients were employed to calculate the frictional pressure drop across the valve at the various angular positions of the disc. Using appropriately conservative conditions the highest closure energy calculated was 1.19×10^6 in-lb. However, an additional margin was arbitrarily added to the closure energy (raising it to 1.35×10^6 in-lb) for design.

A finite element model of the disc, linkage and valve body was developed and an elastic plastic analysis was made to determine deformations and stresses. The stress analysis results show that the element with the most deformation does not exceed acceptable limits of the ultimate strain capability of the material.

Valve Air Cylinder Modification

An analysis performed by the valve vendor indicated possible overstressing of the main steam isolation valve linkage, due to excessive air cylinder pressure. The vendor has recommended that the air cylinders be modified by the addition of a rupture disc assembly. Under normal steam flow conditions, should the valve go closed, excessive pressure buildup in the air cylinder would be relieved through the rupture disc thereby preventing any permanent deformation of the linkage.

Full valve closure, under steam flow conditions, would occur without the rupture disc, since analysis shows the linkage would have yielded to allow full disc travel. Yielding would occur because of the very large torque developed on the rockshaft from the pressure differential across the disc during closure. The vendor stated that a valve of essentially the same design and without a rupture disc has fully closed with some permanent deformation of the linkage. Furthermore, this same valve with a rupture disc assembly accomplished full closure after the disc ruptured, and the valve linkage did not permanently deform.

The analysis indicates that the above modifications will allow the main steam isolation valves to function properly, should they be required to do so during the first fuel cycle.

Very truly yours,

E. W. James, Senior Vice-President
Power Generation & Engineering

EWJ:sna

cc - Mr. Boyce H. Grier