Consumers Power Company

General Offices: 212 West Michigan Avenue, Jackson, Michigan 49201 • Area Code 517 788-0550

May 18, 1971

Dr. P. A. Morris, Director
Division of Reactor Licensing
United States Atomic Energy Commission
Washington, DC 20545

Re: Docket 50-255
License No DPR-20

Dear Dr. Morris:

Att: Mr. D. J. Skovholt

This letter is written to apprise you of a recent difficulty with the primary coolant pumps at the Palisades Plant. At the time the difficulty was detected, the post-core-loading hot functional testing had been successfully completed and the nuclear steam supply system was being cooled down to 260°F preparatory to the initial approach to criticality.

A noise in the suction piping of the "A" primary coolant pump was detected at 8:00 PM on May 8, 1971 and the plant was cooled down. Subsequent inspection revealed that the noise was caused by the hexagonal head cap screw from the suction deflector on the "B" primary coolant pump (see attached figure from the FSAR). In addition, the suction deflector was found in the plenum of the steam generator common to the suction piping for the "A" and "B" primary coolant pumps. Damage to the impellers of both pumps indicated that one or both of the loose parts had impacted against the impellers during a period of pump operation.

Sequence of Events

Heat-up of the primary system for the post-core-loading hot functional testing was initiated on April 29, 1971. During the heat-up and subsequent testing, the "A" pump operated approximately 116 hours and experienced nine start-stop cycles. The "B" pump operated approximately 125 hours and experienced ten start-stop cycles. Both pumps were stopped on May 7 when two of the four seals in the "B" pump started showing excessive leakage. The remainder of the testing was accomplished with only "C" and "D" pumps in operation.

On May 8, a noise was detected in the suction piping to the "A" pump, apparently from a foreign object. The sound could be heard distinctly without the aid of a hearing device. Cooldown of the primary system was started at 1:00 AM on May 9.

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Following cooldown and draining of the primary system to below the loop nozzles, the steam generator manway was removed for entry into the "A" primary suction pipe. A suction deflector (~34 lb) was found in the plenum of the loop 1 steam generator and the 1-1/2 inch x 10 inch cap screw, which held the deflector in place, was found in the 30-inch suction pipe to the "A" primary coolant pump. (Parts were later determined to be from the "B" pump.) The visual inspection of the inlets to "A" and "B" primary coolant pumps was accomplished by entry into the suction pipes.

Following the discovery of the problem in the No 1 loop, the manway on the No 2 steam generator was also removed and the inlets to the "C" and "D" primary coolant pumps were inspected and found to be normal.

Cause of Incident

The suction deflector cap screw and the suction deflector dropped off the lower end of the "B" primary coolant pump shaft. An investigation as to the cause is currently under way; however, the results are inconclusive at this time. The cap screw had been welded to the deflector to prevent the cap screw from backing out. Inspection of the "A" and "B" pump disclosed the following:

"B" Primary Coolant Pump - The suction deflector and cap screw were found missing from the impeller hub. Wear marks about 1-1/2" by 1/2" were found on one edge of each of two impeller-to-shaft hexagonal head cap screws protruding from the bottom of the impeller. Matching marks were noted on two of the suction deflector ribs. A 304 SS locating pin (1/2" diameter, 7/8" long) is presumed to have been installed and has not been located as yet. Impact marks were found on several of the impeller vanes, the most significant one being about 3" by 1-1/2" with about a 1/2" deflection at the leading edge of the impeller vane.

Several impact marks were noted in the pump suction line, none of which showed any indication of significant penetration.

"A" Primary Coolant Pump - Cap-screw-to-suction-deflector welds were found cracked through on five of the six sides of the hexagonal head cap screw. Impact marks were noted on all of the impeller vanes and one vane has a tear approximately three inches into the leading edge. One flap of the tear is bent back about 60°. Several gouges were also noted in the pump casing. However, none of these are more than 1/32" deep or greater than two square inches in area. The suction line elbow from the steam generator has numerous impact marks caused by the bouncing of the cap screw. Preliminary inspection disclosed no cracks or deep penetrations in the clad surface.

Inspection of "C" and "D" primary coolant pump suction lines revealed nothing unusual.

A possible mode of failure is stresses set up in the welds due to differences in heating rate of cap screw and deflector, or from the welding operation. These welds had been reinforced prior to the last installation of pump intervals.

Corrective Action

The "C" and "D" primary coolant pump suction deflectors will be replaced by 2" flat plates (13-1/4" diameter) milled to recess the eight impeller-to-shaft hexagonal head cap screws. A hole will be machined through the center of each plate to allow free flow and assist in reducing thermal stress in the plate-to-impeller cap screws. The plate will be attached with two 3/4" socket head cap screws anchored in the jacking bolt holes. The cap screws will be staked to the plate. The stake pins will be anchored in the plate.

The "B" primary coolant pump will be repaired in a similar manner. The shaft seal cartridge on the "B" pump has been replaced. The "A" primary coolant pump suction deflector cap screw welds will be removed and the cap screw tack welded on two faces 180° apart.

Plans for Resumption of Testing

The low power physics testing will resume when the above modifications are complete; however, we plan to run only the "C" and "D" pumps during this testing. Following the completion of the low power physics testing, other primary coolant pump modifications (addition of an auxiliary impeller to increase the differential pressure across the hydrostatic bearing) are planned. Permanent repairs to the pumps will be accomplished at this time.

Conclusions

We conclude that the modifications described above will effectively prevent any further failure of pump components. The "A" and "B" pumps are operable but will not be used during the low power testing. We do not plan to run these two pumps until repairs to the impeller vanes are accomplished.

The 1/2" x 7/8" locating pin is sufficiently light so that there are no concerns about significant cladding wear if it reached the bottom of the reactor vessel. Also, the size of the pin precludes it from being carried up into a fuel bundle.

Yours very truly,

Robert L. Haueter (Signed)

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Robert L. Haueter
Electric Production
Superintendent - Nuclear

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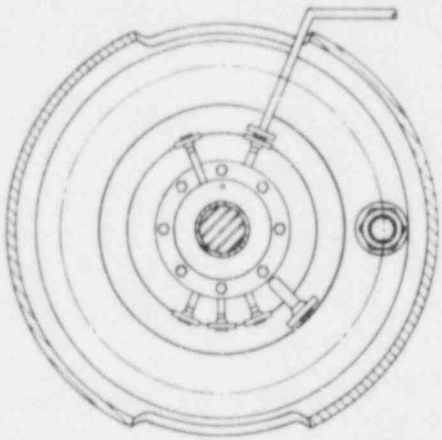
PRIMARY COOLANT CIRCULATING PUMP



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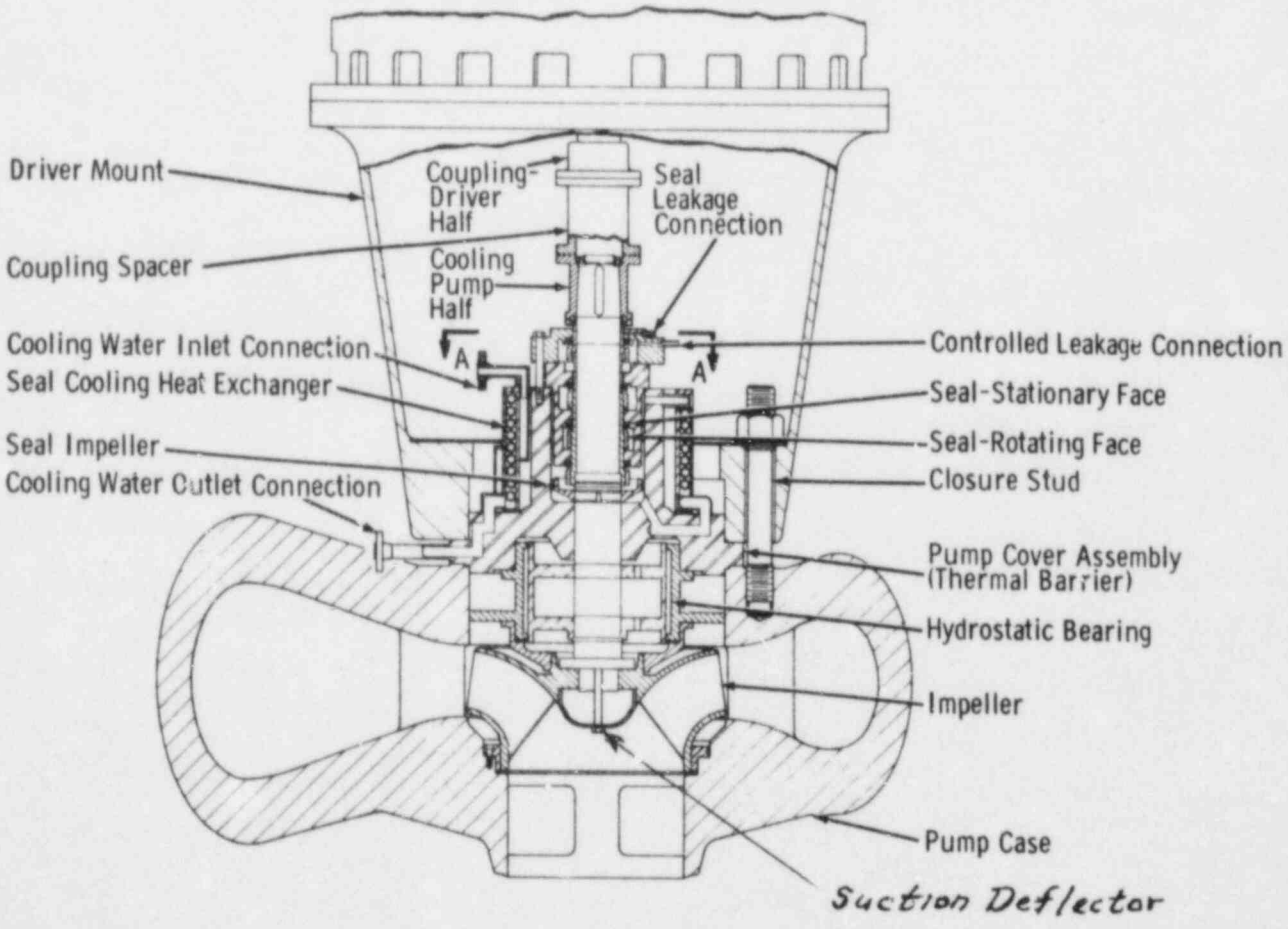

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