



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

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50-255

MEMORANDUM FOR: Richard C. DeYoung, Director  
Office of Inspection and Enforcement

FROM: Carlyle Michelson, Director  
Office for Analysis and Evaluation  
of Operational Data

SUBJECT: ABNORMAL WEAR ENCOUNTERED ON ALOYCO SWING CHECK VALVES  
INSTALLED IN THE LPSI SYSTEM AT THE PALISADES NUCLEAR  
PLANT

It was reported in LER 81-037 that on September 9, 1981, during required modifications of the LPSI system at the Palisades Plant, two of the four LPSI swing check valves were found to have internal damage. The disc nut, disc nut washer and the disc nut pin were missing and severe wear to the valve body, clapper arm, disc clapper arm shaft and clapper arm support had occurred in both valves. The discs were still attached to their clapper arms and the valves were operational, however, valve seat and disc sealing surfaces were damaged and the valves might have been leaking excessively.

The abnormal wear of the check valves was discovered during modifications of the LPSI piping to add leak-testing capability as required by NRC order, dated April 20, 1981, for Event V valve Configurations. This order required the licensee to perform periodic leak-testing of check valves that form the interface between a high pressure system connected to the reactor coolant system (RCS) and a low pressure system whose piping leads outside containment. Event V is identified in WASH-1400 as a sequence of events leading to a core melt that is initiated by the failure of two in-series check valves to function as a pressure isolation barrier between a high pressure system connected to the RCS and a lower pressure system extending beyond containment. This failure causes an overpressurization and rupture of the low-pressure system, which results in a LOCA that bypasses containment.

At Palisades, the ALOYCO check valves form the boundary between the LPSI and HPSI systems. Failure of these check valves could cause overpressurization of the LPSI from the HPSI system and the loss of some HPSI flow following a small break LOCA. The partial loss of HPSI flow to the RCS and the accompanying damage to the LPSI system were not postulated in

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DEC 23 1981

Richard C. DeYoung

- 2 -

the small break LOCA analysis. As a result, a failure of this type may be an unreviewed safety question.

The NRC order caused the licensee to make the first inspection of these valves in about ten years of power operation. It was subsequently discovered that the remaining two LPSI check valves had also failed in a similar fashion. The four LPSI check valves at Palisades were manufactured by Alloy Steel Products Company (ALOYCO), circa 1968. They are six inch swing type check valves with weld ends for attachment to Sch. 120 piping. All four valves were mounted vertically with the flow direction upward.

The swing check valves are of in-line configuration with a ballooned or expanded area in the valve body for movement of the flapper-type disc (see Figure 1). The disc is substantially larger than the pipe or nominal valve I.D. If the disc should become separated from the clapper arm, the disc would be trapped within the expanded portion of the valve body. This could lead to reduced LPSI flow, or with some small probability, the complete blockage of the line during a LOCA or during shutdown cooling.

Operation of the swing check valve in the direction of flow (normal operation) results in the threaded shaft on the back of the valve disc striking the valve body as it opens to the full flow position. (The valve body is the ultimate limiter of disc opening.) In full flow operation, it is presumed the disc will generate sufficient turbulence to cause it to chatter against the valve body. At Palisades these valves, which are used for extended periods of operation during shutdown cooling, exhibited about one-half of an inch of wear (greater than the height of the disc nut) of the threaded portion of the disc shaft. However, although the disc nuts had been worn away, none of the discs had separated from their clapper arm because of the "peening" of the shaft to a larger diameter.

From a generic consideration, the design of ALOYCO swing check valves is different from swing check valves of some other manufacturers. Other designs have removed the possibility of threaded portions of the internals from acting as the striking surface by providing an alternate raised surface on the valve disc to contact the valve body upon full flow conditions (see Figure 2).

ALOYCO swing check valves can be found from two inch to twelve inch pipe size at Palisades. Palisades is replacing the four ALOYCO check valves in the LPSI system with valves of another manufacturer.

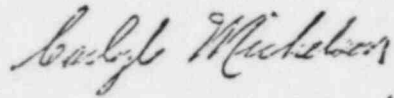
The Event V order was issued because of the unsatisfactory performance of in-series check valves. At Davis-Besse, the valve internals were found disassembled, and at Sequoyah, the check valves jammed open against the valve over-travel limiters. Considering the associate risk postulated from an Event V accident, the possible generic design problem of the ALOYCO swing check valves, and their possible widespread use in the nuclear

DEC 23 1981

Richard C. DeYoung

- 3 -

industry, we recommend that I&E issue an Information Notice to inform the licensees of some of the problems with ALOYCO swing check valves.



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FIGURE 2. Cross Section of a Typical Swing Check Valve (Powell) Showing The Fully Open and Closed Positions of the Flapper Disc

