



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

September 6, 1988

Docket

Docket No. 50-298

Mr. George A. Trevors, Division  
Manager - Nuclear Support  
Nebraska Public Power District  
Post Office Box 499  
Columbus, Nebraska 68601

Dear Mr. Trevors:

SUBJECT: THE IMPACT OF PROLONGED LOW POWER OPERATION  
ON THE RELIABILITY OF CHECK VALVES

Reference: Letter from M. O. Medford to NRC, "Investigation  
Report, San Onofre Unit 1 Water Hammer Event of  
November 21, 1985," dated April, 1986.

Check valves are used in many systems important to plant safety and reliability. Failure of check valves can lead to overpressurization of low-pressure systems, water hammer, steam binding, and extensive damage to other components at nuclear power plants.

Recent industry experience showed that accelerated wear and failure of certain check valves could occur due to continued undesirable flow operations. The primary cause of this premature degradation is continuous fluctuation of the check valve disc when it is not firmly held against the backstop by the fluid forces pushing on it. The position of the check valve disc can be determined by a balance of fluid lifting force and the gravitational force acting on the disc and hinge arm weights. Low flow velocities are not sufficient to lift the disc through its full stroke and hold it firmly in a stable position against a stop. With each minor flow pulsation, the disc then fluctuates causing premature wear of moving parts. This instability if coupled with close proximity upstream flow disturbance such as elbows, tees, control valves and pumps could cause rapid wear and in some cases even failure of the valves.

An analysis (Reference 1) was performed to identify the root causes of check valve failures during the November 21, 1985, water hammer event at San Onofre Nuclear Generation Station, Unit 1. That analysis concluded that the failure of the five failed check valves was caused by repeated hammering of the disc stud and the stud nut against the backstop due to insufficient disc lifting force of the low flow rate during reduced power operation. The plant had been operating at reduced power and the reduced feedwater flow, coupled with a high level of turbulence due to increased throttling of the flow control valve, resulted in an amplified oscillation and accelerated degradation. Eventually it led to failures of the check valves.

Based on the above discussion, it is reasonable to conclude that certain check valves are vulnerable to damage caused by prolonged reduced flow operation.

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Mr. George A. Trevors

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Therefore, I am advising you of this concern and requesting that you review your plant configuration for possible impact of prolonged low flow operation on the reliability of check valves.

This letter requires no formal response.

Sincerely,

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Paul W. O'Connor, Project Manager  
Project Directorate - IV  
Division of Reactor Projects - III,  
IV, V and Special Projects

cc: See next page

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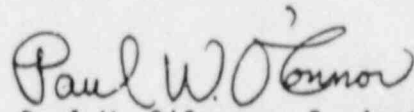
Mr. George A. Trevors

-2-

Therefore, I am advising you of this concern and requesting that you review your plant configuration for possible impact of prolonged low flow operation on the reliability of check valves.

This letter requires no formal response.

Sincerely,

A handwritten signature in cursive script that reads "Paul W. O'Connor". The signature is written in dark ink and is positioned above the typed name and title.

Paul W. O'Connor, Project Manager  
Project Directorate - IV  
Division of Reactor Projects - III,  
IV, V and Special Projects

cc: See next page

Mr. George A. Trevors  
Nebraska Public Power District

Cooper Nuclear Station

cc:

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