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SUBJECT: Forwards response to NRC request for info re feedwater line integrity under reactor feed pump trip conditions.Analysis of feedwater sys containment isolation check valve internals provided by 830401.

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September 26, 1982

Mr. A. Schwencer, Chief
Licensing Branch No. 2
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUSQUEHANNA STEAM ELECTRIC STATION
REACTOR FEED PUMP CHECK VALVE CLOSURE
FEEDWATER LINE BREAK
ER 100450 FILE 841 Docket Nos. 50-387
PLA-1320 50-388

Dear Mr. Schwencer:

Attached is Bechtel's response to the NRC's concerns on Reactor Feed Pump Check Valve Closure and the possibility of a feedwater line break outside containment caused by Feedwater system transients. The response references Bechtel calculation M-106-25. The portion of calculation M-106-25 which provides system pressure surges following feedpump check valve closure is performed in accordance with ASME publications. These publications are ASME 62-WA-219, "Prediction of Surge Pressures from Check Valves for Nuclear Loops" and ASME WA-220 "Minimization of Surge Pressure from Check Valves for Nuclear Loops." The results of these calculations are given in the attached response.

PP&L will provide a dynamic analysis of the Feedwater system containment isolation check valve internals by April 1, 1983.

Very truly yours,

R J Shovlin for

N. W. Curtis
Vice President-Engineering & Construction-Nuclear

RJS:pvm

Attachment

B001

FEEDWATER LINE INTEGRITY UNDER REACTOR FEED PUMP TRIP CONDITIONS

NRC CONCERN

Discuss the possibility of a feedwater line break outside containment due to a transient caused by tripping of the Reactor Feed Pump(s). Include the effects of a Reactor Feed Pump discharge check valve closure pressure wave due to: one Reactor Feed Pump tripping with normal coast down; one Reactor Feed Pump tripping with a fast coast down; and three Reactor Feed Pumps tripping. The three pump trip should consider all transients which could cause all three Reactor Feed Pumps to trip.

RESPONSE

Calculation M-106-25 performed an analysis of the Feedwater line pressure surge resulting from a Reactor Feed Pump discharge check valve closing due to a Reactor Feed Pump trip. This calculation is based on utilizing ASME publication 62-WA-219, "Prediction of Surge Pressure from Check Valves for Nuclear Loops", and 62-WA-220, "Minimization of Surge Pressure from Check Valves for Nuclear Loops". This calculation predicts a feedwater line flow reversal after trip of one Reactor Feed Pump at approximately 4.5 seconds. After that time the reverse flow is arrested by the closing check valve and results in a calculated pressure rise of approximately 10.2 psig. This same calculation checked the pressure rise under an assumed flow reversal of one second after Reactor Feed Pump trip. This assumed condition results in a calculated pressure rise of 115.2 psig.

Based on our engineering background in pressure pulses, a 10.2 psig rise will have negligible effect on the feedwater piping. The fast (one second) flow reversal, which represents an Reactor Feed Pump seizure, requires a complex time history analysis to demonstrate its acceptability. We would not expect pump seizures to occur, and a fast flow reversal that would instantaneously seize a feed pump and coupled turbine would require absorption of a tremendous amount of energy and therefore, is not likely.

We believe that the pressure rise resulting from simultaneous tripping three Reactor Feed Pump/Reactor Feed Pump Turbines would be bounded by the one Reactor Feed Pump trip analysis. Trip of one Reactor Feed Pump results in downstream pressure on the check valves from the other Reactor Feed Pumps. This pressure, of approximately 1450 psig, is attempting to close the feedwater check valve. If all three Reactor Feed Pumps were to trip, the downstream pressure on the feedwater check valves would be reactor pressure, approximately 1000 psig. Since the pressure tending to cause reverse feedwater line flow is greater with one Reactor Feed Pump than with three, the resultant pressure rise should be less with the three Reactor Feed Pump trip. No credit is taken for the closure of the containment check valves in the above. This is conservative, since the fluid column is essentially incompressible, and the reverse flow will act equally on the containment check valves and the Reactor Feed Pump discharge check valves.

We have investigated the types of normal and upset conditions which could result in a simultaneous three Reactor Feed Pump trip and conclude that none will result in a Reactor Feed Pump coastdown faster than the normal Reactor Feed Pump trip coastdown. In general, a reactor scram, main steam stop valve closure or main steam isolation valve closure will trap a volume of steam upstream of the Reactor Feed Pump Turbine stop valve. This will tend to slow deceleration of the Reactor Feed Pump/Reactor Feed Pump Turbine and make the closing transient on the feedwater check valve less severe than a Reactor Feed Pump Turbine stop valve trip.

For additional consideration, a Reactor Feed Pump Turbine coastdown computer calculation was run on Hope Creek. This calculation shows a rapid decay from 4500 rpm to 2000 rpm in approximately .25 minutes, then a gradual decay to zero rpm over the next 4.5 minutes. This leads us to believe that the coastdown assumptions in calculation M-106-25 are conservative. The combined rotating inertia of the Hope Creek Reactor Feed Pump and Reactor Feed Pump Turbine is less than Susquehanna's.

Our conclusion is that the feedwater piping will not break due to normal or upset feedwater transients associated with the Reactor Feed Pumps.