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

MEMORANDUM FOR: Robert L. Tedesco, Assistant Director for Licensing, DL, NRR

Gus C. Lainas, Assistant Director for Safety Assessment, DL, NRR

FROM: Themis P. Speis, Assistant Director for Reactor Safety, DSI, NRR

SUBJECT: IP REQUEST FOR EXPERT REVIEW OF KRSKO STEAM GENERATOR CHANGES

Per your memo dated May 28, 1982, we are requested to review the proposed fix to the KRSKO Nuclear Power Plant Type D-4 steam generator and provide our initial comments regarding overall proposed fix and the additional information is needed to complete the reviews.

Reactor Systems Branch has coordinated with other technical branches within DSI (ASB and ICSB) that are participating in the review of this subject and compiled the following list of comments and questions.

1. The Main Feedwater Systems modifications proposed by Westinghouse for the D-4 type steam generators of the KRSKO Nuclear Power Plant seem reasonable based on our initial review of the system and the proposed modifications. A small purge flow through the main feedwater nozzle during 0-20% power and a small tempering flow through the auxiliary feedwater nozzle during 20-70% power reduces the risk of water-hammer in the auxiliary feedwater nozzle, respectively.

2. There is a discrepancy in the feedwater flow control scheme between the feedwater system description prepared by Gilbert Associates, Inc. and the feedwater system control valves operation curves provided by Westinghouse.

Gilbert Associates	Westinghouse
0-20% power FBCV only	0-20% power FBCV only
20-70% power FVC only	20-60% power FVC only
70-100% power FCV (Constant Flow at 70%) Plus FACV	60-90% power FCV (Constant flow at 60%) Plus FACV
	90-100% power FACV (Constant flow at 30%) Plus FCV

3. The split flow scheme is designed to limit no more than 70% flow through the steam generator preheater. Although a high flow alarm is provided for the operator's action, flow limiting provisions (e.g., orifice or valve control) would be preferred.

4. The Westinghouse scheduled thermal hydraulics and stress analysis to determine the aux/main feed combined impacts should consider the worst combination of the aux/main feed flow assume a control system malfunction.

5. The complicated new control system ~~amy~~ may lead to higher probability of system malfunction and/or feed flow instability.

6. Main feedwater line break should be reanalyzed assuming a break in 16" line at the main feed nozzle with 30% feedwater continuously feeding the broken steam generator through the auxiliary feed nozzle before the feedwater isolation signal is generated.

7. The piping design should be checked to ensure that down-turned elbows are placed immediately upstream of the main and the auxiliary feedwater nozzles to mitigate waterhammer. The idea is to minimize the horizontal lenghts between the steam generator and the vertical run of piping.

8. According to BNL-NUREG-51248, "An Evaluation of Condensation-Induced Water Hammer in Preheat Steam Generators," a waterhammer test is recommended at 20% of power by using feedwater through the auxiliary feedwater nozzle at the lowest feedwater temperature that the plant Standard Operating Procedure (SOP) allows and then switching the feedwater at that temperature from the auxiliary feedwater nozzle to the main feedwater nozzle by following the SOP. The transient should be observed and recorded. It should be noted that at low loads, these will be vapor voids at the preheater section of the steam generator.

9. Please provide block diagrams of the control systems ~~used~~ showing input parameters and output control signals. These diagrams should clearly differentiate safety grade and non safety grade portions of the systems.

10. Please provide discussion of plant operation near the power region where the flow split occurs - i.e., near 70% power - to verify that stable control system operation will occur at this power.

11. Please provide additional information describing which valves are automatically operated and which are manually operated.

12. What is the purpose of the "loop feedwater isolation" discussed on page 16.

13. Please provide failure modes of the various solenoid valves, control valves, and isolation valves on loss of electric power, instrument air, etc.

14. Please provide description of the consequences if the control system fails and results in an incorrect flow split. Additionally, describe how the failure is detected and how rapidly operators action must be taken.

Themis P. Speis, Assistant Director
for Reactor Safety, DSI

cc: R. Mattson
W. Houston
L. Rubenstein
T. Ippolito
J. Youngblood
C. Rossi
O. Parr
W. Kane
P. Ting