

CONTROL BLOCK:

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 ① (PLEASE PRINT OR TYPE ALL REQUIRED INFORMATION)

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Additional Event Description and Probable Consequences:

During power operation, a reactor trip resulted from steam flow/feedwater flow mismatch coincident with steam generator low level on the 'A' steam generator. The apparent cause of the reactor trip was valve FCV-3-478, steam generator 'A' Feedwater Flow Control valve, failing closed. The USNRC Operations Center was notified of the reactor trip via Emergency Notification System (ENS) in accordance with the requirements of 10 CFR 50.72. Following discovery and tightening of a loose connection on the signal converter associated with the feedwater control valve, the nuclear unit was returned to power. The generator was off-line for approximately two and one-half hours.

During the power ascension stage, feedwater control problems were experienced on all three steam generators. To stabilize the condition a second feedwater pump was started to increase the feedwater pressure and to help stabilize the level oscillations in the steam generators. Subsequent to initiation of the second feedwater pump, secondary system vibration increased. Based on this occurrence, load was being reduced in order to remove the unit from the line. During this load reduction, a two inch line connecting an alternate feedwater source from fossil Unit No. 2 to the 3B feedwater regulator bypass line ruptured resulting in a reactor trip due to steam flow/feedwater flow mismatch coincident with low steam generator level on 'C' steam generator. The pipe rupture (through which feedwater was leaking and flashing to steam) was manually isolated within thirty minutes. The USNRC was again notified of the reactor trip via the ENS. Investigation revealed that the plug had separated from the stem on valve FCV-3-489, steam generator 'B' Feedwater Flow Control Bypass valve. Repairs to the bypass flow control valve and the ruptured piping were effected and the nuclear unit was returned to power. The generator was off-line for approximately 20 hours.

During power ascension, feedwater control problems were again exhibited by inability to pass flow through FCV-3-478, steam generator 'A' Feedwater Flow Control valve. While evaluation of the situation was in progress, the load increase was terminated at approximately 90 MWe. A control problem was also associated with FCV-3-479, steam generator 'A' Feedwater Flow Control Bypass valve, in that the controller would only respond to permit flow between 80 and 100 percent. The unit was removed from the line. Investigation revealed that the stem had broken away from the plug in the 3A Feedwater Flow Control valve and that the 3A Feedwater Flow Control Bypass valve was out of calibration. Repairs were effected and the unit was returned to power. The generator was off-line for approximately 17 hours.

Public health and safety were not affected. This occurrence is bounded by the analysis presented in FSAR Section 14.1.1. During these occurrences the auxiliary feedwater system was operable and available. This report is pursuant to TS 6.9.2.b.

Additional Cause Description and Corrective Actions:

The root cause of the series of events was a broken valve stem in FCV-3-478, steam generator 'A' Feedwater Flow Control valve. The apparent



Additional Cause Description and Corrective Actions (cont'd):

cause of the stem failure was improper load distribution between the stem and plug due to the taper on the valve stem. The original cage, plug and stem in the Feedwater Flow Control valves were replaced with a modified cage, plug and stem in accordance with a Plant Change/Modification (PC/M) originated in 1974. This PC/M provided for strengthening the cage, reducing the size of the orifices, and changing the shape of the plug to go along with the change in the size and shape of the orifice in the cage. The taper on the field fabricated stem was found following this occurrence not to have the exacting tolerance on dimensions to distribute load between the stem and plug. The stem failure due to improper load distribution was the most probable cause of the initial trip. The trip caused the stem to drive back into the plug on the feedwater isolation signal. This is supported by the fact that three rows of . . . threads above the break in the stem are damaged.

The feedwater control problems that resulted in the second trip were apparently induced when the plug dislodged from the stem. The upward forces on the plug closely approximating the weight of the plug resulted in the oscillation of the plug in the cage until the level oscillations in the steam generators caused a reactor trip on steam flow/feedwater flow mismatch coincident with low steam generator level on 'B' steam generator. However, this was not discovered because of the visible damage to FCV-3-489 and to the alternate feedwater pipe rupture. Additionally, the main feedwater valves successfully passed stroke testing following the trips.

The valve stems on all three valves of both Unit No. 3 and Unit No. 4 have been replaced. Additionally, the broken stem in the 3B Feedwater Flow Control Bypass valve has been repaired. All connections to the alternate feedwater system from fossil Unit No. 2 have been removed and caps have been welded in place.

Component Data:

Feedwater Flow Control Bypass valve
FCV-3-479 -(steam generator A)
FCV-3-489 -(steam generator B)

Copes-Vulcan Division of Blaw-Knox Co.
4 inch 900 psi USA Standard
Model D-100-160-2½

Feedwater Flow Control valve
FCV-3-478 -(steam generator A)

Copes-Vulcan Division of Blaw-Knox Co.
12 inch 900 psi USA Standard
14 inch inlet and outlet
Model D-100-160-2½



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