

SUMMARY OF STEAM LINE SAFETY VALVE OCCURRENCE  
H. B. ROBINSON NUCLEAR POWER PLANT UNIT 2  
CAROLINA POWER AND LIGHT COMPANY

H. B. Robinson Unit 2 was supplied by the Westinghouse Corporation to the Carolina Power and Light Company under a turnkey contract. Ebasco Services, Inc., designed the main steam piping system and performed site erection. This pressurized water reactor utilizes three steam generators with overpressure protection provided by a total of 12 safety valves. These self-actuated safety valves are located just outside of the containment vessel wall on the main steam lines from the steam generators. Crosby Valve and Gage Company supplied the safety valves; B. F. Shaw Company fabricated the six-inch long, six-inch diameter, transition pipe which connects the steam line and the valves. Basic material of the transition pipe is Grade "B" carbon steel fabricated to ASTM-A-106 specifications. This pipe was supplied by B. F. Shaw by Youngstown Sheet and Tube Company. Ebasco erected the components.

Functional tests of the plant were in progress just prior to the accident. Specifically, the lift pressure of the steam generator safety valve was being checked using a pneumatic device which allows testing without having system pressure up to design pressure. The primary plant temperature was at 533°F and 2225 psi, on automatic pressure control, with operating personnel in attendance. The steam generators were at normal, low load, conditions with main steam line pressure at 900 psi. Tests had been completed on eight of the 12 safety valves. No fuel was in the reactor at the time of the incident.

At 3:23 p.m., on April 28, 1970, the transition pipe connecting the main steam line to safety valve SVI-4C on steam generator Loop 3 failed in an explosive manner. The failure involved complete severance of the pipe and blew the valve assembly against other structures because of the force generated by the steam jet. The escaping steam caused injuries and burns to seven men in the immediate vicinity. These men were transported to a local Hartsville, South Carolina hospital. One man was treated and then released. The other six were admitted to Byerly Hospital for treatment of their injuries. Timely press releases were made by Carolina Power and Light Company with regard to identification of the accident, condition of injured, and status of the plant. The plant had not yet operated and no radioactive materials were involved in the occurrence.

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ENCLOSURE 1

An investigation of the broken transition pipe was performed by the Westinghouse Research Laboratories. Westinghouse, Ebasco Services, B. F. Shaw, and Carolina Power and Light Company participated in this program, as did the Southwest Research Institute, consultants to Carolina Power and Light Company. The investigation disclosed the failure was a ductile, 360° circumferential rupture in an almost horizontal plane of the transition pipe. In this area the transition pipe had been reduced in wall thickness by internal counterboring to schedule 40 dimensions to facilitate welding. The installation had been 100 percent examined using radiography and magnetic particle techniques at the completion of installation. In addition, a cold hydrostatic test at 150 percent of design, 1356 psig, had been performed satisfactorily. However, based on the subsequent metallurgical examination and stress analyses, the failure has been attributed to stress intensification at the reduced thickness section as a result of dynamic conditions developed during operation of the valve.

To prevent future occurrences, the transition pipes have been redesigned to increase conservatism of the stress levels and to decrease possible stress intensification factors. The extent of the revision included increasing the wall thickness to schedule 160 dimensions and enlarging the nozzle diameter to decrease thickness differences between nozzle wall and valve body wall.