SSINS No.: 6835
IN 87-36

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, DC 20555

August 4, 1987

NRC INFORMATION NOTICE NO. 87-36: SIGNIFICANT UNEXPECTED EROSION OF FEEDWATER LINES

Addressees:

All nuclear power reactor facilities holding an operating license or a construction permit.

Purpose:

This information notice is provided to alert recipients to a potentially generic problem pertaining to significant unexpected erosion which resulted in pipe wall thinning in the safety-related portions of feedwater lines and other related problems. It is expected that recipients will review the information for applicability to their facilities and consider actions, if appropriate, to preclude a similar problem. However, suggestions contained in this notice do not constitute NRC requirements; therefore no specific action or written response is required.

Description of Circumstances:

At the Trojan Nuclear Plant it was discovered that at least two areas of the straight sections of the main feedwater piping system experienced wall thinning to an extent that the pipe wall thickness would have reached the minimum thickness required by the design code (ANSI B31.7, "Nuclear Power Piping") during the next refueling cycle. These areas are in safety-related portions of ASME Boiler and Pressure Vessel Code (ASME Code) Class 2 piping inside containment.

The pipe wall had thinned in both horizontal and vertical runs that were at least seven pipe diameters downstream of elbows or other devices that can cause flow turbulence. Criteria developed by the Electric Power Research Institute (EPRI Users Manual NSAC-112, "CHEC [Chexal-Horowitz-Erosion-Corrosion]," dated June 1987) would not have required that the pipe wall in these straight sections be examined.

Although the straight sections of eroded 14-inch pipe were slightly thicker than the minimum required thickness, it was projected that the pipe wall thickness would erode below the minimum required thickness before the next major outage. Consequently, the licensee plans to replace this piping before restart.

IDHR-11C

Concurrence Copy

The Trojan plant is conducting a failure analysis on the degraded components to determine the causes and mechanisms involved in the observed wall thinning event. The NRC is evaluating the data available to determine any generic implication of the event.

Related Generic Communications:

IE Information Notice 82-22, "Failure in Turbine Exhaust Lines," dated July 9, 1982 provides additional information pertaining to erosion/corrosion in wet steam piping. Other erosion/corrosion events pertaining specifically to the feedwater systems (including emergency and auxiliary feedwater) have occurred in feedwater pump minimum-flow lines, J-tubes in steam generator feedwater rings, and emergency feedwater supply to a helium circulator.

IE Information Notice 86-106, "Feedwater Line Break," was issued December 16, 1986. It described the then-known details of the December 9, 1986 failure of the suction line to a main feedwater pump at Surry Power Station Unit 2. Supplement 1 to this information notice, which was issued February 13, 1987, provided additional detail on the failure mechanism. Supplement 2, which was issued on March 10, 1987, discussed the effects of the system interactions that resulted from the line break.

NRC Bulletin 87-01, "Thinning of Pipe Wall in Nuclear Power Plants," issued on July 9, 1987, requested that licensees submit information concerning their programs for monitoring the thickness of pipe walls in high-energy single-phase and two-phase carbon steel piping systems.

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact the Regional Administrator of the appropriate NRC regional office or this office.

Charles E. Rossi

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Technical Contact: Paul C. Wu, NRR
(301) 492-8987

Attachment: List of Recently Issued NRC Information Notices

The licensee believes that the high flow velocity of 22.6 ft/sec, in combination with other operating factors, may be the cause of the thinning.

This thinning was discovered when the steam piping inspection program at the Trojan plant was expanded to include single-phase piping. Trojan personnel inspected essentially all safety-related high energy carbon steel piping inside containment.

In addition, the licensee discovered approximately 30 additional areas of the main feedwater piping system where the pipe wall had thinned so the thickness of the pipe wall was either less than the minimum thickness required by the design code or would have eroded to the minimum required thickness during the next operating cycle. Of these areas, 10 were in the safety-related portions of the system, while the rest were in non-safety-related portions. All of these thirty additional areas were in regions that the EPRI criteria would have indicated as needing examination.

Discussion:

The feedwater system inside containment consists of four lines. Lines A and B are mirror images, as are Lines C and D. The parameters of the ASME Code Class 2 portion of the piping system are as listed below.

Design Temperature	445°F
Operating Temperature	445°F
Design Pressure	1125 psi
Operating Pressure	920 psi
Piping Material	A-106 GRB
Diameter	14-in. OD
Wall Thickness Nominal	0.593 in.
Wall Thickness Minimal (ANSI B31.7)	0.510 in.
Oxygen Content	4 ppb
pH	9.0
Flow Velocity	22.6 ft/sec @ 100% power

The thinning of the straight sections occurred in Lines A and D.

A number of 45- and 90-degree elbows and two 60-degree elbows were also replaced. The thickness of the remaining pipe wall in these areas ranged from 0.43 to 0.46 in. The minimum required thickness is 0.499 in., and nominal wall thickness at time of installation was 0.593 in.

In the non-safety-related portions of the feedwater lines, a total of 20 pieces of 14-in. pipe were replaced. This total included elbows as well as some straight pieces down stream of the elbows or other discontinuities. The thinning in these segments is very similar to that in the ASME Code Class 2 portion except that the minimum required thickness was 0.44 in.

Trojan personnel also replaced a segment of 30-in. header pipe after identifying a localized portion of header pipe that had eroded to 1.018-in. wall thickness (a minimum thickness of 1.63 in. was required).

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LIST OF RECENTLY ISSUED
INFORMATION NOTICES 1987

Information Notice No.	Subject	Date of Issuance	Issued to
87-35	Reactor Trip Breaker, Westinghouse Model DS-416, Failed to Open on Manual Initiation from the Control Room	7/30/87	All nuclear power reactor facilities holding an OL or CP employing W DS-416 reactor trip breakers.
87-34	Single Failures in Auxiliary Feedwater Systems	7/24/87	All holders of an OL or a CP for pressurized water reactor facilities.
87-33	Applicability of 10 CFR Part 21 to Nonlicensees	7/24/87	All NRC licensees.
87-32	Deficiencies in the Testing of Nuclear-Grade Activated Charcoal.	7/10/87	All nuclear power reactor facilities holding an OL or CP.
87-31	Blocking, Bracing, and Securing of Radioactive Materials Packages in Transportation.	7/10/87	All NRC licensees.
87-30	Cracking of Surge Ring Brackets in Large General Electric Company Electric Motors.	7/2/87	All nuclear power reactor facilities holding an OL or CP.
87-29	Recent Safety-Related Incidents at Large Irradiators.	6/26/87	All NRC licensees authorized to possess and use sealed sources in large irradiators.
87-28	Air Systems Problems at U.S. Light Water Reactors.	6/22/87	All nuclear power reactor facilities holding an OL or CP.

OL = Operating License
CP = Construction Permit

The Trojan plant is conducting a failure analysis on the degraded components to determine the causes and mechanisms involved in the observed wall thinning event. The NRC is evaluating the data available to determine any generic implication of the event.

Related Generic Communications:

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