

**LICENSEE EVENT REPORT (LER)**

(See reverse for required number of digits/characters for each block)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)

Millstone Nuclear Power Station Unit 2

DOCKET NUMBER (2)

05000336

PAGE (3)

1 OF 5

TITLE (4)

Pressurizer Spray Line Fatigue Limits Exceeded Due to Insufficient Thermal Effects Analysis

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
12	23	98	98	-- 026 --	00	1	21	99	FACILITY NAME	DOCKET NUMBER
OPERATING MODE (9)		N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5: (Check one or more) (11)							
POWER LEVEL (10)			000	20.2201(b)		20.2203(a)(2)(v)		50.73(a)(2)(i)		50.73(a)(2)(viii)
				20.2203(a)(1)		20.2203(a)(3)(i)	X	50.73(a)(2)(ii)		50.73(a)(2)(x)
				20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71
				20.2203(a)(2)(ii)		20.2203(a)(4)		50.73(a)(2)(iv)		OTHER
			20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below in NRC Form 366A	
			20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)			

LICENSEE CONTACT FOR THIS LER (12)

NAME: R. G. Joshi, MP2 Regulatory Compliance Manager  
 TELEPHONE NUMBER (Include Area Code): (860) 440-2080

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE):  NO  
 EXPECTED SUBMISSION DATE (15): MONTH: DAY: YEAR:

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On December 23, 1998, following a detailed design review of the pressurizer spray piping, it was self-identified that several inconsistencies existed between the design basis analysis, design specification, and actual operation of the pressurizer spray piping, such that fatigue criterion, as prescribed in Section III of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (1971 edition), had not been satisfied. This review was initiated in response to issues identified during configuration management program review as well as applicability review for phenomenon discussed in Information Notice 88-08 and other issues regarding pressurizer spray line thermal transients.

This condition is historical. The root cause is attributed to insufficient awareness of these particular thermal transients, in the early 1970's, when the original pressurizer spray line analysis was prepared. Specifically, due to limited knowledge of actual pressurizer spray line operational transients, this unit (as well as other similarly designed units) relied on the Bechtel specification that described the system operating conditions for the system as they were understood at the time.

To correct this condition, design modifications will be implemented to ensure compliance with the ASME Code requirements.

9902020118 990121  
 PDR ADOCK 05000336  
 S PDR

**LICENSEE EVENT REPORT (LER)**  
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
Millstone Nuclear Power Station Unit 2	05000336	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	2 OF 5
		98	-- 026 --	00	

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

I. Description of Event

On December 23, 1998, following a detailed design review of the pressurizer [PZR] spray [AB] piping (see Figure 1), it was self-identified that several inconsistencies existed between the design basis analysis, design specification, and actual operation of the pressurizer spray piping, such that fatigue criterion, as prescribed in Section III of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, 1971 edition), had not been satisfied. This review was initiated in response to issues identified during configuration management program review as well as applicability review for phenomenon discussed in Information Notice 88-08 and other issues regarding pressurizer spray line thermal transients. At the time of discovery, the unit was defueled.

Specifically the review determined that the current analysis is deficient in the following areas:

1. There is inadequate consideration of pressurizer spray header piping reheating following termination of auxiliary spray flow due to the ensuing inflow of steam that will condense onto the cooler piping;
2. The temperature range of auxiliary spray transients is underestimated. This is caused by use of an incorrect temperature indicator [TI]. This indicator is located immediately downstream of the regenerative heat exchanger [HX] and is not representative of the temperature of stagnant water inside approximately one hundred fifty (150) feet of auxiliary spray piping which must be cleared out first. This condition was reported in LER 50-336/97-022; and
3. The effect of thermal stratification in the upper horizontal spray header piping run, during low flow conditions existing when the Reactor Coolant Pumps (RCPs) [P] are first started, is not appropriately addressed.

Of particular interest was the increased stresses to the pressurizer auxiliary spray line "tee" (a special Taylor Forge tee with an integral boss) that is the most limiting/highly stressed component in the piping evaluated. It was determined that when the main and auxiliary spray events are correctly modeled in the piping stress analysis for the design life of the components, the calculated fatigue usage factor exceeded the factor allowed in the ASME Code.

As stated in Section 1.2.14 of the Final Safety Analysis Report (FSAR), "To ensure the integrity and operability of pressure-containing components important to safety, established codes and standards are used in the design, fabrication and testing. Table 1.2-1 lists these codes and standards for components relied upon to prevent or mitigate the consequences of incidents and malfunctions originating within the reactor coolant pressure boundary, to permit shutdown of the reactor, and to maintain the reactor in a safe shutdown condition [Table 1.2-1 lists ASME Section III Code, 1971 Edition]."

Failure to incorporate the aforementioned issues into applicable design specifications results in the allowable cumulative usage fatigue factor for the piping, as specified in the ASME code, not being satisfied. As a result, this condition is being reported pursuant to 10 CFR 50.73(a)(2)(ii)(B), as a condition that placed the unit outside of its design basis.

**LICENSEE EVENT REPORT (LER)**  
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
Millstone Nuclear Power Station Unit 2	05000336	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	3 OF 5
		98	-- 026 --	00	

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

II. Cause of Event

This condition is historical. The root cause is attributed to insufficient awareness of these particular thermal transients when the original pressurizer spray line analysis was prepared (in the early 1970's). Specifically, due to limited knowledge of actual pressurizer spray line operational transients, this unit (as well as other similarly designed units) relied on the Bechtel specification that described the system operating conditions for the system as they were understood at the time.

Additionally, in 1984 Combustion Engineering issued an information bulletin (84-04) to the Nuclear industry that identified an issue where the actual thermal transients experienced in the pressurizer spray line could "potentially" be more severe than previously anticipated. However, at the time, the facility had just completed a 1982 reanalysis of the pressurizer spray line thermal transients and did not feel that immediate action was neither necessary nor required in response to this submittal. Consequently, this was a missed opportunity to detect and correct this condition during that timeframe.

III. Analysis of Event

The pressurizer system maintains Reactor Coolant System (RCS) [AB] operating pressure and compensates for changes in coolant volume during load changes. During load changes, the pressurizer system limits pressure variations caused by expansion or contraction of reactor coolant. Pressurizer spray is used to control pressure in the RCS and is supplied from each of the two (2) RCP discharge loops to the pressurizer nozzle. Auxiliary spray is provided from the charging pumps to permit pressurizer spray during plant heat-up whenever the RCPs are not in operation (see Figure 1).

Exceeding the ASME fatigue usage limits could result in initiation of a fatigue crack which could potentially propagate to a critical size and compromise the structural integrity of the spray piping. Since the spray piping is connected to the top of the pressurizer, failure of the spray piping would impact the ability of the plant to maintain a leak tight reactor coolant pressure boundary. However, since the predominant crack driving mechanism would be low cycle fatigue, such a crack would be expected to provide early warning through detectable leakage prior to catastrophic failure of the pipe. Operators would respond to this abnormal leakage in accordance with plant procedures. Consequently, this condition is not safety significant.

IV. Corrective Action

As a result of this condition, the following corrective action will be performed.

Prior to entering Mode 4 from the current outage, design modifications will be implemented to ensure compliance with the ASME Code requirements (this includes revising applicable design documents to reflect the design modifications implemented).

**LICENSEE EVENT REPORT (LER)**  
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
Millstone Nuclear Power Station Unit 2	05000336	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	4 OF 5
		98	-- 026 --	00	

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

V. Additional Information

Similar Events

The following previous reportable event involved thermal effects on the pressurizer spray piping:

LER 97-022: This LER identified those issues in which a violation of the unit's Technical Specifications (TS) occurred. One issue involved a discrepancy which was discovered between the actual pressurizer [AB] auxiliary spray temperature and the instrumentation used to indicate that temperature. TS 3.4.9.2c states, "The Pressurizer temperature shall be limited to: A maximum spray water temperature differential of 350°F." The temperature instrument used to determine the spray water temperature is located on the charging line downstream of the regenerative heat exchanger, prior to the branch connection to the auxiliary spray line. During operation the charging line has flow. However, the auxiliary spray line has approximately 187 feet of pipe, containing approximately 22 gallons of stagnant water. With no flow in the auxiliary spray line the actual water temperature would be the same as the containment ambient temperature. A review of past auxiliary spray actuations during the time period from 1981 through 1994 showed that on several occasions the TS 350 degree differential temperature limit was exceeded, assuming the spray water temperature was at the containment ambient temperature of 100 degrees. A subsequent corrective action involved revising appropriate procedures to use containment ambient temperature to indicate auxiliary spray temperature when initiating auxiliary spray. During the implementation of this corrective action, the condition reported by this LER was discovered.

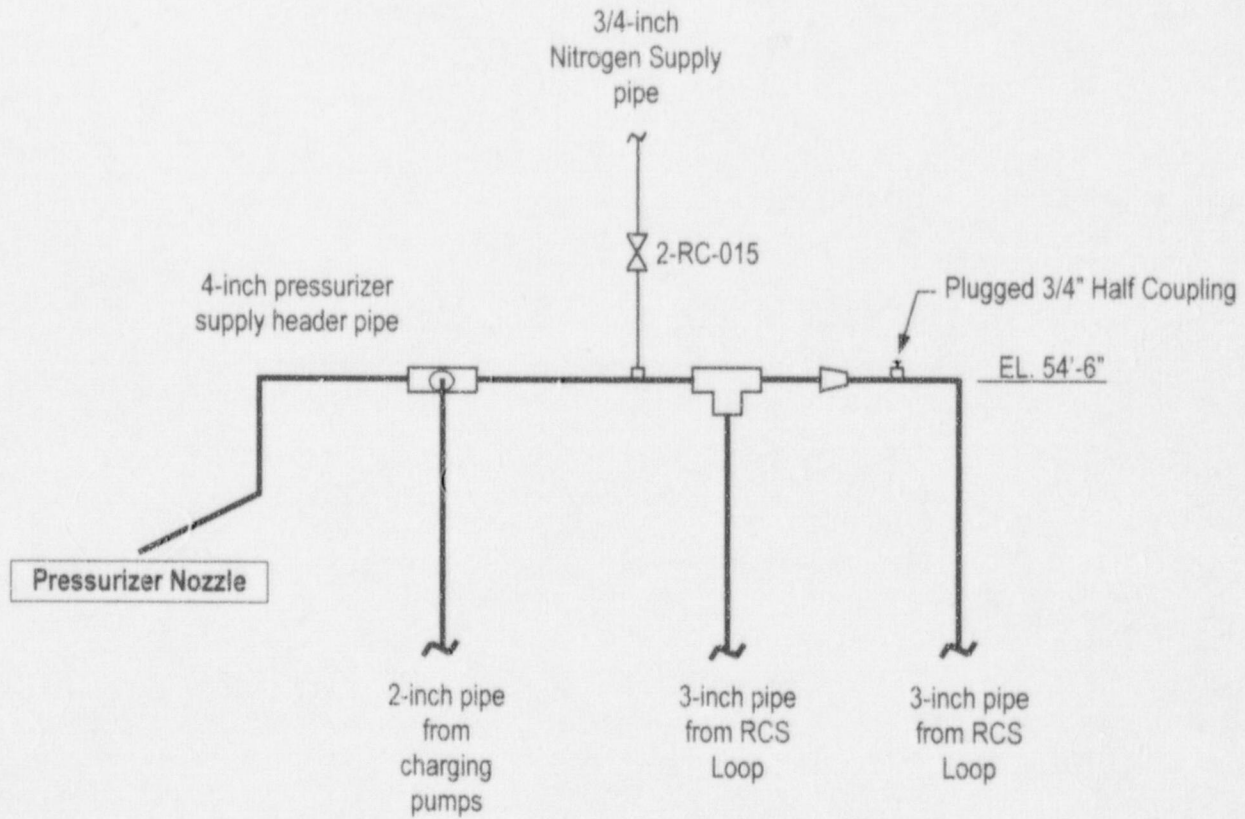
**LICENSEE EVENT REPORT (LER)**  
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET	LER NUMBER (6)			PAGE (3)
Millstone Nuclear Power Station Unit 2	05000336	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	5 OF 5
		98	-- 026 --	00	

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

**FIGURE 1:**

**SKETCH OF EXISTING PRESSURIZER SPRAY LINE PIPING**



Notes:

1. Main Spray Tee is 4x4x3 Sch 160.
2. Aux. Spray Tee is 4x4x2 Special Taylor Forge Tee with Boss to 2" branch
3. 4" Piping is Sch 120.
4. 3/4"-CCA-11 piping connects to half coupling on 4" header.