

EXPIRES 04/30/98

## 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 (IT-6 P33), 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 1

DOCKET NUMBER (2)

05000245

PAGE (3)

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TITLE (4)

Automatic Pressure Relief System May Not Be Single Failure Proof

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
03	27	96	96	037	03	06	30	97	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)		<input checked="" type="checkbox"/> 50.73(a)(2)(i)		50.73(a)(2)(viii)	
			20.2203(a)(1)		20.2203(a)(3)(i)		<input checked="" type="checkbox"/> 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 or 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

Robert W. Walpole, MP1 Nuclear Licensing Manager

TELEPHONE NUMBER (Include Area Code)

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## 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).	<input checked="" type="checkbox"/> NO
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## EXPECTED SUBMISSION

MONTH DAY YEAR

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

On March 27, 1996, with the plant shutdown and the reactor in the COLD SHUTDOWN condition, it was postulated that the automatic pressure relief (APR) system [SB] may be vulnerable to a single failure which could prevent more than one safety/relief valve (SRV) from opening. The APR system rapidly depressurizes the reactor pressure vessel following a small break loss of coolant accident (SBLOCA), to allow coolant injection from low pressure ECCS pumps in the event that the high pressure injection system (i.e., Feedwater Coolant Injection (FWCI)) [BJ] fails, and to facilitate long-term cooling of the core. The single failure vulnerability of APR invalidated assumptions of the operating cycle 15 SBLOCA analysis and an operability determination performed for FWCI in 1993. These analyses were based on the assumption that APR would remain available for accident mitigation and long-term cooling coincident with a single failure. Since the APR was not single failure proof and the plant continued to operate without a qualified FWCI system and an ECCS under postulated accident conditions, these events were promptly reported pursuant to 10CFR50.72.

The safety significance of these events is considered moderate based on the low probability of a SBLOCA concurrent with the type of failure of APR which would disable more than the required number of SRVs. Corrective actions will include the revision to the SBLOCA analysis, implementation of modifications to the APR system, and preparation of design basis summaries for FWCI and APR systems.

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

I. Description of Event

On March 27, 1996, with the plant shutdown and the reactor in the COLD SHUTDOWN condition, it was postulated that the APR system may be vulnerable to a single failure which could prevent more than one SRV from opening. The APR is an ECCS designed to mitigate the consequences of a SBLOCA. The APR performs this function by rapidly depressurizing the reactor pressure vessel (RPV) following a SBLOCA, to allow coolant injection from the low pressure ECCS pumps (i.e., Low Pressure Coolant Injection (LPCI) (BO) and Core Spray (CS) (BM) pumps) in the event that the high pressure system (i.e., FWCI) fails. The operating cycle 15 SBLOCA analysis did not credit FWCI and assumed that there is no single failure in the APR design which will disable more than one SRV.

On May 17, 1996, during the preparation of an engineering evaluation, it was determined that the APR may not be single failure proof (i.e., a single failure could disable more than one SRV). Since the design basis of Millstone Unit No. 1 credits the APR for SBLOCA mitigation, and a single failure may invalidate that assumption, this event was determined to be reportable pursuant to 10CFR50.73(a)(2)(ii) as an unanalyzed condition that significantly compromises plant safety, and was promptly reported pursuant to 10CFR50.72(b)(2)(i).

On February 5, 1997, with the plant in COLD SHUTDOWN, during the on-going engineering review of the APR system, it was determined that the same single failure vulnerability of the APR would not satisfy the long-term cooling requirement of the core following SBLOCA. This was immediately reported on February 5, 1997, as a condition that is outside the design basis of the plant.

During the preparation of single failure position/topical papers as part of the 50.54(f) effort, investigation of a sequence of events involving the FWCI and APR systems potentially permitted plant operation outside of the design basis dependent upon an incomplete operability determination. The operability determination performed during 1993 concluded that safe shutdown could be achieved by the Isolation Condenser and the low pressure ECCS systems which are redundant and single failure tolerant. Operation of the low pressure ECCS systems under these conditions requires the APR system to be single failure proof and function to depressurize the reactor prior to initiating low pressure injection. Since it was determined that the APR system is not single failure proof, this operability determination was based on an invalid assumption. The combination of the APR system not being single failure proof, with the conditions allowed by the operability determination, created a condition in which the unit operated without a qualified ECCS injection system for a SBLOCA for operating cycle 15.

II. Cause of Event

The cause of this event was misinterpretation of the design basis requirements for the APR system during a SBLOCA. This resulted in an incorrect assumption during development of the operability determination for the FWCI system.

General Electric (GE) report NEDO-10139, "Compliance of Protection Systems to Industry Criteria: General Electric BWR Nuclear Steam Supply System," dated June 1970, documents the GE analysis of the conformance of various Nuclear Steam Supply Systems to the Requirements of IEEE Standard 279 (it should be noted that this is a generic document which is not specific to any one BWR). This report was misinterpreted at Millstone Unit No. 1 as being directly applicable to the existing station design and it was believed that the APR system, as installed at Millstone Unit 1 conformed to the system described in the GE

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report. Given this misinterpretation, it was believed that the Millstone Unit No. 1 design was as reliable and as resistant to a single failure as the system described in the GE NEDO-10139 report. Also, this same misinterpretation allowed an incorrect analysis to demonstrate compliance with 10CFR50.46(b)(5), "Long-term cooling," and 10CFR50, Appendix K, "ECCS Evaluation Models."

III. Analysis of Event

The original design basis for the APR did not require APR to be redundant or to meet the single failure criteria by itself. Section VI-2.6.1 of the Millstone Unit No. 1 Final Safety Analysis Report (FSAR) from 1968 states the design bases of the APR system as follows: "The automatic pressure relief sub-system is provided for backup to the FWCI discussed in Sub-Section VI-2.5 and performs the function of reactor vessel depressurization for all small area breaks." Section 7.3.1.1.2 of the current Millstone Unit No. 1 Updated Final Safety Analysis Report also states, "The automatic pressure relief (APR) system, in combination with the core spray system and/or the low pressure coolant injection system, provides a redundant function to that of the feedwater coolant injection system."

Following a SBLOCA, the APR rapidly depressurizes the reactor vessel so that low pressure emergency core cooling systems (e.g., LPCI and CS) can accomplish their safety functions. In the event the APR system fails to operate completely or partially (i.e., more than one valve fails to open), the reactor will not depressurize rapidly enough to allow injection from the LPCI and CS pumps for a range of small breaks. Such injection is necessary for core cooling in the event the FWCI fails to continue to operate. If the SRVs are not capable of depressurizing the RPV following an accident, core cooling pursuant to 10CFR50.46 and 10CFR50, Appendix K is jeopardized. Millstone Unit No. 1 has credited the CS system with providing long-term cooling of the reactor core following a LOCA, however, successful and sustained operation of the CS system is contingent upon successful initial depressurization of the RPV and maintaining the RPV in a depressurized state.

The APR and FWCI are not required under the current operating condition. This event has safety implications since, for a SBLOCA, a failure of the APR concurrent with the unavailability of the feedwater/FWCI system would jeopardize initial and long-term core cooling. However, there were no safety consequences as a result of this event.

IV. Corrective Action

This issue is programmatic. NNECO has previously committed to establish the design basis for safety systems as part of the 50.54(f) review process. Additionally, engineering guidance delineating the detailed requirements for application of the single failure criterion will be prepared and training on the proper application of the single failure criterion will be conducted for personnel identified by the Manager, Design Engineering. The following corrective actions will be implemented prior to startup for operating Cycle 16.

1. Revise the SBLOCA and long-term cooling analysis to include FWCI as an ECCS system.
2. Implement modifications to the design of the APR system such that a single active failure will not disable more than two APR valves.
3. Prepare design basis summaries for FWCI and APR systems.

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V. Additional Information

Similar Events

LER 97-028-00, Identification Of Unacceptable Failure Modes Of Safety Related Components Or Systems Resulting From Postulated Failures Of Non-Safety Related Components

Manufacturer Data

None.

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].