NORTHEAST UTILITIES
The Connecticut Light And Power Company
Western Massachusetts Electric Company
Holyoke Water Power Company
Northeast Utilities Service Company
Northeast Nuclear Energy Company

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Re: 10CFR50.73(a)(2)(vii)
April 17, 1991
MP-91-330

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Reference: Facility Operating License No. NPF-49
Docket No. 50-423
Licensee Event Report 91-008-00

Gentlemen:

This letter forwards Licensee Event Report 91-008-00 required to be submitted pursuant to 10CFR50.73(a)(2)(vii), any event where a single cause or condition caused two independent trains or channels to become inoperable in a single system design to mitigate the consequences of an accident.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

FOR: Stephen E. Scace
Director, Millstone Station

BY: Carl H. Clement
Millstone Unit 3 Director

SES/NDH:ljs

Attachment: LER 91-008-00

cc: T. T. Martin, Region 1 Administrator
W. J. Raymond, Senior Resident Inspector, Millstone Unit Nos. 1, 2 and 3
D. H. Jaffe, NRC Project Manager, Millstone Unit No. 3

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NRC Form 366 (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

Estimated burden per response to comply with this information collection request: 50.0 hrs. Forward comments regarding burden estimate to the Records and Reports Management Branch (p-530), U.S. Nuclear Regulatory Commission, Washington, DC 20555, and to the Paperwork Reduction Project (3150-0104), Office of Management and Budget, Washington, DC 20503

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Millstone Nuclear Power Station Unit 3	0 5 0 0 0 4 2 3	1 OF 0 4

TITLE (4): Pressurizer Level Indication Errors Due to Inadequate Design

EVENT DATE (5) MONTH	DAY	YEAR	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	REPORT DATE (7) MONTH	DAY	YEAR	OTHER FACILITIES INVOLVED (8) FACILITY NAMES	DOCKET NUMBER(S)
0 3	1 8	9 1	9 1	0 0 8	0 0	0 4	1 7	9 1		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): 5

POWER LEVEL (10): 0 0 0

THIS REPORT IS BEING SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

[ ] 20.402(b)	[ ] 20.402(c)	[ ] 50.73(a)(2)(iv)	[ ] 73.71(b)
[ ] 20.405(a)(1)(i)	[ ] 50.36(c)(1)	[ ] 50.73(a)(2)(v)	[ ] 73.71(c)
[ ] 20.405(a)(1)(ii)	[ ] 50.36(c)(2)	[X] 50.73 (a)(2)(vii)	[ ] OTHER (Specify in Abstract below and in Text, NRC Form 366A)
[ ] 20.405(a)(1)(iii)	[ ] 50.73(a)(2)(i)	[ ] 50.73(a)(2)(viii)(A)	
[ ] 20.405(a)(1)(iv)	[ ] 50.73(a)(2)(ii)	[ ] 50.73(a)(2)(viii)(B)	
[ ] 20.405(a)(1)(iv)	[ ] 50.73(a)(2)(iii)	[ ] 50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER AREA CODE	
Nelson D. Hulme, Senior Engineer, Ext. 5398	2 0 3	4 4 7 - 1 7 9 1

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

CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)

[ ] YES (If yes, complete EXPECTED SUBMISSION DATE) [X] NO

EXPECTED SUBMISSION DATE (15): MONTH | DAY | YEAR

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

On March 18, 1991, while shutdown in Mode 5 (Cold Shutdown), an Engineering Evaluation concluded that certain level errors introduced into the three Reactor Coolant System pressurizer level transmitters, created a condition which resulted in two independent channels being inoperable in a single system designed to mitigate the consequences of an accident. The instrument inaccuracies resulted from non-condensable gas accumulation in the condensate pots/reservoirs for the pressurizer level instrument reference legs.

The pressurizer level instrumentation provide the primary indication to the operator for manual actions during and following accident conditions. With the errors postulated, these transmitters would have provided operators misleading information.

The root cause of the accumulation of non-condensible gases is inadequate design. The pressurizer level reference legs were angled upward from the pressurizer to the condensate pots, which allowed gases to build up in the condensate pots. A design change completed during the refueling outage, eliminated the condensate pots. The pressurizer reference leg taps were modified to run straight out and then angle downward via isolation valves to the level transmitters. This allows the free flow of steam and gases along the piping runs to minimize buildup of gases in the reference legs.

NRC Form 366A (6-89) U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

APPROVED OMB NO. 3150-0104 EXPIRES: 4/30/92

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

I. Description of Event

On March 18, 1991, while shutdown in Mode 5 (Cold Shutdown), at 90 degrees Fahrenheit and atmospheric pressure, an Engineering Evaluation concluded that the level errors introduced into the three Reactor Coolant System (RCS) pressurizer level transmitters, due to the inherent design and configuration of the sensing lines, created a condition which resulted in two independent channels being inoperable in a single system designed to mitigate the consequences of an accident. The Engineering Evaluation concluded that the instrument inaccuracies, resulting from the accumulation of non-condensable gases in the condensate reservoir (i.e., condensate pot) for the pressurizer level measurement reference legs, could exceed initial assumptions used for the development of Emergency Operating and Response procedures. The concern was discovered while the plant was shutdown for refueling.

During the previous operating cycle, performance of the pressurizer level transmitters were being monitored due to concerns over instrument drift. As part of the ongoing investigation and performance monitoring, the subject transmitters and associated pressurizer level sensing lines (i.e., reference legs and condensate pots) were inspected. On February 2, 1991, at the beginning of the refueling outage, ultrasonic testing confirmed and quantified the accumulation of gases inside the condensate pots. Based on the ultrasonic tests, the worst case level error observed was 3.6%. The worst level error observed was conservative with respect to the 5% error assumed in the Emergency Operating Procedures (EOPs) for the pressurizer level instruments due to condensate pot blockage.

Based on a detailed evaluation of the incident, it was concluded that the displacement of liquid in the condensate pot(s) and subsequent accumulation of non-condensable gases during a rapid depressurization of the RCS, under certain postulated design basis accident conditions, could create additional pressurizer level errors which would result in the total error being greater than initially postulated.

The Millstone Unit 3 FSAR classifies pressurizer level as a type "A" variable as defined in Regulatory Guide (RG) 1.97 (Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident). A type "A" variable provides the primary indication to the operator for manual actions during and following accident conditions. With the additional errors postulated, these transmitters would provide misleading information to the operators under design basis accident conditions. Since the EOPs and Emergency Response Guidelines (ERGs) did not account for these errors, the pressurizer level channels could not be considered operable as required by RG 1.97.

II. Cause of Event

The root cause for the accumulation of non-condensible gases is inadequate design. The pressurizer level reference legs were angled upward from the pressurizer to the condensate pots. In addition, there are ⅜-inch restrictive orifices in the lines. The combination of reference leg orientation and orifice restriction formed a line block which prevented the free flow of steam and gas between the pressurizer and the condensate pots, thereby precipitating the build up of non-condensable gases in the condensate pots.

III. Analysis of Event

This event is reportable pursuant to the requirements of 10CFR50.73(a)(2)(vii), since two independent trains or channels were deemed inoperable in a single system designed to mitigate the consequences of an accident.

Pressurizer level is an important parameter which is used in the EOPs and ERGs for a variety of actions. In particular, pressurizer level below a minimum indicated level is used throughout the emergency procedures for re-initiation of safety injection (SI), while termination of a SI signal requires level above a minimum indicated level.

Voiding of the reference leg due to the accumulation of non- condensible gases will cause the indicated level to read high. All functions associated with high or increasing level (e.g., reactor trip) are not affected and do not need to be addressed since the affect is in the conservative direction. On the other hand, termination of SI requires RCS sub-cooling, availability of a secondary heat sink, pressurizer level, and stable or increasing RCS pressure. If all of these criteria are not met, SI cannot be terminated. Also, SI is re-initiated if either RCS sub-cooling or pressurizer level is lost. If the minimum level criteria is met due to reference leg voiding with no actual level in the pressurizer, an operator could terminate SI early or not re- initiate SI at the intended time.

Terminating SI early or not re-initiating SI at the intended time because of pressurizer reference leg voiding will not result in any adverse safety consequences. Core damage cannot occur unless level also drops in the reactor vessel. Although pressurizer level may indicate high, the reactor vessel level monitoring system would alert the operator of the potential for core damage. In addition, a loss of sub-cooling would also result, so the SI would be re-initiated based on this criteria. RCS sub-cooling and a stable or increasing RCS pressure, which must be established to terminate SI, are adequate to ensure that core damage is not occurring regardless of pressurizer level. Thus, while an erroneous indication of pressurizer level may result in premature termination, or delayed re-initiation, there are other indications available to the operator for determining the adequacy of core cooling. Therefore, pressurizer level failure will not prevent accident mitigation.

IV. Corrective Action

The features which allowed non-condensible gases to accumulate in the reference legs have been minimized by a design change completed during the refueling outage. The pressurizer reference leg taps now run straight out and then angle downward via isolation valves to the level transmitters. The condensate pots have been removed. The ⅜-inch restrictions are still present, but they no longer serve as line blocks. Except for a short run of pipe that runs horizontally from the taps to the restrictions, all points within the reference legs, including high points within the isolation valves, are below the lowest point of the ⅜-inch orifices. This allows the free flow of steam and gases along the pipe and will minimize the buildup of gases in the reference legs. Verification of proper operation has been obtained through temperature measurements of the reference leg condensing area, and by the output of the transmitters.

V. Additional Information

A search of NPRDS indicated no similar incidents have been reported. There have been no previous LERs initiated at Millstone Unit 3 concerning pressurizer level measurement.

In June 1989, Millstone Unit 3 adjusted pressurizer level operational setpoints in order to allow for the 5 percent error expected due to the buildup of gases in the reference leg due to condensate pot blockage. During the refueling outage, Millstone Unit 3 modified the pressurizer reference leg piping in order to prevent the accumulation of gases.

During investigation of the incident, it was discovered that on February 1, 1989, Westinghouse Corporation - the nuclear steam supply system (NSSS) manufacturer informed Millstone Unit 3 management personnel that the accumulation of non- condensable gases (particularly hydrogen) in the reference legs used for pressurizer level measurements may not have been considered during the development of the Emergency Response Guidelines (ERGS) or the Emergency Operating Procedures (EOPs). Non-condensable gases released under certain postulated accident conditions, the release of these gases may cause the level indication to be greater than actual level. The level measurement error magnitude would be dependent upon variables such as gas concentration at the top of the reference legs, the time at pressure, the rate of depressurization, and the physical configuration of the reference legs.

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

EIIS CODES

System	Components
Reactor Coolant System AB	Pressurizer - PZR Level Transmitters - LT