Northeast
Utilities System

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August 23, 1996

Docket No. 50-423
B15845

Re: 10CFR 50.73(a)(2)(ii)(B)

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

This letter forwards Licensee Event Report 96-026-00, documenting a condition that was determined at Millstone Unit No. 3 on July 30, 1996. This LER is submitted pursuant to 10CFR50.73(a)(2)(ii)(B).

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

FOR

M. H. Brothers
Unit Director, Millstone Unit No. 3

Attachment: LER 96-026-00

cc: H. J. Miller, Region I Administrator
A. C. Cerne, Senior Resident Inspector, Millstone Unit No. 3
V. L. Rooney, NRC Project Manager, Millstone Unit No. 3

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NRC FORM 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 04/30/98

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.

LICENSEE EVENT REPORT (LER)

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

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TITLE (4)

Non-conservative Primary Grade Water Flow Rates Used in Boron Dilution Safety Analysis

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
07	30	96	96	026	00	08	29	96	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (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 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	TELEPHONE NUMBER (Include Area Code)
R. T. Laudenat, Nuclear Licensing Supervisor	(860)444-5248

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)		EXPECTED SUBMISSION	MONTH	DAY	YEAR
[X] YES (If yes, complete EXPECTED SUBMISSION DATE).	[ ] NO		10	14	96

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

On July 30, 1996 with the unit in mode 5 of an extended cold shutdown, it was determined that the maximum Primary Grade Water System (PGS) flow rate to the charging pumps assumed in the boron dilution safety analysis contained with Chapter 15 of the Unit's Final Safety Analysis Report (FSAR) may not have been conservative. The use of non-conservative values was the result of modifications to the normal dilution pathway and inadequate review and assessment of the impact on the Boron Dilution event analysis during the design control process. Therefore, this event is reportable pursuant to 10CFR50.73(a)(2)(ii)(B) as a condition outside the design basis of the unit.

The valves used to isolate the dilution pathways are currently administratively tagged closed for Technical Specification 4.1.1.2.2. Therefore, there is no safety significance associated with the present condition while the plant is maintained in Mode 5 .

A detailed analysis is being performed to determine the maximum system flow. Based on the results of the analysis, plant modifications may be implemented prior to the Unit entering Mode 4 to ensure the Design Basis is maintained. The programmatic conditions which allowed this event to occur are being investigated and will be identified along with appropriate corrective actions in a supplemental report.

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

I. Description of Event

On July 30, 1996 with the unit in mode 5 of an extended cold shutdown, it was determined that the maximum Primary Grade Water System (PGS) flow rate to the charging pumps used in the boron dilution safety analysis contained in Chapter 15 of the Unit's Final Safety Analysis Report (FSAR) was in error. The flow rate value utilized in the boron dilution safety analysis was non-conservative. Therefore, this event is reportable pursuant to 10CFR50.73(a)(2)(ii)(B) as a condition outside the design basis of the unit.

The original plant design calculation utilized 147 gpm as the maximum possible PGS flow rate. This flow rate was achieved via the emergency boration pathway. A calculation was performed in December 1983, to determine the maximum potential unborated water flow rate to the Reactor Coolant System (RCS) via the Chemical and Volume Control System (CVCS) for use in the boron dilution analysis. This calculation determined that the maximum possible PGS flow rate for two PGS pumps was 130 gpm.

A plant design change completed April 16, 1986 replaced a check valve in the normal dilution pathway with one of a different size and type because of the inability to attain the design flow (120 gpm). This problem occurred during initial startup testing when using the normal dilution flow path. In addition, a procedure change was implemented at that time to allow the use of the alternate dilution pathway whenever make up of greater than 115 gpm was required. The calculation performed in support of this design change indicated that the modification lowered the flow resistance in this pathway. The supporting calculation determined that maximum boron dilution flow for this pathway, using one pump, would be 138 gpm.

Currently the boron dilution analyses contained within Chapter 15 of the unit's FSAR is based in a Westinghouse calculation (FSE/SS- NEU 1481, "Millstone Unit 3 Boron Dilution Input," dated 7/30/90). This calculation uses the one PGS pump case with the normal make-up path. It provides a maximum PGS flow of 150 gpm upon which the boron dilution analysis was based.

On July 1, 1996, during the performance of system reviews plant personnel identified this discrepancy in boron dilution flow rates between the normal dilution pathway and the emergency boration pathway. During the resolution of this discrepancy, it was also determined that a potentially higher flow pathway existed. This pathway , the alternate dilution pathway, would be capable of providing greater PGS flow than had previously been considered. This pathway had not been evaluated during the boron dilution analysis. Additionally, because of several modifications to the dilution pathway, including the change out of a check valve (which decreased the path's resistance to flow) and reduction in the orifice diameter for a flow instrument (which increased the path's resistance), the actual value for the maximum dilution flow for both the one and two pump cases is uncertain.

The valves used to isolate the dilution pathways are currently administratively tagged closed for Technical Specification 4.1.1.2.2. Therefore, there is no safety significance associated with the present condition while the plant is maintained in Mode 5 .

II. Cause of Event

As a result of procedure changes and plant modifications to the normal dilution pathway, the flow path required to be utilized in the boron dilution safety analysis changed. This invalidated the previous boron dilution safety analysis calculations. Additionally, no calculations were performed for this pathway utilizing the two PGS pump case. In addition, the most conservative boron dilution path (alternate dilution mode flow path) was not used in the boron dilution analysis. Furthermore, because of several modifications to the dilution path, including the change out of a check valve (which decreased the path's resistance to flow) and the reduction in orifice diameter for a flow instrument (which increased the path's resistance), the actual value for the maximum dilution flow in the one and two pump cases is not certain. Contributing to this situation was an incomplete description of the applicable dilution paths relative to the unit's design basis within Chapter 15 of the Final Safety Analysis Report (FSAR).

These conditions arose as a result of review and assessment inadequacies that occurred over several years. The identification of the specific programmatic deficiencies that led to the present condition is on-going and these deficiencies will be identified in a supplemental report.

III. Analysis of Event

Boron dilution is a Chapter 15 analyzed Design Basis Event. The accident scenario considered is the inadvertent opening of the primary water makeup control valve and failure of the blend system, either by controller or mechanical failure. The addition of unborated water to the RCS would result in a positive reactivity insertion and a reduction of available shutdown margin. For at power operation and start-up conditions, the dilution accident reduces the shutdown margin. For shutdown modes, the dilution accident reduces the total negative reactivity inherent in the borated RCS inventory and thereby reduces the shutdown margin which would normally be available.

The most probable limiting dilution event analyzed is the misoperation of the CVCS reactor makeup control system (RMCS). The specific scenario identified is the inadvertent operation of the primary makeup control valve (FCV-111A) and failure of the blend system (either by controller or mechanical failure). This failure permits the primary makeup water system to inject directly to the charging pump suction (at the Volume Control Tank outlet) without being blended with boric acid at the maximum rate permitted by the piping system. The limiting dilution flow rate for this scenario has been determined to be 150 gpm for all modes of plant operation except Mode 1--automatic . The limiting dilution flow rate for Mode 1--automatic has been determined to be 120 gpm. For conservatism, all analyses for the boron dilution event assumed the limiting case flow rate of 150 gpm dilution flow. An analysis is not performed for an uncontrolled boron dilution accident during refueling. In this mode (mode 6), the event is prevented by administrative procedures which isolate all potentially unborated water paths to the CVCS. This precludes the addition of unborated water to the reactor vessel via CVCS.

While performing the system review it was discovered that a potentially more conservative flow path (i.e. one producing greater flow rate), the alternate dilute flow path, was not analyzed in the boron dilution analysis. This

scenario also assumes identical failure modes as previously analyzed but while operating the CVCS system in an alternate dilute mode. While in the alternate dilute mode, the flow is provided to the top of the VCT via the VCT spray nozzle while simultaneously being provided to the suction side of the charging pumps, thereby bypassing the VCT. These two flow paths are in parallel such that all fluid eventually winds up in the suction side of the charging pumps. Because the flow path in operation has changed, the previously calculated flow for two PGS pumps calculation would no longer be valid. Thus, operation of two PGS pumps could potentially place the plant in a condition outside of the Design Basis condition for the unit (i.e. two PGS pump flow rate may be in excess of 150 gpm). Although the potential exists for exceeding this dilution flow rate assumption, review of the CVCS flow control system indicates that total make-up flow deviation circuit (non-safety grade) most likely would have performed its function and terminated any dilution event within 30 seconds of initiation.

IV. Corrective Action

The corrective action for the resolution of this issue includes a detailed calculation, using the new flow path and accounting for any modifications that have occurred within that path, for both the one PGS pump case and the two PGS pump case. The calculation is currently being performed and will determine the exact flow rates for the cases in question. In addition, Westinghouse and unit personnel will evaluate the technical basis for use of the alternate dilute mode pathway as the limiting case for the boron dilution analysis. Based on the results of these activities the FSAR will be updated to clarify the design basis dilution flow paths.

Following completion of the calculation, if any of the analyzed cases exceeds the 150 gpm maximum boron dilution flow design modifications and/or administrative controls will be evaluated to ensure that the assumptions contained within the analysis for the Boron Dilution event remain valid. These actions will be completed prior to the Unit entering Mode 4 to limit potential dilution flow to less then the analyzed value.

The programmatic conditions which allowed this event to occur are being investigated and will be identified along with appropriate corrective actions in a supplemental report.

V. Additional Information

Similar Events

LER 96-009-00: Inoperable Shutdown Margin Monitors from Low Count Rate, Due to Inadequate Design Control

This event was attributed to an inadequate design control program. During the initial design of the SMM system, the analytical setpoint was determined to be less than or equal to a value of 2. As installed in 1991, the SMMs were conservatively set at 1.5 to account for time delays associated with low count rate operation per the vendor technical manual. A setpoint calculation specifying the minimum shutdown margin monitor count rate necessary for operability was not performed when the system was originally installed. This calculation was required to ensure that the hardware used to mitigate a boron dilution event met the requirements of the

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analysis. The lack of the minimum count rate calculation allowed the possibility for the plant to be in Mode 5 with a SMM count rate that was too low for operability of the system. The assumed accident analysis shutdown margin derived from RCS boron concentration was too low and may not have allowed the required 15 minute response time for the operator to mitigate the event with the SMM alarm setpoint set at 1.5 times the present steady state count rate.

Design Control was identified within the corrective actions as an area in which improvements had occurred in recent years. The implementation of the Design Control Manual, and the training and improvements made in the use and control of vendor services since that time were credited towards preventing future recurrences of this event.

Manufacturer Data

None