

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 3

DOCKET NUMBER (2)

05000423

PAGE (3)

1 of 5

TITLE (4)

Inoperable Shutdown Margin Monitors from Low Count Rate, Due to Inadequate Design Control

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
04	23	96	96	009	02	03	24	97	FACILITY NAME	DOCKET NUMBER
OPERATING MODE (9)		5	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 type="checkbox"/> 50.73(a)(2)(ii)		50.73(a)(2)(x)	
			20.2203(a)(2)(i)		20.2203(a)(3)(ii)		<input type="checkbox"/> 50.73(a)(2)(iii)		73.71	
			20.2203(a)(2)(ii)		20.2203(a)(4)		<input type="checkbox"/> 50.73(a)(2)(iv)		OTHER	
			20.2203(a)(2)(iii)		50.36(c)(1)		<input type="checkbox"/> 50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A	
			20.2203(a)(2)(iv)		50.36(c)(2)		<input type="checkbox"/> 50.73(a)(2)(vii)			

LICENSEE CONTACT FOR THIS LER (12)

NAME

J.M. Peschel, MP3 Nuclear Licensing Manager

TELEPHONE NUMBER (Include Area Code)

(860)437-5840

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

☐ YES

(If yes, complete EXPECTED SUBMISSION DATE).

☒ NO**ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)**

On April 23, 1996, with the plant in Mode 5, at 0-percent power, Engineering personnel discovered that both channels of Shutdown Margin Monitors were inoperable due to the instrument count rate being below a minimum count rate for operability. A review of previous outages indicates the condition may have existed three times within the last two years during Mode 5 operation. The condition is prohibited by Technical Specification 3.3.1, Table 3.3-1, Item 21, which requires two Shutdown Margin Monitor (SMM) channels to be OPERABLE.

Upon discovery an immediate notification was made pursuant to 10CFR50.72(b)(1)(ii)(B). A subsequent review determined that there was no safety significance associated with the shutdown margin monitors being inoperable. The Reactor Coolant System (RCS) was borated significantly higher than the boron concentration assumed in the analysis of a dilution event for the shutdown condition. The SMM alarms at a setpoint above the neutron count rate, 15 minutes prior to criticality, to provide time for operator action to mitigate an unintended dilution. A review of this event and the historical events indicated that the actual, higher than required, RCS boron concentrations provided reasonable assurance of meeting the required 15-minute alarm time to criticality for a postulated dilution event.

As immediate action the plant complied with the applicable Technical Specification Action Statement. The action taken to prevent recurrence was to reduce the SMM setpoint. During a corrective action review of the vendor's boron dilution analysis, a potential non-conservative assumption on subcritical multiplication was identified, and an immediate notification was made on May 13, 1996, pursuant to 10CFR50.72(b)(1)(ii)(B). A subsequent review determined that the analysis was acceptable, and the plant was not in a condition that was outside the design basis.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
		96	-- 009 --	02	

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

I. Description of Event

On April 23, 1996, with the plant in Mode 5 at 0-percent power, Engineering personnel discovered that both channels of the Shutdown Margin Monitors were inoperable due to the instrument count rate being below the minimum count rate required for operability of the system. A review of previous outages indicates that this condition may have existed three other times within the last two years. It was determined that with both channels inoperable, the plant was in a condition that was outside the design basis of the plant. Accordingly, on April 23, 1996, an immediate notification was made pursuant to 10CFR50.72(b)(1)(ii)(B) as a condition outside the design basis of the plant.

Technical Specification 3.3.1, Table 3.3-1 Item 21, requires two Shutdown Margin Monitor (SMM) channels to be OPERABLE. The Limiting Conditions for Operation (LCO) Action for this specification on loss of both channels requires: the suspension of all operations involving positive reactivity additions, isolation of all dilution flowpaths, and a shutdown margin determination within the next hour. The shutdown margin determination must be completed every 12 hours, and the dilution flowpaths must be verified locked every 14 days. The Actions were completed within the required time.

The SMMs were inoperable due to the inability to meet the surveillance requirements of Technical Specification Table 4.3-1, Functional Unit 22, Table Notation 19, which requires the SMM to be set per the Core Operating Limits Report (COLR). The COLR requires the SMMs to be set less than or equal to a value of 2. The calculation that determined the minimum count rate for operability, also determined that with the SMM channels set at 1.5, the actual channel response setpoint (which includes time delays) was in excess of the COLR limit of 2. As the neutron count rate decreases, the time delay associated with SMM increases. This longer instrument response time requires the alarm setpoint to be reduced to provide the necessary operator mitigation response time.

There was no safety significance associated with the SMMs being inoperable. The Reactor Coolant System (RCS) was borated significantly higher than the boron concentration assumed in the analysis of the boron dilution event for the shutdown condition. An evaluation concluded that the higher than required RCS boron concentration provided additional time to criticality, and it determined that the shutdown margin monitors could be expected to alarm at least 15 minutes prior to criticality.

After completing a setpoint change, the SMMs were declared OPERABLE. During a subsequent review of the vendor's boron dilution analysis core design, in support of long term corrective actions for this event, a potential non-conservative assumption was identified by Westinghouse personnel. The potential non-conservative assumption was associated with the prediction of core response to subcritical multiplication, (inverse count rate ratio). Based upon the concern raised by Westinghouse, the SMMs were again declared inoperable on May 13, 1996. It was determined that the plant could have been in a condition that was outside the design basis of the plant. Accordingly, an immediate notification was again made pursuant to 10CFR50.72(b)(1)(ii)(B) as a condition outside the design basis of the plant. During subsequent evaluation as part of the corrective action process, it was determined that the analysis for the prediction of core response to subcritical multiplication was acceptable, and the plant was not in a condition that was outside the design basis. Therefore, the immediate notifications are retracted.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)				PAGE (3)
		YEAR	SEQUENTIAL NUMBER		REVISION NUMBER	
		96	--	009	-- 02	

Millstone Nuclear Power Station Unit 3

05000423

3 of 5

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

II. Cause of Event

This event is 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 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.

III. Analysis of Event

This event is reported as a condition prohibited by Technical Specifications under 10CFR50.73(a)(2)(i)(B). Both channels of Shutdown Margin Monitors were inoperable due to the instrument count rate being below a minimum count rate for operability. A review of previous outages indicates that this condition may have existed three other times within the last two years during Mode 5 operation.

There was no safety significance associated with both shutdown margin monitors being inoperable. An evaluation was conducted to determine whether the SMMs would perform their intended safety function based upon the actual RCS boron concentration for the recent event. The SMM safety function is to alarm at a certain setpoint above the current steady state core neutron count rate and still provide at least 15 minutes prior to reactor criticality for the operator to mitigate an unintended dilution. At the time the SMMs were determined to be inoperable, the RCS was borated at least 200 ppm above the required boron concentration assumed in the boron dilution event analysis. This additional boration provided significant additional operator response time to ensure 15 minutes would have been available for operator mitigation actions. The SMMs would have performed their intended safety function. In addition, in Modes 3 and 4, the SMMs would have been operable as the minimum operable count rate would have existed due to greater neutron leakage from the reactor core at higher RCS temperatures.

The required RCS boron concentration for shutdown margin (SDM) includes additional margin that would also have provided significant additional operator response time. The required SDM RCS boron concentration assumes that the most reactive Rod Control Cluster Assembly (RCCA) is stuck out of the core, which is equivalent to about one percent reactivity. This condition did not occur during the event.

This conservatism built into the shutdown margin requirements coupled with the fact that the RCS was borated to a higher concentration than assumed in the accident analysis provide adequate margin to assure the reactor core was not in an unanalyzed condition, nor was the plant operated outside the design basis during the recent event. A review of three plant outages over the past two years led to a similar conclusion.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)				PAGE (3)
		YEAR	SEQUENTIAL NUMBER		REVISION NUMBER	4 of 5
		96	--	009	-- 02	

Millstone Nuclear Power Station Unit 3

05000423

4 of 5

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

IV. Corrective Action

The immediate corrective actions performed were to comply with Technical Specification 3.3.1, Action 5(b) for both SMM channels being inoperable. The action to prevent recurrence of this event was to reduce the setpoint at which the SMM alarms. The SMMs were originally set to alarm at 1.5 times the steady state pre-event count rate. The alarm setpoint was reduced to 1.25 times the steady state pre-event count rate. A calculation was performed to provide a minimum count rate for operability. This calculation indicates that with the SMM alarm setpoint set at 1.25 above the steady state count rate, the minimum count rate required to ensure the alarm will provide at least 15 minutes of operator response time is 0.8 counts per second. This instrument setpoint ensures that the requirements of the COLR are met.

Additional corrective actions have been developed. First, a Technical Specification change was requested to allow an exemption to LCO 3.0.4 with inoperable Shutdown Margin Monitors. This Technical Specification change was approved on November 14, 1996. Second, the SMMs are being returned to operable status through application of a new Inverse Count Rate Ratio (ICRR) curve. Due to the length of this outage, the core neutron sources have decayed to a level that they are now considered inactive. This situation allows the use of a different, but still conservative, ICRR curve in the boron dilution event analysis. This new ICRR curve will allow the minimum operable count rates to be lowered, and allow the SMM to be declared operable, provided these new minimum count rates are met. This second action provides the design protection of the SMM while the sources are inactive. Prior to entry into Mode 2 from the current outage, procedure changes will either restore the original ICRR curve methodology, or the long term corrective action methodology (described below) will be implemented.

The long term corrective action is to modify the boron dilution event analysis to include appropriate SMM time delays, and submit a Technical Specification change to reflect the augmented SMM requirements for that analysis. This long term corrective action will ensure that the SMMs remain operable at low count rates, except for extreme conditions, such as very long outages, where the LCO 3.0.4 exemption would be needed to change modes.

As described earlier, the root cause was inadequate design control when the monitors were installed in 1991. Design control is a subject that has been identified for improvements 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 would prevent a recurrence of this event, by ensuring a setpoint calculation was performed to specify the minimum required shutdown margin monitor count rate for operability.

V. Additional Information

The first supplement was submitted to remove a previously inaccurate statement. The subject inaccuracy, based upon an incorrect assumption, is discussed in LER 97-007-00, dated February 21, 1997. Supplement 2 is being submitted to describe additional corrective actions.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)				PAGE (3)
		YEAR	SEQUENTIAL NUMBER		REVISION NUMBER	
		96	--	009	-- 02	
Millstone Nuclear Power Station Unit 3	05000423					5 of 5

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

Similar Events

None

Manufacturer Data

EIIS System Codes

Nuclear Instrumentation - IG