



**DUKE POWER**

September 30, 1996

U.S. Nuclear Regulatory Commission  
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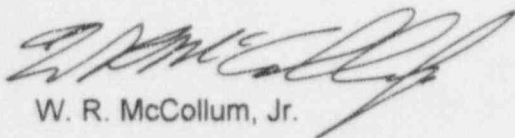
Subject: Catawba Nuclear Station  
Docket No. 50-413  
LER 413/96-008

Gentlemen:

Attached is Licensee Event Report **Closure Response Time Exceeded for Main Steam Isolation Valve 1SM1, B Train.**

This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,



W. R. McCollum, Jr.

Attachment

cc: Mr. S.D. Ebner  
Administrator, Region II  
U.S. Nuclear Regulatory Commission  
101 Marietta St., NW, Suite 2900  
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700 Galleria Place  
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NRC Resident Inspector  
Catawba Nuclear Station

IE22/1

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MMBB 7714), 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)

FACILITY NAME (1)  
Catawba Nuclear Station

DOCKET NUMBER (2)

05000413

PAGE (3)

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TITLE (4)  
Closure Response Time Exceeded For Main Steam Isolation Valve 1SM1, B Train

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(S)
03	07	95	96	- 08	- 00	09	30	96	N/A	05000
OPERATING MODE (9) 5			THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR (Check one or more of the following) (11)							
POWER LEVEL (10) 0			20.402(b)		20.405(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)		50.73(a)(2)(vii)		OTHER (Specify in Abstract below and in Text, NRC Form 366A)	
			20.405(a)(1)(iii)		X 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)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)			

## LICENSEE CONTACT FOR THIS LER (12)

NAME

D. P. Kimball, Safety Review Group Manager

TELEPHONE NUMBER

AREA CODE

(803)

831-3743

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NFRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NFRDS
F	SB	SOL	A585	Y					

## 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)

**Event Description:** On August 30, 1996, with Unit 1 in No Mode, Defueled, Engineering determined that Main Steam Isolation Valve (MSIV) 1SM1 was technically inoperable from March 7, 1995, through refueling outage 1EOC9. However, due to the testing philosophy for valves supplied with dual trains of solenoid valves prior to this event the operability of the B train can not be verified prior to March 7, 1995. This technical inoperability was limited to the B train of 1SM1; periodic testing of the A train indicated that 1SM would have closed within the applicable response time.

**Root Cause:** The root cause of this event is attributed to the spurious failures of the B train exhaust solenoid valve for 1SM1 which was "sticking" for some time when de-energized such that the MSIV failed to close or would not begin closing immediately upon a loss of B train power. The failure mechanism is most likely due to marginal spring force to overcome the forces resisting the spring. This equipment concern is limited to this specific solenoid valve; testing indicates that all other solenoid valves in MSIV applications operated correctly.

**Corrective Action:** All solenoid valves used in the pneumatic controls for the Unit 1 MSIVs have been replaced with a newer design solenoid valve with significantly stronger springs. This replacement will also be performed for the Unit 2 MSIVs during the next suitable outage. Also, Engineering will evaluate the testing and maintenance of MSIV solenoid valves to determine if enhancements are warranted.

**LICENSEE EVENT REPORT (LER)  
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BACKGROUND

The primary purpose of the Main Steam (SM) [EIIS:SB] system is to convey steam from the four steam generators [EIIS:SG] to the high pressure turbine [EIIS:TRB]. Each SM line is supplied with a main steam isolation valve (MSIV) [EIIS:ISV]. MSIVs are normally open, pneumatically controlled, fail closed valves [EIIS:V] which close on a SM isolation signal.

MSIVs are provided with dual train solenoid [EIIS:SOL] valves designated A and B train. Either train of solenoid valves is capable of venting air via a dump valve and metering valve to close the MSIV.

MSIVs are containment isolation valves specified in Technical Specification 3.6.3 and must be operable in Modes 1 - Power Operation, 2 - Startup, 3 - Hot Standby, and 4 - Hot Shutdown.

Technical Specification 3.7.1.4 states that each MSIV shall be operable in Modes 1, 2, and 3. Per surveillance requirement 4.7.1.4, each MSIV shall be demonstrated operable by verifying full closure within 8 seconds when tested pursuant to Technical Specification 4.0.5.

Technical Specification 3.3.2, Engineered Safety Features (ESF) Actuation System [EIIS:JE], requires a steam line isolation with a response time of less than or equal to 10 seconds upon receipt of an initiating signal.

PT/1/A/4200/09, Engineered Safety Features Actuation Periodic Test, is used to verify the proper operation of MSIVs on an individual train of solenoids basis. This test verifies that the main steam line isolation valves stroke to the closed position within the specified time of 8 seconds.

PT/1/A/4200/30A, SM Valve Inservice Test, enclosure 13.1, is used to perform valve inservice (IWV) and fail-safe testing, on 1SM1, Steam Generator D Main Steam Isolation Valve.

EVENT DESCRIPTION

March 7, 1995      Unit 1 was in Mode 5, Cold Shutdown, with refueling outage 1EOC8 in progress. Valve 1SM1 was response time tested to the closed position per PT/1/A/4200/09 during B train ESF testing. The response time was 10.6 seconds. Work Order 95021246 01 was initiated to investigate the failure of 1SM1 to respond within the required 8 seconds.

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March 8, 1995 Valve 1SM1 was response time tested to the closed position per PT/1/A/4200/09 during A Train ESF testing. The stroke time to valve closure was 4.6 seconds.

March 15, 1995 Work Order 95021246 01 identified that the metering valve associated with 1SM1 B train was adjusted too restrictive. Procedure IP/0/A/3890/01, Controlling Procedure for Troubleshooting and Corrective Maintenance, was used during this repair.

March 17, 1995 Valve 1SM1 was stroke time tested using the B train solenoids per Work Order 95021246 02 and PT/1/A/4200/030A. The valve responded to the closed position in 4.5 seconds. 1SM1 was considered fully operable at this point.

November 9, 1995 It was determined that the previous philosophy for testing valves with solenoid valves in dual train arrangements may be incorrect.

Valves with dual trains of solenoids were immediately tested/verified to be operable from both trains of solenoids.

November 24, 1995 During Engineering's follow-up evaluation of the dual train solenoid testing issue, it was identified that 1SM1 had failed its B train response time test during refueling outage 1EOC8 and that an operability evaluation of the as-found condition was not performed.

December, 1995-  
April, 1996 Engineering performed extensive research with respect to the pneumatic operation of MSIVs. Engineering and Safety Assurance concluded that the excessive closure response time of 1SM1 on March 7, 1995, was due to a spurious occurrence. Engineering developed a root cause process to determine the failure mode which caused 1SM1 to close in 10.6 seconds on March 7, 1995.

June 12, 1996 Unit 1 outage 1EOC9 begins.

June 14, 1996 Unit 1 entered Mode 5, Cold Shutdown, at 1625 hours. 1SM1 is no longer required to be operable.



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Refueling Outage  
1EOC9

Engineering and Instrument and Electrical (IAE) personnel began troubleshooting activities on 1SM1. Spurious failures of 1SM1 to close via actuation from the B train of solenoid valves during this testing were documented.

The valve circuitry was tested and determined to be operating correctly. Extensive testing, including disassembly and inspection of the solenoid valves, was performed without conclusive evidence of the failure mechanism being identified. The testing did identify that the B train exhaust solenoid valve was the potentially defective device.

Disassembly of a newer design solenoid valve revealed internal return springs that were stronger, had a larger wire diameter, were significantly taller, and had more coils than the springs installed in 1SM1's solenoid valves.

Even though spurious failures had only occurred on one solenoid valve a conservative decision was made to replace all of the existing solenoids with the newer design solenoid valves with larger springs.

Testing was performed to demonstrate the effect of the metering valve position on MSIV closure response time. Positioning of the metering valve was originally considered to be the cause of 1SM1 failing to close within 8 seconds via the B train on March 7, 1995. This testing demonstrated that metering valve positioning has minimal effect on MSIV closure.

August 29, 1996

The current design solenoid valves have been installed on all Unit 1 MSIVs.

1SM1 is closure response time tested per PT/1/A/4200/30A. The closure response time per the B train solenoids was 4.57 seconds. 1SM1 is fully operable.

August 30, 1996

Engineering completes their evaluation. 1SM1 is determined to have been inoperable due to the potential to not close via one of the two trains of solenoid valves. The period of indeterminate operability of the B train of 1SM1 was from March 7, 1995, to June 15, 1996.

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at which point Unit 1 entered Mode 5. 1SM1 is not required to be operable in Mode 5.

CONCLUSION

The root cause of this event is attributed to the spurious failures of the B train exhaust solenoid valve for 1SM1 which was "sticking" for some time when de-energized such that the MSIV failed to close or, in the case of the original 10.6 second failure, would not begin closing immediately upon a loss of B train power. The failure mechanism is most likely due to marginal spring force to overcome the forces resisting the spring. This equipment concern is limited to this specific solenoid valve; testing indicates that solenoid valves in MSIV applications operated correctly.

Corrective action has included the installation of newer design solenoid valves in each MSIV in Unit 1. The solenoid valves for the Unit 2 MSIVs will be replaced during the next outage of suitable duration. Additionally, Engineering will evaluate the environmental qualification (EQ) preventative maintenance program for MSIVs to determine if enhancements to the testing and maintenance of solenoid valves are warranted.

The solenoid valve failure is NPRDS reportable.

A review of the Operating Experience Database for the three years prior to this event revealed two events which involved MSIV equipment failures.

- Licensee Event Report (LER) 414/94-006 involved a Unit 2 reactor trip following closure of a MSIV due to a short circuit in a normally energized relay coil.
- LER 414/95-001 involved a Unit 2 reactor trip following closure of a MSIV due to a degraded optical isolator.

The previous events did not involve the same equipment, nor would the corrective actions associated with the previous events affected or prevented the current event. This event is not considered recurring.

CORRECTIVE ACTIONSUBSEQUENT

- 1) Unit 1 MSIV supply and exhaust solenoid valves have been replaced with a newer design which utilizes a stronger spring.

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**PLANNED**

- 1) Unit 2 MSIV supply and exhaust solenoid valves will be replaced with the newer design solenoid valve which utilizes a stronger spring.
- 2) Engineering will evaluate the environmental qualification (EQ) preventative maintenance program for MSIVs to determine if enhancements to the testing and maintenance of solenoid valves are warranted.

**SAFETY ANALYSIS**

This event involves the failure of 1SM1 to close via the B train of solenoid valves within the required response time of 8 seconds. The A train of solenoid valves for 1SM1 were fully operable and capable of closing 1SM1 within the required timeframe during the period in which valve closure via the B train was questionable. In addition to closure response time testing during outages, the A train of MSIVs are tested quarterly to ensure that they are capable of closure.

The design basis of the Main Steam Isolation Valves, relative to this event, is to prevent the uncontrolled blowdown of more than one steam generator following a main steam line break. This is to prevent excessive cooldown and the resulting positive reactivity insertion.

1SM1 response time of 10.6 seconds was evaluated with respect to Updated Final Safety Analysis Report (UFSAR) Chapter 15 analyses which credit closure of MSIVs in order to limit the consequence of the event. In doing so, section 15.1.5, Steam System Piping Failure, is identified as the only event which may be significantly impacted by a decrease in the response time. The conclusion was that the current SM line break analysis will support MSIV response times as long as 14.3 seconds including instrument delay. Additionally, the failure of a MSIV to close is bound by UFSAR section 15.1.5.

The health and safety of the public were unaffected by this event.