ACCELERATED DOCUMENT DISTRIBUTION SYSTEM

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:9306040215 DOC.DATE: 93/05/26 NOTARIZED: NO DOCKET #
FACIL:50-305 Kewaunee Nuclear Power Plant, Wisconsin Public Servic 05000305
AUTH.NAME AUTHOR AFFILIATION
ROZELL,D.L. Wisconsin Public Service Corp.
SCHROCK,C.A. Wisconsin Public Service Corp.
RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 93-011-00:on 930421,identified AFW discharge cross connect valve failed to fully close during MOV dynamic testing.Caused by design basis conditions.Plant EOP revised & request generated to review design.W/930526 ltr.

DISTRIBUTION CODE: IE22T COPIES RECEIVED:LTR 1 ENCL 1 SIZE: 14
TITLE: 50.73/50.9 Licensee Event Report (LER), Incident Rpt, etc.

NOTES:

	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL
	PD3-3 LA	1	1	PD3-3 PD	1	1
	HANSEN,A.	1	1			
INTERNAL:	ACNW	2	2	ACRS	2	2
	AEOD/DOA	1	1	AEOD/DSP/TPAB	1	1
	AEOD/ROAB/DSP	2	2	NRR/DE/EELB	1	1
	NRR/DE/EMEB	1	1	NRR/DORS/OEAB	1	1
	NRR/DRCH/HHFB	1	1	NRR/DRCH/HICB	1	1
	NRR/DRCH/HOLB	1	1	NRR/DRIL/RPEB	1	1
	NRR/DRSS/PRPB	2	2	NRR/DSSA/SPLB	1	1
	NRR/DSSA/SRXB	1	1	REG FILE 02	1	1
	RES/DSIR/EIB	1	1	RGN3 FILE 01	1	1
EXTERNAL:	EG&G BRYCE,J.H	2	2	L ST LOBBY WARD	1	1
	NRC PDR	1	1	NSIC MURPHY,G.A	1	1
	NSIC POORE,W.	1	1	NUDOCS FULL TXT	1	1

NOTE TO ALL "RIDS" RECIPIENTS:

PLEASE HELP US TO REDUCE WASTE! CONTACT THE DOCUMENT CONTROL DESK, ROOM P1-37 (EXT. 504-2065) TO ELIMINATE YOUR NAME FROM DISTRIBUTION LISTS FOR DOCUMENTS YOU DON'T NEED!

FULL TEXT CONVERSION REQUIRED
TOTAL NUMBER OF COPIES REQUIRED: LTTR 32 ENCL 32

RIDS/ADDS

RIDS/ADDS

A0-4

WPSC (414) 433-1598
TELECOPIER (414) 433-5544

WISCONSIN PUBLIC SERVICE CORPORATION

EASYLINK 62891993

600 North Adams • P.O. Box 19002 • Green Bay, WI 54307-9002

May 26, 1993

10 CFR 50.73

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

Ladies/Gentlemen:

Docket 50-305
Operating License DPR-43
Kewaunee Nuclear Power Plant
Reportable Occurrence 93-011-00

In accordance with the requirements of 10 CFR 50.73, "Licensee Event Report System," the attached Licensee Event Report for reportable occurrence 93-011-00 is being submitted.

Sincerely,

C.A. Schrock

C.A. Schrock
Manager-Nuclear Engineering

DLR/cjt

Attach.

cc - INPO Records Center
US NRC Senior Resident Inspector
US NRC, Region III

G:\WPFILES\LIC\NRC\LER11.WP

IE22
1/1

NRC FORM 366 (5 92) — U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

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 (MNBB 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)

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

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Kewaunee Nuclear Power Plant	05000305	1 OF 13

TITLE (4) Auxiliary Feedwater Discharge Cross Connect Valve Failed to Fully Close During MOV Dynamic Testing

EVENT DATE (5)			LER NUMBER (6)			REPORT NUMBER (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
04	21	93	93	-- 011 --	00	05	26	93	N/A	05000
									FACILITY NAME	DOCKET NUMBER
										05000

OPERATING MODE (9)	N
POWER LEVEL (10)	035

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

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)	X OTHER
20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	(Specify in Abstract below and in Text, NRC Form 366A)
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	TELEPHONE NUMBER (Include Area Code)
Dennis L. Rozell	414 388-2560

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 DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE.)	X	NO				

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

On April 21, 1993, at 1201 hours, with the reactor operating at 35% power, the following significant items were identified during dynamic motor operated valve (MOV) testing of auxiliary feedwater discharge cross connect valve AFW-10A: 1) the as-found setup of the actuator exceeded the manufacturer's recommended limits, and 2) the as-left setup may not fully isolate flow based on test results with similar setups. Valve AFW-10A was being tested in response to Generic Letter 89-10.

It was determined that the actuator is undersized for design basis conditions. The actuator was sized during initial system design using actuator sizing calculations which did not consider current design requirements, such as closure against full pump discharge pressures or weak link calculations.

Since the operator was undersized for this application, a safety analysis and 10 CFR 50.59 evaluation were initiated to determine the acceptability of modifying plant emergency operating procedures to allow the operators to stop the auxiliary feedwater pump(s) to reduce the high differential pressure across the valve and allow it to close. Danger tags were immediately placed on the valve control switches to address this concern. The procedures have since been revised. The long term corrective action has been initiated to investigate an appropriate design change for AFW-10A and B.

Due to the potential generic information associated with this event, it was decided on April 26 that a voluntary LER be submitted to the NRC.

Description of Event

On April 21, 1993, at 1201 hours, with the reactor operating at 35% power, the following significant items were identified during dynamic Motor Operated Valve (MOV) testing of auxiliary feedwater discharge cross connect valve AFW-10A [ISV](see Figure 1):

1) the as-found setup of the actuator exceeded manufacturer's recommended limits, and

2) the as-left setup of the actuator may not fully isolate flow based on test results with similar setups.

Valve AFW-10A was being tested in accordance with Special Operating Procedure SOP-AFW-05B-5, "AFW-10A/MV-32027 MOV Dynamic Test" in response to NRC Generic Letter 89-10.

Prior to performing this type of testing, calculations are performed, using general maintenance procedure (GMP) 238, "MOV Thrust & Torque Evaluations", to establish a target thrust window. The lower target thrust is the calculated minimum static thrust required for the MOV to perform its function under maximum differential pressure conditions. The maximum thrust is based on the weak link calculations that ensure components in the valve and actuator are not overstressed. For AFW-10A the target window calculated is:

Minimum Thrust Limit - 6270 lbs
Maximum Thrust Limit - 8332 lbs

In addition to thrust limits, there is also a torque limit for the actuator, which is provided by the motor operator manufacturer, Limitorque. For AFW-10A that limit is 90 ft-lbs. After allowing for instrument error and torque switch repeatability, the measurable range for a torque of 90 ft-lbs is 84.7 ft-lbs to 95.3 ft-lbs.

Therefore, to ensure the 90 ft-lbs limit is not exceeded, the maximum measured torque cannot exceed 84.7 ft-lbs.

The 72 hour limiting condition of operation (LCO) action statement for the turbine driven auxiliary feedwater pump (TDAFWP) [P] was entered at 1130 hours on April 21 when testing of AFW-10A began. As-found static testing was performed to determine the current demonstrated thrust and torque values of the valve actuator. The as-found static testing found that the maximum thrust developed went off scale at 8385 lbs and was calculated to be 9394 lbs. This indicated an overthrust condition. The thrust at the torque switch [33] trip (TST) was 7588 lbs. The maximum (peak) torque value measured was 89 ft-lbs. This was identified as a potential overtorque condition. The concern with an overtorque condition is potential damage to the actuator gearing. The as-found torque switch setting was approximately 3.5.

The next step in the test process was to adjust the torque switch setting to bring the actuator output to allowable levels for both torque and thrust. The final adjustment prior to the dynamic test set the torque switch between 2.5 and 2.75 and resulted in the following actuator output values:

Thrust at TST - 5888 lbs
Maximum Thrust - 8210 lbs
Maximum Torque - 75.1 ft-lbs

The thrust at TST was below the calculated minimum. Rather than attempting to adjust the torque switch, which could have resulted in exceeding the maximum thrust value, the torque switch was not adjusted any further. Since the calculated target values are conservative, it was decided that, although the thrust at torque switch trip was below the minimum thrust limit, the MOV may still be able to pass the dynamic test.

The dynamic test was then performed at a differential pressure of approximately 800 psid across AFW-10A. The calculated maximum differential pressure is 1445 psid. During the dynamic test, the valve was opened and the measured parameters were all within prescribed limits. However, during the closing stroke, the torque switch tripped and stopped the actuator prior to full closure. At that point, there was approximately 15 gpm of flow through the valve. During this closing stroke, the following actuator output values were recorded:

Thrust at TST - 3758 lbs
Maximum Thrust - 4101 lbs
Maximum Torque - 50.5 ft-lbs

The difference between the static and dynamic thrust values is known as rate-of-loading, and it can be attributed to the loss of actuator efficiency under dynamic conditions.

The torque switch was then adjusted as high as could be attained without exceeding the Limitorque rating under static conditions. Flow cutoff could not be obtained under the subsequent dynamic test conditions. Based on the information contained in the Kalsi Engineering report, which justifies actuator operation at thrust values 40% greater than the Limitorque limits, it was decided to proceed with torque switch adjustments which could result in maximum thrust values in excess of Limitorque's recommended maximum thrust limit of 8332 lbs. After adjusting the torque switch setting to approximately 3.25, the static actuator output values, prior to the dynamic test, were:

Thrust at TST - 7143 lbs
Maximum Thrust - 9262 lbs
Maximum Torque - 83.4 ft-lbs

At 2100 hours on April 21, the dynamic test was again performed. Again during the opening stroke the valve performed satisfactorily and the measured parameters were all within prescribed limits. During the closing stroke, the actuator torqued out just prior to flow cutoff. The actuator output values for the dynamic test were:

Thrust at TST - 4919 lbs

Maximum Thrust - 4969 lbs

Maximum Torque - 58 ft-lbs

The test results showed that the actuator exceeded torque and thrust limits at the higher torque switch settings and could not isolate flow at the lower torque switch settings.

Since this higher torque switch setting was not successful, plant management decided to return the actuator to within the original calculated thrust band. This would maintain the maximum thrust and torque values below their respective limits. Plant procedures needed to be modified to reduce the pressure drop across the valve to allow it to close. Since there were no problems encountered during testing the opening stroke of the valve, plant management decided to leave the valve closed and suspend testing for the night due to the late hour (2100 hours). The 72 hour LCO action statement for the TDAFWP was exited at this time. The individuals involved believed that, as long as the valve was able to open from the control room to ensure adequate flow to the steam generator (SG)[HX], the pump was operable.

Testing resumed the next day, April 22. The final as-left torque switch setting was approximately 2.75 and the static output values were:

Thrust at TST - 5504 lbs

Maximum Thrust - 8084 lbs

Maximum Torque - 74.1 ft-lbs

After a re-examination of the operability determination from the previous night, plant management determined that the TDAFWP should be considered inoperable. Therefore, the 72 hour LCO action statement for the TDAFWP was re-entered at 1320 hours on April 22. The pump was considered to be out-of-service from the beginning of testing at 1130 hours on April 21.

On April 23, testing was performed on the train B valve, AFW-10B [ISV], using special operating procedure SOP-AFW-05B-6, "AFW-10B/MV-32028 MOV Dynamic Test." This valve recently had preventive maintenance performed on it whereas AFW-10A had not. The maximum differential pressure, thrust and torque limits for AFW-10B are identical to AFW-10A. The as-found actuator torque switch setting was approximately 3.5 and the static output values were also above the Limitorque limits:

Thrust at TST - 7909 lbs

Maximum Thrust - 10181 lbs

Maximum Torque - 113.1 ft-lbs

The torque switch setting was adjusted to bring the actuator output to allowable levels for both torque and thrust. The as-left torque switch setting was approximately 2.0 and the actuator static output values were:

Thrust at TST - 4677 lbs

Maximum Thrust - 7291 lbs

Maximum Torque - 84.3 ft-lbs

The dynamic test was then performed. The actuator output values at the first of two torque switch trips were:

Thrust at TST - 4385 lbs

Maximum Thrust - 4468 lbs

Maximum Torque - 48.1 ft-lbs

After initial torque switch trip, the torque switch reset and the actuator started to close the valve again. After the TDAFWP was turned off, the torque switch tripped a second time as the differential pressure decreased. Flow was not completely isolated at the time of the first TST. The test results showed that the actuator exceeded torque and thrust limits at the higher, as-found torque switch setting during static testing and could not isolate flow at the lower torque switch settings during dynamic testing. It was decided to leave the actuator set at the lower torque switch setting to maintain the maximum thrust and torque values below their limits. A modification to the plant procedures would be initiated to ensure that the valve could be closed if needed to isolate a SG, by allowing the operators to stop the AFW pump(s) [P] to reduce the differential pressure across the valve.

On April 22, the safety analysis and 10 CFR 50.59 evaluation were performed to determine the acceptability of modifying plant emergency operating procedures to allow the operators to stop the AFW pump(s) to reduce the differential pressure across the valve and ensure its closure. This action would reduce the pressure drop across the valve and allow the valve to completely close when required. The 10 CFR 50.59 evaluation and safety analysis determined that there is sufficient time during accident conditions, when the pressure drop across the valve would be the greatest, to perform these actions without adversely affecting the health and safety of the public. The safety analysis and 10 CFR 50.59 evaluation were reviewed and accepted by the Plant Operation Review Committee on April 23.

The special operating procedures for dynamic testing of AFW-10A and B were completed at 1700 hours on April 23. The control room switch for each valve was danger tagged with the comment that the valves may not close with a high differential pressure; therefore, running AFW pump(s) may have to be stopped to allow the valve to close.

The TDAFWP was returned to service and the LCO action statement exited at 1629 hours on April 23, 1993.

Cause of Event

The suspected cause of this event is an undersized motor operator for AFW-10A and B. During original system design (the late 1960's to early 1970's time period) standard industry calculations used by valve manufacturers were not required to consider maximum (full pump discharge) differential pressure conditions or weak link data. This resulted in calculated minimum thrust values and other parameters, which, when compared to current design requirements, resulted in underestimated required thrusts and undersized actuators. The current actuator is capable of supplying sufficient thrust to close the valve but this would result in an overtorque condition. Generic Letter 89-10, associated supplements and NRC Information Notices have documented the concern of improper operation of motor operated valves under maximum differential pressure conditions.

The suspected cause of this event will be verified by an engineering evaluation of the design of the valves and appropriate corrective actions will be determined and implemented.

Analysis of Event

On April 26, plant management decided that this event contained information of potential generic interest to the rest of the nuclear industry and that a voluntary Licensee Event Report should be submitted to the NRC.

Prior to running the first static test on AFW-10A, the minimum thrust required to isolate flow was calculated using GMP 238. The calculated minimum thrust required to close the valve at maximum differential pressure (1445 psid) was calculated to be 5292 lbs. By applying an instrument error, a torque switch repeatability error, and a rate-of-loading factor of 13%, a required static thrust of 6270 lbs or greater must be measured.

The as-found values measured during the first static test demonstrated that the required thrust could be achieved but not without exceeding the Limitorque torque limits and weak link maximum thrust limits. In order to reduce the actual thrust values the torque switch setting was lowered and a series of tests were performed to reach the optimum setting. The maximum thrust measured during the as-found test of AFW-10A was 113% (AFW-10B was 122%) of the Limitorque limits. Since this is well below the 140% values that the Kalsi report has determined to be acceptable (given the assumptions of the testing performed for the study), the valve and operator are not suspected to be damaged. AFW-10B has been operated at the higher torque and thrust values and no damage was found during the recent preventive maintenance performed on the actuator. AFW-10A operated satisfactorily during the MOV testing. The data collected during MOV testing on both valves (AFW-10A/B) did not indicate valve degradation.

The motor operator was left with torque switch settings, determined by the testing, that would maintain the operating thrust and torque within the Limitorque recommended limits.

Because the minimum thrust required to close the valve cannot be met without exceeding the maximum thrust limit, based on the Limitorque weak link calculations, and torque limits, plant management decided to modify plant procedures which will allow the operators to minimize a large differential pressure across the valve by stopping the AFW pump(s) to allow complete closure of the valve during an accident. A safety analysis and a 10 CFR 50.59 evaluation were completed and accepted by the Plant Operations Review Committee on April 23, 1993 for the change in the plant emergency operating procedures to allow the operator to stop the AFW pump(s) and allow the valve to close.

As part of the safety analysis, the Updated Safety Analysis Report (USAR), NRC Safety Evaluation Reports, emergency operating procedures and background documents, and Westinghouse topical reports (WCAPs) were reviewed to determine the ramifications of AFW-10A or B not fully closing upon operator demand. The following specific events were reviewed:

1. Isolating a faulted steam generator due to a feedwater line or steam line break,
2. isolating a steam generator with a tube rupture,
3. ensuring adequate feedwater flow to the intact steam generator, and
4. ensuring adequate feedwater flow during a station blackout event.

The potential areas of concern, which were reviewed with regards to a faulted steam generator, were the containment pressure response and the possibility of a return to criticality in the core. The results of this analysis showed that the energy deposited into containment from the steam line break is always less than the containment design capability. This analysis also justified that, due to various indications available in the control room, taking credit for operator action to manually isolate AFW within 10 minutes is acceptable. The results of this analysis also showed that the core reactivity transient during a steam line break is insensitive to AFW flow, since the limiting core conditions occur before the AFW flow becomes a major contributing factor. For a feedwater line break, the effects of water leakage past AFW-10A or B would not affect the containment pressure response or criticality response.

During a steam generator tube rupture event or station blackout event, the maximum differential pressure would not be obtained across AFW-10A or B; therefore, each valve would fully close on demand.

Additional concerns were the effects of stopping AFW flow to the intact steam generator prior to closing valves AFW-10A and AFW-10B, coincident with a faulted steam generator. The various documents were reviewed to determine if a temporary interruption of AFW would lead to steam generator dryout, subsequent

RCS heatup, and RCS voiding. This review determined that it is conservative to assume SG dryout would not occur within 20 minutes after a loss of all feedwater to the SGs. The safety analysis determined that there is sufficient time for the operators to diagnose the situation and then to stop the AFW pump(s), close the valve, and re-initiate AFW flow to the intact SG. At a minimum there is 26 minutes after a loss of all feedwater for the operator to isolate the valve manually. The valve could have been closed to isolate a steam generator even if it did not completely close the first time, because manual action has always been required to isolate the SGs which relied upon sufficient indication in the control room to identify the problem and all actions can be accomplished from the control room.

The safety analysis also determined that the proposed procedural changes will not affect the time required to identify and isolate a ruptured SG. Furthermore, tripping the AFW pump(s) will isolate AFW to the ruptured SG as quickly as closing the affected valve and tripping the affected pump. Once the pump(s) is tripped, the operator will have approximately 20 minutes to ensure the AFW cross connect valve is closed and re-initiate AFW flow.

Corrective Actions

Short Term Corrective Action:

Danger tags were put in place to address the need to stop the AFW pump(s) prior to closing AFW-10A and -10B valves in the event of high differential pressure across the valves. This would occur when a steam generator would need to be isolated due to a steam line break or feedwater line break.

Intermediate Term Corrective Action:

The plant emergency operating procedures have been revised to allow the operators to stop the AFW pump(s) to ensure full closure of AFW valves 10A and 10B.

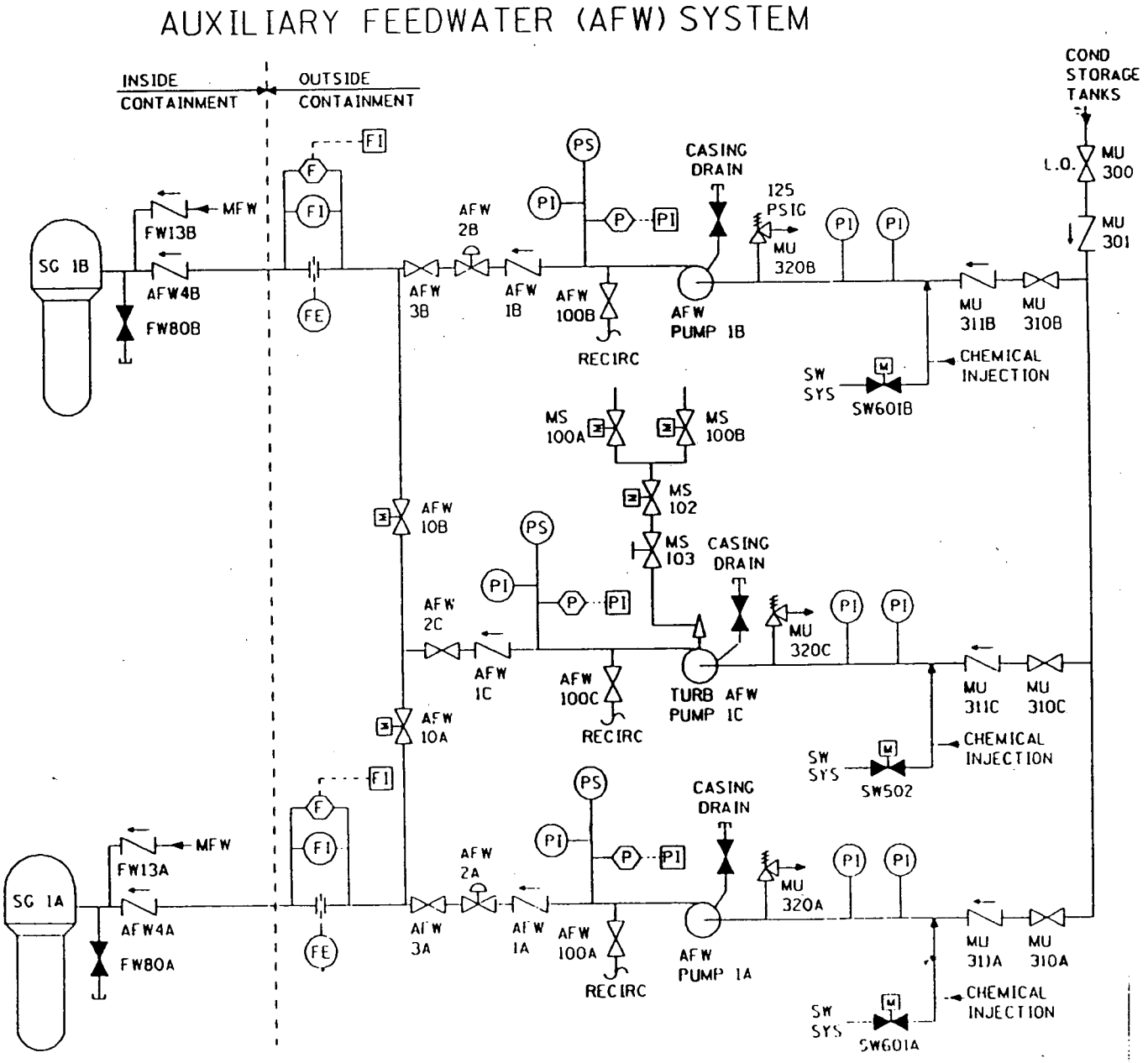
Long Term corrective action:

An Engineering Support Request has been generated to review the design of AFW-10A and 10B determine the appropriate design change for this situation. The possible actions could include, but are not limited to, actuator replacement, valve replacement, or both. This is scheduled to be completed by the end of the 1994 refueling outage; however, this schedule is dependent on equipment lead time and availability.

Additional Information

Auxiliary Feedwater Cross-connect valves are 3 inch, 900 pound OSY W.H. Powell Co. gate valves (Fig. No. 19023 WE) with a Limitorque SMB-000-5, 125 VDC motor operator.

Figure 1


AUXILIARY FEEDWATER (AFW) SYSTEM
INSIDE CONTAINMENT
OUTSIDE CONTAINMENT
COND STORAGE TANKS
L.O.
MU 300
MU 301
SG 1B
SG 1A
MFW
FW13B
FW13A
AFW4B
AFW4A
FW80B
FW80A
F
FI
FE
PS
PI
P
AFW 2B
AFW 2A
AFW 3B
AFW 3A
AFW 1B
AFW 1A
AFW 100B
AFW 100A
RECIRC
CASING DRAIN
125 PSIG
MU 320B
MU 320A
AFW PUMP 1B
AFW PUMP 1A
MU 311B
MU 310B
MU 311A
MU 310A
CHEMICAL INJECTION
SW SYS
SW601B
SW601A
MS 100A
MS 100B
MS 102
MS 103
AFW 10B
AFW 10A
AFW 2C
AFW 1C
AFW 100C
MU 320C
TURB AFW PUMP 1C
MU 311C
MU 310C
SW502