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April 5, 1993

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

Subject: Catawba Nuclear Station
Docket No. 50-413
LER 413/93-002

Gentlemen:

Attached is Licensee Event Report 413/93-002, concerning TECHNICAL SPECIFICATION 3.0.3 ENTERED DUE TO INOPERABLE PUMP DISCHARGE VALVES.

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

Very truly yours,

M. S. Tuckman

M. S. Tuckman

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

LICENSEE EVENT REPORT (LER)

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

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.

FACILITY NAME (1): Catawba Nuclear Station, Unit 1

DOCKET NUMBER (2): 05000413

TITLE (4): Technical Specification 3.0.3 Entered Due To Inoperable Pump Discharge Valves

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
									CNS, Unit 2	05000414
02	25	93	93	-- 002 --	00	04	05	93	FACILITY NAME	05000

OPERATING MODE (9): 1

POWER LEVEL (10): 100

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)		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)	X	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: R. C. Futrell, Compliance Manager

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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)

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

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

On February 25, 1993, at 1431 hours, with Unit 1 in Mode 1, Power Operation, at 100 percent power, and Unit 2 in No Mode, Defueled, "B" train Nuclear Service Water (RN) System pump discharge valves (1(2)RN38B) failed to open during RN pump start. At 1745 hours, Unit 1 entered Technical Specification (TS) 3.0.3 due to both trains of RN being inoperable due to "A" train having a potential for similar problem. At 2205 hours, valve 1RN38B was declared operable and Unit 1 exited TS 3.0.3. Failure of the RN pump discharge valves to open has been attributed to a lack of detailed information in the motor operated valve (MOV) torque switch setup procedure, sizing variables that are possibly inadequate for these specific applications and/or a potentially degraded valve subcomponent. Corrective actions include adjusting valve settings for both Unit 1 and Unit 2 valves, evaluating similar valves in other applications, and further Engineering evaluation and testing. During this event, Operations failed to perform a Power Availability Test within one hour of declaring the Diesel Generators inoperable due to RN being inoperable. This resulted in a TS Surveillance being missed. The missed TS Surveillance is attributed to policy guidance that was not well defined or understood. Corrective actions included performing the TS Surveillance, developing a TS Interpretation, and training.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	PAGE (3)
Catawba Nuclear Station, Unit 1	05000413	93	- 002 -	00	02 OF 19

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

BACKGROUND

Background for RN System

The discharge valves [EIIS:V] that failed to open and are the subject of this report are in the Nuclear Service Water [EIIS:BI] (RN) system. A simplified flow diagram of the RN system is included in the report as Attachment A. The flow diagram will help to understand the arrangement of the components discussed in this report.

The Nuclear Service Water System (RN) provides essential auxiliary support functions to Engineered Safety Features (ESF) of the station. The system is designed to supply cooling water to various heat loads in both the safety and non-safety portions of each unit. Provisions are made to ensure a continuous flow of cooling water to those systems and components necessary for plant safety during normal operation and under accident conditions. Sufficient redundancy of piping and components is provided to ensure that cooling is maintained to essential loads at all times.

Functionally, the system consists of four sections which serve to assure a supply of water to various station heat loads and return the heated effluent back to its heat sink. These sections are the source and intake section, the RN pumphouse section, the station heat exchanger [EIIS:HX] section, and the main discharge section.

Lake Wylie is the normal source of nuclear service water. A single transport line conveys water from a Class 1 seismically designed intake structure at the bottom of the lake to both the A and B pits of the RN pumphouse serving the RN pumps [EIIS:P] in operation. Should Lake Wylie be lost due to a seismic event in excess of the design of Wylie Dam, the Standby Nuclear Service Water Pond (SNSWP), formed by the Class 1 seismically designed SNSWP Dam, contains sufficient water to bring the station safely to a cold shutdown condition under all normal, transient, and accident conditions. The SNSWP has an intake structure designed to Class 1 seismic requirements, with two Class 1 seismic, redundant lines to transport water independently to each pit in the RN pumphouse. Automatically upon loss of Lake Wylie (as detected by RN pump pit level instrumentation), Lake Wylie double isolation valves are closed and the SNSWP valves are opened to both pit A and pit B.

RN pumps 1A and 2A take suction from pit A and discharge through RN strainers [EIIS:FLT] 1A and 2A respectively. The outlet piping of the 1A and 2A RN strainers then join back together to form the train A supply line to train A components in both units. RN pumps 1B and

2B take suction from pit B, discharging through RN strainers 1B and 2B respectively. The outlet piping of strainers 1B and 2B join together to form the train B supply line to train B components in both units. The operation of any two pumps on either or both supply lines is sufficient to supply all cooling water requirements for unit startup, cooldown, and refueling and post-accident operation of two units. However, one pump has sufficient capacity to supply all cooling water requirements during normal power operation of both units or during post-accident conditions if the unaffected unit is already in cold shutdown. All four pumps are started during a postulated combined accident and loss of normal power. During an accident, a safety injection signal automatically starts all four pumps.

Nuclear service water is used in both units to supply both essential and non-essential components. Essential components are those necessary for safe shutdown of the unit, and must be redundant to meet single failure criteria. Non-essential components are not necessary for safe shutdown of the unit, and are not redundant. Each unit has two trains of essential heat exchangers designated A and B, and one train of non-essential heat exchangers supplied from either A or B and isolated on Engineered Safety Features actuation. The following components or services are supplied by each essential header of the RN system:

- RN pump motor cooler
- RN strainer backflush
- RN pump bearing lube injection water
- RN pump motor upper bearing oil cooler
- Diesel Generator (D/G) engine jacket water cooler
- Diesel Generator building essential fire water
- Diesel Generator engine starting air aftercooler
- Component cooling heat exchanger
- Assured auxiliary feedwater [EIIS:BA] (CA) supply
- Assured fuel pool makeup
- Assured component cooling [EIIS:CC] (KC) system makeup
- Containment spray [EIIS:BE] (NS) heat exchanger
- Control room area chiller condensers (fed by Unit 1 essential headers only)
- Auxiliary shutdown panel air conditioning units
- Assured containment penetration valve injection [EIIS:JM] (NW) system makeup

There are two main discharge headers with train 1A and 2A components returning flow to the A header, and train 1B and 2B components returning flow to the B header.

The RN system is designed to supply the cooling water requirements of a simultaneous LOCA on one unit and cooldown on the other unit assuming a single failure anywhere on the system, loss of offsite power, and loss of Lake Wylie. Upon complete train separation, both units are assured of having a source of water, at least one pump capable of supplying required flow on its associated train, and at least one essential header to provide cooling water to components served by RN.

RN Pump Discharge Isolation Valves 1RN28A, 2RN28A, 1RN38B, and 2RN38B

These valves are Basic In Flow (BIF) butterfly valves required to be open when their respective nuclear service water pump is operating. The valves are interlocked to open when the associated RN pump is running and close when the pump is tripped. The valves do not directly receive an ESF signal themselves; however, the pumps are started on a safety injection signal from either unit or loss of offsite power. There are no control switches in the control room for these valves.

The pertinent RN system Technical Specification (TS), 3.7.4, requires that at least two independent RN loops shall be operable:

a) With both Units in Mode 1, Power Operation, Mode 2, Startup, Mode 3, Hot Standby, or Mode 4, Hot Shutdown, each loop shall contain two operable RN pumps and associated emergency diesel generators, two essential equipment supply and return headers, and a supply and discharge flow path capable of being aligned to the Standby Nuclear Service Water Pond (SNSWP).

b) With only one unit in Mode 1, 2, 3, or 4, each loop shall contain at least one operable RN pump, associated emergency D/G, and the essential equipment supply and return header associated with the unit in Mode 1, 2, 3, or 4, and a supply and discharge flow path capable of being aligned to the SNSWP.

Since both trains of RN on Catawba Unit 1 were determined to be inoperable, TS 3.7.4 could not be met because there is no action statement which addresses both trains of RN being inoperable. With both trains of RN inoperable, Unit 1 entered TS 3.0.3.

TS 3.0.3 is required to be entered when the Unit is operating in a condition not permitted by Technical Specifications. This condition exists when a Limiting Condition for Operation is not met except as provided in the associated Action Requirements. It requires that within one hour action shall be initiated to place the Unit in a Mode in which the specification does not apply by placing it, as applicable, in:

a) At least Hot Standby in the next 6 hours,

b) At least Hot Shutdown within the following 6 hours, and

c) At least Cold Shutdown within the subsequent 24 hours.

The Catawba Nuclear Station TS 3.0.3 interpretation states that the purpose of the one hour is to allow for preparation of an orderly shutdown before initiating a change in plant operation. It further states that if the equipment problem can be resolved within three hours, no load reduction is necessary. The remaining four hours leaves sufficient time to shutdown in a controlled and orderly manner, and well within the specified maximum cooldown rate and within the cooldown capabilities of the facility assuming only the minimum required equipment is operable. The Unit 1 RN pump discharge valves were returned operable before any load reduction was required.

The Unit 1 RN pump discharge valves were setup in accordance with the requirements outlined in Generic Letter (GL) 89-10 which requires licensee to implement a program to ensure that all "safety-related" gate, globe, and butterfly valves are selected, set, and maintained to ensure ability to operate under their design basis conditions. This requires review of the design basis operating requirements and the actuator sizing calculation to determine the operating torque/thrust required to operate each valve. Individual valves are then diagnostic tested to measure and ensure the calculated torque/thrust is being delivered to the valve during a baseline or "static" (no pressure and flow conditions) test. A validation of the sizing calculation is then required within the timeframe of the 89-10 commitments by operating the valve against conditions of flow and pressure, or by providing some means of alternative justification. After initial validation, each valve is then periodically tested and maintained to ensure continued ability to operate. Unit 2 RN pump discharge valves are scheduled to be GL 89-10 tested during 2EOC6 outage in May 1994.

<u>Background for Missed TS Surveillance</u>

Since the RN system supplies cooling water the Diesel Generators (D/Gs), the loss of both trains of RN affected both D/Gs causing them to also become inoperable. The pertinent TS regarding power source availability is TS 3.8.11. This TS requires that as a minimum, the following A.C. electrical power sources shall be operable in Modes 1, 2, 3, and 4:

a) Two physically independent circuits between the offsite transmission network and the Onsite Essential Auxiliary Power System, and

b) Two separate and independent D/G's.

If both D/Gs are inoperable, the appropriate action to be taken is to demonstrate the OPERABILITY of two offsite A.C. circuits by performing Specification 4.8.1.1.1a within 1 hour and at least once per 8 hours thereafter; restore at least one of the inoperable D/G's to OPERABLE status within 2 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours. Restore both D/Gs to OPERABLE status within 72 hours from time of initial loss or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

Periodic test PT/1/A/4350/03 (Electrical Power Source Alignment Verification) is performed to verify proper breaker [EIIS:BKR] alignment, breaker operability, and power availability at the switchyard, 6900 V switchgear, 4160 V switchgear, 600 V essential load and motor [EIIS:MO] control centers, 120 VAC vital buses, and 125 VDC vital buses. This particular activity was not performed within one hour of declaring Unit 1 D/Gs inoperable.

EVENT DESCRIPTION

To fully understand the event that occurred on February 25, 1993, the history of the torque switch settings (TSS) for the RN pump discharge valves is provided as well as a detailed event description. A diagram is included as Attachment B to aid in the understanding of the previous TSS and operability of the RN pump discharge valves. Also, a simplified flow diagram of the RN system is included in this report as Attachment A.

In October 1988, PIR 0-C88-0314 was originated to address the problem associated with butterfly valves 1(2)RN-148A failing to open under high differential pressure (DP) conditions. The cause of the valves not opening was attributed to significant hardening of BIF seat materials. The seat hardening causes the valves to open at a higher unseating torque than the valves were setup to at the time. Corrective action identified fifty-six valves that needed to have their "open" torque switches reset to the maximum allowable TSS. Four of the fifty-six valves were the RN pump discharge valves.

In July 1989, the corrective action of PIR 0-C88-0314 (seat hardening problem noted above) was performed on the RN pump discharge valves. The Unit 1 and Unit 2 RN pump discharge valves were to be adjusted to maximum "open" TSS (3.0). Unit 1 RN pump discharge valves were actually set to the maximum TSS. Unit 2 RN discharge valves TSS were inadvertently left at 1.5. The "closed" TSS was adjusted to maximum TSS (3.0) instead of the "open" TSS. The four RN pump discharge valves were part of the fifty-six valves noted above in PIR 0-C88-0314.

In December 1989, PIR 0-C89-0376/LER 413/89-029, was initiated because component cooling system (KC) valves 1KC-81B and 2KC-56A may not have sufficient torque output to overcome additional friction due to seat hardening. Corrective action was to modify the KC valves with an open torque switch bypass.

In March 1990, NRC issued IEN-90-21 which addressed increased seat friction on butterfly valves due to seat hardening. This document was issued based on the Catawba event discussed in PIR 0-C89-0376/LER 413/89-029.

In August 1992, Unit 1 RN pump discharge valves were setup per GL 89-10 criteria. The TSS for Unit 1 RN discharge valves were changed from 3.0 to approximately 2.0 for the "open" position because the required torque to open the RN pump discharge valves equates to a TSS of approximately 2.0. Unit 2 valves are scheduled to be setup to GL 89-10 during 2EOC6 outage in May 1994. Their TSS remained at 1.5 for the "open" position.

> The TSS described above indicates the status of the RN pump discharge valves prior to this event. The following information describes the specific event that lead to the discovery of the RN pump discharge valves problem.

On February 25, 1993, Unit 1 was in Mode 1, Power Operation, at 100% power, and Unit 2 in No Mode, Defueled, with RN pump 1A running to supply necessary cooling water.

At 1140 hours, RN pump 1B was started to perform an Inservice Pump Test (IWP). The "A" and "B" train headers were isolated due to train crossover valves being closed. This action depressurized "B" train header.

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

At 1424 hours, RN pump 1B was shutdown upon completion of the IWP test. RN pump 2B was then started to perform its IWP test. Upon starting RN pump 2B, discharge valve (2RN38B) failed to open. The header downstream of the valve was depressurized, so this valve was trying to open against maximum different pressure.

At 1426 hours, RN pump 2B was shutdown and RN pump 1B was restarted to verify that its discharge valve would open. The discharge valve (1RN38B) for 1B RN pump also failed to open with the header downstream of the valve depressurized.

At 1430 hours, Operations opened the RN crossover valve, which pressurized the "B" train header and allowed valve 1RN38B to open. RN pump 1B was shutdown. Operations contacted Engineering to ask for assistance in resolving the failure of RN discharge valves to open. Operations also initiated work orders to investigate why the "B" train RN pump discharge valves did not open during RN pump start.

At 1432 hours, RN pump 2B was restarted and discharge valve 2RN38B opened which previously failed to open with the "B" train header depressurized.

At 1600 hours, a meeting was held with Operations and Engineering personnel to review the status of the investigation into the failure of the RN pump discharge valves.

At 1730 hours, after reviewing Engineering information and the results of the inspection of the RN pump discharge valves. Engineering concluded that the failure of the "B" train valves was due to higher than expected torque to open the valves with the header downstream of the valves depressurized. Engineering also determined that the "A" train RN pump discharge valves had a similar setup and therefore potentially had a similar problem. Based on the conclusion, Engineering recommended that both trains of RN on Unit 1 be declared inoperable. Engineering also advised Operations of an immediate corrective action which was to open the RN pump discharge valves and then remove power. Once the RN pump discharge valves were declared inoperable, Station Management continued to discuss potential reportability requirements.

At 1745 hours, Operations entered Unit 1 into TS 3.0.3 due to both trains of RN being inoperable based on input from Engineering.

At 1805 hours, Operations opened RN pump discharge valves and then removed power to the valves in order to assure the RN pumps would be available.

At 1845 hours, the Electrical Power Source Alignment Verification Test (PT/1/A/4350/03) should have been performed within one hour of declaring the Diesel Generators inoperable due to both trains of RN being inoperable.

At 2015 hours, following further discussion with Engineering, Station Management concluded that a one hour notification to NRC per 10CFR50.72(b)(ii)(B) was required due to RN system being "Outside Design Basis".

At 2030 hours, the one hour notification was made to the NRC.

At 2035 hours, Operations performed Electrical Power Source Alignment Verification Test (PT/1/A/4350/03) to meet the requirements of TS Surveillance 4.8.1.1.1a.

At 2048 hours, based on Engineering's evaluation, Operations restored power to Unit 1 and Unit 2 RN pump discharge valves in preparation for changing the setup on the Unit 1 valves. Engineering determined that the Unit 1 discharge valves should be placed 20 degrees opened so that the valves would open against full differential pressure.

At 2130 hours, valve 1RN38B was positioned at 20 degrees open and was tested with the RN header downstream of the valve depressurized. Valve 1RN38B opened when 1B RN pump was started and was declared operable. At 2205 hours, Unit 1 exited TS 3.0.3. Operations then entered TS 3.7.4 which requires returning one train of RN within 72 hours.

On February 26, 1993, at 0030 hours, following Engineering evaluation, valve 1RN28A was positioned at 20 degrees open. 1A RN pump was started and valve 1RN28A opened against full differential pressure and was declared operable. At 0115 hours, Unit 1 exited the 72 hour TS Action Statement.

On February 27, 1993, while working to return Unit 2 valves to operable status, Engineering discovered that the torque switch settings for valves 2RN28A and 2RN38B were reversed when they were setup in 1989. The Unit 2 RN pump discharge valves were adjusted to the maximum TSS (3.0). The valves were tested with the header downstream of the valves depressurized and the valves tested successfully. Valves 2RN28A and 2RN38B were declared operable.

The following actions were taken after Unit 2 valves were returned to operable status on February 27, 1993.

DP tests were performed on RN pump discharge valves (1RN28A and 1RN38B) to measure unseating and dynamic torque loads under flow and pressure conditions. The unseating and dynamic torque load were higher than was predicted by the manufacturer sizing calculations for the valves.

A DP test was performed on the as found TSS (1.5 "open") position of valve 2RN28A with the header depressurized. Valve 2RN28A actuator tripped and reset several times while trying to open. The valve finally opened but it took twenty-five additional seconds. The test results concluded that valve 2RN28A was operable as setup with TSS of 1.5 "open" with the header depressurized. Thus, valve 2RN28A was considered operable since 1980.

Engineering evaluated BIF motor operated valves in other applications. Valves 1(2)RN28A, 1(2)RN38B, 1(2)KC56A, and 1(2)KC81B were tested under DP conditions and tested successfully. These valves have a required safety function to open. Engineering also reviewed the manufacturer's sizing calculations for the RN pump discharge valves.

Valve 2RN38B was replaced with a new valve of different design and manufacturer. The new valve was a Fisher posi seal butterfly valve. The valve was tested and tested successfully. Engineering reviewed the test data and found the results to be acceptable.

Engineering is continuing to analyze the data from diagnostic tests and is continuing to conduct testing to identify causes of higher then expected torque requirements.

CONCLUSION

Conclusion of RN Pump Discharge Valves

The period of time from August 1992 through February 1993, three of the four RN pump discharge valves (1RN28A and 1(2)RN38B) were unable to open against full differential pressure. This results in a potential loss of RN to both Catawba Nuclear Station (CNS) units assuming a single failure of the one operable RN pump discharge valve.

Failure of the Unit 1 discharge valves 1RN28A and 1RN38B to open has been attributed to sizing variables that are possibly inadequate for a reason unique to these specific applications and/or a potentially degraded valve subcomponent. Corrective actions included setting the Unit 1 discharge valves to 20 degrees open, setting Unit 2 valves to maximum TSS (3.0), evaluating BIF motor operated valves in other applications, reviewing of the manufacturing sizing calculations, analyzing data from diagnostic testing and conducting additional testing to identify causes of higher than expected torque requirements.

Data recorded after the event from DP testing of valves 1RN28A and 1RN38B indicates that both unseating and dynamic torque loads under flow and pressure conditions are higher than was predicted by the manufacturer sizing calculations for these valves. Detailed review of the sizing calculation has identified a number of factors or assumptions that can not easily be validated or may not be addressed specifically in the calculation. Seat hardening can increase the required unseating load, but there is not any well known method to predict the magnitude or potential for this occurrence. Factors are included for gearbox efficiency and turbulence in the system, but these also have some degree of assumption involved. Packing or bearing frictions beyond those assumed in the calculations will also result in higher than expected loads required to operate the valve.

The presently available technology for diagnostic testing of butterfly valves limits the ability to perform "separate effects" testing. Only the total load can be measured, so it is not possible to determine the portion that each of these individual factors contribute under in-plant testing conditions. Advances in technology and additional testing will likely be required to fully understand the significance of each factor in predicting the total load required to operate these valves.

Failure of 1RN28A and 1RN38B following setup per the GL 89-10 design calculation does not appear to indicate a generic problem with the BIF sizing equation since other BIF valves have been successfully operated under DP conditions. Both 1KC56A and 1KC81B were setup per the GL 89-10 sizing calculation during the 1EOC6 refueling outage (Summer '92), and successfully tested near their design basis conditions. Measured loads under the DP test conditions are bounded by the values predicted in the sizing calculation and used in the field setup. Sizing of these valves used the same basic equations as the RN system valves to predict the operating torque requirements. Major differences in these applications is use of raw water for RN versus a treated water system for KC. Also their design calculations included different factors selected by the manufacturer with the intent of addressing application specific conditions such as valve location relative to a pipe bend or pump. The successful operation of the BIF valves in the KC application indicates that the methodology used in the BIF calculation is valid. Any deficiency with this process would appear to be limited to the proper selection of application specific factors, or the possible degradation of components such that the initial factors no longer model the application. The attempt to ensure proper selection and subsequent validation of factors used in sizing calculations is the basis for implementation of a GL 89-10 Motor Operated Valve (MOV) program.

Failure of the Unit 2 discharge valves (2RN28A, 2RN38B) to open has been attributed to a lack of detailed information in the motor operated valves (MOVs) torque switch setup procedure (IP/0/A/3820/04). Enclosure (11.1) that provided a diagram of the actuator, did not specify which adjusting screw was for the "open" or "close" switch and the switch itself was not clearly marked for this purpose. The technician could have mistaken these two switches during the TSS adjustments made in 1989. Procedure IP/0/A/3820/04 was revised on April 18, 1990 and March 4, 1991. During these revisions the enclosure showing a diagram of the actuator was updated to identify the "open" and "closed" adjusting screws for the torque switch. These changes were made due to a concern identified by technicians when trying to identify "open" versus "close" setting adjustments. The procedure was revised as an enhancement prior to discovery of the switches being reversed. Corrective actions include setting the Unit 2 valves to maximum TSS (3.0) and verifying the TSS on similar valves to ensure they are properly adjusted.

Review of additional BIF valve applications has indicated that all remaining valves are set to meet their operating requirements. The valve design is such that the closing direction of the valve is assisted under flow and pressure conditions, so only valves with a function requiring them to open are of any concern for this potential problem. Of the GL 89-10 safety related, active valves, with open required function, 1(2)RN28A, 1(2)RN38B, 1(2)KC56A, and 1(2)KC81B are the only BIF valves. All of these valves have been verified to operate under DP conditions at their present settings and are considered operable. Six additional non-safety valves in the Auxiliary Feedwater (CA) system are included in GL 89-10 with function to open; however, these valves operate at a maximum DP of approximately 5 psi and have their "open" torque switch setting at the maximum allowable position. With this low operating DP and maximum torque switch setting, these valves are considered to be capable of opening. These valves will be further addressed under the GL 89-10 program.

Additional non GL 89-10 BIF valves which function to open were included in the review of BIF valve application; however, these are contained in air systems which operate at conditions of less than 1 psi. These low operating conditions would cause no more additional load on the valve than is seen during normal operation. These valves are considered acceptable from previous strokes at normal conditions.

All remaining BIF valves have been confirmed to require operation in the closing direction only. Some of this population have been setup under GL 89-10 design calculations; however, no DP testing has yet been conducted for this group. DP testing or some other means of validating these valves setup will be performed in accordance with GL 89-10. These valves are considered operable at their present setup due to the low torque requirement for closing the valves, and the fact that flow and pressure conditions assist in closing the valve. The assumption of low torque required for closing the BIF valve was confirmed by review of the DP test data taken for the Unit 1 KC valves.

Conclusion for Missed TS Surveillance

The failure to perform the TS Surveillance is attributed to policy guidance which was not well defined or understood. Shift personnel did not recognize the need to perform the surveillance test when RN was in TS 3.0.3. Shift personnel considered surveillance requirements for TS 3.0.3 to be more restrictive than TS Surveillance requirements for 4.8.1.1.1a, so they thought they did not have to perform the power availability test.

Corrective actions include preparing a TS Interpretation to address TS Surveillance requirements of TS 4.8.1.1.1a when TS 3.0.3 is entered. Training will also be provided to operators on the TS Interpretation.

A review of the Operating Experience Program (OEP) database for the past 24 months prior to this event did not identify any reportable events attributed to policy guidance not well defined or understood concerning missed TS Surveillances involving power alignment surveillances. No reportable events were attributed to information in procedures being too generic, or analysis deficiency involving RN system. Both of these events are considered not to be recurring.

CORRECTIVE ACTIONS

SUBSEQUENT

1) Adjusted discharge valves (1RN28A and 1RN38B) to 20 degrees open per work order 93016083-01 and 93016077-01. Successfully tested the valves with header downstream of the valves depressurized.

2) Adjusted discharge valves (2RN28A and 2RN38B) to maximum TSS per work order 93016227-01 and work order 93007497-01. Successfully tested the valves with the header downstream of the valves depressurized.

3) Evaluated BIF motor operated valves in other applications.

4) Reviewed the manufacturers sizing calculations for the RN pump discharge valves.

5) Valve 2RN38B was removed on March 20, 1993 and replaced with a valve designed by a different manufacturer per work order 93020922-01. The valve was tested per work order 93020922-02 and the valve tested successfully. Engineering reviewed test data and found the results to be acceptable.

PLANNED

1) Engineering is continuing to analyze the data from diagnostic testing and to conduct additional testing to identify causes of higher than expected torque requirements.

2) Compliance will prepare a TS Interpretation concerning TS Surveillance requirements of TS 4.8.1.1.1a when TS 3.0.3 is entered.

3) Training will be provided on the TS Interpretation.

SAFETY ANALYSIS

Safety Analysis for Inoperable RN Pump Discharge Valves

This event has been evaluated by considering station response to design basis events. The period to be considered is from August 1992 through February 1993. The Past Operability evaluation for PIR 0-C93-0126 indicates that this is the time period when three of the four RN pump discharge valves (1RN28A and 1(2)RN38B) were unable to open against full differential pressure. This results in a potential loss of RN to both CNS units assuming a single failure of the one operable RN pump discharge valve.

A review of CNS design basis events indicates that the bounding event during the time period stated above would be a simultaneous Loss of Coolant Accident (LOCA) on Unit 2, Loss of Offsite Power (LOOP), and worst case failure of RN.

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The worst case RN failure is one that would depressurize the RN system such that the 1A, 1B, and 2B RN pumps would be isolated from the supply header. RN pump 2A and the associated isolation valve 2RN28A were capable of operating to pressurize the shared RN supply header if one of the other three pumps failed while running. Assume only RN pump 2A is running prior to a LOOP. A failure of D/G 2A to start would have been the worst case single failure and would have resulted in a loss of all RN.

A seismic event would not further impair the RN system and is not considered.

Limiting Design Basis Event

Assume a loss of all RN (failure of D/G 2A) simultaneous with a LOOP and large break LOCA. Three D/Gs would have started and powered the respective Essential Buses. Reactor Trip and Safety injection is initiated automatically. The three idle RN pumps would have started and achieved dead head against the respective isolation valves.

Per the Safety Injection procedure, the Control Room (CR) would verify Reactor trip, Turbine trip, AC power, and safety injection. The procedure then requires verification of safety injection equipment alignment using the Monitor Light Panel. Indicators on the Monitor Light Panel for 1RN28A and 1(2)RN38B would be dark, alerting the CR to the loss of RN event.

All ESF response would occur as designed with the exception assumed single failure of the 2A DG. The KC system has sufficient heat capacity to support accident mitigation until initiation of containment sump recirculation. Given the worst case LOCA scenario of a double ended guillotine pipe break at the Reactor Coolant pump suction and one train of Emergency Core Cooling System (ECCS) in operation, sump recirculation will not begin sooner than 28.3 minutes into the event.

After 6 minutes, the D/G annunciators would begin to alarm due to high D/G Cooling water [EIIS:LB] (KD) system temperature.

At approximately 10 minutes past event initiation, the expected Control Room operator response would be to secure one of the operating Unit 1 D/Gs and the only operating Unit 2 D/G. In addition, the Control Room operator would also dispatch an non-licensed operator to the RN pump structure to manually align one or more RN pump discharge valves.

A loss of all A/C would have occurred on Unit 2 from approximately 10 minutes into the event until RN could be manually aligned and D/G 2B restarted.

RN pump discharge valves would be manually aligned in less than 15 minutes from the time an operator is dispatched from the CR. Given that an operator is dispatched to the RN pump structure 10 minutes into the event, then at least one RN pump discharge valve would have been manually aligned 25 minutes into the event.

Assuming a loss of all A/C power at 10 minutes into the event and D/G 2B restart at 25 minutes, a period of 15 minutes exists when there would be no ECCS available. Duke analysis indicates that core damage during this period is a possibility, but is inconclusive as to whether core damage would have occurred. We have taken a conservative approach using NUREG 1465 source term technology in further analyzing the dose consequences of this event.

Were severe core damage to occur, the containment hydrogen concentration is predicted to reach values that could initiate a burn in some compartments when power is recovered. Hydrogen concentrations and resulting hydrogen burn containment pressure spikes are estimated to be of a magnitude which would not have threatened containment integrity.

The Westinghouse limiting case LOCA analysis under which CNS is currently operating indicates that ice bed melt out will occur 69 minutes into a large break LOCA event. Peak containment pressure is expected to occur at 122 minutes into the event. Since the loss of all A/C power occurs during ice melt out and prior to sump recirculation, long term containment pressure is not affected. Therefore, long term containment integrity is not threatened by the limited loss of RN event.

Dose analysis has been performed for the event described using NUREG 1465 source term technology and the offsite dose limits are within 10CFR100 limits.

Safety Analysis Conclusion

During the seven month period beginning August 1992 through February 1993 the Nuclear Service Water system could not have responded automatically to mitigate the consequences of Design Basis events considering the unlikely failure of RN pump 2A while running. Sufficient system redundancy exists to maintain the station in a safe condition following all credible events until RN could have been restored by manual operator actions. The Limiting Design Bases Event (simultaneous LOOP, LOCA, and Loss of RN) may have resulted in core damage, but

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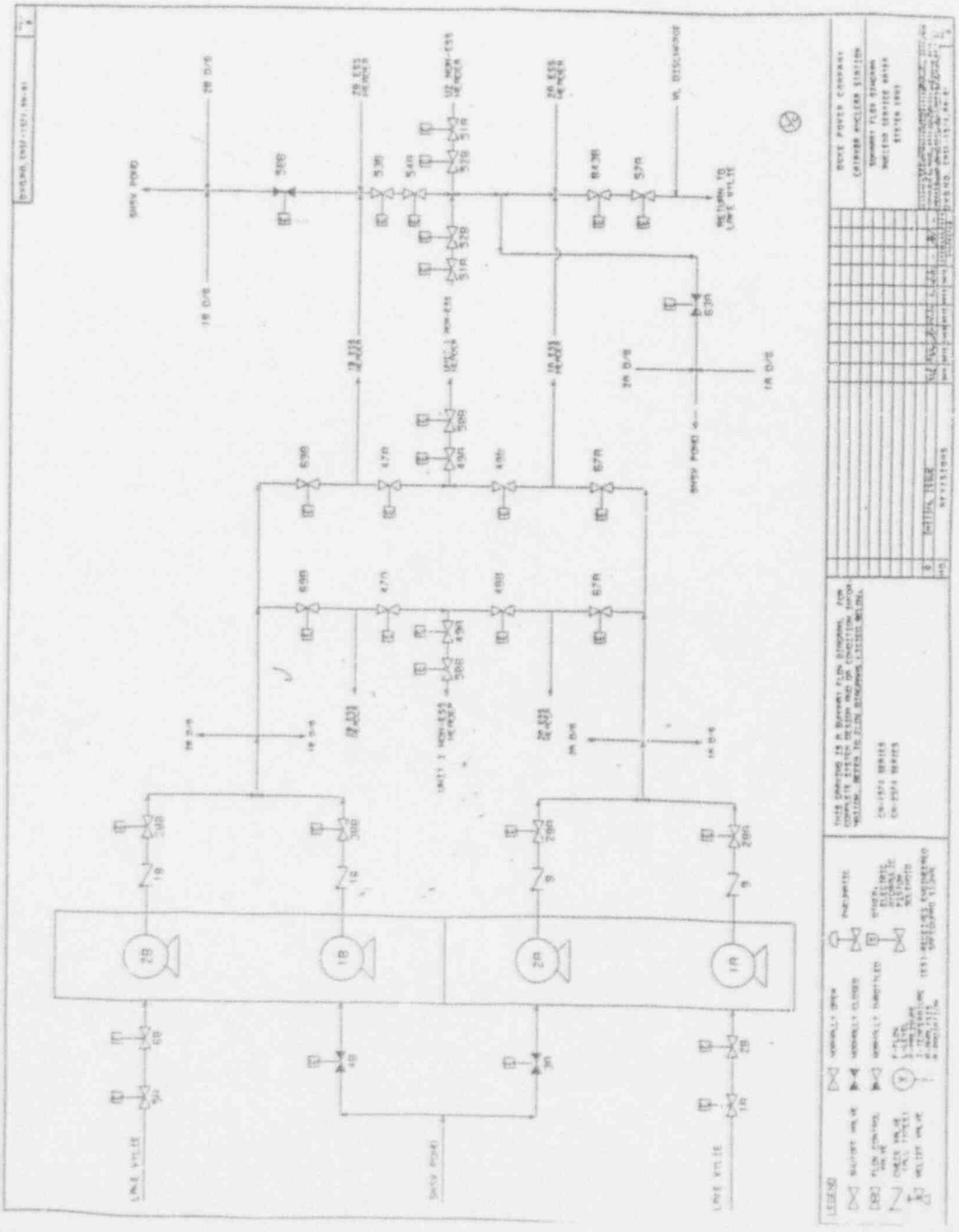
10CFR100 dose release limits would not have been exceeded. The postulated worst case RN failure described in the Safety Analysis did not actually occur at CNS. The health and safety of the public were not affected by this event.

Safety Analysis for Missed TS Surveillance

On February 25, 1993, between 1745 hours and 2035 hours, the operability of offsite power sources was not verified as required by TS 4.8.1.1.1a. Offsite power was verified operable at 2035 hours by performance of Electrical Power Source Alignment Verification Periodic Test (PT/1/A/4350/03). No problems were discovered while performing the test. Offsite power source was available between 1745 hours and 2035 hours. In the event of a loss of offsite power, annunciators would have alerted the CR personnel. No related alarms were received during this time period. Therefore, it is apparent the redundant AC power sources were available the entire time D/G 1A and 1B were inoperable due to RN being inoperable. The health and safety of the public were not affected by this event.

Attachment A



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Attachment B