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DUKE POWER

January 8, 1992

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

Subject: Catawba Nuclear Station
Docket No. 50-414
LER 414/91-016

Gentlemen:

Attached is Licensee Event Report 414/91-016 concerning TECHNICAL SPECIFICATION VIOLATION DUE TO FAILURE OF PRESSURIZER POWER OPERATED RELIEF BLOCK VALVE 2NC-31B.

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

Very truly yours,

W. R. McCollum
Station Manager

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LICEN3EE EVENT REPORT (LER)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST 500 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (F530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555 AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1) Catawba Nuclear Station, Unit 2										DOCKET NUMBER (2) 0 5 0 0 0 4 1 4 1										PAGE (3) 1 OF 0 6													
TITLE (4) Technical Specification Violation Due To Failure Of Pressurizer Power Operated Relief Block Valve 2NC-31B																																	
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 NAMES N/A						DOCKET NUMBER(S) 0 5 0 0 0																		
1	2	0	9	9	1	9	1	0	1	6	0	0	0	1	0	8	9	2	0 5 0 0 0														
OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5. (Check one or more of the following) (11)																															
5		20.402(b)										20.405(c)										50.73(a)(2)(iv)										73.71(b)	
POWER LEVEL (10)		20.405(a)(1)(i)										50.38(a)(1)										50.73(a)(2)(v)										73.71(c)	
1		20.405(a)(1)(ii)										50.38(a)(2)										50.73(a)(2)(vi)										OTHER (Specify in Abstract below and on Test, NRC Form 300A)	
		20.405(a)(1)(iii)										50.73(a)(2)(i)										50.73(a)(2)(vii)(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)(ix)											
LICEN3EE CONTACT FOR THIS LER (12)																																	
NAME R. C. Futrell, Compliance Manager										TELEPHONE NUMBER 8 0 3 8 3 1 - 3 6 6 5																							
COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)																																	
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC									
F	NC	VILIV	R13410	Y																													
SUPPLEMENTAL REPORT EXPECTED (14)										EXPECTED SUBMISSION DATE (15)										MONTH		DAY		YEAR									
YES (If yes, complete EXPECTED SUBMISSION DATE)										NO																							

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single space typewritten lines) (16)

On December 9, 1991, at 0230 hours, Unit 2 was in Mode 5, Cold Shutdown. The Pressurizer (PZR) failed to depressurize prior to the PZR Nitrogen fill. A PZR Power Operated Relief Valve (PORV) Block Valve, 2NC-31B, was not open as indicated. 2NC-31B remained closed because the stem separated from the wedge assembly. The PZR PORVs had been closed in the auto open mode since December 2 at 2000 hours. With the final PZR safety relief valve in place, T/S require that an inoperable PZR PORV be returned to service within 7 days or depressurize and vent the NC system within the next 8 hours. Due to the 2NC-31B failure, one of the two PORVs required to be operable was not available and the T/S action requirement was not satisfied. Therefore, the T/S violation occurred. This event is attributed to Equipment Failure. The Unit 1 and 2 PZR PORV isolation valves were radiographed to verify that the valves are open. 2NC-31B was replaced and the initial stem analysis was performed. Planned corrective actions include verification of block valve position following stroke tests and to continue evaluation of stem failure analysis data.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 600 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (PS-30), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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DOCKET NUMBER (2)

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Catawba Nuclear Station, Unit 2

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YEAR SEQUENTIAL REVISION

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TEXT (If more space is required, use additional NRC Form 365A's) (17)

BACKGROUND

The Reactor Coolant [E11S:AB] System (NC) consists of four heat transfer loops (A,B,C,and D) connected in parallel to the Reactor vessel [E11S:VSL]. Loop B contains a pressurizer [E11S:VSL] (PZR), over-pressure relief valves [E11S:V], and the interconnecting over-pressure relief discharge piping to the PZR relief tank (PRT).

NC System pressure is controlled by use of the PZR which is designed to accommodate positive and negative surges caused by load transients. The PZR provides a point in the NC System where liquid and vapor can be maintained in equilibrium under saturated conditions for pressure control purposes.

The PZR Power Operated Relief Valves (PORVs), NC-32B, NC-34A, NC-36B, are designed to limit system pressure for a large power mismatch and to prevent actuation of a high pressure Reactor trip. The operation of these valves also limit the undesirable lifting of spring loaded PZR safety valves. The PORVs operate automatically when NC pressure exceeds the Process Control System (7300) setpoint.

The PZR block valves (NC-31B, NC-33A, NC-35B) are used to isolate its associated PORV if excessive leakage occurs by closing the inlet to the associated PORV. Each PZR relief discharge line is monitored to alert operators when an increase in temperature occurs (representing relief valves lifting or leaking). 2NC-31B is a Rockwell International (now Edward Valve Company) 3 inch Equiwedge gate valve.

NC System Low Temperature Overpressure Protection (LTOP) is provided to prevent the NC System from exceeding the pressure/temperature limits. To ensure that NC System pressure does not exceed these limits, the PZR PORVs are set to open when the pressure exceeds 400 PSIG during low temperatures and when the Reactor vessel head is in place with all NC vents closed. Should a pressure excursion exceeding the setpoint occur during these low conditions, the PORVs would automatically open and relieve pressure to the PRT. The PZR PORVs can also be manually operated from the Control Room. The PZR PORVs are air operated and NC-32B and NC-34A featuring a back-up Nitrogen System [E11S:LK] supply to ensure that the valves can be opened in the event that the Instrument Air [E11S:LD] System is unavailable. Credit for NC-36B can not be taken during LTOP because it does not have a Nitrogen supply.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 600 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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TEXT (If more space is required, use additional NRC Form 366A's (1/7))

Technical Specification (T/S) 3.4.9.3, Overpressure Protection Systems Limiting Conditions For Operation, states that two PORVs shall be operable if the Reactor vessel head is on and the NC vents are closed. With one inoperable PORV, the T/S requires that the inoperable PORV be returned to service within 7 days, or to depressurize and vent the NC System within 8 hours.

EVENT DESCRIPTION

On November 25, 1991, Unit 2 was in Mode 6, Refueling. Following valve spring-pack adjustments on 2NC-31B, 2NC-31B was tested using VOTES methodology to ensure that the proper thrust was being provided by the actuator and to assess combined performance of the valve and actuator. The test results appeared normal and within the required values.

On December 2, at 2015 hours, the final PZR code safety valve, 2NC-1, was set. At 2045 hours, Operations began fill and vent for the NC System following refueling. All three PZR PORVs had been in the Auto-Open mode with a setpoint of 400 PSIG since 2000 hours.

On December 8, Operations (OPS) suspected that 2NC-32B was not operating properly due to unexpected conditions within the Pressurizer Relief Tank. Mechanical Maintenance personnel observed the operation of 2NC-31 and 2NC-32B. The valve appeared to stroke normally to the open and closed positions.

On December 9, at 0300 hours, the NC System was pressurized to 117 PSIG. 2NC-32B was opened and NC pressure remained at 117 PSIG. NC pressure did not drop as expected. 2NC-32B was closed and the NC system was depressurized. Two options were considered to verify the position of 2NC-31B, perform a radiograph of the valve internals or to perform a VOTES test. VOTES results from the test performed on November 25, 1991, were reviewed and the data suggested that the stem was separated from the gate assembly since the stem pullout force appeared to be lower than normal. OPS initiated a work request to repair 2NC-31B. At 1900 hours, Maintenance Engineering Services reported that the stem of 2NC-31B was broken and that the gate assembly was stuck on the valve seats.

On December 10, at 0400 hours, Mechanical Maintenance had been unsuccessful in removing the assembly from the valve body and determined that it was necessary to drill it out. At 1130 hours, the assembly had been removed from the valve body. At 1500 hours it was determined that 2NC-31 would have to be drilled out and replaced since the valve body was severely damaged.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 500 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-830), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1) Catawba Nuclear Station, Unit 2	DOCKET NUMBER (2) 05000414	LER NUMBER (3)			PAGE (3)		
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TEXT (If more space is required, use additional NRC Form 350A's) (17)

A Nuclear Station Modification (NSM) was required and initiated for the valve replacement since a direct replacement was not available.

On December 12, at 0530 hours, a new valve body for 2NC-31 had been installed and the welds were ready for inspection. Since a potential material problem existed for Unit 1 and the remaining Unit 2 PORV block valves, Unit 2 NC fill activities were put on hold. It was determined that if the Unit 1 and Unit 2 block valves were found open and could be closed when necessary, that the PORV block valves would be considered operable. Unit 2 pressurization and heat-up commenced.

On December 14, at 1100 hours, Unit 1 was in Mode 1, Power Operation. The Unit 1 and remaining Unit 2 PORV block valves were radiographed and verified to be open. The valves were then stroked to the closed position and reopened. The block valves were radiographed again to ensure that the valves had reopened.

On December 15, at 0200 hours, all work and retest of 2NC-31B was complete. At 1505 hours, Unit 2 entered Mode 4, Hot Shutdown.

CONCLUSIONS

This incident is attributed to Equipment Failure because the valve stem for 2NC-31 separated from the gate assembly. The detached assembly effectively kept the valve closed, blocking the 2NC-32B flow path. This incident is reportable because only one PZR PORV was operable while two are required. Credit could not be taken for 2NC-36B because it is not backed up by Nitrogen from the accumulator blanket which is supplied by the Generator Nitrogen (E11S:LK) (GN) System.

A review of the VOTES data for 2NC-31B (tests performed during November 25, 1991 and March, 1989) revealed an order of magnitude difference for stem pullout force measurements. Several conditions that can affect pullout force have been identified. However, there is no known method to quantify these conditions or predict the effect on stem pullout force.

The failed valve stem has been received by Babcock and Wilcox (B&W), Lynchburg, Virginia for analysis. Initial observations indicated fractures that appear to have been present before the stem failure. Torsional loading occurred immediately before the failure. Continued testing revealed a significant loss of ductility on the area where the stem was exposed to the steam space. The stem failure involved three fractured surfaces; the lower stem ears, an axial shearing of a section of the tapered stem backseat, and a transverse fracture across the stem.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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TEXT - If more space is required, use additional NRC Form 366A's (17)

approximately 3/8 inch above the stem backseat. The investigation has concentrated on the material properties of the stem. The stem material was tested through use of the Charpy Test method in conjunction with the manufacturer. Tests of the failed stem material indicated reduced ductility at room temperature. An independent consultant will be obtained to verify the tests. An analysis following these tests will determine what additional corrective actions will be required.

Subsequent corrective actions include depressurizing NC, removal of the failed valve, radiographs of the remaining PORV isolation valves to ensure that the valves are open, and initial analysis of the failed stem.

Planned corrective actions include verification of PZR PORV block valve position following valve stroke, a review of the component and operating history and a detailed failure analysis of 2NC-31B, and further evaluation of operability and continued use of the stem material following an independent analysis by Siemens/Edward Valve Company.

An Operational Experience Program Data Base (OEP) review revealed that there have been no reportable failures of this kind during the last two years. Therefore this incident is not considered to be a recurring event.

CORRECTIVE ACTION

SUBSEQUENT

- 1) Operations depressurized the NC System after determining that the flow path through 2NC-32B was not operable.
- 2) Maintenance replaced the valve after determining that the valve could not be repaired.
- 3) The failed stem was transported to B&W for analysis.
- 4) Unit 2 commenced pressurization and heat-up.

PLANNED

- 1) Perform a detailed failure analysis on the failed stem and identify relevant plant applications.
- 2) Identify and revise station procedures and activities that affect the position of PZR PORV block valves so that the position of these valves are verified following valve strokes.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 500 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P&RD), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104) OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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TEXT (IF LER IS REVISOR, USE A FOLLOW-UP NRC FORM 366A-1 (17))

- 3) Re-evaluate operability of affected valves as new analysis information is received.
- 4) Revise specifications invoking use of 17-4 PH stems if the root cause is determined to be generic. Evaluate other valves using 17-4 PH stems where applications exceed 600 F if the problem is determined to be generic.
- 5) Coordinate Siemens/Edward stress analysis investigation and finalize the root cause of the failure. Determine if the root cause is generic and recommend a long term fix.

SAFETY ANALYSIS

Because 2NC-31B failed in the closed position, LTOP would not have occurred through the 2NC-32B flowpath. However, the relief path through 2NC-34A was operable and LTOP protection would have been adequate if NC pressure would have exceeded 400 PSIG as long as only one Chemical And Volume Control [E1IS:CB] (NV) System charging pump [E1IS:P] is running. NV Charging Pump 2A was running during this event and 2B was removed from service. During this event, NC pressure did not exceed 300 PSIG. In addition to 2NC-34A, 2NC-36B was available for use as long as Instrument Air [E1IS:LD] was present.

In addition to LTOP, the Residual Heat Removal [E1IS:BP] (ND) System is unisolated from the NC system at pressures below 400PSIG. In this state, the ND Suction Relief Valves (ND-3 and ND-35) provide NC overpressure protection with relief setpoints of 450 PSIG. The ND Suction Isolation Valves (ND-1B, ND-2A, ND-36B, and ND-37A) have interlocks which automatically isolate ND when NC pressure exceeds 600 PSIG. Through experience from past events (Reference LER 413/90-17) ND Suction Relief Valves are effective in limiting pressure transients.

It is concluded that adequate relief capacity and overpressure protection existed throughout this event.

The health and safety of the public was not affected by this incident.