TENNESSEE VALLEY AUTHORITY
Browns Ferry Nuclear Plant
Post Office Box 2000
Decatur, Alabama 35609-2000

OCT 05 1989

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

Dear Sir:

TVA - BROWNS FERRY NUCLEAR PLANT (BFN) UNIT 1 - DOCKET NO. 50-259 - FACILITY OPERATING LICENSE DPR-33 - REPORTABLE OCCURRENCE REPORT BFRO-50-259/89020

The enclosed report provides details concerning core spray system minimum flow bypass valves not being qualified due to a design error in the original analysis for torus hydrodynamic motions. This report is submitted in accordance with 10 CFR 50.73 (a)(2)(v).

Very truly yours,

TENNESSEE VALLEY AUTHORITY

J. R. Bynum
Vice President
Nuclear Power Production

Enclosures
cc (Enclosures):

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NRC Resident Inspector, BFN

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1/1

NRC FORM 366 (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
BROWNS FERRY UNIT 1	0 5 0 0 0 2 5 9	1 OF 0 5

TITLE (4) CORE SPRAY SYSTEM MINIMUM FLOW BYPASS VALVES NOT QUALIFIED DUE TO DESIGN ERROR IN ORIGINAL ANALYSIS FOR TORUS HYDRODYNAMIC MOTIONS

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	DOCKET NUMBER(S)
									BROWNS FERRY UNIT 2	0 5 0 0 0 2 6 0
0 9	0 8	8 9	8 9	— 0 2 0	— 0 0	1 0	0 5	8 9	BROWNS FERRY UNIT 3	0 5 0 0 0 2 9 6

OPERATING MODE (9): N

POWER LEVEL (10): 0 0 0

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

20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
20.405(a)(1)(i)	50.36(c)(1)	X 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)	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	TELEPHONE NUMBER (AREA CODE)
DENZEL A. HOUSLEY, ENGINEER, COMPLIANCE LICENSING	2 0 5 7 2 9 - 2 8 7 4

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 fifteen single-space typewritten lines) (16)

On September 8, 1989, engineering analysis revealed that the valve yokes for the core spray (CS) system minimum flow bypass valves for units 1, 2, and 3 would exceed the allowable yield stress when subjected to loadings from torus hydrodynamic motions. Yielding of the valve yoke could prevent the CS minimum flow bypass valves and, therefore, the CS system from performing its intended safety function. This discrepancy was identified during the component qualification analysis which was being performed for a design change.

The root cause of this event is a design error in the original analysis used to qualify the CS system minimum flow bypass valves for torus hydrodynamic motions. As the result of an inadequate engineering judgment, the CS system minimum flow bypass valves were incorrectly determined to be qualified for the additional torus hydrodynamic loadings.

Following this event, a review of torus attached piping active valves with motor or air actuators required for unit 2 operation was performed to identify this type valve. Additionally, a valve identical to the CS system minimum flow bypass valves was identified on unit 1. Investigation/evaluation of the unit 1 valve is still in progress. Additional evaluation for all three units is underway. Appropriate corrective actions will be implemented as a result of this evaluation. The affected CS system minimum flow bypass valves will be modified or replaced as necessary to ensure that the valves meet the required design stresses.

DESCRIPTION OF EVENT

On September 8, 1989, engineering analysis revealed that the valve yokes for the core spray (CS) system [BM] minimum flow bypass valves for units 1, 2, and 3 would exceed the allowable yield stress when subjected to loadings from torus [NH] hydrodynamic motions. Yielding of the valve yoke could prevent the CS minimum flow bypass valves and, therefore, the CS system from performing its intended safety function. This discrepancy was identified during the component qualification analysis which was being performed for a design change involving the motor operator for the unit 2 CS system train B minimum flow bypass valve (2-FCV-75-37).

The original design of the containment system considered postulated accident loads previously associated with a loss of coolant accident (LOCA), seismic loads, dead weight loads, jet-impingement loads, hydrostatic loads (due to water in the torus), overload pressure test loads, and construction loads. However, after the establishment of the original design criteria, additional loading conditions were identified by General Electric. New torus loads which had not explicitly been included in the containment design bases were identified. These loads result from dynamic effects of drywell air and steam being rapidly released to the torus during a postulated LOCA and during safety relief valve discharge associated with plant transient operating conditions. These issues were evaluated by NRC in NUREG-0661.

Based on these identified loadings, reanalysis of the entire torus, vent system, torus internals, and attached piping was performed. The CS system minimum flow bypass valves are on piping attached to the torus and were analyzed as part of this effort. Allowable acceleration values for the CS system minimum flow bypass valves were not found in the contract files at the time of the 1984 analysis. However, allowable acceleration values for another valve by the same manufacturer were available and an engineering judgment was made to apply these values to the CS system minimum flow bypass valves.

The CS system minimum flow bypass valves are three-inch, 300 pound class, motor operated, bolted bonnet, gate valves with SMB-00 limitorque operators which weigh 210 pounds. The valves are designated ASTM A216 GR WCB. The other valve used in the analysis was a three-inch, 300 pound class, motor operated, bolted bonnet, gate valve with a SMB-00 limitorque operator that weighs 220 pounds. The valve material designation is ASTM A105 GR II. Both valves were manufactured by Velan Valve Corporation. The two valve materials have very similar mechanical properties. Based on the similarity of the valves, it was concluded that the available allowable acceleration levels would also be applicable for the CS system minimum flow bypass valves. The original analytical calculations for torus hydrodynamics motions performed in 1984 determined that the CS system minimum flow bypass valves were acceptable in their original configuration.

During the analysis conducted for the design change to evaluate the replacement motor for 2-FCV-75-37, it was discovered that the qualification analysis performed in 1984 was in error. A field inspection identified that the valve yoke dimensions for valve 2-FCV-75-37 were smaller than the valve yoke dimensions for the similar valve used in the 1984 analysis. On August 28, 1989, as the result of an informal analysis, it was determined that the valve stresses for the combination of seismic, torus, and normal operating loads for valve 2-FCV-75-37 were above the yoke material yield stress. This would result in deformation of the valve yoke that could prevent further operation of the valve.

This analysis also determined that for current plant conditions where only seismic and normal loads apply, the valve yoke stresses would be within the acceptable limits. However, the valve yoke yield stress could be exceeded for any plant condition which is capable of producing torus hydrodynamic motion.

On September 8, 1989, as a result of additional investigation, it was determined that this same discrepancy applied to both trains of the unit 2 CS system. Additionally, it was identified that all three Browns Ferry units were affected by this discrepancy. Each unit has two CS system trains with one minimum flow bypass valve per train. This event was reported to NRC in accordance with 10 CFR 50.72 on September 8, 1989.

A review of torus attached piping active valves with motor or air actuators required for unit 2 operation was performed to determine if this type Velan valve was utilized anywhere in addition to the CS system minimum flow bypass valves. This review did not identify any additional Velan valves required for unit 2 similar to the CS system minimum flow bypass valves. However, during a field inspection, it was discovered that the unit 3 CS system train A minimum flow bypass valve (3-FCV-75-9) was not manufactured by Velan. Additionally, the unit 1 high pressure coolant injection (HPCI) system [BJ]/reactor core isolation cooling (RCIC) system [BN] turbine exhaust vacuum breakers isolation valve (1-FCV-71-59) was identified to be a Velan valve identical to the other CS system minimum flow bypass valves. Investigation revealed that valves 3-FCV-75-9 and 1-FCV-71-59 had been interchanged as required by a plant modification during initial startup of unit 1. Valve 1-FCV-71-59 is on piping attached to the torus and its expected stresses due to the torus hydrodynamic motions is greater than the yield stress for the yoke material. Investigation/evaluation of this discrepancy is still in progress.

During this event, unit 2 was in the cold shutdown condition with irradiated fuel in the reactor vessel. Units 1 and 3 were defueled. No fuel handling or operations over spent fuel were in progress during this event. Under current plant conditions, torus hydrodynamic motions does not apply; therefore, the CS system minimum flow bypass valves were qualified and could perform their safety function. However, this condition has existed while the units have been operated. This event is reportable in accordance with 10 CFR 50.73(a)(2)(v), as a condition that alone could have prevented the fulfillment of the safety function of the CS system.

ANALYSIS OF EVENT

The CS system is designed to provide protection for the reactor core for the large break in the nuclear system when the control rod drive water pumps, RCIC system, and the HPCI system are unable to maintain reactor vessel water level. The protection provided by the CS system also extends to a small break in which the control rod drive water pumps, RCIC system, and HPCI system are all unable to maintain the reactor vessel water level, and the automatic depressurization system has operated to lower the reactor vessel pressure so that the low pressure coolant injection (LPCI) system and the CS system can provide core cooling. Failure of the CS system minimum flow bypass valve in the closed position could result in overheating of the CS system pump when pumping against a closed discharge valve. Failure of the CS system minimum flow bypass valve in the open position would result in less than the required CS system flow rate into the reactor vessel. Since this event affected both trains of the CS system, this event is considered safety significant.

CAUSE OF EVENT

The root cause of this event is a design error in the original analysis used to qualify the CS system minimum flow bypass valves for torus hydrodynamic motions. As the result of an inadequate engineering judgment, the CS system minimum flow bypass valves were incorrectly determined to be qualified for the additional torus hydrodynamic loadings.

CORRECTIVE ACTIONS

Following this event, a review of torus attached piping active valves with motor or air actuators required for unit 2 operation was performed to determine if this type Velan valve was utilized anywhere in addition to the CS system minimum flow bypass valves. In addition, a field inspection identified that the unit 1 HPCI/RCIC turbine exhaust vacuum breakers isolation valve was a Velan valve identical to the CS system minimum flow bypass valves. Investigation/evaluation of this discrepancy is still in progress. Additional evaluation for all three units is underway to determine if this type discrepancy could exist for other valves. Appropriate corrective actions will be implemented as a result of this evaluation.

The five Velan CS system minimum flow bypass valves will be modified or replaced as necessary to ensure that the valves meet the required design stresses. This action will be completed before the startup of each affected unit.

PREVIOUS SIMILAR EVENTS

None

COMMITMENTS

1. Investigation/evaluation of the unit 3 CS system train A minimum flow bypass valve and the HPCI/RCIC turbine exhaust vacuum breakers isolation valve is continuing. Appropriate corrective actions will be initiated as a result of this evaluation prior to restart of each affected unit.

2. Additional evaluation for all three units is underway to determine if this type discrepancy could exist for other valves. This evaluation will be completed by November 20, 1989 for unit 2 and prior to restart for units 1 and 3. Appropriate corrective actions will be implemented as a result of this evaluation prior to restart of the respective unit.

3. The five Velan CS system minimum flow bypass valves will be modified or replaced as necessary to ensure that the valves meet the required design stresses. This action will be completed before the startup of each affected unit.

Note: Energy Industry Identification System (EIIS) codes are identified in the text as [XX].