May 11, 2004

U.S. Nuclear Regulatory Commission
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Gentlemen:

In the Matter of) Docket No. 50-259
Tennessee Valley Authority)

BROWNS FERRY NUCLEAR PLANT (BFN) UNIT 1 – GENERIC LETTER 95-07, PRESSURE LOCKING AND THERMAL BINDING OF SAFETY-RELATED POWER-OPERATED GATE VALVES

This letter provides the response to NRC Generic Letter 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," for BFN Unit 1.

On August 17, 1995, NRC issued Generic Letter 95-07, which requested licensees to ensure safety-related power-operated gate valves susceptible to pressure locking or thermal binding are capable of performing their required safety function. TVA provided response to NRC in References 1 through 5 for Browns Ferry Units 2 and 3, Sequoyah Units 1 and 2, and Watts Bar. The NRC's Safety Evaluation for Generic Letter 95-07 was provided in Reference 6.

Enclosure 1 provides the detailed and specific valve identification, descriptions and analysis for BFN Unit 1. There are specific differences between the Unit 1 evaluations and those performed for Units 2 and 3 (e.g., valve types, whether or not valve discs had been drilled, some Unit 1 valves were evaluated as part of the Units 2 and 3 evaluations, etc.). However, the Unit 1 evaluations also used the guidance provided in Generic Letter 95-07 and the review methodology for Unit 1 is the same as that used for TVA's other operating nuclear plants.

All safety related power operated gate valves in Unit 1 have been reviewed for potential susceptibility to the pressure locking and thermal binding phenomenon. There is one High

Pressure Coolant Injection valve in Unit 1 which is susceptible to thermal binding.

Prior to Unit 1 restart, this valve will be replaced with a double disc valve of similar design as Unit 2 and 3. Double disc gate valves are not susceptible to thermal binding. In addition, five safety related power operated gate valves will be modified prior to Unit 1 restart to preclude the potential for pressure locking. The reactor side disc face of these five valves will be modified by drilling a hole in the disc face into the cavity between the disc faces to avoid pressure locking. These actions will ensure that the pressure locking and thermal binding concerns described in Generic Letter 95-07 will be resolved prior to Unit 1 restart.

Enclosure 2 provides a summary of the new commitment contained in this letter and a schedule for its completion. If you have any questions about this submittal, please contact me at (256) 729-2636.

I declare under penalty of perjury that the foregoing is true and correct. Executed on May 11, 2004.

Sincerely,

Original signed by:

T. E. Abney
Manager of Licensing
and Industry Affairs

References:

1. TVA letter, P. P. Carrier to NRC, "Browns Ferry (BFN), Sequoyah (SQN), and Watts Bar (WBN) Nuclear Plants - Response to Generic Letter, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," October 16, 1995.

2. TVA letter, P. P. Carrier to NRC, "Browns Ferry (BFN), Sequoyah (SQN), and Watts Bar (WBN) Nuclear Plants - Supplemental Response to Generic Letter, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," December 15, 1995.

3. TVA letter, P. P. Carrier to NRC, "Browns Ferry (BFN), Sequoyah (SQN), and Watts Bar (WBN) Nuclear Plants - 180-Day Response to Generic Letter, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," February 13, 1996.

4. TVA letter, P. Salas to NRC, Browns Ferry Nuclear Plant (BFN) - Units 2 and 3, Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves – Response to Request for Additional Information (TAC Nos. M93437 and M93438), July 30, 1996.

5. TVA letter, T. E. Abney to NRC, Browns Ferry Nuclear Plant (BFN) - Units 2 and 3 - Generic Letter (GL) 95-07, Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves – Supplemental Response (TAC Nos. M93437 and M93438), February 19, 1999.

6. NRC letter, W. O. Long to TVA, Safety Evaluation for Generic Letter, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," Browns Ferry Nuclear Plant (BFN) - (TAC Nos. M 93436, M93437 and M93438), June 23, 1999.

cc: See Page 4

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ENCLOSURE 1
TENNESSEE VALLEY AUTHORITY
BROWN FERRY NUCLEAR (BFN) UNIT 1

RESPONSE TO NRC GENERIC LETTER 95-07
PRESSURE LOCKING AND THERMAL BINDING
OF SAFETY-RELATED POWER-OPERATED GATE VALVES

TABLE OF CONTENTS

I. BACKGROUND

In response to NRC Generic Letter 95-07, Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves, TVA reviewed the safety related systems and safety related power operated gate valves for Browns Ferry Units 2 and 3, Sequoyah Units 1 and 2, and Watts Bar to determine their susceptibility to pressure locking and thermal binding. As stated in the Generic Letter, pressure locking and thermal binding can occur on gate valves which are subjected to various external and process temperature variations. The conditions which can result in these phenomenona are fully described in the Generic Letter and are briefly described below. For purposes of these evaluations, power operated valves are those which are pneumatically, hydraulically or motor operated. Pressure locking and thermal binding have been experienced in high pressure / temperature water and steam systems. Cryogenic liquid or gaseous systems are not considered susceptible to these conditions. Since these conditions can prevent valve opening, this condition will only have a safety significance for those gate valves with a safety function to open. This evaluation documents the review of any safety-related power operated gate valves required for accident mitigation for Browns Ferry Unit 1.

Pressure Locking

As stated in Generic Letter 95-07, the pressure locking phenomenon can occur in water or steam systems subjected to two basic conditions. The first is pressure induced pressure locking, where a flex-wedge or double disc type gate valve is subjected to a high differential pressure. This pressure causes the upstream seat to leak and allow the water in the bonnet cavity of the valve to become pressurized. When line pressure is removed, the pressure in the bonnet cavity remains and prevents valve opening. This type of pressure locking can also occur on steam systems, where steam enters the bonnet and condenses. The process of condensing will lower the bonnet pressure and allow additional steam to enter the bonnet cavity. This cycle is repeated until the bonnet becomes water solid and causes pressure locking to occur. The second condition is thermally induced pressure locking and occurs when the bonnet cavity is water solid and an increase in ambient temperature causes the water in the bonnet to become pressurized preventing the valve from opening.

Thermal Binding

The condition of thermal binding occurs primarily on solid wedge gate valves. If the valve is initially open and at an elevated temperature, when the valve is closed and cools down, the valve body shrinks more than the disc and causes the disc to become stuck in the valve seat. Flexible wedge gate valves can also

become susceptible to thermal binding and are evaluated in the thermal binding portion of the discussion of potentially susceptible valves.

II. REVIEW FOR POTENTIALLY SUSCEPTIBLE VALVES

System Review

To determine the scope of valves potentially susceptible to these phenomenona a review which included the following steps was performed. First, a review of systems which contain safety related valves was performed. Safety related control valves were identified from a search of Unit 1 data. From this information, any system which was not a water or steam system was eliminated from the scope of this evaluation. In addition, any valve in a low pressure system used as a boundary to a higher pressure system was also considered. For Unit 1, a list of all power operated valves was obtained and then reviewed against the Flow Diagrams to identify the Unit 1 safety related power operated valves. This search identified the following systems as containing safety related gate valves and whether any gate valve in that system could be considered potentially susceptible to pressure locking/thermal binding:

SYSTEM (NUMBER)	REVIEW
Main Steam (01)	This system contains two safety related power operated gate valves, FCV-1-55 and 56, which may be susceptible to pressure locking or thermal binding. The remaining valves in this system are either globe type or not safety related.
Feedwater (3)	There are four Feedwater valves identified as safety related (FCV-3-98, 99, 188A, and 188B). Unit 1 contains two power operated gate (FCV-3-98 and 99) and two power operated globe (FCV-3-188A and 188B) valves. The globe valves have been excluded from the requirements of Generic Letter 95-07. The gate valves are only used for Reactor Pressure Vessel vent, hydrostatic test or during system fill-up. Therefore, these valves are not included in Generic Letter 95-07 program.

SYSTEM (NUMBER)	REVIEW
Residual Heat Removal (RHR) Service Water (RHRSW) (23)	This system has two normally closed common gate valves (1/2-FCV-23-57) which remain closed for pressure boundary integrity. These valves form the boundary between the RHRSW and RHR systems, therefore may be potentially susceptible to pressure locking and/or thermal binding. These valves were previously evaluated under the Units 2 and 3 program. The remaining valves in this system are globe or butterfly valves.
Raw Coolong Water (24)	The safety related power operated valves in this system are of butterfly or globe type. Therefore, there are no valves in this system which are required to be evaluated for pressure locking or thermal binding.
Component Cooling Water (CCW)(27)	The safety related valves in this system are butterfly type valves. Therefore, this system contains no safety related gate valves which may be subject to this condition.
Control Bay HVAC (31)	There are no power operated, safety related gate valves in the chilled water portion of this system. Therefore, there are not any valves in this system which may be potentially susceptible to pressure locking or thermal binding.
Control Air (32)	There are safety related gate valves in this system. Since this is a compressed air system, the safety related valves in this system are not susceptible to pressure locking or thermal binding.
Containment (64)	There are safety related valves in this system. Since these valves are in the ventilation portion of the system, these valves are not susceptible to pressure locking or thermal binding.

SYSTEM (NUMBER)	REVIEW
Emergency Equipment Cooling Water (EECW) (67)	There are safety related power operated valves in this system. All of these valves are globe, ball or butterfly type. Therefore, there are no power operated valves in this system that are subject to the pressure locking and/or thermal binding phenomenon.
Recirculation (68)	There are safety related gate valves in this system and only two valves have a safety function to operate (close). This system operates at high pressure and temperatures. Therefore, the valves in this system must be evaluated for susceptibility to pressure locking and thermal binding.
Reactor Water Cleanup (69)	There are safety related gate valves in this system. This system operates at high pressure and temperatures. Therefore, the valves in this system must be evaluated for susceptibility to pressure locking and thermal binding.
Reactor Building Closed Cooling Water (RBCCW) (70)	There are safety related gate valves in this system. Only one valve has a safety function to operate, FCV-70-47. This valve is normally open and must close for its safety function. The test mode for this valve is closed. Therefore, this valve must be evaluated for potential susceptibility to pressure locking and/or thermal binding. The remaining valves in the system are safety related for pressure boundary integrity only. Therefore, these valves are not required to function and are not subject to the requirements of this Generic Letter.
Reactor Core Isolation Cooling (RCIC) (71)	There are safety related gate valves in this system. This system operates at high pressure and temperatures. This system is not considered safety related but the system is required to function for certain licensing basis events. Therefore, all gate valves in the RCIC system will be evaluated for susceptibility to pressure locking and/or thermal binding.

SYSTEM (NUMBER)	REVIEW
High Pressure Coolant Injection (73)	There are safety related gate valves in this system. This system operates at high pressure and temperatures. Therefore, the gate valves in this system must be evaluated for susceptibility to pressure locking and/or thermal binding.
RHR (74)	There are safety related gate valves in this system. This system operates at high pressure and temperatures. Therefore, the gate valves in this system must be evaluated for susceptibility to pressure locking and/or thermal binding.
Core Spray (75)	There are safety related gate valves in this system. This system operates at high pressure and temperatures. Therefore, the valves in this system must be evaluated for susceptibility to pressure locking and/or thermal binding.
Containment Inerting (76)	This system contains safety related gate valves. Since this is a gaseous nitrogen system and has no safety related power operated gate valves, this system is not subject to pressure locking and thermal binding.
Radwaste (77)	There are safety related gate valves in this system. This system operates at potentially high pressure and temperatures. Therefore, the gate valves in this system must be evaluated for susceptibility to pressure locking and/or thermal binding.
Fuel Pool Cooling (78)	There are safety related gate valves in this system. This system may operate at high pressure and/or temperatures. Therefore, the gate valves in this system must be evaluated for susceptibility to pressure locking and/or thermal binding.
Containment Atmospheric Dilution (84)	This system contains several safety related gate valves. Since this is a gaseous nitrogen system, and has no safety related power operated gate valves, this system is not subject to pressure locking and thermal binding.

SYSTEM (NUMBER)	REVIEW
Control Rod Drive (85)	There are safety related valves in this system. The scram inlet and outlet valves FCV 85-39A and 39B and the directional control valves FCV 85-40A, 40B, 40C, and 40D are all plug/manifold type valves and are not susceptible to pressure locking and/or thermal binding. Unit 1 contains safety related power operated valves which are either globe or angle except for FCV-85-56 which is gate. The globe and angle valves are excluded from the requirements of Generic Letter 95-07 and the gate valve is subjected to low pressure and temperature. Therefore, this system on Unit 1 is not subject to pressure locking and thermal binding.

Valve Review

Table 1 below (see Page E1-8), lists the safety related power operated gate valves in each system identified above, which required evaluation for pressure locking and thermal binding. The information presented in the table also identifies the normal operating position, the safety position, and test position of each valve. The test position is based on system or valve functional operability testing or Section XI valve testing which is performed during reactor power operation. In accordance with the guidance provided, the following matrix is a guide in determining whether a gate valve is potentially susceptible to pressure locking and/or thermal binding. The "matrix" column in Table 1 designates which valves may be potentially susceptible in accordance with the NRC matrix.

NRC MATRIX FOR POTENTIALLY SUSCEPTIBLE GATE VALVES

Normal Position	Safety Position	Test Position	Within Scope
Closed	Open	Closed	Yes
Closed	Open	Open	Yes
Closed	Closed	Closed	No
Closed	Closed	Open	No
Open	Open	Closed	Yes
Open	Open	Open	No
Open	Closed	Closed	No
Open	Closed	Open	No

In addition to the above criteria, additional features were also considered to exclude a valve from the scope of potentially susceptible valves. These include whether a valve has been previously modified to prevent the pressure locking phenomenon, by drilling the disc face, and whether the power supply for a valve is disconnected or otherwise de-energized.

TABLE 1
SAFETY RELATED POWER OPERATED GATE VALVES
REQUIRING EVALUATION FOR PRESSURE LOCKING AND THERMAL BINDING

UNID	DESCRIPTION	NORMAL	SAFETY	TEST	COMMENTS	TYPE	MATRIX
1-FCV-01-055	MS DRAIN ISOLATION VALVE	CLOSED	CLOSED	OPEN		GATE	NO
1-FCV-01-056	MS DRAIN ISOLATION VALVE	CLOSED	CLOSED	OPEN		GATE	NO
1-FCV-68-001	RECIRCULATION PUMP A SUCTION	OPEN	OPEN	N/A	TEST AT SHUTDOWN ONLY	GATE	NO
1-FCV-68-003	RECIRCULATION PUMP A DISCHARGE	OPEN	CLOSED	CLOSED		GATE	NO
1-FCV-68-077	RECIRCULATION PUMP B SUCTION	OPEN	OPEN	N/A	TEST AT SHUTDOWN ONLY	GATE	NO
1- FCV-68-079	RECIRCULATION PUMP B DISCHARGE	OPEN	CLOSED	CLOSED		GATE	NO
1-FCV-69-001	RWCU SUCTION ISOLATION	OPEN	CLOSED	CLOSED		GATE	NO
1-FCV-69-002	RWCU SUCTION ISOLATION	OPEN	CLOSED	CLOSED		GATE	NO
1-FCV-70-047	RBCCW PCI OUTLET VALVE	OPEN	CLOSED	CLOSED		GATE	NO
1-FCV-71-002	RCIC STEAM ISOLATION VALVE	OPEN	CLOSED	CLOSED		GATE	NO
1-FCV-71-003	RCIC STEAM ISOLATION VALVE	OPEN	CLOSED	CLOSED		GATE	NO
1-FCV-71-017	RCIC TORUS SUCTION VALVE	CLOSED	CLOSED	OPEN		GATE	NO
1-FCV-71-018	RCIC TORUS SUCTION VALVE	CLOSED	CLOSED	OPEN		GATE	NO
1-FCV-71-019	RCIC CST SUCTION VALVE	OPEN	OPEN	CLOSED*		GATE	YES
1-FCV-71-037	RCIC PUMP DISCHARGE VALVE	OPEN	OPEN	CLOSED*		GATE	YES
1-FCV-71-039	RCIC INJECTION VALVE	CLOSED	OPEN	OPEN		GATE	YES

UNID	DESCRIPTION	NORMAL	SAFETY	TEST	COMMENTS	TYPE	MATRIX
1-FCV-71-059	RCIC VACUUM RELIEF ISOLATION	OPEN	OPEN	N/A	POWER TO BE DISCONNECTED **	GATE	NO
1-FCV-73-002	HPCI STEAM ISOLATION VALVE	OPEN	CLOSED	CLOSED		GATE	NO
1-FCV-73-003	HPCI STEAM ISOLATION VALVE	OPEN	CLOSED	CLOSED		GATE	NO
1-FCV-73-016	HPCI STEAM ADMISSION VALVE	CLOSED	OPEN	OPEN		GATE	YES
1-FCV-73-026	HPCI TORUS SUCTION VALVE	CLOSED	OPEN	OPEN		GATE	YES
1-FCV-73-027	HPCI TORUS SUCTION VALVE	CLOSED	OPEN	OPEN		GATE	YES
1-FCV-73-034	HPCI PUMP DISCHARGE VALVE	OPEN	OPEN	CLOSED*		GATE	YES
1-FCV-73-036	HPCI TEST RETURN VALVE	CLOSED	CLOSED	OPEN		GATE	NO
1-FCV-73-040	HPCI CST SUCTION VALVE	OPEN	CLOSED	CLOSED		GATE	NO
1-FCV-73-044	HPCI INJECTION VALVE	CLOSED	OPEN	OPEN		GATE	YES
1-FCV-74-001	RHR PUMP A TORUS SUCTION	OPEN	OPEN	CLOSED*		GATE	YES
1-FCV-74-002	RHR PUMP A SDC SUCTION	CLOSED	CLOSED	OPEN		GATE	NO
1-FCV-74-007	RHR MIN FLOW VALVE	OPEN	BOTH	BOTH		GATE	YES
1-FCV-74-012	RHR PUMP C TORUS SUCTION	OPEN	OPEN	CLOSED*		GATE	YES
1-FCV-74-013	RHR PUMP C SDC SUCTION	CLOSED	CLOSED	OPEN		GATE	NO
1-FCV-74-024	RHR PUMP B TORUS SUCTION	OPEN	OPEN	CLOSED*		GATE	YES
1-FCV-74-025	RHR PUMP B SDC SUCTION	CLOSED	CLOSED	OPEN		GATE	NO
1-FCV-74-030	RHR-II MIN FLOW VALVE	OPEN	BOTH	BOTH		GATE	YES
1-FCV-74-035	RHR PUMP D TORUS SUCTION	OPEN	OPEN	CLOSED*		GATE	YES
1-FCV-74-036	RHR PUMP D SDC SUCTION	CLOSED	CLOSED	OPEN		GATE	NO
1-FCV-74-046	RHR LOOP CROSS-TIE VALVE	CLOSED	CLOSED	N/A	TO BE REMOVED	GATE	NO
1-FCV-74-047	RHR SD COOLING VALVE	CLOSED	CLOSED	OPEN		GATE	NO
1-FCV-74-048	RHR SD COOLING VALVE	CLOSED	CLOSED	OPEN		GATE	NO

UNID	DESCRIPTION	NORMAL	SAFETY	TEST	COMMENTS	TYPE	MATRIX
1-FCV-74-053	RHR-I LPCI INJECTION	CLOSED	OPEN	OPEN		GATE	YES
1-FCV-74-057	RHR I TEST RETURN VALVE	CLOSED	CLOSED	OPEN		GATE	NO
1-FCV-74-060	RHR-I DRYWELL SPRAY VALVE	CLOSED	OPEN	OPEN		GATE	YES
1-FCV-74-061	RHR-I DRYWELL SPRAY VALVE	CLOSED	OPEN	OPEN		GATE	YES
1-FCV-74-067	RHR II LPCI INJECTION VALVE	CLOSED	OPEN	OPEN		GATE	YES
1-FCV-74-071	RHR II TEST RETURN VALVE	CLOSED	CLOSED	OPEN		GATE	NO
1-FCV-74-074	RHR-I I DRYWELL SPRAY VALVE	CLOSED	OPEN	OPEN		GATE	YES
1-FCV-74-075	RHR-I I DRYWELL SPRAY VALVE	CLOSED	OPEN	OPEN		GATE	YES
1-FCV-74-098	RHR PUMP B SUCTION CROSS-TIE	CLOSED	CLOSED	OPEN		GATE	NO
1-FCV-74-099	RHR PUMP D SUCTION CROSS-TIE	CLOSED	CLOSED	OPEN		GATE	NO
1-FCV-74-101	RHR-II DISCHARGE CROSS-TIE	CLOSED	CLOSED	OPEN		GATE	NO
1-FCV-74-104	RHR DRAIN PUMP C SUCTION	CLOSED	CLOSED	CLOSED		GATE	NO
1-FCV-74-106	RHR DRAIN PUMP B SUCTION	CLOSED	CLOSED	CLOSED		GATE	NO
1-FCV-75-002	CORE SPRAY PUMP A SUCTION VALVE	OPEN	OPEN	N/A		GATE	NO
1-FCV-75-009	CORE SPRAY-I MIN FLOW VALVE	OPEN	BOTH	BOTH		GATE	YES
1-FCV-75-011	CORE SPRAY PUMP C SUCTION VALVE	OPEN	OPEN	N/A		GATE	NO
1-FCV-75-023	CORE SPRAY-I OUTBOARD INJECTION VALVE	OPEN	OPEN	CLOSED*		GATE	YES
1-FCV-75-025	CORE SPRAY-I INBOARD INJECTION VALVE	CLOSED	OPEN	OPEN		GATE	YES
1-FCV-75-030	CORE SPRAY PUMP B SUCTION VALVE	OPEN	OPEN	N/A		GATE	NO
1-FCV-75-037	CORE SPRAY-II MIN FLOW VALVE	OPEN	BOTH	BOTH		GATE	YES
1-FCV-75-039	CORE SPRAY PUMP D SUCTION VALVE	OPEN	OPEN	N/A		GATE	NO

UNID	DESCRIPTION	NORMAL	SAFETY	TEST	COMMENTS	TYPE	MATRIX
1-FCV-75-051	CORE SPRAY-II OUTBOARD INJECTION VALVE	OPEN	OPEN	CLOSED*		GATE	YES
1-FCV-75-053	CORE SPRAY-II INBOARD INJECTION VALVE	CLOSED	OPEN	OPEN		GATE	YES
1-FCV-77-02A	FLOOR DRAIN PUMP DISCHARGE	OPEN	CLOSED	CLOSED		GATE	NO
1-FCV-77-02B	FLOOR DRAIN PUMP DISCHARGE	OPEN	CLOSED	CLOSED		GATE	NO
1-FCV-77-15A	EQUIPMENT DRAIN PUMP DISCHARGE	OPEN	CLOSED	CLOSED		GATE	NO
1-FCV-77-15B	EQUIPMENT DRAIN PUMP DISCHARGE	OPEN	CLOSED	CLOSED		GATE	NO
1-FCV-78-061	RHR CROSS-TIE VALVE TO FUEL POOLING COOLING	CLOSED	CLOSED	CLOSED		GATE	NO
1-FCV-78-067	REACTOR WELL RETURN OUTBOARD	CLOSED	CLOSED	CLOSED		GATE	NO
1-FCV-78-068	REACTOR WELL INBOARD	CLOSED	CLOSED	OPEN		GATE	NO

* CLOSED FOR VALVE OPERABILITY TESTING ONLY

** THE POWER WILL BE REMOVED FROM THE VALVE PRIOR TO UNIT 1 RESTART AND NO EVALUATION WAS PERFORMED

III. EVALUATION OF POTENTIALLY SUSCEPTIBLE VALVES

After the system and valve operation reviews were performed, the valves in Table 1 with a 'YES' in the Matrix column were considered as potentially susceptible to pressure locking or thermal binding. Table 2 lists these valves and provides additional details for each valve. Results of the detailed evaluation for each valve for pressure locking and thermal binding are provided after the table.

TABLE 2
POTENTIALLY SUSCEPTIBLE VALVES

UNID	DESCRIPTION	DISK	MANUFACTURER	DRAWING	SIZE	MEDIUM
1-FCV-71-019	RCIC CST SUCTION VALVE	SOLID	WALWORTH	A-7514-M-161	6"	WATER
1-FCV-71-037	RCIC PUMP DISCHARGE VALVE	FLEX	WALWORTH	A-12323-M	6"	WATER
1-FCV-71-039	RCIC INJECTION VALVE	FLEX	WALWORTH	A-12323-M1	6"	WATER
1-FCV-73-016	HPCI STEAM ADMISSION VALVE	DOUBLE	ANCHOR DARLING	SEE SECTION VII	10"	STEAM
1-FCV-73-026	HPCI TORUS SUCTION VALVE	SOLID	CRANE	PB- 139991	16"	WATER
1-FCV-73-027	HPCI TORUS SUCTION VALVE	SOLID	CRANE	PB- 139991	16"	WATER
1-FCV-73-034	HPCI PUMP DISCHARGE VALVE	SOLID	CRANE	PC-139988	14"	WATER
1-FCV-73-044	HPCI INJECTION VALVE	SOLID	CRANE	PC-139988	14"	WATER
1-FCV-74-001	RHR PUMP A TORUS SUCTION	SOLID	WALWORTH	A-12349	24"	WATER
1-FCV-74-007	RHR MIN FLOW VALVE	SOLID	POWELL	035945	4"	WATER
1-FCV-74-012	RHR PUMP C TORUS SUCTION	SOLID	WALWORTH	A-12349	24"	WATER
1-FCV-74-024	RHR PUMP B TORUS SUCTION	SOLID	WALWORTH	A-12349	24"	WATER
1-FCV-74-030	RHR-II MIN FLOW VALVE	SOLID	POWELL	035945	4"	WATER
1-FCV-74-035	RHR PUMP D TORUS SUCTION	SOLID	WALWORTH	A-12349	24"	WATER
1-FCV-74-053	RHR-I LPCI INJECTION VALVE	FLEX	WALWORTH	A-12334	24"	WATER
1-FCV-74-060	RHR-I DRYWELL SPRAY VALVE	SOLID	WALWORTH	A-12329M4C	12"	WATER
1-FCV-74-061	RHR-I DRYWELL SPRAY VALVE	SOLID	WALWORTH	A-12329M4C	12"	WATER

UNID	DESCRIPTION	DISK	MANUFACTURER	DRAWING	SIZE	MEDIUM
1-FCV-74-067	RHR-II LPCI INJECTION VALVE	FLEX	WALWORTH	A-12334	24”	WATER
1-FCV-74-074	RHR-II DRYWELL SPRAY VALVE	SOLID	WALWORTH	A-12329	12”	WATER
1-FCV-74-075	RHR-II DRYWELL SPRAY VALVE	SOLID	WALWORTH	A-12329	12”	WATER
1-FCV-75-009	CORE SPRAY-I MIN FLOW VALVE	DOUBLE	ANCHOR DARLING	03-26706-01	3”	WATER
1-FCV-75-023	CORE SPRAY-I OUTBOARD INJECTION VALVE	FLEX	WALWORTH	IVP-11978	12”	WATER
1-FCV-75-025	CORE SPRAY-I INBOARD INJECTION VALVE	FLEX	WALWORTH	IVP-11978	12”	WATER
1-FCV-75-037	CORE SPRAY-II MIN FLOW VALVE	DOUBLE	ANCHOR DARLING	03-26706-01	3”	WATER
1-FCV-75-051	CORE SPRAY-II OUTBOARD INJECTION VALVE	FLEX	WALWORTH	IVP-11978	12”	WATER
1-FCV-75-053	CORE SPRAY-II INBOARD INJECTION VALVE	FLEX	WALWORTH	IVP-11978	12”	WATER

Pressure Locking

FCV-71-37 - RCIC Pump Discharge Valve

This valve is normally open and stays open during RCIC system operation. It is closed for Technical Specification valve operability testing once every 3 months. Valve testing is performed by stroking the valve closed and returning it to the open position. The downstream valve FCV-71-39 is closed during valve operability testing of the pump discharge valve. The water in the RCIC pump discharge line is at ambient temperature. The system is not in operation at the time the valve is closed for valve operability testing. This valve remains open during system operability flow testing. The RCIC system is declared inoperable during testing of this valve and if the valve failed to re-open, appropriate Technical Specifications would be followed. Therefore, there are no conditions that subject this valve to elevated pressure or temperature excursions, while it is closed, which could cause the pressure locking phenomenon.

FCV-71-39 - RCIC Injection Valve

This valve is normally closed and must open to inject water into the 'B' Feedwater line. There is a check valve between the feedwater line and the subject valve. In the event of leakage across this check valve, the RCIC injection valve would be subjected to the operating pressure of the feedwater system. The

RCIC injection line intersects the 'B' Feedwater line between the redundant inboard and outboard Feedwater primary containment isolation check valves. One scenario which would cause the loss of pressure at the RCIC discharge line occurs when feedwater pressure is lost (either by a trip of all three feedwater pumps (loss of all feedwater transient) or a feedwater line break upstream of the primary containment isolation valves), in combination with the leakage across the outboard FW check valve being greater than the leakage across the inboard check valve. The valve will be modified by drilling a ¼" hole the downstream disc face to prevent the potential for pressure locking from occurring.

FCV-73-16 - HPCI Steam Admission Valve

There are no events which would cause pressure locking since upstream steam line pressure is always present any time the valve is required to open. The Unit 1 valve stem is mounted horizontally with a steam trap located just upstream of the valve. Any condition which causes loss of steam pressure such as HPCI steam line break, also disables the HPCI. In addition, an interlock prevents this valve from opening when a line break is detected. Therefore, there are no conditions which cause this valve to become pressure locked.

FCV-74-53 and FCV-74-67 - RHR LPCI Injection Valves

These valves are normally closed and required to open in order to accomplish the system safety function. The system is not in operation during power operation and the downstream side (Reactor side) of the valve is exposed to high pressure due to the leakage through the check valve downstream of this valve while the reactor is in operation. Therefore, the valves will be modified by drilling a ¼" hole in the disc face into the cavity between the downstream disc faces to avoid pressure locking.

FCV-75-09 and FCV-75-37 - Core Spray Minimum Flow Valves

These valves are double disc design which are required to open and close in response to Core Spray system flow. These valves will close after sufficient flow has been achieved in the Core Spray injection flow path. There are no events which would cause a significant ambient temperature increase in the area where these valves are located. The maximum fluid temperature the main injection flow path reaches is 193°F. These valves would be closed prior to being exposed to any elevated process fluid temperatures and are located on a branch line from the main injection piping approximately 30 feet from the main piping. Since the flow through this line would be stagnant while these valves are closed, the subject valves would not be exposed to

elevated fluid temperatures. Therefore, there are no mechanisms which would induce pressure locking in these valves.

FCV-75-23 and FCV-75-51 - Core Spray Outboard Injection Valves

These valves are normally open and stay open during Core Spray system operation. These valves are closed for Technical Specification valve operability testing once every 3 months. The operability testing is then performed on the associated inboard injection valve (FCV-75-25 or 53). The affected Core Spray loop is declared inoperable whenever the outboard isolation valves are not open. After the inboard valve is returned to its normally closed position, the outboard valve is returned to its normally open position. The water in this portion of the Core Spray injection line is at ambient temperature conditions. These valves are not susceptibility to pressure locking.

FCV-75-25 and FCV-75-53 - Core Spray Outboard Injection Valves

These valves are normally closed and are required to open in order to accomplish the system safety function. Normally the system is not in operation and the downstream side (Reactor side) of the valve is exposed to high pressure due to the leakage through the check valve downstream of this valve while the reactor is in operation. Therefore, the valves need to be modified by drilling a ¼" hole in the disc face into the cavity between the downstream disc faces to avoid pressure locking.

Thermal Binding

The flexible wedge gate valves were reviewed for thermal binding. The flexible wedge valves, discussed in the pressure locking section, are potentially exposed to a maximum post-accident torus water temperature of 193°F. With the exception of the RCIC injection valve (FCV-71-39), RHR Injection Valves (FCV-74-53, FCV-74-67) and Core Spray Injection valves (FCV-75-53, FCV-75-25), the normal and safety position of these valves is open. If these valves are outside of their safety position, the associated loop or system is declared inoperable. The RCIC injection valve is opened prior to exposure to elevated water temperatures, with the normal source of water being from the condensate storage tank (CST) which remains at ambient temperature conditions. The RHR and Core Spray injection valves are opened prior to exposure to elevated water temperatures, with the normal source of water from the torus. The water in the lines is at ambient temperature conditions prior to opening. Therefore, none of the flexible wedge valves are exposed to conditions which could induce thermal binding.

The solid wedge valves listed in Table 2 are potentially susceptible to thermal binding. These will be addressed in groups

according to their application. The double disc gate valves listed in Table 2 are not susceptible to thermal binding.

FCV-71-19 - RCIC Condensate Storage Tank Suction Valve & FCV-74-01, 12, 24, & 35 - RHR Pump (A, B, C & D) Torus Suction Valves

These valves are normally aligned open and stay open during system operation. These valves are closed for Technical Specification valve operability testing once every 3 months. Valve testing is performed by manually stroking the valve closed and then returning it to the open position. The water in the torus or CST suction lines is at ambient temperature conditions. The system is not in operation at the time the valve is closed for testing. Since these valves are closed only during valve testing, and the water in these lines is at ambient temperature conditions, these valves are not exposed to temperature decreases which could cause the thermal binding phenomenon. In addition, closing of the RHR suction valves causes the associated RHR pump to be declared inoperable for LPCI injection. Therefore, in the event of failure of any of these valves to be returned to its normally open position, the applicable requirements of the Technical Specifications would be followed.

FCV-73-26 and -27 - HPCI Torus Suction Valves

These valves are normally aligned in the closed position and must open to maintain a water supply to the HPCI pump upon loss of the normal CST suction path. These valves are maintained closed under normal plant operations. When these valves are closed for system alignment or during stroke time testing, the temperature of the water in the suction line is ambient. These valves open on low CST level or high torus level. HPCI injection continues in response to small break LOCA conditions until it is no longer required due to reactor depressurization. The maximum torus water temperature of 193°F is based on reactor depressurization after maximum LOCA conditions. In the event HPCI was isolated and then restarted these valves may have been exposed to slightly warmer water from the torus, but still within the 200°F limit which would induce thermal binding. Maximum torus water temperature results when the reactor is depressurized by the Automatic Depressurization System (ADS). ADS is used when the high pressure systems – RCIC and HPCI – cannot restore reactor water level. When ADS is initiated the plant is committed to the low pressure systems and steam pressure will be reduced below the functional pressure for the turbine driven HPCI and RCIC pumps. Therefore, there are no conditions where these valves are closed under high temperature which could cause thermal binding.

FCV-73-34 - HPCI Pump Discharge Valve

This valve is normally open and its safety position is open. This valve is closed for valve operability testing every 3 months. The HPCI system is declared inoperable whenever this valve is not in its safety position of open. Thermal binding could potentially occur during post accident HPCI system operation. This could occur when hot, post accident, water from the torus was being pumped through the injection line. This valve could be closed at elevated temperature after post accident HPCI system operation, where HPCI had already performed its design basis safety function. The highest torus temperature of 193°F is experienced after a design basis LOCA condition, which is less than a 100°F temperature rise above ambient. In this event, the HPCI system becomes inoperable due to the loss of reactor steam pressure. Valve operability testing is performed under no flow, and ambient temperature conditions. Therefore, there are no conditions which could cause the thermal binding phenomenon to occur in this valve.

FCV-74-07 & 30 - RHR Minimum Flow Valves

These solid wedge gate valves are normally open and close when sufficient system flow in the injection flow path is developed. In the event the RHR system is operated in response to an accident, the torus water can heat up to approximately 193°F. These valves would be closed prior to the fluid temperature reaching this maximum value. In addition, these valves are located on branch lines and approximately 30 feet from the main process pipe, which separates these valves from any elevated process line temperature. The normal water temperature in the torus is 85°F. Therefore, the maximum temperature rise is less than 107.5°F, which would not be sufficient to induce thermal binding. Also, the temperature rise occurs after the minimum flow valves have closed. Since these valves are separated from the main process line and the fluid in the minimum flow branch line is stagnant, these valves would not be exposed to the higher temperature water. Therefore, they are not susceptible to thermal binding .

FCV-74-60, 61, 74, & 75 - RHR Drywell Spray Valves

These valves are normally closed and open under manual initiation of the containment (drywell) spray mode of RHR. These valves are also opened for valve operability testing. Testing of these valves is performed when the system is not operating and the water in this line is at ambient conditions. Therefore, these valves are not closed under any conditions which could cause thermal binding and induce a failure of these valves to open for their safety function.

FCV-73-44 - HPCI Injection Valve

This normally closed valve must open to perform its safety function upon HPCI system initiation. The HPCI system must be operable whenever the reactor is above 150 psig. The CST and Torus are the sources of water used for HPCI during system operation under both normal and accident conditions. This valve is stroke time tested during reactor operation every 3 months. There is no flow through these valves at the time of valve testing. This valve is physically remote from the downstream HPCI testable check valve and would not be exposed to elevated temperatures even with check valve leakage. Therefore, this valve is aligned to the closed position while at ambient temperature conditions. The only time that the injection valve could experience closure under elevated temperature conditions would be during shutdown of the HPCI system after post accident operation of the system. At that time the HPCI system and the injection valve would have performed its design basis function. This valve would not be closed until the injection function had been completed. Therefore, this valve is not exposed to conditions which would induce thermal binding which could prevent the valve from performing its safety function.

IV. SUMMARY / CONCLUSIONS

All safety related power operated gate valves in Unit 1 have been reviewed for potential susceptibility to the pressure locking and thermal binding phenomenon.

There is one valve (1-FCV-74-46 - RHR Loop Cross-Tie valve) in Unit 1 listed in Table 1 which will be removed from the system prior to Unit 1 restart and no evaluation was performed. There is one valve (1-FCV-71-59 - RCIC Vacuum Relief Isolation) in Unit 1 listed in Table 1 which will have the power removed from the valve prior to Unit 1 restart and no evaluation was performed.

There is one valve (1-FCV-73-16 - HPCI Steam admission valve) in Unit 1 which is susceptible to thermal binding. Prior to Unit 1 restart this valve will be replaced with a double disc valve of similar design as Unit 2 and 3. Two valves (1-FCV-75-09 & 37 - Core Spray I & II Min Flow valves) in Unit 1 will be replaced with double disc valves prior to Unit 1 restart. Double disc gate valves are not susceptible to thermal binding. The preceding evaluation assumes the double disc gate valves are in place.

Five safety related power operated gate valves will be modified prior to Unit 1 restart to preclude the potential for pressure locking. Reactor side disc face of the following five valves need to be modified by drilling ¼" hole in the disc face into the cavity between the disc faces to avoid pressure locking:

1-FCV-71-39 (RCIC Injection Valve);

1-FCV-74-53 and 1-FCV-74-67 (RHR LPCI Injection Valves); and
1-FCV-75-25 and 1-FCV-75-53 (Core Spray Outboard Injection Valves.

ENCLOSURE 2

TENNESSEE VALLEY AUTHORITY
BROWN FERRY NUCLEAR (BFN) UNIT 1

RESPONSE TO NRC GENERIC LETTER 95-07
PRESSURE LOCKING AND THERMAL BINDING
OF SAFETY-RELATED POWER-OPERATED GATE VALVES

COMMITMENT SUMMARY

TVA will replace, modify or remove the following valves prior to Unit 1 restart to resolve Generic Letter 95-07 concerns with pressure locking and thermal binding:

FCV-71-39 (RCIC Injection Valve);
FCV-71-59 (RCIC Vacuum Relief Isolation);
FCV-73-16 (HPCI Steam Admission Valve);
FCV-74-46 (RHR Loop Cross-Tie Valve);
FCV-74-53 (RHR LPCI Injection Valve);
FCV-74-67 (RHR LPCI Injection Valve);
FCV-75-09 (Core Spray-I Min Flow Valve);
FCV-75-25 (Core Spray Outboard Injection Valve);
FCV-75-37 (Core Spray-II Min Flow Valve); and
FCV-75-53 (Core Spray Outboard Injection Valve).