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W3F1-96-0013
A4.05
PR

February 13, 1996

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

Subject: Waterford 3 SES
Docket No. 50-382
License No. NPF-38
NRC Generic Letter 95-07

Gentlemen:

The NRC on August 17, 1995 issued Generic Letter 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves." The NRC requested that licensees provide the following information within 180 days of the date of the Generic Letter:

1. The susceptibility evaluation of operational configurations and further analyses performed in response to (or consistent with) the requested actions, as well as, the criteria for determining susceptibility to pressure locking or thermal binding.

2. The results of the susceptibility evaluation and any further analyses including a listing of the susceptible valves identified.

3. The corrective actions, or other dispositioning, (including completion schedule) for the valves identified as susceptible to pressure locking or thermal binding.

This letter provides the foregoing information in the attached report.

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Please contact me or Robert J. Murillo at (504) 739-6715, should there be any questions regarding this submittal.

Very truly yours,

W. H. Pendergrass
for

R.F. Burski
Director
Nuclear Safety

RFB/RJM/ssf
Attachment

cc: L.J. Callan, NRC Region IV
C.P. Patel, NRC-NRR
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N.S. Reynolds
NRC Resident Inspectors Office

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the matter of	)	
	)	
Entergy Operations, Incorporated	)	Docket No. 50-382
Waterford 3 Steam Electric Station	)	

AFF'DAVIT

William Harold Pendergrass, being duly sworn, hereby deposes and says that he is (Acting) Director, Nuclear Safety - Waterford 3 of Entergy Operations, Incorporated; that he is duly authorized to sign and file with the Nuclear Regulatory Commission the attached Response to NRC Generic Letter 95-07; that he is familiar with the content thereof; and that the matters set forth therein are true and correct to the best of his knowledge, information and belief.

William Harold Pendergrass
William Harold Pendergrass
(Acting) Director, Nuclear Safety - Waterford 3

STATE OF LOUISIANA	)
	) ss
PARISH OF ST. CHARLES	)

Subscribed and sworn to before me, a Notary Public in and for the Parish and State above named this 13TH day of FEBRUARY, 1996.

Steve E. Fc
Notary Public

My Commission expires WITH LIFE.

ENTERGY OPERATIONS

WATERFORD 3 STEAM ELECTRIC STATION

NRC GENERIC LETTER 95-07
180 DAY RESPONSE

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1.0 INTRODUCTION

The Nuclear Regulatory Commission issued Generic Letter 95-07: Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves to request that licensees perform evaluations of operational configurations of safety-related, power-operated gate valves for susceptibility to pressure locking and thermal binding and perform any needed evaluations or corrective actions.

Valve failures due to pressure locking and thermal binding have prevented safety-related systems from performing their required function. Binding of the valve disc in the closed position due to differential thermal contraction (i.e., thermal binding) or high pressure water trapped in the bonnet cavity (i.e., pressure or hydraulic locking) represent potential common mode failure mechanisms for these valves.

As part of the response to GL 95-07 the NRC requested that within 90 days of issuance of the generic letter, each licensee complete the following actions:

1. Perform a screening evaluation of the operational configurations of all safety-related power-operated (i.e., motor operated, air operated and hydraulically operated) gate valves to identify those valves that are potentially susceptible to pressure locking or thermal binding; and

2. Document a basis for the operability of the potentially susceptible valves or, where operability cannot be supported, take action in accordance with individual plant Technical Specifications.

In addition, the NRC requested that within 180 days of issuance of the generic letter, each licensee perform further analyses as appropriate, and take needed corrective actions (or justify longer schedules), to ensure that the susceptible valves identified are capable of performing their intended safety function(s) under all modes of plant operation, including test configuration.

The NRC requested that the following information be submitted within 180 days of issuance of the generic letter.

1. The susceptibility evaluation of operational configurations and further analyses performed in response to (or consistent with) the requested actions, as well as, the criteria for determining susceptibility to pressure locking or thermal binding.

2. The results of the susceptibility evaluation and any further analyses including a listing of the susceptible valves identified.

3. The corrective actions, or other dispositioning, (including completion schedule) for the valves identified as susceptible to pressure locking or thermal binding.

2.0 SCOPE

This report documents the status of the forty-eight (48) power-operated valves evaluated under GL 95-07. These valves represent all safety-related power-operated gate valves at Waterford 3. Appendix I provides a listing of all GL 95-07 valves, operators, gate types and function.

The evaluations encompass all system modes of operation which are within the plant's design basis. The evaluations were completed through review of the Waterford 3 system operating and emergency operation procedures, the system design basis documents, the system flow diagrams, surveillance testing and maintenance evolutions. The scenarios reviewed bound those conditions during emergency and normal system operations, maintenance and testing with the exception of system hydros which would be governed by PORC approved special test procedures. These procedures typically include controls for returning equipment back to service.

Each valve evaluated was categorized under hydraulic locking, boiler effect or thermal binding, as Not Susceptible, Non-Priority Susceptible or Priority Susceptible. The difference between Non-Priority and Priority Susceptible is whether the valve has a safety function to open. As stated during the NRC sponsored workshop on GL 95-07 held at Region 4, valves witnout an active safety function to open are not considered part of the scope of GL 95-07.

3.0 REFERENCES

1. NRC Generic Letter 95-07, Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves

2. NUREG 1275 Volume 9, Operating Experience Feedback Report - Pressure Locking and Thermal Binding of Gate Valves

3. INPO SOER 84-7 dated December 14, 1984.

4. IE Circular 77-05 dated March 29, 1977.

5. AEOD/S92-07, "Special Study, Pressure Locking and Thermal Binding of Gate Valves,".

6. W3 SES NRC Generic Letter 95-07 Screening Document.

4.0 THERMAL BINDING & BONNET PRESSURIZATION EVALUATION CRITERIA

4.1 Thermal Binding Evaluation Criteria

Piping Thermal Expansion Loads are generally not significant and in fact are not discussed as a failure mechanism in SOER 84-7, AEOD/S92-07, NUREG 1275 Vol. 9 or GL95-07. In addition, no documented industry gate valve failures presented in Information Notice 92-26, SER 20-84, SER 77-83 and SER 8-88 have been attributed to this failure mechanism. Therefore, review of Waterford 3 gate valves for piping thermal expansion loads is not necessary.

Valve Thermal Expansion Loads (Stem Elongation) may create an excessive closing force which can contribute to thermal binding. This closing force will tend to drive the disc more tightly into the seat and on cooling, the Thermal Contraction Load (Body Contraction) effects may be increased. These phenomena were evaluated concurrently using the criteria defined below.

A. System Temperature: Valves located in systems with operating temperatures of 200°F or less are not considered to be susceptible to thermal binding. The dividing point between a hot and cold system has been selected as 200°F based upon past evaluations of thermal binding for Limerick, Perry, Susquehanna and Grand Gulf nuclear power stations. INPO confirmed the acceptability of the 200°F dividing line during the Susquehanna evaluation (GAI/PP&L Study ME-277 Rev. 0). The line temperatures used for this evaluation were the maximum service condition values specified in the Valve and Line List, Operations Procedures or the System Temperature Histograms in Ebasco Nuclear Safety Class 1 Piping Specification.

B. Disc Configuration: Double-disc type gate valves are not susceptible to thermal binding. The wedging mechanism between the discs collapses as the stem rises allowing the discs to move inward away from the seats. This allows the discs to be raised regardless of system temperatures.

C. Potential for Movement: Valves that have power removed or are in some other way disabled or locked in position were also considered for thermal binding since they may be expected to functionally change positions post-accident, for normal system operations and during plant maintenance and testing evolutions. Normal valve position was determined through the use of the P&ID's and operation procedures.

D. Valve Function: Thermal binding occurs when valves are closed hot and allowed to cool before re-opening. Plant procedures, system design criteria and system operating instructions were reviewed to determine valve functions and system operating modes. Valves without an active safety function to open do not affect the design basis plant safe shutdown if they are bound shut, and are outside the scope of GL 95-07.

4.3 Hydraulic Lc g Evaluation Criteria

A. Disc Configuration: Solid-wedge gate valves were not considered for hydraulic locking. It is not possible for the faces of a solid wedge to be pushed in opposite directions against both seating surfaces.

B. Bonnet Relief: Valves with a bonnet drain, a bonnet relief valve or a small hole through the upstream side of the valve bridge or valve disc are not considered for hydraulic locking. Any pressure that leaks into the bonnet area has an escape path that prevents hydraulic locking. If a bonnet drain is provided, it must be connected to an open piping path (drain piping installed and any in-line valves are open) to be considered not susceptible to hydraulic locking. The existence of open bonnet drain paths were determined by use of P&ID's, valve drawings or discussions with system engineers.

C. Potential for Movement: Valves with power removed or which are in some other way disabled or locked in position were also considered for hydraulic locking since they may be expected to functionally change positions post- accident, for normal system operations and during plant maintenance and testing evolutions. They were evaluated for potential damage during valve stroking. Normal valve position was determined through the use of P&ID's and operation procedures.

D. Valve Function: Hydraulic locking can occur when a closed flex-wedge or double-disc gate valve is required to open after a differential pressure condition has allowed higher pressure fluid into the bonnet cavity. Plant procedures and system design criteria were reviewed to determine valve functions. Valves that do not have an active safety function to open do not affect the design basis plant safe shutdown if they are bound shut, and are outside the scope of GL 95-07.

E. Line Pressure: If the pressure in the piping upstream or downstream of the valve is greater than or equal to the pressure in the valve bonnet (valve bonnet pressure resulting from preceding system conditions) prior to opening the valve, it was not considered for pressure locking. The reason for this is that the line pressure will offset the pressure trapped between the faces of the disc resulting in a maximum differential pressure across one face of the disc. The upstream piping pressure at opening was determined by using the plant operating procedures.

4.4 Boiler Effect Evaluation Criteria

A. Disc Configuration: Solid-wedge gate valves are not considered for boiler effect. It is not possible for the faces of a solid wedge to be pushed in opposite directions against both seating surfaces.

B. Gas Systems: Valves which are part of gas systems were not considered for liquid entrapment (Boiler Effect) if their valve stems were oriented above the horizontal. It is highly unlikely that the valve bonnet would contain liquid with these orientations. Without the bonnet containing a significant amount of liquid, it is not possible to buildup the high bonnet pressures that would arise from heating an incompressible fluid.

C. Bonnet Relief: Valves with a bonnet drain, a bonnet relief valve or a small hole through the upstream side of the valve bridge or valve disc were not considered for boiler effect since any water that leaks into the bonnet area will have an escape path that will prevent any pressure buildup. If a bonnet drain is provided, it must be connected to an open piping path (drain piping installed and any in-line valves are open) to be considered not susceptible to boiler effect. The existence of an open bonnet drain path was determined by use of the P&ID's, valve drawings or discussions with system engineers.

D. Potential for Movement: Valves with power removed or which are in some other way disabled or locked in position were also considered for boiler effect since they may be expected to functionally change positions post-accident, for normal system operations and during plant maintenance and testing evolutions. Normal valve position was determined through the use of P&ID's and operation procedures.

E. Valve Function: Boiler effect occurs when a fluid-filled or partially filled bonnet is heated. The resulting pressure may prevent the valve from reopening. Procedures, system design criteria and system operating instructions were reviewed to determine valve functions. Valves without an active safety function to open do not affect the design basis plant safe shutdown if they are bound shut, and are outside the scope of GL 95-07.

F. Valve Heat-up: Valves which have water in their bonnets can experience the boiler effect phenomenon only when the trapped water is heated. For this criteria to apply, the valve must be in the closed position when the heat source is applied. The following potential heat sources were considered for this evaluation.

The temperature increase may be a result of close proximity to another heat source, such as, heat conduction through the piping from a hot adjacent branch line. In addition, the surrounding air temperature can increase due to plant events such as a LOCA. This will heat the bonnet liquid and could cause locking.

Additionally, if a gas or steam system valve is installed with the stem orientation either horizontal or below the horizontal, liquid could collect in the valve bonnet. If a valve in this configuration has a bonnet completely filled with liquid while closed and experiences a temperature increase, the resultant pressurization could prevent the valve from re-opening.

Normal ambient conditions: Normal ambient conditions are typically not expected to cause bonnet pressurization since the normal ambient temperature swings are small enough and gradual enough not to cause binding. There are not any building areas where the maximum normal ambient temperatures are excessive and may cause boiler effect binding.

Accident ambient conditions: These conditions could potentially impact the fluid if they elevate the area temperature to a point more than a couple of degrees above the normal area temperatures for a significant period of time (several hours) while the valve is closed.

Fluid Temperatures: If the closed valve is located in a branch of a hot system, there is the potential that the heat will conduct through the fluid or the piping. The piping temperature histograms provide the thermal gradient that bound the temperatures utilized in the evaluations.

5.0 EVALUATION RESULTS

The hydraulic locking screening indicates that there are

- eight (8) Priority Susceptible valves,
- six (6) Non-Priority Susceptible valves and
- thirty-four (34) Not Susceptible valves.

The screening for boiler effect indicates that there are

- no Priority Susceptible valves,
- four (4) Non-Priority Susceptible valves and
- forty-four (44) Not Susceptible valves.

The screening for thermal binding indicates that there are

- no Priority Susceptible valves,
- ten (10) Non-Priority Susceptible valves and
- thirty-eight (38) Not Susceptible valves.

The following table contains a listing of the Priority and Non-Priority Susceptible valves. Blank spaces indicate that the valve is Not Susceptible to the associated phenomenon.

Valve UNID	Hydraulic Locking	Boiler Effect	Thermal Binding
BD-102A		Non-Priority	Non-Priority
BD-102B		Non-Priority	Non-Priority
BD-103A		Non-Priority	Non-Priority
BD-103B		Non-Priority	Non-Priority
FW-184A	Non-Priority		
FW-184B	Non-Priority		
SI-120A			Non-Priority
SI-120B			Non-Priority
SI-121A			Non-Priority
SI-121B			Non-Priority
SI-125A	Priority		
SI-125B	Priority		
SI-135A	Non-Priority		Non-Priority
SI-135B	Non-Priority		Non-Priority
SI-219A	Non-Priority		
SI-219B	Non-Priority		
SI-331A	Priority		
SI-331B	Priority		
SI-332A	Priority		
SI-332B	Priority		
SI-412A	Priority		
SI-412B	Priority		

The valves that are Non-Priority are outside the scope of GL 95-07, and these valves require no further evaluation within the scope of this generic letter.

Valves SI-331A(B), SI-332A(B), SI-125A(B) and SI-412A(B) are Priority Susceptible to hydraulic locking. SI-331A(B) and SI-332A(B) are Safety Injection Tank (SIT) discharge isolation valves and are susceptible to hydraulic locking only during a Loss of Cooling Accident while in Mode 4. Although unlikely, this scenario can occur during both heat up and cool down. These valves are normally open during Modes 1, 2 and 3 with power removed and are closed in Mode 4 at an RCS pressure no greater than 377 psig. The SIT pressure in Mode 4 is maintained between 235 and 300 psig (plus elevation head). In the event of a rapid depressurization of the RCS, while in this configuration, the valves would receive an Safety Injection Actuation Signal (SIAS) to open. The rapid depressurization could cause 377 psig to be trapped in the valve bonnet with the highest upstream pressure being no greater than 326 psig in the SITs.

SI-125A(B) and SI-412A(B) are the Shutdown Cooling heat exchanger isolation valves. These valves are susceptible to hydraulic locking following surveillance testing of the Low Pressure Safety Injection and Containment Spray pumps.

Operability of all Priority Susceptible valves was demonstrated by Engineering Calculation EC-M95-011, which uses the Entergy "hub" method. The calculation shows that all eight valves are capable of overcoming the increased unseating thrust associated with hydraulic locking. This calculation uses a sliding coefficient of friction for stellite on stellite of 0.40. The calculated additional thrust due to the hydraulic locking condition is added to the "As Left" static unseating thrust. The resulting total required thrust is compared to the maximum allowable thrust which is the lower of either the valve limiting component thrust or the actuator capability at reduced voltage. For conservatism, this calculation does not use piston effect to reduce the total required thrust.

The results indicate that all Priority Susceptible valves are capable of opening against calculated hydraulic locking loads. Therefore, there is no operability concern.

6.0 WATERFORD 3 ACTION PLAN

The A-train Shutdown Cooling Heat Exchanger inlet isolation valve, SI-125A, will be modified by using the existing abandoned packing leak-off line, which currently provides constant fluid communication with the valve bonnet, as a bypass line to the upstream piping. The B-train Shutdown Cooling Heat Exchanger inlet isolation valve, SI-125B, has an operable packing leak-off line which will be eliminated and used as a bypass line. This valve will be repacked to allow constant fluid communication between the bonnet and leak-off line. This work will be completed by the end of the Refuel 8 outage currently scheduled for the spring of 1997.

The remaining six Priority Susceptible valves will not be modified based on the results of Engineering Calculation EC-M95-011. This calculation shows that all eight Priority Susceptible valves have sufficient margin and are capable of overcoming the increased unseating thrust associated with hydraulic locking. In addition, none of the valves are included in Waterford 3 Probabilistic Safety Analysis model, as determined from calculation EC-S93-008, because these valves do not affect events which contribute to core damage frequency.

Waterford 3 reserves the right to alter these plans. In the event additional information becomes available to the industry, Waterford 3 will re-evaluate the long term operability of its valves and the need to make modifications. In addition, future operational procedure changes that would eliminate the conditions that lead to pressure locking may eliminate the need for any valve modifications.

APPENDIX I

GL 95-07 Gate Valve Listing			
Valve UNID	Operator	Gate Type	Description
BAM-113A,B	Motor	Solid Wedge	Boric Acid Gravity Feed
BAM-133	Motor	Solid Wedge	Emergency Boration
BD-102A,B	Air	Flexwedge	Steam Generator Blowdown Inside Containment Isolation
BD-103A,B	Air	Flexwedge	Steam Generator Blowdown Outside Containment Isolation
CS-125A,B	Air	Sluice	Containment Spray Header Isolation
CVC-183	Motor	Solid Wedge	Volume Control Tank Outlet Isolation
CVC-507	Motor	Solid Wedge	RWSP to Charging Pumps Suction Isolation
FW-184A,B	Hydraulic	Double Disc	Feedwater Isolation
MS-124A,B	Hydraulic	Double Disc	Main Steam Isolation
MS-401A,B	Motor	Flexwedge	EFW Pump AB Turbine Steam Supply
SI-120A,B	Motor	Flexwedge	SI Recirculating Header to RWSP Upstream Isolation
SI-121A,B	Motor	Flexwedge	SI Recirculating Header to RWSP Downstream Isolation
SI-125A,B	Motor	Flexwedge	Shutdown Cooling Heat Exchanger Inlet
SI-135A,B	Motor	Flexwedge	Shutdown Cooling Warm-up
SI-219A,B	Motor	Flexwedge	HPSI Discharge Header Orifice Bypass
SI-301	Air	Double Disc	Hot Leg Injection Leakage Drain
SI-302	Air	Double Disc	Hot Leg Injection Leakage Drain
SI-303A,B	Air	Double Disc	Safety Injection Tank 1A,B Leakage Drain
SI-304A,B	Air	Double Disc	Safety Injection Tank 2A,B Leakage Drain
SI-331A,B	Motor	Flexwedge	Safety Injection Tank 1A,B Outlet Isolation
SI-332A,B	Motor	Flexwedge	Safety Injection Tank 2A,B Outlet Isolation
SI-343	Air	Double Disc	Safety Injection Tank Drain Header to RWSP Isolation
SI-401A,B	Motor	Flexwedge	Shutdown Cooling Upstream Suction Isolation
SI-405A,B	Hydraulic	Flexwedge	Shutdown Cooling Suction Inside Containment Isolation
SI-407A,B	Motor	Flexwedge	Shutdown Cooling Suction Outside Containment Isolation
SI-412A,B	Motor	Flexwedge	Shutdown Cooling Heat Exchanger Outlet Isolation
SI-502A,B	Motor	Solid Wedge	Hot Leg Injection Isolation