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U. S. Nuclear Regulatory Commission
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Subject: Arkansas Nuclear One - Units 1 and 2
Docket Nos. 50-313 and 50-368
License Nos. DPR-51 and NPF-6
Generic Letter 95-07, 180-Day Response

Gentlemen:

On August 17, 1995, the NRC 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 performed in response to (or consistent with) 180-day Requested Action 1, and the further analysis performed in response to (or consistent with) 180-day Requested Action 2, including the bases or criteria for determining that valves are, or are not, susceptible to pressure locking or thermal binding;

2. The results of the susceptibility evaluation and the further analyses referred to in 1 above, including a listing of the susceptible valves identified; and

3. The corrective actions, or other dispositioning for the valves identified as susceptible to pressure locking or thermal binding, including (a) equipment or procedural modifications completed and planned (including the completion schedule for such actions); and (b) justification for any determination that particular safety-related power-operated gate valves susceptible to pressure locking or thermal binding are acceptable as is.

The requested information is provided in the attached report. Should you have questions or comments, please contact me.

A056
1/1

Very truly yours,

for Dwight C. Mims
Director, Licensing

DCM/dwb
Attachment

To the best of my knowledge and belief, the statements contained in this submittal are true.

SUBSCRIBED AND SWORN TO before me, a Notary Public in and for Logan **County and the State of Arkansas, this** 13th **day of** February**, 1996.**

Sandy Siebenmorgen
Notary Public
My Commission Expires May 11, 2000

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ARKANSAS NUCLEAR ONE

EVALUATION OF SAFETY-RELATED POWER OPERATED GATE VALVES FOR THERMAL BINDING AND HYDRAULIC LOCKING IN RESPONSE TO USNRC GENERIC LETTER 95-07

Table of Contents

1.0 INTRODUCTION

Generic Letter (GL) 95-07: Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves requests 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.

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, air , solenoid and hydraulically operated) gate valves to identify those valves that are potentially susceptible to pressure locking or thermal binding.

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.

Arkansas Nuclear One (ANO) responded to the 90-Day request in a letter to the NRC dated October 16, 1995 (0CAN109509). Within 180 days from the date of issuance of GL 95-07 each licensee is requested to implement and complete the following items:

1. Evaluate the operational configurations of safety-related power operated gate valves to identify valves that are susceptible to pressure locking and thermal binding.

2. Perform further analyses, as appropriate, and take needed corrective action(s) to ensure that the susceptible valves identified in 1 above are capable of performing their intended safety function(s) under all modes of plant operation, including test configuration.

Generic Letter 95-07 requested each licensee to provide a summary description of the following:

1. The susceptibility evaluation of operational configurations performed in response to 180-day Requested Action 1, and the further analyses performed in response to 180-day Requested Action 2, including the bases or criteria for determining that valves are or are not susceptible to pressure locking and thermal binding.

2. The results of the susceptibility evaluations and the further analyses referred to in 1 above, including a list of the susceptible valves identified.

3. The corrective actions, or other dispositioning, for the valves identified as susceptible to pressure locking and thermal binding, including: (a) equipment or procedure modifications completed and planned with associated schedule; and (b) justification for any determination that particular safety-related power operated gate valves susceptible to pressure locking and thermal binding are acceptable as is.

The response to the 180-Day Requested actions is contained herein.

2.0 SCOPE

This report documents the results of evaluations performed for pressure locking and thermal binding per GL 95-07 for 214 ANO Unit 1 and 2 power-operated, safety-related gate valves. These valves represent all safety-related power-operated gate valves at ANO.

The evaluation encompasses all system modes of operation within the plant's design basis. The evaluations were conducted by reviewing ANO system operating and emergency operating procedures, system design basis documents, piping and instrumentation drawings, 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 hydrostatic testing, that would be governed by approved special test procedures. These procedures typically include controls for returning equipment back to service.

Each valve was categorized under hydraulic locking, boiler effect or thermal binding as Not Susceptible, Potentially Susceptible, and Susceptible. Changes to any actions herein will be made consistent with ANO's Commitment Change Process which is based on the NEI document, "Guideline for Managing NRC Commitments," which was recently endorsed by the NRC.

3.0 GATE VALVE SELECTION CRITERIA

Of the total set of 214 valves, 23 were considered to be not susceptible to binding or locking. For instance, Unit 1 & 2 sluice gate valves were removed from further consideration because they have no bonnet and do not wedge the gate into the seats. Pressure locking or thermal binding of these valves is not possible. The list was further screened to 39 potentially susceptible valves by considering only valves with an active safety function to open. Though not considered active safety related valves, ANO-2 "once through cooling" valves, 2CV-4698-1 and 2CV-4740-2, and the ANO-1 electromatic relief valve (ERV) block valve, CV-1000, were added to the population of potentially susceptible active valves, based on information provided in GL 95-07 regarding power-operated relief valves (PORVs) and associated block valves. Fourteen (14) additional normally open valves were added to the scope to address concerns related to pressure locking or thermal binding concerns during surveillance testing. Appendix 1 lists the valves included in the ANO review scope. This screening was based primarily on data obtained during the GL 89-10 program, but also included interviews with operations, design and system engineering and maintenance personnel. A total of 56 valves were identified as potentially susceptible to binding or locking.

Appendix 2 describes the logic by which the valves were reviewed for susceptibility to binding or locking. Evaluations for pressure locking effects are subdivided into evaluations for 1) hydraulic locking, 2) ambient temperature induced (environmental) boiler effect locking, and 3) branch line induced (proximity) boiler effect locking. The evaluation methodology is described in Section 4.0.

Section 5.0 provides a listing of valves susceptible to binding or locking, and the corrective actions taken or proposed by ANO. Since a valve can be subject to more than one effect, several actions could be proposed for a single valve. Valves, which could not be shown to be in full compliance with the design basis were evaluated for operability through the ANO Condition Reporting process. A total of nine (9) valves were determined to be susceptible to pressure locking. These valves were determined to be degraded but operable. Two of the valves were modified during the last refueling outage. Modifications are planned for six (6) valves during the next respective unit's refueling outage. For ANO-1, two (2) valves will be modified by the end of the next refueling outage (1R13). For ANO-2, four (4) valves will be modified by the end of the next refueling outage (2R12).

One (1) of the nine (9) susceptible valves was determined acceptable based on procedural controls.

In addition to any pressure locking modifications, eleven (11) valves have procedural changes in place to mitigate the potential for thermal binding or pressure locking.

The evaluations are summarized in Section 6.0 of this report.

4.0 THERMAL BINDING AND PRESSURE LOCKING EVALUATION METHODOLOGY

The valves were evaluated utilizing the methodology discussed below and presented as logic diagrams in Appendix 2. The absence of a history of thermal binding or pressure locking did not preclude the valve from being evaluated. For example, as routine maintenance is performed on valves, the pressure-tightness of the valves may be increased. In such cases, valves which have not experienced hydraulic locking problems in the past because the bonnet was leaking, may become susceptible. Unless a valve has successfully opened cold, without damage, after closure at maximum potential temperature, the possibility of thermal binding was also considered to exist.

4.1 Safety Function

All power-operated, safety-related, active gate valves were considered for binding/locking including valves with the power removed from them or in some other way disabled, valves locked in position, and keylocked valves. The first screening applied to the population of power-operated, safety-related gate valves was to eliminate those which could not physically lock or bind. Next, those valves that did not have an active safety function to open from a closed position were eliminated, based on the logic shown in Table 1 on the following page. Valves in the decay heat removal and shutdown cooling systems were eliminated since both ANO units are Hot Shutdown licensed plants. The ability to further cool the reactor coolant system using decay heat or shutdown cooling is not a safety-related function. Neither the decay heat or shutdown cooling systems are required to mitigate a design basis event.

Three valves that do not have an active safety function to open at ANO, the Unit-1 ERV block valve and the Unit-2 once-through cooling valves, were added to the population because of concerns with PORVs, Generic Letter 90-06 and Generic Issue 94 (low temperature over pressure protection [LTOP]). Fourteen (14) additional normally open valves were added to address concerns related to pressure locking or thermal binding during surveillance testing. These valves all have a safety direction of open; however, they are periodically closed for surveillance testing. To ensure that they will perform their safety function when called upon, they were evaluated for the potential to thermally bind or pressure lock during the surveillance test. The listing in Appendix 1 tabulates these valves. Of the 191 physically potentially susceptible valves, 56 were found to require evaluation using this first pass screening. During this process, the valves were checked by knowledgeable system/design engineers and operators to determine if the normal and safety direction information were correct. Calculations 91-E-0091-01, Design Control Logic Review of Unit 1 Motor Operated Valves and, 91-E-0091-02, Design Control Logic Review of Unit 2 Motor Operated Valves, were used extensively in these reviews. These reviews were augmented by research of System Operating and Emergency Operating Procedures, the Upper Level Document for the system, the System Training Manual and the Safety Analysis Report, where necessary. The 56 valves which received individual pressure locking and thermal binding reviews are presented in Section 6.0.

Table 1

NORMPOSIT	SAFETY DIR	ACTIVE FUNCTION TO OPEN?
OPEN	OPEN	YES (Surveillance Testing)
OPEN	CLOSED	NO
CLOSED	CLOSED	NO
OPEN/CLOSED	CLOSED	NO
CLOSED	OPEN	YES
OPEN/CLOSED	OPEN	YES
CLOSED	OPEN/CLOSED	YES
OPEN/CLOSED	OPEN/CLOSED	YES
OPEN	OPEN/CLOSED	YES

4.2 Thermal Binding Evaluation Criteria

Thermal contraction loads (body contraction) and valve stem thermal expansion (stem elongation) effects were evaluated concurrently using the criteria defined below.

A. *System Temperature*: Valves located in systems with operating temperatures of 200°F or less were exempted from consideration of thermal binding. 200°F was chosen as the dividing point between a hot and cold system, based upon past evaluations of thermal binding for the Limerick Generating Station, the Perry Nuclear Power Plant and the Susquehanna Steam Electric Station. INPO confirmed the acceptability of the 200°F dividing line during the Susquehanna evaluation. The line temperatures that were used during this evaluation were the maximum service condition values specified in ANO's line lists M-2083 R20 and M-83 R19.

B. *Disc Configuration*: Valve disc identification data identifying whether the valve discs were of solid wedge, flexible wedge, or double-disc parallel-seat construction was obtained. Double disc type gate valves are not considered 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 permits the discs to be raised regardless of the system temperatures. For the purposes of this evaluation, both solid wedge and flexible wedge valves will be assumed to be susceptible to thermal binding.

Piping thermal expansion loads are generally not significant and, in fact, are not discussed as a failure mechanism in SOER 84-7 or AEOD/S92-07. In addition, no documented industry gate valve failures attributed to piping thermal expansion were noted in Information Notice 92-26, SER 20-84, SER 77-83 and SER 8-88. Therefore, a review of ANO gate valves for piping thermal expansion loads was not done.

4.3 Hydraulic Locking Evaluation Criteria

The gate valve hydraulic locking phenomenon was evaluated using the following methods:

A. *Disc Configuration*: Solid-wedge gate valves were exempted from consideration for hydraulic locking, because it is not possible for the faces of a solid wedge to be pushed in opposite directions against both seating surfaces. Valve disc identification data was obtained stating whether the valve discs were of solid wedge, flexible wedge, or double-disc parallel-seat construction. The Type 1 valve disc (see Figure 1) is occasionally designated on valve drawings as flexible wedge but in reality offers limited flexibility. For the purposes of this evaluation, all flexible wedges were assumed as solid wedge for the thermal binding evaluation and as flexible wedge for the hydraulic locking evaluation. This assures conservatism in the evaluation.

B. *Bonnet Relief*: Valves with a bonnet drain, a bonnet relief valve or a hole through either side of the valve bridge or valve disc were exempted from consideration for hydraulic locking. This is acceptable because any pressure that leaks into or is trapped in the bonnet area will have an escape path to prevent hydraulic locking. If a bonnet drain was provided, it must have been connected to an open piping path (drain piping installed and in line valves open) to exempt the valve from consideration.

C. *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, the line pressure will offset the pressure trapped between the faces of the disc. This will result in a maximum differential pressure across a single face of the valve disc no greater than those analyzed in the existing Generic Letter 89-10 differential pressure calculations. The upstream and downstream piping pressures at opening will be determined using system/plant procedure reviews.

Results of these evaluations are provided in Section 6.0, Table 2.

4.4 Boiler Effect Evaluation (Environmental and Proximity)

Gate valves were screened for susceptibility using the following criteria:

A. *Gas Systems*: Valves which are part of gas or steam systems were not considered for boiler effect if their valve stems were oriented above the horizontal. It is highly unlikely that the valve bonnet contains liquid in these orientations. Unless the bonnet contains a significant amount of liquid, it is not possible to build up the high pressures in the bonnet that arise from heating an incompressible fluid. If the local piping configuration will not collect condensate and the valve stem is horizontal, then the valve was not considered capable of collecting sufficient liquid for boiler effect.

B. *Bonnet Relief*: Valves with a bonnet drain, a bonnet relief valve or a hole through either one side of the valve bridge or the valve disc were exempted from consideration for boiler effect locking, because any pressure that leaks into the bonnet area will have an escape path to prevent locking. If a bonnet drain is provided, it must be connected to an open piping path (drain piping installed and in line valves open) to exempt the valve from consideration.

C. *Valve Heat-up*: Valves which have water in their bonnets experience the boiler effect phenomenon only when the trapped water is heated. For this criterion to apply, the valve must be in the closed position when the heat source is applied. The potential heat sources that were considered for this evaluation are listed below.

- Normal ambient conditions: Normal ambient conditions were typically not expected to cause bonnet pressurization since the normal ambient temperature swings are small enough and gradual enough not to cause binding. If binding were to occur, the condition would become apparent during periodic system surveillance testing and would be corrected.

- Accident ambient conditions: Accident ambient conditions potentially impact the fluid if they elevate the area temperature around a closed valve for a significant period of time (several hours) before the valve must open (environmental boiler effect). Valves which are required to open within minutes of an accident would not be impacted by the elevated ambient conditions and were not evaluated. Accident ambient conditions were determined from ANO Technical Standard NES-13, "Environmental Qualification - Environmental Service Conditions," and its associated sources.

- Fluid Temperatures: If the closed valve is located in a stagnant branch of a hot system, there is the potential that heat will be conducted through the fluid and/or the piping (proximity boiler effect). As the distance from the hot piping increases, the heat lost to the atmosphere increases and the potential for bonnet pressurization decreases. Based on thermal gradient calculations for similar nuclear power plant applications, 20 feet was used as the cutoff beyond which the heat input to the bonnet would be insignificant. This 20 foot distance must be outboard of another closed valve, a vertical drop of piping, or a restricting orifice so convection currents in the fluid are not created (see Figure 2).

The maximum theoretical valve internal pressure due to "boiler effect" can be determined by the Bulk Modulus of Elasticity Equation [1] or by interpolation of specific volume data from the Steam Tables:

$$Pressure_{Max} = 319,000\ [(V_{Temp\text{-}hot} - V_{Temp\text{-}cold}) / V_{temp\text{-}cold}]$$

Where: $V_{temp\text{-}hot}$ = Specific volume of water at the hot temperature as found in the Saturated Steam Table (Temperature).

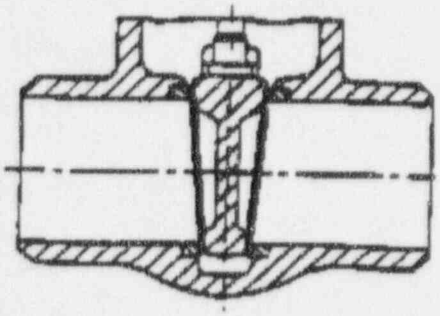
$V_{temp\text{-}cold}$ = Specific volume of water at the cold temperature as found in the Saturated Steam Table (Temperature).

D. *Disc Configuration*: Solid-wedge gate valves were exempted from consideration for boiler effect locking, because it is not possible for the faces of a solid wedge to be pushed in opposite directions against both seating surfaces. The Type 1 valve disc (see Figure 1) is occasionally designated on valve drawings as flexible wedge but in reality offers limited flexibility. For the purposes of this evaluation, all flex wedges, including Type 1, were assumed as solid wedge for the thermal binding evaluation and as flexible wedge for the boiler effect locking evaluation for conservatism.

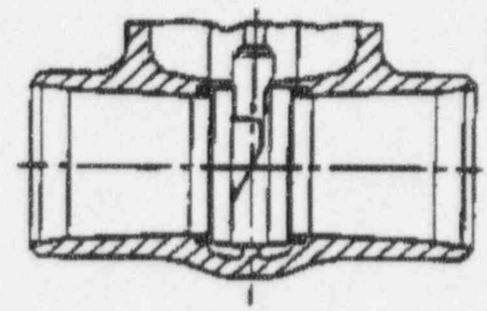
[1] Reference Standard Handbook for Mechanical Engineers, Eighth Edition, pages 3 - 35

Figure 1

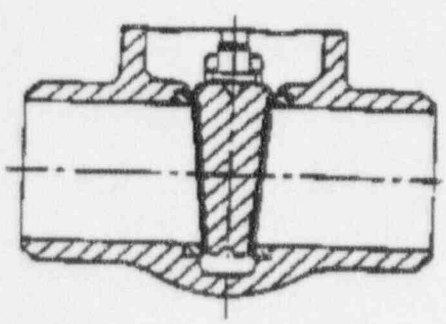
GATE VALVE DISC CONFIGURATIONS



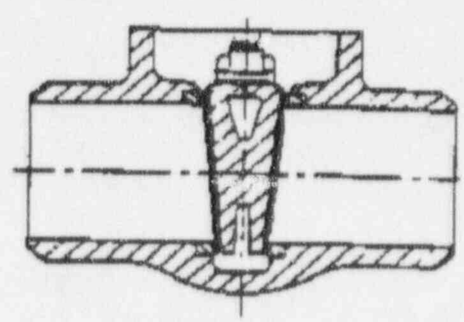
Solid Wedge



Double Disc,
Parallel Seat



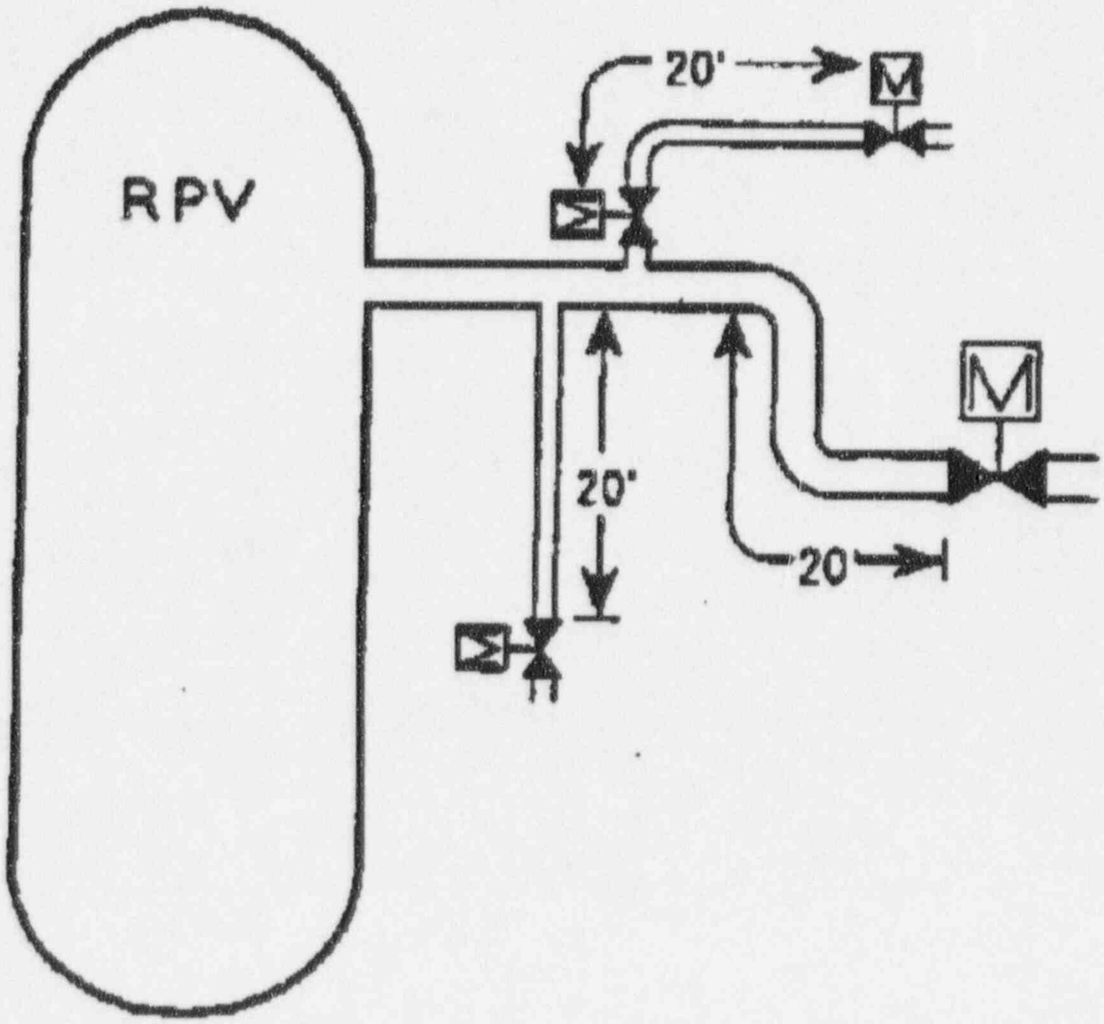
Type 1 Flexible Wedge



Type 2 Flexible Wedge

Figure 2

THERMAL CONDUCTION



4.5 Entergy "Hub" Analysis

Valves not eliminated from consideration by the above screening for pressure locking were further evaluated using the Entergy "Hub" analysis method (see Appendix 3).

4.6 Surveillance Testing

If a system (train) is to be considered operable during the conduct of a surveillance test, then safety-related valves in the system (train) must be capable of repositioning, as necessary, in response to an engineered safeguards signal. To assure that these systems remain operable at ANO, safety-related power-operated normally open valves with a safety position of "Open", that are closed during a surveillance test were evaluated for susceptibility to pressure locking or thermal binding during the test. Because of the short time during the test that the valves are actually closed, thermal binding was not considered to be a concern. The valve would not have sufficient time to change temperature by more than a few degrees. Therefore, no solid disk valves were considered for thermal binding or pressure locking during surveillance testing. A listing of the flexible wedge valves evaluated for pressure locking is shown in Appendix 1.

5.0 SUMMARY AND RESULTS

This section summarizes valves determined to be susceptible to pressure locking/thermal binding. Evaluations and/or corrective actions taken to resolve binding or locking concerns are listed.

Valve required thrust values were determined by utilizing the "Hub" analysis method (see Appendix 3) developed at the Grand Gulf Nuclear Station. The required thrust values were compared to the weak link and operator capability. Conservative design basis assumptions were used as inputs to the calculation of expected margin. A test performed by Wyle Laboratories demonstrated good agreement between the required force predicted by the "Hub" analysis and the required thrust to open a test valve.

The probabilistic safety assessment (PSA) ranking process utilized for GL 95-07 was similar to the process used in ranking motor operated valves (MOVs) for GL 89-10. The subject MOVs were initially placed into one of four priority categories based on PRA analyses: high, medium, low, and low-low (see Appendix 1).

The PSA ranking process involved a series of "screening" calculations using the existing ANO IPE/PSA models. Because these priorities were established in a sequential process, they will be defined in the same order as they were assessed.

High — High Priority MOVs were identified in the first screening. High Priority MOVs are those which have a single Functional Failure Mode (FFM) which, when assumed to occur (i.e., set to TRUE), doubles the nominal core damage frequency (CDF). Thus, the given failure results in a Risk Achievement Worth (RAW) which is equal to or greater than 2.0. The RAW value is defined as the CDF calculated with the MOV FFM failed divided by the nominal CDF.

Low-Low The Low-Low Priority MOVs were identified in the second screening. Low-Low Priority MOVs are those whose combined FFMs, which when assumed to occur concurrently (i.e., all set to TRUE), result in a CDF which is less than twice the nominal CDF.

Low The Low Priority MOVs were identified in the third screening. Low priority valves are those whose combined FFMs, which when all are assumed to have a bounding high failure probability (i.e., all set to 8.7 E-2), result in a CDF which is less than twice the nominal CDF.

Medium The Medium priority MOVs were identified in the last screening. Medium Priority MOVs are those which are not in either the High, Low-Low, or Low categories.

The following valves were determined to be susceptible to pressure locking or thermal binding:

Pressurizer ERV Isolation Valve **CV-1000**

A. Susceptible to *Thermal Binding*
Corrective Action:

To eliminate thermal binding as a concern, when CV-1000 has been isolated at normal operating temperatures, plant cooldown procedures have been revised to require that CV-1000 be opened at the start of the cooldown and left open. As an alternative to this, the valve is allowed to be cycled approximately every 100 °F during the cooldown to LTOP conditions.

B. Susceptible to *Environmental & Prox. Boiler Effect*
Corrective Action:

Procedural heatup guidance has been established to require that CV-1000 remain open following steam bubble formation. The valve can be opened and closed while the plant is at normal operating temperature without declaring it inoperable. "Operability" of the valve is not required as part of the ANO-1 licensing basis, since the valve has no active credited safety function. The valve is part of a redundant RCS vent path as described in ANO-1 Technical Specification 3.1.1.7.

LPI/DH Loop Isolation Valves **CV-1400, CV-1401**

A. Susceptible to *Thermal Binding*
Corrective Action

The operating procedures have been revised to add a caution stating that the valves should remain open above 200° F, since they are potentially susceptible to thermal binding. If they are closed while above 200° F, an engineering evaluation is required.

RB Sump Isolation Valves	**CV-1405, CV-1406**
A. Susceptible to *Thermal Binding*	
Corrective Action:	To preclude the potential for thermal binding, procedural requirements exist to ensure the lines are filled with water to act as a buffer. Procedures have been revised to require water filled sump suction lines any time the reactor coolant system temperature is above 200 °F.

EFW Valves	**CV-2620, CV-2626, CV-2627, CV-2670**
A. Susceptible to *Thermal Binding*	
Corrective Action:	Procedures caution against thermal binding and require an engineering review of the valves before they are placed back in service following such an event. The valves are shut during plant cooldown. To avoid thermal binding, procedural guidance cautions against shutting the valves hot and cooling down. Engineering analysis is currently required if this situation occurs.

EFW P7A/B SW Suction Isolation Valves	**CV-2803, CV-2806**
A. Susceptible to *Environmental Boiler Effect Locking*	
Margin:	0% (both valves)
Corrective Actions:	Night orders have been issued to inform operators of the potential of these valves to bind, and provide methods of dealing with the occurrence should it happen. The valves will be modified by the end of refueling outage 1R13.

Steam to EFWP K-3 and 2K-3 Turbine	**CV-2613, CV-2663, 2CV-0340-2**
A. Susceptible to *Thermal Binding*	
Documentation Results:	These valves are stroked monthly and have been closed hot and opened cold successfully. Maintenance records were examined to demonstrate that the valves have not suffered damage during previous cycles

SW to EFW Pump Isolation Valves **2CV-0711-2, 2CV-0716-1**

A. Susceptible to *Environmental Boiler Effect Locking*
Margin: 0% (both valves)
Corrective Actions: Night orders have been issued to inform operators of the potential of these valves to bind, and provide methods of dealing with the occurrence should it happen. The valves will be modified by the end of refueling outage 1R13

EFW 2P7A to A/B Steam Generators **2CV-1026-2, 2CV-1076-2**

A. Susceptible to *Thermal Binding*
Corrective Action: To eliminate binding due to back leakage of feedwater through the check valves, procedures were revised to require opening the valves successfully following an event of this type. Engineering is required to be notified if the valve body temperature exceeds 200 °F.

RB Spray Header Isolation Valves **2CV-5612-1, 2CV-5613-2**

A. Susceptible to *Hydraulic Locking*
Margin: 0% (both valves)
Corrective Action: Implemented short term action to stroke the valves prior to entering MODE 3 in order to relieve any trapped bonnet pressure. These valves will be modified by the end of refueling outage 2R12.

B. Susceptible to *Proximity Boiler Effect Locking*
Corrective Action: Same as above

Sump Recirculation Outside Isolation Valves **2CV-5649-1, 2CV-5650-2**

A. Susceptible to *Environmental Boiler Effect Locking*
Corrective Action: Bonnet pressure relief valves were installed on these valves during refueling outage 2R11 in 1995.

6.0 SUMMARY TABLE OF DETAILED VALVE EVALUATIONS

Table 2 summarizes the results for each of the 56 valves requiring detailed evaluation for potential susceptibility to binding/locking.

**TABLE 2
ARKANSAS NUCLEAR ONE
DETAILED VALVE EVALUATION SUMMARY**

	Susceptible to:				Minimum Corrective Action:		
Valve Tag No.	Thermal Binding	Hydraulic Locking	Boiler Effect (Env.)	Boiler Effect (Prox.)	Use As Is	Modify	Required Doc't Changes
CV-1000	Yes	No	Yes	Yes	-	-	Yes
CV-1276	No	No	No	No	-	-	-
CV-1277	No	No	No	No	-	-	-
CV-1400	Yes	No	No	No	-	-	Yes
CV-1401	Yes	No	No	No	-	-	Yes
CV-1405	Yes	No	No	No	-	-	Yes
CV-1406	Yes	No	No	No	-	-	Yes
CV-1407	No	No	No	No	-	-	-
CV-1408	No	No	No	No	-	-	-
CV-1414	No	No	No	No	-	-	-
CV-1415	No	No	No	No	-	-	-
CV-1436	No	No	No	No	-	-	-
CV-1437	No	No	No	No	-	-	-
CV-1616	No	No	No	No	-	-	-
CV-1617	No	No	No	No	-	-	-
CV-2613	Yes	No	No	No	Yes	-	-
CV-2617	No	No	No	No	-	-	-
CV-2620	Yes	No	No	No	-	-	Yes
CV-2626	Yes	No	No	No	-	-	Yes
CV-2627	Yes	No	No	No	-	-	Yes
CV-2663	Yes	No	No	No	Yes	-	-
CV-2667	No	No	No	No	-	-	-
CV-2670	Yes	No	No	No	-	-	Yes
CV-2803	No	No	Yes	No	-	Yes	-
CV-2806	No	No	Yes	No	-	Yes	-

	Susceptible to:				Minimum Corrective Action:		
Valve Tag No.	Thermal Binding	Hydraulic Locking	Boiler Effect (Env.)	Boiler Effect (Prox.)	Use As Is	Modify	Required Doc't Changes
CV-3806	No	No	No	No	-	-	-
CV-3807	No	No	No	No	-	-	-
CV-3812	No	No	No	No	-	-	-
CV-3813	No	No	No	No	-	-	-
CV-3850	No	No	No	No	-	-	-
CV-3851	No	No	No	No	-	-	-
2CV-0205-2	No	No	No	No	-	-	-
2CV-0340-2	Yes	No	No	No	Yes	-	-
2CV-0711-2	No	No	Yes	No	-	Yes	-
2CV-0716-1	No	No	Yes	No	-	Yes	-
2CV-1026-2	Yes	No	No	No	-	-	Yes
2CV-1036-2	No	No	No	No	-	-	-
2CV-1037-1	No	No	No	No	-	-	-
2CV-1038-2	No	No	No	No	-	-	-
2CV-1039-1	No	No	No	No	-	-	-
2CV-1076-2	Yes	No	No	No	-	-	Yes
2CV-1501-5	No	No	No	No	-	-	-
2CV-4698-1	No	No	No	No	-	-	-
2CV-4740-2	No	No	No	No	-	-	-
2CV-4950-2	No	No	No	No	-	-	-
2CV-5612-1	No	Yes	No	Yes	-	Yes	Yes
2CV-5613-2	No	Yes	No	Yes	-	Yes	Yes
2CV-5630-1	No	No	No	No	-	-	-
2CV-5631-2	No	No	No	No	-	-	-
2CV-5647-1	No	No	No	No	-	-	-
2CV-5648-2	No	No	No	No	-	-	-
2CV-5649-1	No	No	Yes	No	-	2R11*	-
2CV-5650-2	No	No	Yes	No	-	2R11*	-
2CV-5657-1	No	No	No	No	-	-	-
2CV-5667-2	No	No	No	No	-	-	-
2CV-8233-1	No	No	No	No	-	-	-

* Completed during 1995

APPENDIX 1

VALVES IN THE ANO GL 95-07 REVIEW SCOPE (POWER-OPERATED SAFETY- RELATED, PHYSICALLY POTENTIALLY SUSCEPTIBLE, ACTIVE SAFETY FUNCTION TO OPEN/ADDED SCOPE)

TAG NUMBER	FUNCTION	OPER_TYPE	PSA_RANK	SIMMS
2CV-0205-2	EFW PUMP STEAM BYP.	MOV	H	E1
2CV-0340-2	EFW MS ISOLATIONL	MOV	H	E1
2CV-0711-2	SW TO EFW PUMP ISOLATIONL	MOV	LL	E1
2CV-0716-1	SW ISOLATIONL. FROM EFW	MOV	LL	E1
2CV-1026-2	2P7A DISCH TO "A" SG	MOV	L	E1
2CV-1076-2	EFW to "B" SG	MOV	L	E1
2CV-1501-5	2VUC7C ISOLATION	MOV	LL	O3
2CV-4698-1	PZR VENT	MOV	H	C4
2CV-4740-2	LTOP ISOLATIONL	MOV	H	C4
2CV-4950-2	RWT ISOLATION	MOV	LL	A3
2CV-5612-1	RB SPRAY HDR ISOLATIONL.	MOV	H	G1
2CV-5613-2	RB SPRAY HDR ISOLATIONL.	MOV	H	G1
2CV-5649-1	RB SUMP OUTSIDE ISOLATION	MOV	H	B1
2CV-5650-2	RB SUMP OUTSIDE ISOLATION	MOV	H	B1
2CV-5657-1	2P136 SUCTION	MOV	LL	F1
2CV-5667-2	NAOH SUCTION	MOV	LL	F1
2CV-8233-1	H2 PUR ISOLATION	MOV	LL	F1
CV-1000	PZR ERV ISOLATION	MOV	M	D4
CV-1276	DH LOOP DISC. TO MU PUMP	MOV	LL	A3
CV-1277	DH LOOP DISC. TO MU PUMP	MOV	LL	A3
CV-1400	LPI/DH LOOP B ISOLATION	MOV	L	A1
CV-1401	LPI/DH LOOP A ISOLATION	MOV	L	A1
CV-1405	RB SUMP ISOLATION	MOV	H	A3
CV-1406	RB SUMP ISOLATION	MOV	H	A3
CV-1407	BWST OUTLET ISOLATION	MOV	H	A1
CV-1408	BWST OUTLET ISOLATION	MOV	H	A1
CV-1616	NAOH T-10 ISOLATION	MOV	LL	F1
CV-1617	NAOH T-10 ISOLATION	MOV	LL	F1
CV-2613	MS TO EFW TURB K-3	MOV	L	E1
CV-2620	EFW DISCHARGE ISOLATION	MOV	LL	E1
CV-2626	EFW DISCHARGE ISOLATION	MOV	LL	E1
CV-2627	EFW DISCHARGE ISOLATION	MOV	LL	E1
CV-2663	MS TO EFW TURB. K-3	MOV	L	E1
CV-2670	EFW DISCHARGE ISOLATION	MOV	LL	E1
CV-2803	EFW P7B SW SUCTION ISOLATION	MOV	LL	E3
CV-2806	EFW P7A SW SUCTION ISOLATION	MOV	LL	E3
CV-3806	EDG CLR SW ISOL	MOV	H	O1
CV-3807	SW TO EDG E20B ISOLATION	MOV	H	O1
CV-3812	RB EMER CLR INLET	MOV	L	O1
CV-3813	RB EMER CLR INLET	MOV	L	O1
CV-3850	EFW P7B SW SUCTION ISOLATION	MOV	LL	E3
CV-3851	EFW P7A SW SUCTION ISOLATION	MOV	LL	E3

SIMS QFUNC Codes ending in 1, 2, or 3 are considered to be active valves.

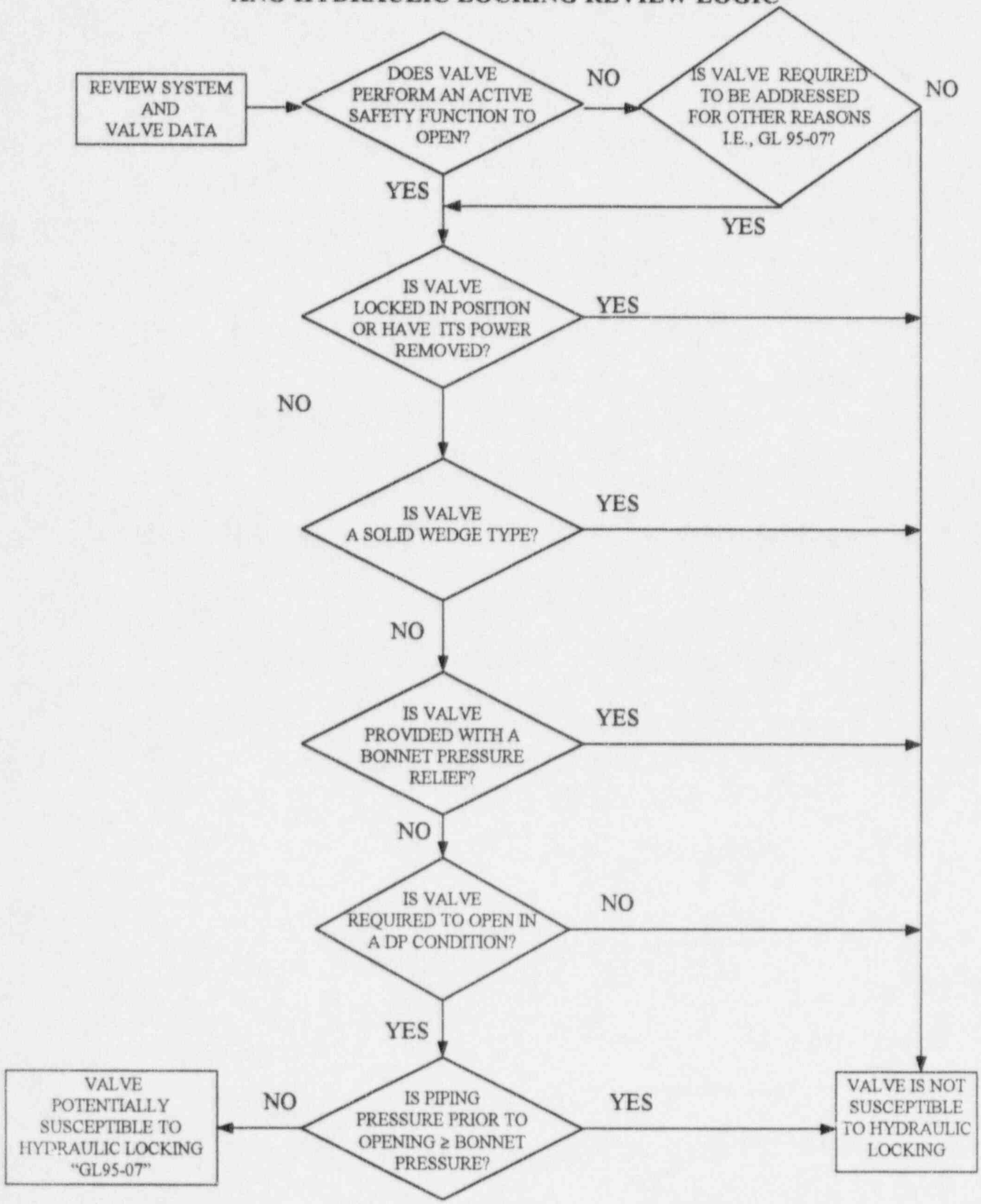
VALVES ADDED FOR SURVEILLANCE TESTING CONCERNS

FULLTAGNO	FUNCTION	PSA_RANK	SIMMS QFUNC
2CV-1036-2	EFW BLOCK TO SG-	LL	E1
2CV-1037-1	EFW BLOCK TO SG-	LL	E1
2CV-1038-2	EFW BLOCK TO SG-	LL	E1
2CV-1039-1	EFW BLOCK TO SG-	LL	E1
2CV-5630-1	BS SUCTION	LL	A1
2CV-5631-2	BS SUCTION	LL	A1
2CV-5647-1	RB SPRAY SUCTION	LL	B4
2CV-5648-2	RB SPRAY SUCTION	LL	B4
CV-1414	RB SUMP ISO	LL	B4
CV-1415	RB SUMP ISO	LL	B4
CV-1436	DH SUCTION	LL	B3
CV-1437	DH SUCTION	LL	B3
CV-2617	EFW MS ISOLATION	LL	E1
CV-2667	MS TO EFW TURB ISOL	LL	E1

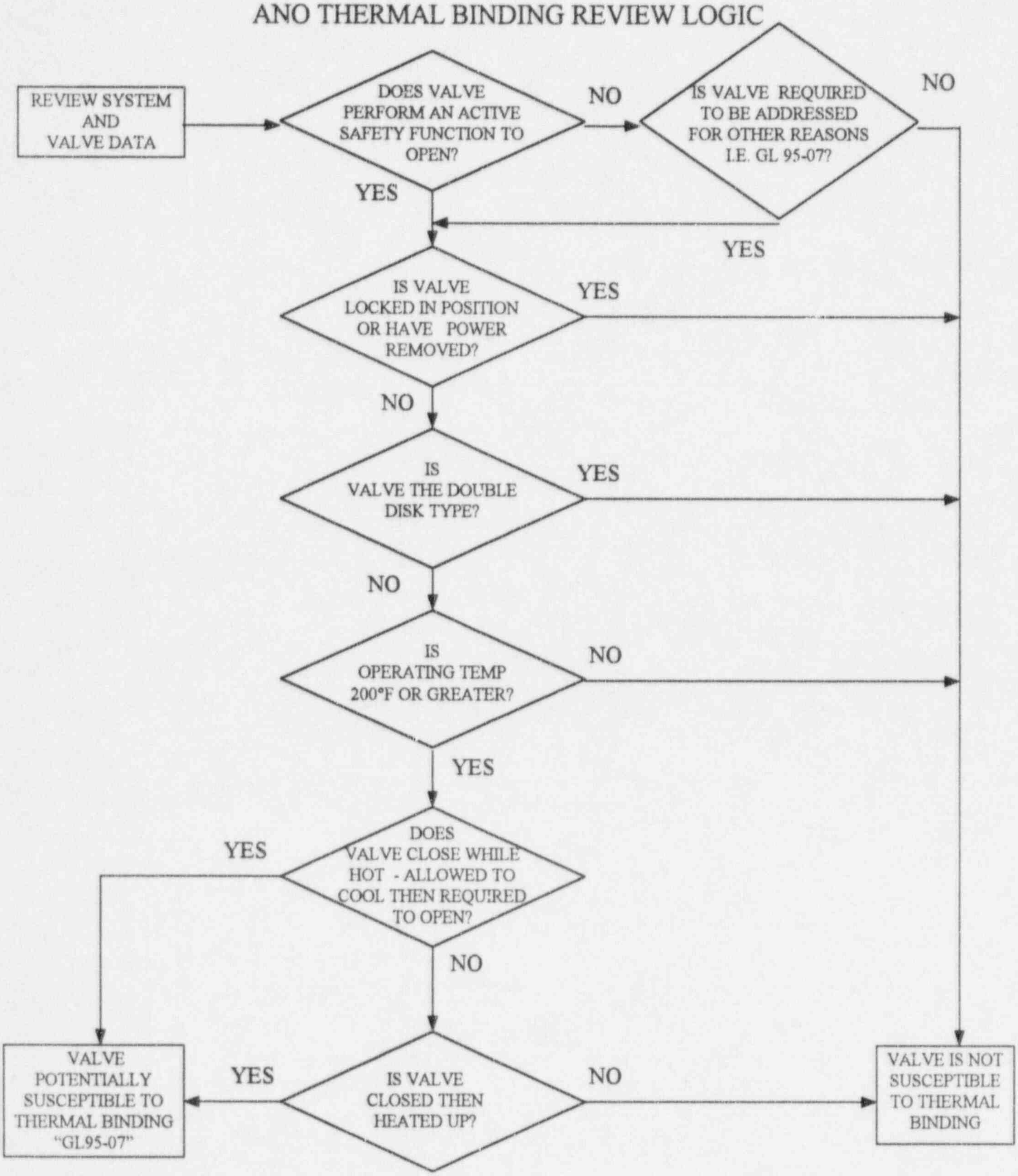
SIMS QFUNC Codes ending in 1, 2, or 3 are considered to be active valves.

APPENDIX 2

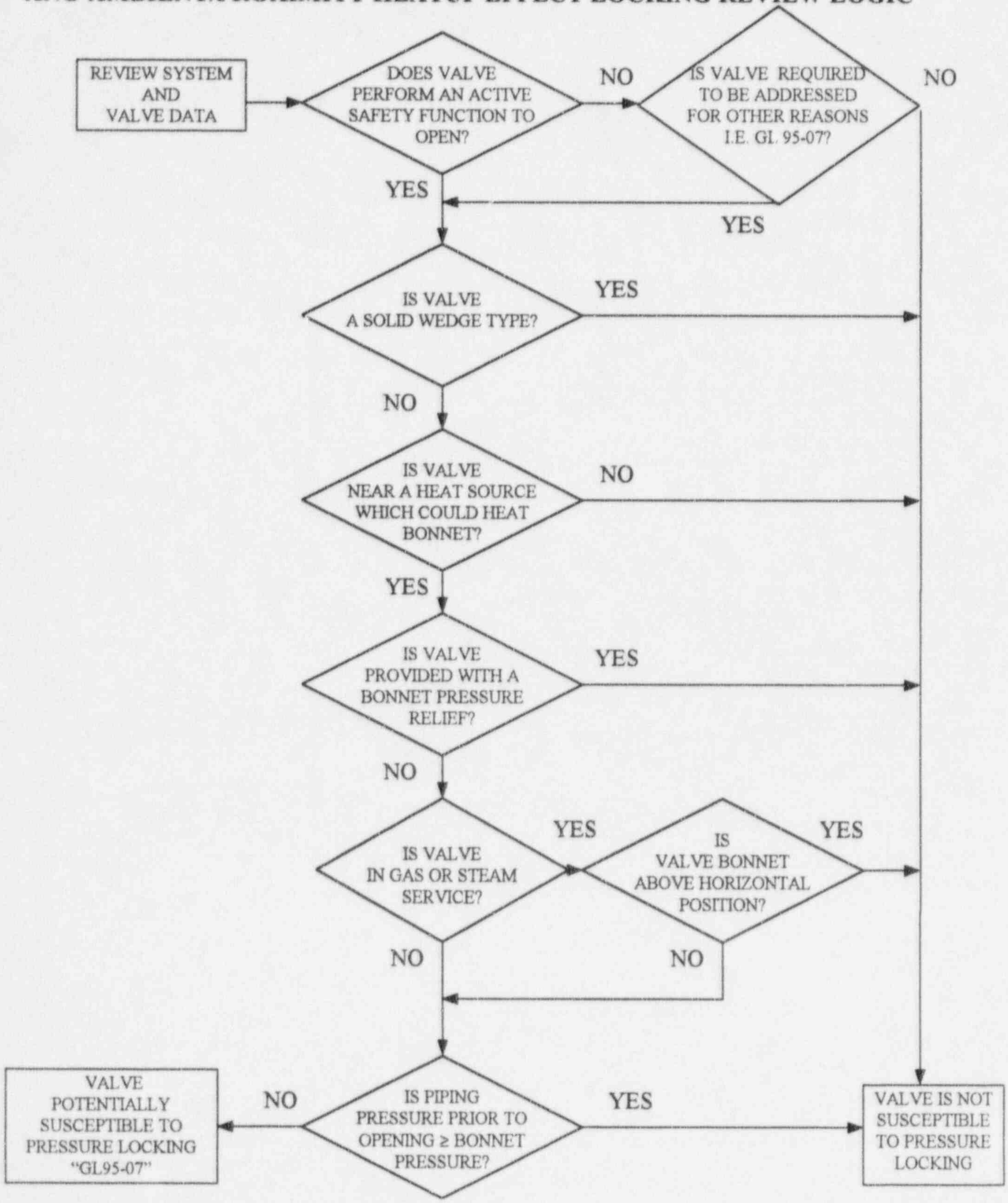
ANO HYDRAULIC LOCKING REVIEW LOGIC



ANO THERMAL BINDING REVIEW LOGIC



ANO AMBIENT/PROXIMITY HEATUP EFFECT LOCKING REVIEW LOGIC



APPENDIX 3

Entergy Calculational Methodology

A calculational methodology referred to as the "Hub analysis" was developed by Entergy based on "first principle" analysis (i.e., forces applied and basic trigonometric evaluation of valve discs/seats) as suggested in NUREG/CR-5807 "Improvements in Motor Operated Gate Valve Design and Prediction Models for Nuclear Power Plant Systems." These calculations were used to evaluate valve operability under combination loading of pressure locking and design basis conditions.

On December 28 and 29, 1992, Wyle Labs performed pressure lock testing on a Grand Gulf Nuclear Station Unit 2, 14" - 900 # flexible wedge gate valve. The test simulated the accident conditions associated with the LPCI/LPCS Injection Valves (1E12-F042A, 1E12-F042B and 1E21-F005). One of the goals of the test was to substantiate the calculational methodology and results which were used in the Operability Resolution of GGNS's Material Non-Conformance Report 0270-92. The report stated under accident conditions, the required thrust to open the referenced injection valves would be 82,645 lbs., 87,724 lbs., and 76,822 lbs, respectively. The variance in opening thrusts is attributed to the differences in the as-tested static opening thrust values. By utilizing the results of the Wyle test, the GGNS calculation yields 87,297 lbs required to open the test valve vs. 87,000 lbs noted during the test. This value is based on information (90,000 lbs closing, 55,000 lbs static opening, 452/1080/320 psig accident conditions test pressures) provided in the trip report after witnessing the Wyle test. As evidenced by these results, one could conclude that the methodology used in determining operability of the low pressure injection valves is acceptable and sound. This methodology was presented during an NRC public workshop on February 4, 1994, which was summarized in NUREG/CP-0146.

To support this methodology, Entergy Operations' sites (Grand Gulf and Waterford 3) have reviewed dynamic test data from their GL 89-10 programs. Review of the data suggests that the hub analysis is conservative in its ability to estimate total required thrust for pressure locked valves. Therefore, the Hub analysis was used as the standard methodology to estimate thrust requirements for pressure locked valves.