IES Utilities Inc.
200 First Street S.E.
P.O. Box 351
Cedar Rapids, IA 52406-0351
Telephone 319 398 8162
Fax 319 3[illegible]192

UTILITIES

John F. Franz, Jr.
Vice President, Nuclear

February 13, 1996
NG-96-0351

Mr. William T. Russell, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station P1-37
Washington, DC 20555-0001

Subject: Duane Arnold Energy Center
Docket No: 50-331
Op. License No: DPR-49
180 Day Response to Generic Letter 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves"

Reference: Letter, J. Franz (IES) to W. Russell (NRC) dated October 16, 1995, NG-95-3089, Sixty Day Response to Generic Letter 95-07

File: A-101b

Dear Mr. Russell:

Generic Letter (GL) 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," requested that licensees evaluate the operational configurations of safety-related, power-operated gate valves to identify valves that are susceptible to pressure locking or thermal binding. Furthermore, GL 95-07 requested that licensees perform further analyses and take corrective actions as appropriate to ensure that the susceptible valves identified during the evaluation are capable of performing their intended safety function(s) within the current licensing bases of the facility. The purpose of this letter is to provide IES Utilities' 180 day response to this GL.

The attachment to this letter provides the information requested by the GL (Requested Information items numbers one, two and three) including screening criteria, operability evaluations and a summary of valve modifications proposed and performed.

Our GL 95-07 sixty day response (Reference) indicated that three valves, identified as being susceptible to pressure locking, were scheduled to be modified during the next refueling outage. However, as a result of a more detailed engineering evaluation using the most recent industry information, it has been determined that only two valves will require modifications during the next refueling outage. Specifically, it has been determined that the Loop B Outboard Torus Spray Isolation Valve (MO-1932) is not susceptible to pressure locking and thus will not be modified during the next refueling outage.

A056

This letter contains the following revised commitment:

> Complete modifications (to prevent pressure locking) to Loop B Inboard Low Pressure Coolant Injection Valve (MO-1905) and Loop B Inboard Drywell Spray Valve (MO-1902) during the next refueling outage (scheduled to commence October, 1996).

Please contact this office if you have further questions regarding this matter.

This letter is true and accurate to the best of my knowledge and belief.

IES UTILITIES INC.

By John F. Franz
John F. Franz
Vice President, Nuclear

State of Iowa
County of Linn

Signed and sworn to before me on this 13th day of February, 1996, by John F. Franz.

Debra J. Schwenker
Notary Public in and for the State of Iowa

DEBRA J. SCHWENKER
MY COMMISSION EXPIRES
11-9-98
Commission Expires

Attachment

cc: R. Murrell
L. Liu
G. Kelly (NRC-NRR)
H. Miller (Region III)
NRC Resident Office
Docu

Engineering Evaluation for Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves

Introduction

This report documents the results of a review of safety-related, power-operated gate valves at the Duane Arnold Energy Center (DAEC) for susceptibility to pressure locking and thermal binding. This review was conducted in accordance with the guidance provided in NRC Generic Letter 95-07. Valves determined to be potentially susceptible to pressure locking or thermal binding were subjected to further detailed evaluations and analyses. Previously completed and planned corrective actions deemed necessary to ensure that safety-related, power-operated gate valves are capable of performing their safety-related functions are also described.

Screening Criteria

The following screening criteria were used to determine those safety-related, power-operated gate valves that may be susceptible to pressure locking or thermal binding during design basis events.

1. General Screening. A list was made of all safety-related, power-operated (motor, pneumatic, or hydraulic) gate valves used in plant systems at DAEC (Table 1). For each valve listed in Table 1, the normal position and the required safety position of the valve was identified. Valves which are normally closed and are required to open during a design basis event, or as part of any normal operating or emergency operating procedure, were put on a list of valves to be screened for susceptibility to pressure locking and thermal binding (Table 2). All other valves were excluded (screened out) from further evaluation.

2. Screening Criteria for Pressure Locking. From the list of valves in Table 2, the following were excluded from further consideration for susceptibility to the pressure locking phenomena. Note: Valves excluded from pressure locking must also be screened for thermal binding. See Item 3, below.

   a. Valve designs with a solid wedge gate. All other designs (e.g., flexible wedge, split wedge, and double-disc parallel-seat gate designs) are considered potentially susceptible to pressure locking.

   b. Valves with either a hole drilled in the disc or the bonnet vented to the process piping.

   c. Valves installed in systems containing a compressible gas other than steam.

d. Valves which could have their bonnets filled with water, but do not experience a significant decrease in upstream or downstream pressure and are only subjected to normal ambient room temperature changes.

Valves that could not be screened out based on the above screening criteria were considered as potentially susceptible to pressure locking and were subjected to further detailed evaluations. Six valves (MO1902, MO1905, MO1913, MO1921, MO2012, and MO2015) were found to be in this category.

3. Screening Criteria for Thermal Binding. From the list of valves in Table 2, the following were excluded from further consideration for the susceptibility to the thermal binding phenomena. Note: Valves excluded from thermal binding must also be screened for pressure locking. See Item 2, above.

   a. Valves with a double-disc parallel-seat gate. All other designs (e.g., solid wedge, flexible wedge, and split wedge gate designs) are considered susceptible to thermal binding.

   b. Valves which are closed cold and are then required to open at a higher temperature than they were closed.

   c. Valves which are subject to only ambient room temperature changes and are isolated from potential heat sources by sufficient distance or a normally closed shutoff valve.

   Valves which could not be screened out based on the above screening criteria were considered as potentially susceptible to thermal locking and were subjected to further detailed evaluations. Three valves (MO2202, MO2312, and MO2512) were found to be in this category.

4. Assumptions. In applying the screening criteria described above, the following assumptions were made:

   a. In-line check valves are assumed to leak thereby pressurizing the line up to the first shutoff valve. Leakage of fluid past the first closed shutoff valve is considered insufficient to heat the water in the line up to the first shutoff valve.

   b. Once pressurized, the valve bonnet will remain pressurized for hours.

   c. No credit may be taken for air that may be trapped in the valve bonnet.

   d. Thermal binding is a concern only for valves that are closed hot and are then required to open at a lower temperature than they were closed.

   e. Valves subject to only normal ambient room temperature changes are not subject to thermally induced pressure locking or thermal binding. In applying these screening criteria, normal ambient room temperature changes were taken as less than or equal to 25°F.

f. Evaluation for pressure locking and thermal binding is not required for the following valves which have a safety function to be open:

- Normally open valves that are closed only for stroke testing and then subsequently opened.
- Normally open valves that are assumed to be mispositioned.

Detailed Evaluations

Detailed evaluations and analyses were performed for the nine valves that were considered to be potentially susceptible to pressure locking or thermal binding during design basis events. Based on these detailed evaluations, two valves (MO1902 and MO1905) are considered to be potentially susceptible to pressure locking during a design basis Loss of Coolant Accident (LOCA) and modifications to these valves are planned. The detailed evaluations for the other seven valves showed that these valves are not susceptible to pressure locking or thermal binding during design basis events and no modifications are deemed necessary. A summary of the results of the detailed evaluations for the nine valves evaluated for pressure locking and thermal binding is provided in Table 3.

Summary of Valve Modifications

This section of the report summarizes modifications completed and planned to safety-related, power-operated gate valves at DAEC to address concerns with pressure locking and thermal binding.

Residual Heat Removal System

The loop A inboard LPCI injection valve (MO2003), inboard drywell spray valve (MO2000), and outboard torus cooling/spray valve (MO2005) were drilled during Refueling Outage (RFO) 13 (Spring 1995) to eliminate the potential for pressure locking of these valves. Based on these modifications, the A side of the RHR system is not susceptible to the pressure locking phenomena.

The loop B inboard LPCI injection valve (MO1905) and inboard drywell spray valve (MO1902) are scheduled for modifications during the next refueling outage (RF014 in Fall 1996). We currently plan to drill the disc of MO1902 and vent the bonnet of MO1905. In the interim, the loop B inboard LPCI injection valve (MO1905) has been realigned to be normally open and the loop B outboard LPCI injection valve (MO1904) has been closed for system isolation. MO1904 is a motor-operated globe valve and is not subject to the pressure locking phenomena. MO1904 opens automatically on an LPCI initiation signal. With this valve lineup, LPCI operability is maintained.

The loop B outboard torus cooling/spray valve (MO1932), was also scheduled to have its bonnet vented during RFO14 for pressure locking. However, based on the additional screening and evaluations performed in connection with GL 95-07, it is now concluded that MO1932 is not susceptible to pressure locking during design basis events. Therefore, we plan to cancel the planned modification to MO1932.

The only valve in the RHR system still considered to be potentially susceptible to pressure locking or thermal binding is the loop B inboard drywell spray valve (MO1902). This valve is scheduled for modification during RFO14. Justification for waiting until RFO14 to modify MO1902 is based on the following:

1. MO1902's loop A sister valve (MO2000) was modified by drilling a hole in the disc during RFO13. Therefore, the concern of a "common mode failure" of the drywell spray function due to pressure locking has been eliminated.

2. The thrust capability of the motor operator for MO1902 is more than 100 percent greater than the thrust required to open the valve against the maximum design differential pressure with no pressure locking. Thus, the motor operator has sufficient capacity to overcome a significant amount of pressure locking in MO1902.

3. Risk analyses show that a postulated common mode failure of MO1902 and MO2000 would have a negligible effect on the probability of core damage. With regard to radiation release, the valve prioritization study performed in connection with the GL 89-10 program found that with MO2000 drilled, the added risk from MO1902 not being drilled was small, placing the valve in the low-low risk category (the lowest category for this study).

4. The drywell spray function is manually initiated by Control Room operators to maintain the drywell temperature below its design temperature of 340°F during a LOCA. Transient temperature analyses by GE have shown that drywell temperature will be less than 340°F for the limiting accident (a small break LOCA) assuming no drywell sprays and no drywell heat sink. Thus, the drywell spray function is not required for accident mitigation.

Core Spray System

Loop A inboard injection valve (MO2117) and loop B inboard injection valve (MO2137) were drilled during RFO13 for pressure locking. Based on the evaluations performed in connection with GL 95-07, there are no other valves in the core spray system that are considered susceptible to pressure locking or thermal binding.

High Pressure Coolant Injection

High Pressure Coolant Injection (HPCI) injection valve (MO2312) was drilled during RFO13 for pressure locking. Based on the evaluations performed in connection with GL 95-07, there are no other valves in the HPCI system that are considered susceptible to pressure locking or thermal binding.

Reactor Core Isolation Cooling

Reactor Core Isolation Cooling (RCIC) injection valve (MO2512) was drilled during RFO13 for pressure locking. Based on the evaluations performed in connection with GL 95-07, there are no other valves in the RCIC system that are considered susceptible to pressure locking or thermal binding.

Table 1
General Screening of DAEC
Safety-Related Power-Operated Gate Valves

ID	System	Description	Normal Position	Safety Position	P&ID	Eval for PL/TB	Comments
MO2100	Core Spray	Loop A Outboard Torus Suction	Open	Op/Cl	M121	No	
MO2104	Core Spray	Pump 1P211A Min Flow Bypass	Open	Op/Cl	M121	Yes	
MO2115	Core Spray	Loop A Outboard Injection	Open	Open	M121	No	
MO2117	Core Spray	Loop A Inboard Injection	Closed	Op/Cl	M121	Yes	Disk Drilled RFO13
MO2120	Core Spray	Loop B Outboard Torus Suction	Open	Op/Cl	M121	No	
MO2124	Core Spray	Pump 1P211B Min Flow Bypass	Open	Op/Cl	M121	Yes	
MO2135	Core Spray	Loop B Outboard Injection	Open	Open	M121	No	
MO2137	Core Spray	Loop B Inboard Injection	Closed	Op/Cl	M121	Yes	Disk Drilled RFO13
MO2146	Core Spray	Loop B Inboard Torus Suction	Open	Op/Cl	M121	No	
MO2147	Core Spray	Loop A Outboard Torus Suction	Open	Op/Cl	M121	No	
MO2238	HPCI	Inboard Steam Line Isolation	Open	Closed	M122	No	
MO2239	HPCI	Outboard Steam Line Isolation	Open	Closed	M122	No	
MO2202	HPCI	Turbine Steam Supply Isolation	Closed	Open	M122	Yes	
MO2321	HPCI	Inboard Torus Suction Isolation	Closed	Op/Cl	M123	Yes	
MO2322	HPCI	Outboard Torus Suction Isolation	Closed	Op/Cl	M123	Yes	
MO2316	HPCI	Redundant Shutoff	Closed	Closed	M123	No	
MO2312	HPCI	HPCI Injection	Closed	Op/Cl	M123	Yes	Disk Drilled RFO13
MO2311	HPCI	Pump Discharge	Open	Open	M123	No	
MO2300	HPCI	CST Suction	Open	Closed	M123	No	
MO2290A	HPCI	Turbine Exhaust Vacuum BRKR	Open	Closed	M122	No	
MO2290B	HPCI	Turbine Exhaust Vacuum BRKR	Open	Closed	M122	No	
MO2400	RCIC	Inboard Steam Line Isolation	Open	Closed	M124	No	
MO2401	RCIC	Outboard Steam Line Isolation	Open	Closed	M124	No	
MO2516	RCIC	Inboard Torus Suction	Closed	Op/Cl	M125	Yes	
MO2517	RCIC	Outboard Torus Suction	Closed	Op/Cl	M125	Yes	
MO2500	RCIC	CST Suction	Open	Closed	M125	No	
MO2511	RCIC	Pump Discharge	Open	Open	M125	No	

Table 1 (Cont.)
General Screening of DAEC
Safety-Related Power-Operated Gate Valves

ID	System	Description	Normal Position	Safety Position	P&ID	Eval for PL/TB	Comments
MO2512	RCIC	RCIC Injection	Closed	Op/Cl	M125	Yes	Disk Drilled RFO13
MO1989	RHR	B Torus Suction	Open	Op/Cl	M119	No	
MO1913	RHR	B Pump Torus Suction	Open	Op/Cl	M119	Yes	
MO1912	RHR	B Pump SDC Suction	Closed	Closed	M119	No	
MO1920	RHR	D Pump SDC Suction	Closed	Closed	M119	No	
MO1921	RHR	D Pump Torus Suction	Open	Op/Cl	M119	Yes	
MO1935	RHR	B Min Flow Bypass	Closed	Op/Cl	M119	Yes	
MO1939	RHR	B Hx Inlet	Open	Open	M119	No	
MO1941	RHR	B Hx Outlet	Open	Open	M119	No	
MO1932	RHR	B Torus Cooling/Spray	Closed	Op/Cl	M119	Yes	
MO1902	RHR	B Inboard Drywell Spray	Closed	Op/Cl	M119	Yes	Drill Disk RFO14
MO1937	RHR	Inboard Drain to RW	Closed	Closed	M119	No	
MO1943A	RHR	RHRSW X-Tie To RHR 'A'	Closed	Closed	M113	No	
MO1943B	RHR	RHRSW X-Tie To RHR 'B'	Closed	Closed	M113	No	
MO1905	RHR	B Inboard Inject Isolation	Closed	Op/Cl	M119	Yes	Bonnet Vent RFO14
MO1908	RHR	B Inboard SDC Isolation	Closed	Closed	M119	No	
MO1909	RHR	B Outboard SDC Isolation	Closed	Closed	M119	No	
MO2069	RHR	A Torus Suction	Open	Op/Cl	M120	No	
MO2010	RHR	RHR Loops Cross Tie	Open	Open	M120	No	
MO2012	RHR	A Pump Torus Suction	Open	Op/Cl	M120	Yes	
MO2011	RHR	A Pump SDC Suction	Closed	Closed	M120	No	
MO2016	RHR	C Pump SDC Suction	Closed	Closed	M120	No	
MO2015	RHR	C Pump Torus Suction	Open	Op/Cl	M120	Yes	
MO2009	RHR	A Min Flow Bypass	Closed	Op/Cl	M120	Yes	
MO2029	RHR	A HX Inlet	Open	Open	M120	No	
MO2031	RHR	A HX Outlet	Open	Open	M120	No	
MO2005	RHR	A Outboard Torus Cooling/Spray	Closed	Op/Cl	M120	Yes	Disk Drilled RFO13

Table 1 (Cont.)
General Screening of DAEC
Safety-Related Power-Operated Gate Valves

ID	System	Description	Normal Position	Safety Position	P&ID	Eval for PL/TB	Comments
MO2000	RHR	A Inboard Drywell Spray	Closed	Op/Cl	M120	Yes	Disk Drilled RFO13
MO2003	RHR	A Inboard Inject Isolation	Closed	Op/Cl	M120	Yes	Disk Drilled RFO13
MO2039A	ESW	Chiller WW Supply	Open	Closed	M113	No	
MO2039B	ESW	Chiller WW Supply	Open	Closed	M113	No	
MO2077	ESW	A Chiller WW Discharge	Open	Closed	M113	No	
MO2078	ESW	B Chiller WW Discharge	Open	Closed	M113	No	
MO2700	RWCU	Inboard Inlet Isolation	Open	Closed	M127	No	
MO2701	RWCU	Outboard Suction Isolation	Open	Closed	M127	No	
MO2731	RWCU	Drain to Condenser	Closed	Closed	M127	No	
MO2732	RWCU	Drain to RW	Closed	Closed	M127	No	
MO4320A	CAD	N2 Supply Reg. Isolation	Closed	Op/Cl	M143<3>	Yes	
MO4320B	CAD	N2 Supply Reg. Isolation	Closed	Op/Cl	M143<3>	Yes	
MO4423	Main Steam	MSL Drain Inboard Isolation	Closed	Closed	M114	No	
MO4424	Main Steam	MSL Drain Outboard Isolation	Closed	Closed	M114	No	
MO4601	Recirc	A Suction	Open	None	M116	No	
MO4602	Recirc	B Suction	Open	None	M116	No	
MO4627	Recirc	A Discharge	Open	Closed	M116	No	
MO4628	Recirc	B Discharge	Open	Closed	M116	No	
MO4629	Recirc	A Discharge Bypass	Open	None	M116	No	
MO4630	Recirc	B Discharge Bypass	Open	None	M116	No	
MO4841A	RBCCW	DW Return Isolation	Open	Closed	M112	No	
MO4841B	RBCCW	DW Supply Isolation	Open	Closed	M112	No	
CV1956A	ESW	A Chiller Discharge	Closed	Open	M113	Yes	
CV1956B	ESW	B Chiller Discharge	Closed	Open	M113	Yes	
CV2234	HPCI	Cond. PMP Disch to RW Inboard	Open	Closed	M122	No	
CV2235	HPCI	Cond. PMP Disch to RW Outboard	Closed	Closed	M122	No	
CV2211	HPCI	Steam Line Drain Isolation	Open	Closed	M122	No	

Table 1 (Cont.)
General Screening of DAEC
Safety-Related Power-Operated Gate Valves

ID	System	Description	Normal Position	Safety Position	P&ID	Eval for PL/TB	Comments
CV2212	HPCI	Steam Line Drain Isolation	Open	Closed	M122	No	
CV2435	RCIC	Cond. PMP Disch to RW	Closed	Closed	M124	No	
CV2436	RCIC	Cond. PMP Disch to RW	Open	Closed	M124	No	
CV2410	RCIC	Steam Line Drain Isolation	Open	Closed	M124	No	
CV2411	RCIC	Steam Line Drain Isolation	Open	Closed	M124	No	
CV3704	DW Floor Sump	Inboard Isolation	Open	Closed	M137<1>	No	
CV3705	DW Floor Sump	Outboard Isolation	Open	Closed	M137<1>	No	
CV3728	DW Equip Sump	Inboard Isolation	Open	Closed	M137<1>	No	
CV3729	DW Equip Sump	Outboard Isolation	Open	Closed	M137<1>	No	
CV4310	CAC	Inboard Drywell Vent	Closed	Closed	M143<1>	No	
CV4311	CAC	Containment N2 Make Up Supply	Closed	Closed	M143<1>	No	
CV4312	CAC	DW N2 Make Up Inlet	Closed	Closed	M143<1>	No	
CV4313	CAC	Torus N2 Make Up Inlet	Closed	Closed	M143<1>	No	
CV4371A	CAC	DW Valves N2 Supply Isolation	Open	Closed	M143<1>	No	
CV4371C	CAC	Torus/DW Vacuum BRKR N2 Sup.	Open	Closed	M143<1>	No	
CV4378A	CAC	1K14 DW Suction	Open	Closed	M143<1>	No	
CV4378B	CAC	1K14 DW Suction	Open	Closed	M143<1>	No	
CV5837A	SBGT	A Deluge Isolation	Closed	Open	M158	Yes	
CV5837B	SBGT	B Deluge Isolation	Closed	Open	M158	Yes	
CV6919A	CB Ventilation	Sec. Chill Loop HX 'A' Inlet	Closed	Op/Cl	M169<2>	Yes	
CV6919B	CB Ventilation	Sec. Chill Loop HX 'B' Inlet	Closed	Op/Cl	M169<2>	Yes	
CV7328A	SFU	A Carbon Bed Deluge Isolation	Closed	Open	M173	Yes	
CV7328B	SFU	B Carbon Bed Deluge Isolation	Closed	Open	M173	Yes	

Table 2
Safety-Related Power-Operated Valves to be Screened for Pressure Locking and Thermal Binding

ID	System	Description	Susceptible to PL?	Susceptible to TB?	Detail Eval.
MO1902	RHR/Containment Spray	Inboard Drywell Spray (Loop B)	Yes	No	Yes
MO1905	RHR/LPCI Mode	Inboard LPCI Injection (Loop B)	Yes	No	Yes
MO1913	RHR/LPCI Mode	Pump 1P229B Torus Suction	Yes	No	Yes
MO1921	RHR/LPCI Mode	Pump 1P229D Torus Suction	Yes	No	Yes
MO1932	RHR/Containment Spray	Outboard Torus Spray (Loop B)	No	No	No
MO1935	RHR/LPCI Mode	Loop B Min Flow Bypass	No	No	No
MO2000	RHR/Containment Spray	Inboard Drywell Spray (Loop A)	No	No	No
MO2003	RHR/LPCI Mode	Inboard LPCI Injection (Loop B)	No	No	No
MO2005	RHR/Containment Spray	Outboard Torus Spray (Loop B)	No	No	No
MO2009	RHR/LPCI Mode	Loop B Min Flow Bypass	No	No	No
MO2012	RHR/LPCI Mode	Pump 1P229A Torus Suction	Yes	No	Yes
MO2015	RHR/LPCI Mode	Pump 1P229C Torus Suction	Yes	No	Yes
MO2104	Core Spray	Pump 1P211A Min Flow Bypass	No	No	No
MO2117	Core Spray	Loop A Inboard Injection	No	No	No
MO2124	Core Spray	Pump 1P211B Min Flow Bypass	No	No	No
MO2137	Core Spray	Loop B Inboard Injection	No	No	No
MO2202	High Pressure Coolant Injection	HPCI Turbine Steam Supply	No	Yes	Yes
MO2312	High Pressure Coolant Injection	HPCI Injection	No	Yes	Yes
MO2321	High Pressure Coolant Injection	Inboard Torus Suction	No	No	No
MO2322	High Pressure Coolant Injection	Outboard Torus Suction	No	No	No

Table 2 (Cont.)
Safety-Related Power-Operated Valves to be Screened for Pressure Locking and Thermal Binding

ID	System	Description	Susceptible to PL?	Susceptible to TB?	Detail Eval.
MO2512	Reactor Core Isolation Cooling	RCIC Injection	No	Yes	Yes
MO2516	Reactor Core Isolation Cooling	Inboard Torus Suction	No	No	No
MO2517	Reactor Core Isolation Cooling	Outboard Torus Suction	No	No	No
MO4320A/B	Containment Atmosphere Dilution	N2 Supply Regulator Isolation	No	No	No
CV1956A/B	Emergency Service Water	A/B Chiller Discharge	No	No	No
CV5737A/B	Standby Gas Treatment	A/B Carbon Bed Deluge	No	No	No
CV6919A/B	Control Building Ventilation	Secondary Chiller Hx A/B Inlet	No	No	No
CV7328A/B	Standby Filter Unit	A/B Carbon Bed Deluge	No	No	No

Table 3
Summary of Detailed Evaluations

Valve	System	Description	Result of Evaluations	Corrective Actions
MO1902	RHR	Loop B Inboard Drywell Spray	Concern: During standby mode, MO1902 could be pressurized to RHR pump shutoff head. During LOCA, MO1902 is exposed to drywell temperature conditions (340°F max). Heatup of water in bonnet could potentially subject valve to pressure locking. Evaluation: Valve disc is a flexible wedge design and is considered potentially susceptible to pressure locking during LOCA conditions. Modification recommended.	Disc scheduled to be drilled during next refuel outage (RFO14)
MO1905	RHR	Loop B Inboard LPCI Injection	Concern: During standby mode, MO1905 could be pressurized to RCS pressure (1000 psig). During LOCA, decrease in pressure in downstream leg could potentially subject valve to pressure locking. Evaluation: Valve disc is a flexible wedge design and is considered potentially susceptible to pressure locking during LOCA conditions. Modification recommended.	Bonnet scheduled to be vented during next refuel outage (RFO14). In interim, MO1905 is open and MO1904 is closed for system isolation.
MO1913 Loop B SDC (MO2012) Loop A SDC	RHR	B Pump Torus Suction A Pump Torus Suction	Concern: MO1913 (MO2012) is normally open during standby LPCI mode but is closed during Shut Down Cooling (SDC). Heatup of water in bonnet of MO1913 (MO2012) during SDC could potentially subject valve to pressure locking if realignment of the RHR system to LPCI mode is required. Evaluation: MO1913 (MO2012) is located approximately 5 ft from the hot Reactor Coolant System (RCS) water flowing through MO1912 (MO2011) during SDC. Thermal calculations indicate that the heatup of MO1913 (MO2012) would be less than about 10°F. This temperature rise is less than normal ambient room temperature changes and therefore is considered insufficient to cause pressure locking.	Not required.

Table 3
Summary of Detailed Evaluations

Valve	System	Description	Result of Evaluations	Corrective Actions
MO1921 Loop B SDC (MO2015) Loop A SDC	RHR	D Pump Torus Suction C Pump Torus Suction	Concern: MO1921 (MO2015) is normally open during standby LPCI mode but is closed during SDC. Heatup of water in bonnet of MO1921 (MO2015) during SDC could potentially subject valve to pressure locking if realignment of the RHR system to LPCI mode is required. Evaluation: MO1921 (MO2015) is located approximately 5 ft from the hot RCS water flowing through MO1920 (MO2016) during SDC. Thermal calculations indicate that the heatup of MO1921 (MO2015) would be less than about 10°F. This temperature rise is less than normal ambient room temperature changes and therefore is considered insufficient to cause pressure locking.	Not required.

Table 3
Summary of Detailed Evaluations

Valve	System	Description	Result of Evaluations	Corrective Actions
MO2202	HPCI	Steam Supply Valve	Concern: During standby mode MO2202 is exposed to dry steam at RCS pressure/temperature (1000 psig/545°F) conditions. Valve stroke tests are conducted at these conditions. During reactor shutdown the steam temperature to MO2202 is reduced to 365°F at 150 psig. Valve is closed hot and required to open at a lower temperature than it was closed and is potentially susceptible to thermal binding. Evaluation: Valve body and disc are same material, cast carbon steel. Stem is T416 stainless steel which has approximately the same coefficient of thermal expansion as carbon steel. Therefore MO2202 is relatively insensitive to thermal binding due to differential thermal expansion between valve parts as the valve cools down. Tests conducted by EPRI indicate that the coefficient of friction for Stellite on Stellite increases with a decrease in temperature. Based on EPRI data the coefficient of friction between the disc and seats could be expected to increase by a maximum of about 25% during cooldown of the valve from 1000 psig/545°F to 150 psig/365°F. However, during this time the pressure on the disc would decrease by a factor of 6.67. The reduction in pressure force more than compensates for the increase in friction force. On this basis, MO2202 is not considered susceptible to thermal binding during shutdown conditions.	Not required.

Table 3
Summary of Detailed Evaluations

Valve	System	Description	Result of Evaluations	Corrective Actions
MO2312	HPCI	Injection Valve	Concern: MO2312 is located in the steam tunnel and could experience normal ambient room temperature changes on the order of 100°F and could be potentially susceptible to thermal binding. Evaluation: MO2312 is located about 15 ft from its connection to the Feed Water (FW) system (425°F) and below the FW pipe. A check valve is located between MO2312 and the FW pipe. A thermal analysis indicated that the fluid temperature at MO2312 would be approximately equal to the ambient room temperature. MO2312 is not heated by the FW system. During plant shutdown, the temperature in the steam tunnel will not change significantly during the time it takes to reach 150 psig (about 6 to 8 hours). Thus, MO2312 is not closed hot and opened at a temperature significantly lower than the temperature that it was closed, therefore it is not susceptible to thermal binding.	Not required.
MO2512	RCIC	Injection Valve	Concern: MO2512 is located in the steam tunnel and could experience normal ambient room temperature changes on the order of 100°F and could be potentially susceptible to thermal binding. Evaluation: MO2512 is located about 19 ft from its connection to the FW system (425°F)and below the FW pipe. A check valve is located between MO2512 and the FW pipe. A thermal analysis indicated that the fluid temperature at MO2512 would be approximately equal to the ambient room temperature. Thus, MO2512 is not heated by the FW system. During plant shutdown, the temperature in the steam tunnel will not change significantly during the time it takes to reach 150 psig (about 6 to 8 hours). MO2512 is not closed hot and opened at a temperature significantly lower than the temperature that it was closed, therefore it is not susceptible to thermal binding.	Not required.