# CATEGORY 1

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SUBJECT: Provides 180-day response to GL 95-07, "Pressure Locking & Thermal Binding of Safety-Related Power-Operated Gate Valves."

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CATEGORY 1

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Florida Power & Light Company, P.O. Box 128, Fort Pierce, FL 34954-0128

FPL

February 13, 1996

L-96-31
10 CFR 50.4
10 CFR 50.54(f)

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

RE: St. Lucie Units 1 and 2
Docket Nos. 50-335 and 50-389
Generic Letter 95-07 - 180-Day Response

This letter provides the Florida Power and Light Company (FPL) 180-day response to NRC Generic Letter (NRC GL) 95-07 "Pressure Locking and Thermal Binding of Safety Related Power Operated Gate Valves" for St. Lucie Units 1 and 2.

FPL letter L-95-282 dated October 11, 1995, stated that FPL plans to implement the actions proposed in NRC GL 95-07 and that the requested information would be provided on or before February 13, 1996. In addition, our response stated that if our evaluations determined that modifications were required and they would not be completed by that submission date, FPL would provide a schedule along with the necessary justification in our February 1996 submittal.

In accordance with the reporting requirements of NRC GL 95-07, Attachment 1 to this letter provides a summary of the evaluations performed to demonstrate that power operated gate valves installed at St. Lucie Units 1 and 2 will not be prevented from performing their active safety functions by the phenomena of pressure locking or thermal binding. Attachment 1 also provides the plans and schedules for the corrective actions implemented or planned to assure the susceptible power operated gate valves will remain capable of performing their intended safety functions. Attachment 2 provides a summary of the operability assessment for the three shutdown cooling system valves that remain to be modified and the justification for our implementation schedule.

The corrective actions on the remaining three valves that may be susceptible to pressure locking are scheduled to be completed during the next St. Lucie Unit 2 refueling outage (SL2-10) which is currently scheduled for the Spring of 1997.

RE: St. Lucie Units 1 and 2 L-96-31
Docket No. 50-335 and 50-389
Generic Letter 95-07 - 180-Day Response

This response is provided pursuant to the requirements of Section 182a of the Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f).

Please contact us if there are any questions about this submittal.

Very truly yours,

W. H. Bohlke
Vice President
St. Lucie Plant

WHB/GRM

Attachments

cc: Stewart D. Ebneter, Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, St. Lucie Plant

St. Lucie Units 1 and 2
Docket No. 50-335 and 50-389
Generic Letter 95-07 - 180-Day Response

STATE OF FLORIDA )
) ss.
COUNTY OF ST. LUCIE )

W. H. Bohlke being first duly sworn, deposes and says:

That he is Vice President, St. Lucie Plant for the Nuclear Division of Florida Power & Light Company, the Licensee herein;

That he has executed the foregoing document; that the statements made in this document are true and correct to the best of his knowledge, information and belief, and that he is authorized to execute the document on behalf of said Licensee.

W. H. Bohlke

STATE OF FLORIDA

COUNTY OF St. Lucie

The foregoing instrument was acknowledged before me this 13th day of February, 1996 by W. H. Bohlke, who is personally known to me and who did take an oath.

Karen West

KAREN WEST
Name of Notary Public

My Commission expires 4-18-98

Commission No. CC 359926

KAREN WEST
MY COMMISSION # CC359926 EXPIRES
April 18, 1998
BONDED THRU TROY FAIN INSURANCE, INC.

St. Lucie Units 1 and 2
Docket No. 50-335 and 50-389
Generic Letter 95-07 - 180-Day Response

# ATTACHMENT 1

# ST. LUCIE UNITS 1 & 2

# PRESSURE LOCKING AND THERMAL BINDING OF POWER OPERATED GATE VALVES EVALUATION METHODOLOGY SUMMARY

## EVALUATION METHODOLOGY SUMMARY

The assessment of the susceptibility of St. Lucie Units 1 and 2 power operated valves (POVs) to pressure locking and thermal binding utilized a three phase method consisting of:

1) Initial screening to eliminate POVs that obviously do not meet the conditions conducive to pressure locking and/or thermal binding.

2) Gate valve evaluation to determine the power operated gate valves that may be susceptible to pressure locking and/or thermal binding.

3) A detailed, valve specific analysis to determine whether a power operated gate valve is susceptible to pressure locking and/or thermal binding.

**PHASE 1 INITIAL SCREENING CRITERIA** The valve initial screening was a three step review to determine whether a POV was a valve type susceptible to pressure locking and/or thermal binding. The first step was power operated valve type screening, the second step was pressure locking susceptibility screening, and the third step was thermal binding susceptibility screening. The results of the valve screening process of motor operated valves (MOV) for pressure locking and/or thermal binding are delineated in Table 1 for St. Lucie Unit 1 and Table 2 for St. Lucie Unit 2. The results of the valve screening process for other POVs for pressure locking and/or thermal binding are delineated in Table 3 for St. Lucie Unit 1 and Table 4 for St. Lucie Unit 2.

Power Operated Valve Type Screening Criteria All non-safety related gate valves have been excluded with the exception of those non-safety-related gate valves that perform a safety-related or quality-related function as defined in plant operating procedures. POVs were reviewed to determine safety significance under the NRC GL 89-10 Program. Motor operated valves (MOVs) excluded from NRC GL 89-10 Program were excluded from the evaluation.

Pressure locking and thermal binding only concerns gate valves. Therefore, all of the remaining valve designs have been excluded from the evaluation of thermal binding and pressure locking conditions. The plant equipment database was utilized to determine the valve types.

Valves pressure lock or thermally bind when opened from a full closed position. Therefore, only gate valves that have a safety-related function to open were evaluated for pressure locking and/or thermal binding.

Pressure Locking Screening Criteria After all safety-related power-operated gate valves were identified, this population of valves was then screened based on valve type and active safety function to determine whether there was a potential for pressure locking or thermal binding that could prevent the valves from performing their intended safety related functions.

Pressure locking can only occur in double disc or flexible wedge gate valves; therefore solid wedge designs were not evaluated for pressure locking. Valve types were based on a review of the valve drawings.

Pressure locking is caused by fluid getting into the valve bonnet and between the discs of a flexible-wedge or double-disc wedge. This could prevent disc movement due to the pressure being higher in the valve bonnet and between the discs than in the valve body and the incompressibility of the fluid in the bonnet. Compressible fluids have the ability to occupy a smaller volume and allow the disc to move, whereas incompressible fluids do not. Steam systems can be susceptible to pressure locking due to the condensation of steam that may occur in the valve bonnet.

Gate valves with design features that prevent pressure locking (e.g., small hole in disc, relief valve on bonnet, etc.) were screened.

Thermal Binding Screening Criteria Double-disc parallel-seat disc valves are not susceptible to thermal binding. From a review of the valve drawings, all the NRC GL 89-10 gate valves at St. Lucie are either flexible-wedge or solid-wedge design with the exception of the Unit 2 auxiliary feed water steam supply isolation valves (MV-08-12 and MV-08-13) which are double disc gate valves.

The condition conducive to thermal binding is when a wedge gate valve is closed while the system is hot, then thermal binding can occur as the system cools. Therefore, thermal binding will not occur if the gate valve is closed at normal ambient temperatures.

**PHASE 2 GATE VALVE EVALUATION METHODOLOGY** The methodology used for the evaluation of motor operated gate valves not excluded by initial screening consisted of a pressure locking evaluation and a thermal binding evaluation. Thirty-four motor operated vales remained to be evaluated during this phase. Summaries of the gate evaluations for the St. Lucie Unit 1 MOVs are provided in Appendix 1A. Summaries of the gate evaluations for the St. Lucie Unit 2 MOVs are provided in Appendix 1B.

Pressure Locking Evaluation Methodology Various plant operational sequences could introduce conditions conducive to pressure locking. Irrespective of initial bonnet cavity fluid pressure (low or high) and temperature, it is clear that a subsequent temperature increase of the fluid could cause an increase in bonnet cavity pressure due

to thermal expansion of the fluid. The temperature increase can occur as fluid on either side of a disc heats up during various modes of plant operation or possible changes in ambient air temperature caused by plant operation, leaking pumps or valves, or in the event of a high-energy line break. In these situations, the rate of temperature increase, which may be relatively slow to very high, controls the bonnet cavity pressure and valve susceptibility to pressure locking. Conversely, a bonnet cavity filled with high pressure fluid, such as leakage from the reactor coolant system, becomes a pressure locking candidate should a loss-of-coolant accident (LOCA) or other transient cause pipe line depressurization.

Based upon the above, the evaluation for potential susceptibility of a POV to pressure locking consists of two questions:

1) Can the bonnet be pressurized due to $\Delta P$ across the valve and subsequently, the valve body is depressurized?

2) Can the bonnet be filled with fluid with a subsequent temperature increase of the fluid which causes an increase in bonnet cavity pressure due to thermal expansion?

A positive response to either of these questions indicates that a valve may be susceptible to pressure locking and further analysis is required.

Thermal Binding Evaluation Methodology The evaluation for potential susceptibility of a power operated gate valve to thermal binding consists of one question:

Can the valve be closed while hot and required to open when at a lower temperature?

A positive response to this question indicates that a gate valve may be susceptible to thermal binding and further analysis is required.

**PHASE 3 VALVE SPECIFIC ANALYSIS** A detailed, valve specific analysis was performed on MOVs that were not excluded by either the initial valve screening or gate valve evaluation processes. Nine motor operated valves were identified as potentially susceptible to pressure locking and/or thermal binding and were evaluated in this phase. Six valves were modified as described below. Three valves on Unit 2 remain to be modified; the basis for their continued operability is described in Attachment 2.

On St. Lucie Unit 1, the shutdown cooling (SDC) system isolation valves (V-3480, V-3481, V-3651, and V-3652), which isolate the reactor coolant system (RCS) hot legs from the SDC system, are

susceptible only to pressure locking. No power operated valves were identified as being susceptible to thermal binding on Unit 1.

A calculation was performed to determine the thrust required to open these valves assuming the bonnet becomes pressure locked at 2235 psig. As a result, the actuator gear ratio was changed during the Fall 1994 St. Lucie Unit 1 refueling outage (SL1-13). The modification increased the actuator capability sufficiently to overcome the worst case pressure locking scenario. Therefore, pressure locking is no longer a concern for the Unit 1 valves (V-3480, V-3481, V-3651, and V-3652).

On St. Lucie Unit 2, the SDC isolation valves (V-3480, V-3481, V-3651, and V-3652), which isolate the RCS hot legs from the SDC system, and the SDC suction cross-tie valve (V-3545), are susceptible only to pressure locking. No power operated valves were identified as being susceptible to thermal binding.

The corrective action for the St. Lucie Unit 2 gate valves, V-3481 and V-3545, was implemented during the Fall 1995 Unit 2 refueling outage (SL2-9). A plant modification was implemented to add an equalization hole in the high pressure side disc of V-3481 and a second modification was implemented to change the normal position of V-3545 to normally open.

Attachment 2 of this letter provides a summary of the operability assessment and the schedule justification for St. Lucie Unit 2 Cycle 9 for the remaining three SDC isolation motor-operated gate valves, V-3480, V-3651 and V-3652. The corrective actions for these valves will be implemented during the St. Lucie Unit 2 Cycle 10 refueling outage (SL2-10) currently scheduled for the Spring of 1997. The modification to V-3481 was the pilot implementation of the planned corrective actions for the remaining three valves.

The safety-related function of these SDC valves is to open to establish shutdown cooling for decay heat removal following a postulated accident. Since these valves are not required to open for 3 to 4 hours following an accident, it was determined that a pressure locking condition would not exist if adequate seat leakage existed to equalize the pressure between the valve bonnet and the valve body. The known valve seat leakage would depressurize the bonnet over this time period and permit the motor operator to open the valve.

# TABLE 1

## ST. LUCIE UNIT 1
## PRESSURE LOCKING AND THERMAL BINDING SCREENING FOR MOTOR OPERATED VALVES

| VALVE NO. | NRC GL[a] 89-10 | GATE[a] VALVE | SAFETY[a] FUNCTION TO OPEN | PRESSURE LOCKING[b] 1 | 2 | 3 | THERMAL BINDING[c] 1 | 2 |
|---|---|---|---|---|---|---|---|---|
| V-1403 | YES | YES | YES | NO | - | - | YES | YES |
| V-1405 | YES | YES | YES | NO | - | - | YES | YES |
| V-2501 | YES | YES | NO | - | - | - | - | - |
| V-2504 | YES | YES | YES | YES | YES | YES | NO | NO |
| V-2508 | YES | YES | YES | YES | YES | YES | NO | NO |
| V-2509 | YES | YES | YES | YES | YES | YES | NO | NO |
| V-2514 | YES | YES | YES | YES | YES | YES | NO | NO |
| V-2525 | YES | YES | NO | - | - | - | - | - |
| V-3206 | YES | YES | NO | - | - | - | - | - |
| V-3207 | YES | YES | NO | - | - | - | - | - |
| V-3432 | YES | YES | NO | - | - | - | - | - |
| V-3444 | YES | YES | NO | - | - | - | - | - |
| V-3452 | YES | YES | YES | YES | YES | YES | YES | YES |
| V-3453 | YES | YES | YES | YES | YES | YES | YES | YES |
| V-3456 | YES | YES | YES | YES | YES | YES | YES | YES |
| V-3457 | YES | YES | YES | YES | YES | YES | YES | YES |
| V-3480 | YES | YES | YES | YES | YES | YES | YES | YES |
| V-3481 | YES | YES | YES | YES | YES | YES | YES | YES |
| V-3614 | NO | - | - | - | - | - | - | - |
| HCV-3615 | YES | NO | - | - | - | - | - | - |
| HCV-3616 | YES | NO | - | - | - | - | - | - |
| HCV-3617 | YES | NO | - | - | - | - | - | - |
| V-3624 | NO | - | - | - | - | - | - | - |
| HCV-3625 | YES | NO | - | - | - | - | - | - |

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a If the answer in any of these columns is NO, then additional screening for susceptibility to pressure locking and/or thermal binding is not required.

b PRESSURE LOCKING SCREENING CRITERIA:

If the answer to any of the following Questions is NO then the valve is not susceptible to pressure locking and further evaluation is not required.

1. Does the Valve have a Flexible-Wedge or Double-Disc Wedge Design?
2. Is the Valve installed in a process media containing incompressible fluid and/or steam?
3. Is the Valve lacking design features that prevent pressure locking (e.g., small hole in disc, relief valve on bonnet, etc.).?

c THERMAL BINDING SCREENING CRITERIA:

If the answer to any of the following Questions is NO, then the valve is not susceptible to thermal binding and further evaluation is not required.

1. Does the Valve have a Flexible-Wedge, Solid-Wedge or Split-Wedge Design?
2. Can the Valve be closed under temperature conditions greater than normal ambient conditions or due to HOT ambient conditions (e.g., HELB or MSLB/LOCA)?

# TABLE 1

## ST. LUCIE UNIT 1
## PRESSURE LOCKING AND THERMAL BINDING SCREENING FOR MOTOR OPERATED VALVES

| VALVE NO. | NRC GL[a] 89-10 | GATE[a] VALVE | SAFETY[a] FUNCTION TO OPEN | PRESSURE LOCKING[b] 1 | 2 | 3 | THERMAL BINDING[c] 1 | 2 |
|---|---|---|---|---|---|---|---|---|
| HCV-3626 | YES | NO | - | - | - | - | - | - |
| HCV-3627 | YES | NO | - | - | - | - | - | - |
| V-3634 | NO | - | - | - | - | - | - | - |
| HCV-3635 | YES | NO | - | - | - | - | - | - |
| HCV-3636 | YES | NO | - | - | - | - | - | - |
| HCV-3637 | YES | NO | - | - | - | - | - | - |
| V-3644 | NO | - | - | - | - | - | - | - |
| HCV-3645 | YES | NO | - | - | - | - | - | - |
| HCV-3646 | YES | NO | - | - | - | - | - | - |
| HCV-3647 | YES | NO | - | - | - | - | - | - |
| V-3651 | YES | YES | YES | YES | YES | YES | YES | YES |
| V-3652 | YES | YES | YES | YES | YES | YES | YES | YES |
| V-3653 | NO | - | - | - | - | - | - | - |
| V-3654. | YES | YES | NO | - | - | - | - | |
| V-3655 | NO | - | - | - | - | - | - | |
| V-3656 | YES | YES | NO | - | - | - | - | - |
| V-3659 | YES | YES | NO | - | - | - | - | - |
| V-3660 | YES | YES | NO | - | - | - | - | - |
| V-3662 | YES | YES | YES | YES | YES | YES | YES | YES |
| V-3663 | YES | YES | YES | YES | YES | YES | YES | YES |
| MV-02-1 | NO | - | - | - | - | - | - | - |
| MV-02-2 | NO | - | - | - | - | - | - | - |
| MV-03-2 | YES | NO | - | - | - | - | - | - |
| MV-03-1A | YES | NO | - | - | - | - | - | - |

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a If the answer in any of these columns is NO, then additional screening for susceptibility to pressure locking and/or thermal binding is not required.

b PRESSURE LOCKING SCREENING CRITERIA;

If the answer to any of the following Questions is NO then the valve is not susceptible to pressure locking and further evaluation is not required.

1. Does the Valve have a Flexible-Wedge or Double-Disc Wedge Design?
2. Is the Valve installed in a process media containing incompressible fluid and/or steam?
3. Is the Valve lacking design features that prevent pressure locking (e.g., small hole in disc, relief valve on bonnet, etc.).?

c THERMAL BINDING SCREENING CRITERIA:

If the answer to any of the following Questions is NO, then the valve is not susceptible to thermal binding and further evaluation is not required.

1. Does the Valve have a Flexible-Wedge, Solid-Wedge or Split-Wedge Design?
2. Can the Valve be closed under temperature conditions greater than normal ambient conditions or due to HOT ambient conditions (e.g., HELB or MSLB/LOCA)?

# TABLE 1

## ST. LUCIE UNIT 1
## PRESSURE LOCKING AND THERMAL BINDING SCREENING FOR MOTOR OPERATED VALVES

| VALVE NO. | NRC GL[a] 89-10 | GATE[a] VALVE | SAFETY[a] FUNCTION TO OPEN | PRESSURE LOCKING[b] 1 | 2 | 3 | THERMAL BINDING[c] 1 | 2 |
|---|---|---|---|---|---|---|---|---|
| MV-03-1B | YES | NO | - | - | - | - | - | - |
| MV-07-1A | YES | NO | - | - | - | - | - | - |
| MV-07-1B | YES | NO | - | - | - | - | - | - |
| MV-07-2A | YES | NO | - | - | - | - | - | - |
| MV-07-2B | YES | NO | - | - | - | - | - | - |
| MV-08-1A | YES | NO | - | - | - | - | - | - |
| MV-08-1B | YES | NO | - | - | - | - | - | - |
| MV-08-3 | YES | NO | - | - | - | - | - | - |
| MV-08-13 | YES | NO | - | - | - | - | - | - |
| MV-08-14 | YES | NO | - | - | - | - | - | - |
| MV-09-1 | YES | YES | NO | - | - | - | - | - |
| MV-09-2 | YES | YES | NO | - | - | - | - | - |
| MV-09-7 | YES | YES | NO | - | - | - | - | - |
| MV-09-8 | YES | YES | NO | - | - | - | - | - |
| MV-09-9 | YES | NO | - | - | - | - | - | - |
| MV-09-10 | YES | NO | - | - | - | - | - | - |
| MV-09-11 | YES | NO | - | - | - | - | - | - |
| MV-09-12 | YES | NO | - | - | - | - | - | - |
| MV-09-13 | YES | NO | - | - | - | - | - | - |
| MV-09-14 | YES | NO | - | - | - | - | - | - |
| MV-14-1 | YES | NO | - | - | - | - | - | - |
| MV-14-2 | YES | NO | - | - | - | - | - | - |
| MV-14-3 | YES | NO | - | - | - | - | - | - |
| MV-14-4 | YES | NO | - | - | - | - | - | - |

a

If the answer in any of these columns is NO, then additional screening for susceptibility to pressure locking and/or thermal binding is not required.

b

PRESSURE LOCKING SCREENING CRITERIA;

If the answer to any of the following Questions is NO then the valve is not susceptible to pressure locking and further evaluation is not required.

1. Does the Valve have a Flexible-Wedge or Double-Disc Wedge Design?
2. Is the Valve installed in a process media containing incompressible fluid and/or steam?
3. Is the Valve lacking design features that prevent pressure locking (e.g., small hole in disc, relief valve on bonnet, etc.).?

c

THERMAL BINDING SCREENING CRITERIA:

If the answer to any of the following Questions is NO, then the valve is not susceptible to thermal binding and further evaluation is not required.

1. Does the Valve have a Flexible-Wedge, Solid-Wedge or Split-Wedge Design?
2. Can the Valve be closed under temperature conditions greater than normal ambient conditions or due to HOT ambient conditions (e.g., HELB or MSLB/LOCA)?

# TABLE 1

## ST. LUCIE UNIT 1
## PRESSURE LOCKING AND THERMAL BINDING SCREENING FOR MOTOR OPERATED VALVES

| VALVE NO. | NRC GL[a] 89-10 | GATE[a] VALVE | SAFETY[a] FUNCTION TO OPEN | PRESSURE LOCKING[b] 1 | 2 | 3 | THERMAL BINDING[c] 1 | 2 |
|---|---|---|---|---|---|---|---|---|
| MV-14-5 | YES | NO | - | - | - | - | - | - |
| MV-14-6 | YES | NO | - | - | - | - | - | - |
| MV-14-7 | YES | NO | - | - | - | - | - | - |
| MV-14-8 | YES | NO | - | - | - | - | - | - |
| MV-15-1 | YES | YES | NO | - | - | - | - | - |
| MV-18-1 | YES | YES | NO | - | - | - | - | - |
| MV-21-2 | YES | NO | - | - | - | - | - | - |
| MV-21-3 | YES | NO | - | - | - | - | - | - |
| FCV-25-9 | YES | NO | - | - | - | - | - | - |

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a If the answer in any of these columns is NO, then additional screening for susceptibility to pressure locking and/or thermal binding is not required.

b PRESSURE LOCKING SCREENING CRITERIA;

If the answer to any of the following Questions is NO then the valve is not susceptible to pressure locking and further evaluation is not required.

1. Does the Valve have a Flexible-Wedge or Double-Disc Wedge Design?
2. Is the Valve installed in a process media containing incompressible fluid and/or steam?
3. Is the Valve lacking design features that prevent pressure locking (e.g., small hole in disc, relief valve on bonnet, etc.).?

c THERMAL BINDING SCREENING CRITERIA:

If the answer to any of the following Questions is NO, then the valve is not susceptible to thermal binding and further evaluation is not required.

1. Does the Valve have a Flexible-Wedge, Solid-Wedge or Split-Wedge Design?
2. Can the Valve be closed under temperature conditions greater than normal ambient conditions or due to HOT ambient conditions (e.g., HELB or MSLB/LOCA)?

# TABLE 2

## ST. LUCIE UNIT 2
## PRESSURE LOCKING AND THERMAL BINDING SCREENING FOR MOTOR OPERATED VALVES

| VALVE NO. | NRC GL[a] 89-10 | GATE[a] VALVE | SAFETY[a] FUNCTION TO OPEN | PRESSURE LOCKING[b] 1 | 2 | 3 | THERMAL BINDING[c] 1 | 2 |
|---|---|---|---|---|---|---|---|---|
| V-1476 | YES | YES | YES | YES | YES | YES | YES | YES |
| V-1477 | YES | YES | YES | YES | YES | YES | YES | YES |
| V-2185 | NO | - | - | - | - | - | - | - |
| V-2501 | YES | YES | NO | - | - | - | - | - |
| V-2504 | YES | YES | YES | YES | YES | YES | YES | NO |
| V-2508 | YES | YES | YES | YES | YES | YES | YES | NO |
| V-2509 | YES | YES | YES | YES | YES | YES | YES | NO |
| V-2514 | YES | YES | YES | YES | YES | YES | YES | NO |
| V-2525 | YES | YES | NO | - | - | - | - | - |
| V-2553 | YES | NO | - | - | - | - | - | - |
| V-2554 | YES | NO | - | - | - | - | - | - |
| V-2555 | YES | NO | - | - | - | - | - | - |
| V-2598 | NO | - | - | - | - | - | - | - |
| FCV-3301 | YES | NO | - | - | - | - | - | - |
| FCV-3306 | YES | NO | - | - | - | - | - | - |
| V-3432 | YES | YES | NO | - | - | - | - | - |
| V-3444 | YES | YES | NO | - | - | - | - | - |
| V-3456 | YES | YES | YES | YES | YES | YES | YES | YES |
| V-3457 | YES | YES | YES | YES | YES | YES | YES | YES |
| V-3480 | YES | YES | YES | YES | YES | YES | YES | YES |
| V-3481 | YES | YES | YES | YES | YES | YES | YES | YES |
| HCV-3512 | YES | NO | - | - | - | - | - | - |
| V-3517 | YES | YES | YES | YES | YES | YES | YES | YES |
| V-3523 | YES | NO | - | - | - | - | - | - |
| V-3536 | YES | NO | - | - | - | - | - | - |
| V-3539 | YES | NO | - | - | - | - | - | - |

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a If the answer in any of these columns is NO, then additional screening for susceptibility to pressure locking and/or thermal binding is not required.

b PRESSURE LOCKING SCREENING CRITERIA:

If the answer to any of the following Questions is NO then the valve is not susceptible to pressure locking and further evaluation is not required.

1. Does the Valve have a Flexible-Wedge or Double-Disc Wedge Design?
2. Is the Valve installed in a process media containing incompressible fluid and/or steam?
3. Is the Valve lacking design features that prevent pressure locking (e.g., small hole in disc, relief valve on bonnet, etc.).?

c THERMAL BINDING SCREENING CRITERIA:

If the answer to any of the following Questions is NO, then the valve is not susceptible to thermal binding and further evaluation is not required.

1. Does the Valve have a Flexible-Wedge, Solid-Wedge or Split-Wedge Design?
2. Can the Valve be closed under temperature conditions greater than normal ambient conditions or due to HOT ambient conditions (e.g., HELB or MSLB/LOCA)?

# TABLE 2

## ST. LUCIE UNIT 2
## PRESSURE LOCKING AND THERMAL BINDING SCREENING FOR MOTOR OPERATED VALVES

| VALVE NO. | NRC GL[a] 89-10 | GATE[a] VALVE | SAFETY[a] FUNCTION TO OPEN | PRESSURE LOCKING[b] 1 | 2 | 3 | THERMAL BINDING[c] 1 | 2 |
|---|---|---|---|---|---|---|---|---|
| V-3540 | YES | NO | - | - | - | - | - | - |
| V-3545 | YES | YES | YES | YES | YES | YES | YES | YES |
| V-3550 | YES | NO | - | - | - | - | - | - |
| V-3551 | YES | NO | - | - | - | - | - | - |
| V-3614 | NO | - | - | - | - | - | - | - |
| HCV-3615 | YES | NO | - | - | - | - | - | - |
| HCV-3616 | YES | NO | - | - | - | - | - | - |
| HCV-3617 | YES | NO | - | - | - | - | - | - |
| V-3624 | NO | - | - | - | - | - | - | - |
| HCV-3625 | YES | NO | - | - | - | - | - | - |
| HCV-3626 | YES | NO | - | - | - | - | - | - |
| HCV-3627 | YES | NO | - | - | - | - | - | - |
| V-3634 | NO | - | - | - | - | - | - | - |
| HCV-3635 | YES | NO | - | - | - | - | - | - |
| HCV-3636 | YES | NO | - | - | - | - | - | - |
| HCV-3637 | YES | NO | - | - | - | - | - | - |
| V-3644 | NO | - | - | - | - | - | - | - |
| HCV-3645 | YES | NO | - | - | - | - | - | - |
| HCV-3646 | YES | NO | - | - | - | - | - | - |
| HCV-3647 | YES | NO | - | - | - | - | - | - |
| V-3651 | YES | YES | YES | YES | YES | YES | YES | YES |
| V-3652 | YES | YES | YES | YES | YES | YES | YES | YES |
| V-3654 | YES | YES | NO | - | - | - | - | - |
| V-3656 | YES | YES | NO | - | - | - | - | - |
| HCV-3657 | YES | NO | - | - | - | - | - | - |
| V-3658 | YES | YES | YES | YES | YES | YES | YES | YES |

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a If the answer in any of these columns is NO, then additional screening for susceptibility to pressure locking and/or thermal binding is not required.

b PRESSURE LOCKING SCREENING CRITERIA:

If the answer to any of the following Questions is NO then the valve is not susceptible to pressure locking and further evaluation is not required.

1. Does the Valve have a Flexible-Wedge or Double-Disc Wedge Design?
2. Is the Valve installed in a process media containing incompressible fluid and/or steam?
3. Is the Valve lacking design features that prevent pressure locking (e.g., small hole in disc, relief valve on bonnet, etc.).?

c THERMAL BINDING SCREENING CRITERIA:

If the answer to any of the following Questions is NO, then the valve is not susceptible to thermal binding and further evaluation is not required.

1. Does the Valve have a Flexible-Wedge, Solid-Wedge or Split-Wedge Design?
2. Can the Valve be closed under temperature conditions greater than normal ambient conditions or due to HOT ambient conditions (e.g., HELB or MSLB/LOCA)?

# TABLE 2

## ST. LUCIE UNIT 2
## PRESSURE LOCKING AND THERMAL BINDING SCREENING FOR MOTOR OPERATED VALVES

| VALVE NO. | NRC GL[a] 89-10 | GATE[a] VALVE | SAFETY[a] FUNCTION TO OPEN | PRESSURE LOCKING[b] 1 | 2 | 3 | THERMAL BINDING[c] 1 | 2 |
|---|---|---|---|---|---|---|---|---|
| V-3659 | YES | YES | NO | - | - | - | - | - |
| V-3660 | YES | YES | NO | - | - | - | - | - |
| V-3664 | YES | YES | YES | YES | YES | YES | YES | YES |
| V-3665 | YES | YES | YES | YES | YES | YES | YES | YES |
| MV-07-1A | YES | NO | - | - | - | - | - | - |
| MV-07-1B | YES | NO | - | - | - | - | - | - |
| MV-07-2A | YES | NO | - | - | - | - | - | - |
| MV-07-2B | YES | NO | - | - | - | - | - | - |
| MV-08-1A | YES | NO | - | - | - | - | - | - |
| MV-08-1B | YES | NO | - | - | - | - | - | - |
| MV-08-3 | YES | NO | - | - | - | - | - | - |
| MV-08-12 | YES | YES | YES | YES | YES | YES | NO | - |
| MV-08-13 | YES | YES | YES | YES | YES | YES | NO | - |
| MV-08-14 | YES | YES | NO | - | - | - | - | - |
| MV-08-15 | YES | YES | NO | - | - | - | - | - |
| MV-08-16 | YES | YES | NO | - | - | - | - | - |
| MV-08-17 | YES | YES | NO | - | - | - | - | - |
| MV-08-18A | YES | NO | - | - | - | - | - | - |
| MV-08-18B | YES | NO | - | - | - | - | - | - |
| MV-08-19A | YES | NO | - | - | - | - | - | - |
| MV-08-19B | YES | NO | - | - | - | - | - | - |
| MV-09-9 | YES | NO | - | - | - | - | - | - |
| MV-09-10 | YES | NO | - | - | - | - | - | - |
| MV-09-11 | YES | NO | - | - | - | - | - | - |
| MV-09-12 | YES | NO | - | - | - | - | - | - |
| MV-09-13 | NO | - | - | - | - | - | - | - |

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a If the answer in any of these columns is NO, then additional screening for susceptibility to pressure locking and/or thermal binding is not required.

b PRESSURE LOCKING SCREENING CRITERIA;

If the answer to any of the following Questions is NO then the valve is not susceptible to pressure locking and further evaluation is not required.

1. Does the Valve have a Flexible-Wedge or Double-Disc Wedge Design?
2. Is the Valve installed in a process media containing incompressible fluid and/or steam?
3. Is the Valve lacking design features that prevent pressure locking (e.g., small hole in disc, relief valve on bonnet, etc.).?

c THERMAL BINDING SCREENING CRITERIA:

If the answer to any of the following Questions is NO, then the valve is not susceptible to thermal binding and further evaluation is not required.

1. Does the Valve have a Flexible-Wedge, Solid-Wedge or Split-Wedge Design?
2. Can the Valve be closed under temperature conditions greater than normal ambient conditions or due to HOT ambient conditions (e.g., HELB or MSLB/LOCA)?

# TABLE 2

## ST. LUCIE UNIT 2
## PRESSURE LOCKING AND THERMAL BINDING SCREENING FOR MOTOR OPERATED VALVES

| VALVE NO. | NRC GL[a] 89-10 | GATE[a] VALVE | SAFETY[a] FUNCTION TO OPEN | PRESSURE LOCKING[b] 1 | 2 | 3 | THERMAL BINDING[c] 1 | 2 |
|---|---|---|---|---|---|---|---|---|
| MV-09-14 | NO | - | - | - | - | - | - | - |
| MV-14-1 | YES | NO | - | - | - | - | - | - |
| MV-14-2 | YES | NO | - | - | - | - | - | - |
| MV-14-3 | YES | NO | - | - | - | - | - | - |
| MV-14-4 | YES | NO | - | - | - | - | - | - |
| MV-14-9 | YES | NO | - | - | - | - | - | - |
| MV-14-10 | YES | NO | - | - | - | - | - | - |
| MV-14-11 | YES | NO | - | - | - | - | - | - |
| MV-14-12 | YES | NO | - | - | - | - | - | - |
| MV-14-13 | YES | NO | - | - | - | - | - | - |
| MV-14-14 | YES | NO | - | - | - | - | - | - |
| MV-14-15 | YES | NO | - | - | - | - | - | - |
| MV-14-16 | YES | NO | - | - | - | - | - | - |
| MV-14-17 | YES | NO | - | - | - | - | - | - |
| MV-14-18 | YES | NO | - | - | - | - | - | - |
| MV-14-19 | YES | NO | - | - | - | - | - | - |
| MV-14-20 | YES | NO | - | - | - | - | - | - |
| MV-21-2 | YES | NO | - | - | - | - | - | - |
| MV-21-3 | YES | NO | - | - | - | - | - | - |
| MV-21-4A | YES | NO | - | - | - | - | - | - |
| MV-21-4B | YES | NO | - | - | - | - | - | - |
| FCV-25-29 | YES | NO | - | - | - | - | - | - |
| FCV-25-32 | YES | NO | - | - | - | - | - | - |
| FCV-25-33 | YES | NO | - | - | - | - | - | - |
| FCV-25-34 | YES | NO | - | - | - | - | - | - |

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a If the answer in any of these columns is NO, then additional screening for susceptibility to pressure locking and/or thermal binding is not required.

b PRESSURE LOCKING SCREENING CRITERIA:

If the answer to any of the following Questions is NO then the valve is not susceptible to pressure locking and further evaluation is not required.

1. Does the Valve have a Flexible-Wedge or Double-Disc Wedge Design?
2. Is the Valve installed in a process media containing incompressible fluid and/or steam?
3. Is the Valve lacking design features that prevent pressure locking (e.g., small hole in disc, relief valve on bonnet, etc.).?

c THERMAL BINDING SCREENING CRITERIA:

If the answer to any of the following Questions is NO, then the valve is not susceptible to thermal binding and further evaluation is not required.

1. Does the Valve have a Flexible-Wedge, Solid-Wedge or Split-Wedge Design?
2. Can the Valve be closed under temperature conditions greater than normal ambient conditions or due to HOT ambient conditions (e.g., HELB or MSLB/LOCA)?

# TABLE 3

## ST. LUCIE UNIT 1
## PRESSURE LOCKING AND THERMAL BINDING SCREENING OF POWER OPERATED VALVES

| VALVE NO. | POV[a] GATE VALVE | SAFETY[a] FUNCTION TO OPEN | PRESSURE LOCKING[b] 1 | 2 | 3 | THERMAL BINDING[c] 1 | 2 |
|---|---|---|---|---|---|---|---|
| V-3459 | YES | NO | - | - | - | - | - |

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a If the answer in any of these columns is NO, then additional screening for susceptibility to pressure locking and/or thermal binding is not required.

b PRESSURE LOCKING SCREENING CRITERIA;

If the answer to any of the following Questions is NO then the valve is not susceptible to pressure locking and further evaluation is not required.

1. Does the Valve have a Flexible-Wedge or Double-Disc Wedge Design?
2. Is the Valve installed in a process media containing incompressible fluid and/or steam?
3. Is the Valve lacking design features that prevent pressure locking (e.g., small hole in disc, relief valve on bonnet, etc.).?

c THERMAL BINDING SCREENING CRITERIA:

If the answer to any of the following Questions is NO, then the valve is not susceptible to thermal binding and further evaluation is not required.

1. Does the Valve have a Flexible-Wedge, Solid-Wedge or Split-Wedge Design?
2. Can the Valve be closed under temperature conditions greater than normal ambient conditions or due to HOT ambient conditions (e.g., HELB or MSLB/LOCA)?

# TABLE 4

## ST. LUCIE UNIT 2
## PRESSURE LOCKING AND THERMAL BINDING SCREENING FOR POWER OPERATED VALVES

| VALVE NO. | POV[a] GATE VALVE | SAFETY[a] FUNCTION TO OPEN | PRESSURE LOCKING[b] 1 | 2 | 3 | THERMAL BINDING[c] 1 | 2 |
|---|---|---|---|---|---|---|---|
| FCV-07-1A | YES | YES | NO | - | - | NO | - |
| FCV-07-1B | YES | YES | NO | - | - | NO | - |
| HCV-09-1A | YES | NO | - | - | - | - | - |
| HCV-09-1B | YES | NO | - | - | - | - | - |
| HCV-09-2A | YES | NO | - | - | - | - | - |
| HCV-09-2B | YES | NO | - | - | - | - | - |

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a If the answer in any of these columns is NO, then additional screening for susceptibility to pressure locking and/or thermal binding is not required.

b PRESSURE LOCKING SCREENING CRITERIA:

If the answer to any of the following Questions is NO then the valve is not susceptible to pressure locking and further evaluation is not required.

1. Does the Valve have a Flexible-Wedge or Double-Disc Wedge Design?
2. Is the Valve installed in a process media containing incompressible fluid and/or steam?
3. Is the Valve lacking design features that prevent pressure locking (e.g., small hole in disc, relief valve on bonnet, etc.).?

c THERMAL BINDING SCREENING CRITERIA:

If the answer to any of the following Questions is NO, then the valve is not susceptible to thermal binding and further evaluation is not required.

1. Does the Valve have a Flexible-Wedge, Solid-Wedge or Split-Wedge Design?
2. Can the Valve be closed under temperature conditions greater than normal ambient conditions or due to HOT ambient conditions (e.g., HELB or MSLB/LOCA)?

# APPENDIX 1A

# ST. LUCIE UNIT 1

# GATE EVALUATION SUMMARY OF

# PRESSURE LOCKING AND THERMAL BINDING

# FOR POWER OPERATED GATE VALVES

## ST. LUCIE UNIT 1 PHASE 2 GATE VALVE EVALUATION SUMMARY

### V-1403 and V-1405 "Power Operated Relief Valve (PORV) Block Valves"

Description: V-1403 and V-1405 are $2^1/_2$" Velan solid wedge gate valves with SMB-00 actuators. The valves are located in the containment building, outside the pressurizer cubicle. The maximum opening differential pressure is 2485 psid. During power operation both block valves are required to remain open. V-1403 and V-1405 perform the safety-related function to passively maintain RCS pressure boundary. The quality-related function of these valves is to isolate the pressurizer in the event a PORV is stuck open. In addition, the PORVs are utilized for contingencies for functional recovery: RCS pressure control success path 5, PORVs and RCS and core heat removal, success path 4, "once-through-cooling". Both of these contingencies require verifying the PORV block valves are open.

Pressure Locking: No evaluation is required because V-1403 and V-1405 are solid wedge gate valves which have not been demonstrated to be susceptible to pressure locking.

Thermal Binding: During a LOCA, if actions to isolate the LOCA can not be accomplished, the Operators are directed to close the PORVs or close V-1403 or V-1405. These valves could be closed at high temperature early in a LOCA scenario then later be required to open, aligning a PORV for low temperature overpressure protection (LTOP) or once-through-cooling, after the RCS has been depressurized and cooled down. The LTOP scenario is considered to be the bounding thermal binding scenario. A review was conducted to determine if V-1403 and V-1405 had ever been closed hot (e.g., to isolate a leaking PORV) and subsequently opened to align for LTOP. It was determined that both V-1403 & V-1405 had been used to isolate a leaking PORV when the unit was at 100% power and subsequently successfully opened to align for LTOP. In addition, subsequent to this event, these valves were changed to close on limit switch - in lieu of torque switch. The use of limit switch control in the closing direction reduces the valve seating loads and the potential for thermal binding.

Conclusion: V-1403 and V-1405 are not susceptible to thermal binding because the valves have been subjected to the postulated worst case thermal binding scenario, at a time when the potential of thermal binding was greater due to torque switch seating of the valves, and the valves opened. V-1403 and V-1405 are not susceptible to pressure locking.

### V-2504 "Refueling Water Tank (RWT) Isolation Valve"

Description: This valve is a 3" Velan flex-wedge gate valve with an SMB-00 actuator. The valve is located in the 2A charging pump cubicle at elevation 0'9". The maximum opening differential

pressure is 93 psid. The valve is normally closed. The safety-related function of V-2504 is open to align the charging pumps to the RWT for an alternate borated water supply required by Technical Specifications. The quality-related function of V-2504 is to automatically open upon receipt of a volume control tank (VCT) low low level signal to align the RWT to the charging pump(s) suction.

Pressure Locking: There is no severe depressurization postulated for the piping system upstream of V-2504 on the order of a LOCA or a high-energy-line-break (HELB). The most severe depressurization would occur due to loss of RWT level. Therefore, pressure locking due to upstream depressurization is not credible. In regards to thermal expansion of fluid trapped in the bonnet, significant temperature changes at this valve are not postulated due to the limitation on solution temperature between 55°F and 100°F. Due to the physical location of the valve, V-2504 should remain close to ambient temperatures at all times and pressure locking is not a concern.

Thermal Binding: V-2504 is restricted by the Technical Specification limitation on temperature for the RWT of 55°F to 100°F. Therefore, it is postulated that V-2504 would not be closed hot. Therefore, thermal binding is not a concern.

Conclusion: V-2504 is not susceptible to pressure locking or thermal binding.

**V-2508 & V-2509 "Boric Acid Gravity Feed Valves"**

Description: V-2508 & V-2509 are 3" Velan flex-wedge gate valves with SMB-00 actuators. The valves are located in the reactor auxiliary building (RAB) inside the boric acid makeup tank (BAMT) cubicle at elevation 2'-$7^{7}/_{8}$". V-2508 & V-2509 are located at the outlet of BAMTs. The maximum opening differential pressure is 28 psid. The safety-related function of these valves is to open upon receipt of a safety injection actuation signal (SIAS) to provide concentrated borated water to the charging pumps.

Pressure Locking: There is no severe depressurization postulated for the piping system upstream of these valves on the order of a LOCA or HELB. The most severe depressurization would occur due to changes in boric acid makeup tank level. Therefore, pressure locking due to upstream depressurization is not credible. In regards to thermal expansion of fluid trapped in the bonnet, significant temperature changes at these valves is not postulated because of the low temperatures in the system.

Thermal Binding: Due to the low temperatures in the system, thermal binding is not considered to be credible.

Conclusion: V-2508 and V-2509 are not susceptible to pressure locking or to thermal binding.

**V-2514 "Make-up Bypass to Charging Pumps"**

Description: V-2514 is a 3" Anchor Darling flex-wedge gate valve with an SMB-000 actuator. The valve is located in the reactor auxiliary building (RAB) -0.5 elevation. The maximum opening differential pressure is 146 psid. The valve is normally closed. The safety-related function of V-2514 is open to align the charging pumps to the boric acid make-up (BAM) pumps for an alternate borated water supply required by Technical Specifications.

Pressure Locking: There is no severe depressurization postulated for the piping system upstream of V-2514 on the order of a LOCA or HELB. The most severe depressurization would occur due to loss BAMT level or loss of a BAM pump. Therefore, pressure locking due to upstream depressurization is not credible. In regards to thermal expansion of fluid trapped in the bonnet, significant temperature changes at this valve are not postulated due to the flow of BAMT fluid because of the limitation on solution temperature $\geq$ 55°F and environmental conditions $\leq$120°F.

Thermal Binding: Due to the limitation on system and environmental temperatures between 55°F and 120°F, thermal binding is not a concern.

Conclusion: V-2514 is not susceptible to pressure locking or thermal binding.

**V-3452, V-3453, V-3456 and V-3457 "Shutdown Cooling Heat Exchanger Isolation Valves"**

Description: These valves are 10" Velan flex-wedge gate valves with SMB-1 actuators. The valves are located outside the containment building, inside the RAB, in the 1A and 1B shutdown cooling heat exchanger rooms at elevation 4'7". V-3452, V-3453, V-3456 and V-3457 are normally locked closed isolation valves that serve to isolate the SDC heat exchangers (HXs) from the low pressure safety injection (LPSI) system when the SDC HXs are not in use. The safety-related function for these valves is to open to allow warmup and operation of the SDC HXs. The maximum opening differential pressure is 207 psid.

Pressure Locking: For normal SDC system warm-up, for placing the SDC system in operation, and restoration of SDC HXs, these valves are opened with a LPSI pump running. There is no rapid depressurization event upstream or downstream of these valves (e.g., due to a line break) that would require these valves to open. In regards to thermal expansion of fluid trapped in the bonnet, these valves are required to open for warming up the SDC system and for restoring the SDC system to service following isolation of the SDC HXs. Therefore, the valves would not be heated prior to opening. For restoration of the SDC HX, during the time frame where the SDC HX is bypassed, there is a potential for an increase in SDC system temperature. However, these valves are not affected by the system temperature increases because of the

physical location of the valve relative to the SDC HX inlet/outlet lines and the SDC bypass line. Therefore, these valves will not heatup after closing due to system temperature increases.

Thermal Binding: The most limiting scenario for these valves is due to a loss of component cooling water (CCW) to the SDC HXs. For this event, these valves could be closed hot (300°F) and required to open after the system has cooled due to the restoration of CCW or due to ambient conditions. However, thermal binding is not likely because it is anticipated that the restoration of CCW to the SDC HXs would be a short evolution (i.e., the St. Lucie Unit 1 Technical Specifications require corrective action to restore the SDC loops to operable within 1 hour or establish other appropriate corrective actions) and the body and wedge are composed of materials which have comparable mean coefficients of thermal expansion. Therefore, thermal expansion differences would be small and are within the capability of the actuators.

Conclusion: V-3452, V-3453, V-3456 and V-3457 are not susceptible to pressure locking and/or thermal binding.

**V-3480 & V-3652 "Shutdown Cooling Isolation Valves"**

Description: These valves are 10" Velan flex-wedge gate valves with SMB-1 actuators. The valves are located in the containment building, inside the secondary shield wall at elevation 34'1". V-3480 and V-3652 are the inboard (to the RCS) isolation valves that isolate 1A and 1B trains of SDC system from the RCS. The maximum opening differential pressure is 273 psid. The safety-related function for these valves is to open to align the RCS to the SDC system in order to cool the RCS from hot shutdown (Mode 4) to cold shutdown (Mode 5).

Thermal Binding: Typically, V-3480 and V-3652 are closed under hot conditions (300°F) when isolating the SDC system during heatup and opened cold (<120°F due to the valves cooling to ambient conditions). In addition, these valves could be isolated under hot conditions due to an inadvertent isolation of SDC and cool if left isolated for a significant period of time. Under these conditions, thermal binding could occur. However, it is important to note that thermal binding has not been observed in these valves when the valves are opened to align the SDC system to the RCS during a plant cooldown.

Conclusion: V-3480 and V-3652 are potentially susceptible to pressure locking but not thermal binding. In addition, these valves may be susceptible to an increase in bonnet pressures above maximum RCS pressure due to ambient temperature increase associated with a main steam line break (MSLB) inside containment and due to system heatup effects after the valve bonnets have become pressurized. These valves required a phase 3 review, the detailed valve specific analysis described in Attachment 1 (see page 1-4), in order to

determine if sufficient heat input from containment is available to increase the valve bonnet temperature.

**V-3481 & 3651 "Shutdown Cooling Isolation Valves"**

Description: These valves are 10" Velan flex-wedge gate valves with SMB-1 actuators. The valves are located in the containment building, inside the secondary shield wall at elevation 36'9" (V-3481) and 29'7" (V-3651). V-3481 and V-3651 are the outboard (to the RCS) isolation valves that isolate 1A and 1B trains of SDC system from the RCS. The maximum opening differential pressure is 273 psid. The safety-related function for these valves is to open to align the RCS to the SDC system in order to cool the RCS from hot shutdown (Mode 4) to cold shutdown (Mode 5).

Thermal Binding: Typically, V-3481 and V-3651 are closed under hot conditions (300°F) when isolating the SDC system during heatup and opened cold (<120°F) due to the valves cooling to ambient conditions. In addition, these valves could be isolated under hot conditions due to an inadvertent isolation of SDC. As a result, the valves could cool if left isolated for a significant period of time due to the distance of the valves from the RCS. Under these conditions, thermal binding could occur. However, it is important to note that thermal binding has not been observed in these valves when the valves are opened to align the SDC system to the RCS during a plant cooldown.

Conclusion: V-3481 and V-3651 are potentially susceptible to pressure locking but not thermal binding. In addition, these valves may be susceptible to an increase in bonnet pressures above maximum RCS pressure due to ambient temperature increase associated with a main steam line break (MSLB) inside containment after the valve bonnets have become pressurized. These valves required a phase 3 review, the detailed valve specific analysis described in Attachment 1 (see page 1-4), in order to determine if sufficient heat input from containment is available to increase the valve bonnet temperature.

**V-3662 & V-3663 "High Pressure Safety Injection (HPSI) Pump Suction Valves From SDC HXs"**

DESCRIPTION: V-3662 & V-3663 are 4" Velan flex wedge gate valves with SMB-000 actuators. The valves are located in the SDC HX room at elevation 4'6". The maximum opening differential pressure is 223 psid. The safety function of these valves is to open to supply cooled water from the SDC HX to the suction of the high pressure safety injection (HPSI) pumps just prior to initiation of an recirculation actuation signal (RAS).

Pressure Locking: These valves are not affected by the rapid depressurization associated with MSLB or LOCA due their location in the emergency core cooling system (ECCS). The most significant depressurization would be associated with the starting and stopping of a LPSI pump. However, these valves are stroke tested quarterly

which adequately demonstrates the capability of these valves to stroke after starting and stopping a LPSI pump. In regards to thermal expansion of fluid trapped in the bonnet, V-3662 & V-3663 are required to open post-LOCA after the containment spray pumps have been injecting 55°F - 100°F water from the RWT and prior to RAS. Therefore, there is no heat input into the SDC system (prior to RAS) when V-3662 and V-3663 are required to open.

Thermal Binding: It is not credible to postulate a thermal binding condition for these valves when they are required to open to perform their safety function because the temperature of the SDC system is greater than ambient only when the SDC HXs are in-service to shutdown the unit. These valves are not cycled during the time the SDC system is aligned to the RCS to shutdown the unit.

Conclusion: V-3662 & V-3663 are not susceptible to pressure locking and/or thermal binding.

# APPENDIX 1B

# ST. LUCIE UNIT 2

# GATE EVALUATION SUMMARY OF

# PRESSURE LOCKING AND THERMAL BINDING

# FOR POWER OPERATED GATE VALVES

**V-1476 and V-1477 "Power Operated Relief Valve (PORV) Block Valves"**

Description: These valves are 3" Westinghouse flex-wedge gate valves with SB-00 actuators. The valves are located in the containment building, outside the pressurizer cubicle. The maximum opening differential pressure is 2485 psid. In accordance with St. Lucie Unit 2 TS, during power operation only one block valve is permitted to remain open, the other is closed. V-1476 and V-1477 perform the safety-related function to passively maintain RCS pressure boundary. The quality-related function of these valves is to be remote-manually actuated to isolate the associated PORV in order to satisfy the "fail-closed" requirements of their respective PORV. In addition, the PORVs are utilized for contingencies for functional recovery: the RCS pressure control success path 5, PORVs, and the RCS and core heat removal success path 4, once-through-cooling. Both of these contingencies require verifying the PORV block valves are open.

Pressure Locking: In Modes 1,2 and 3, the pressurizer level is maintained so that the PORVs and safety relief valves (and V-1476 & V-1477) will relieve only steam. The bonnet could become pressurized in a steam system and due to a large or small break LOCA, experience rapid depressurization upstream of the valve. However, the compressibility of the steam in the bonnet precludes this scenario from causing a pressure locked condition. Steam pressurization of MOV bonnets is a pressure locking concern due to configurations that permit condensate to collect and drain into the valve bonnet (e.g., vertical pipe runs) with a subsequent temperature increase of the valve bonnet. "Upright" valves have not experienced pressure locking due to steam in the bonnet. V-1476 and V-1477 are oriented in the "upright" position.

Thermal Binding: Under normal conditions, either V-1476 or V-1477 is closed prior to heating up the RCS to above 325°F. In addition, the valves are demonstrated operable at least once per 92 days by operating the valve through one complete cycle of full travel (unless closed with power removed). The valves are re-opened to align for LTOP when RCS temperature is less than 240°F. There is no evidence that thermal binding occurs with these valves because these valves have performed the function of opening to align for LTOP at less than 240°F after operation in Modes 1, 2 and 3. In addition, these valves have Limitorque type SB operators which have compensating spring packs that absorb inertial closing forces and prevent excessive wedging of the disc into the seat. The installation of compensating spring packs on motor operators reduces the valve seating loads and the potential for thermal binding.

Conclusion: V-1476 and V-1477 are not susceptible to pressure locking and/or thermal binding.

**V-2504 "RWT Isolation Valve"**

Description: This valve is a 3" Westinghouse flex-wedge gate valve with an SB-00 actuator. The valve is located in the 2A charging pump cubicle at elevation 0'9". The maximum opening differential pressure is 29 psid. The valve is normally closed. The safety-related function of V-2504 is open to align the charging pumps to the refueling water tank (RWT) for an alternate borated water supply required by Technical Specifications. However, credit is not taken for remote operation of V-2504 because the operator is not Class 1E. Instead, the assumption is plant operators will manually open the valve. In addition, the quality-related function if V-2504 is to automatically open upon receipt of a VCT low low level signal to align the RWT to the charging pump(s) suction.

Pressure Locking: There is no severe depressurization postulated for the piping system upstream of V-2504 on the order of a LOCA or HELB. The most severe depressurization would occur due to loss of RWT level. Therefore, pressure locking due to upstream depressurization is not credible. In regards to thermal expansion of fluid trapped in the bonnet, significant temperature changes at this valve are not postulated due to the flow of RWT fluid because of the limitation on solution temperature between 55°F and 100°F.

Thermal Binding: Fluid temperature in V-2504 is restricted by the Technical Specification limitation on temperature for the RWT of 55°F to 100°F. It is postulated that V-2504 would not be closed at temperatures greater than 100°F; therefore thermal binding is not a concern.

Conclusion: V-2504 is not susceptible to pressure locking or thermal binding.

**V-2508 & V-2509 "Boric Acid Gravity Feed Valves"**

Description: V-2508 & V-2509 are 3" Westinghouse flex-wedge gate valves with SB-00 actuators. The valves are located in the reactor auxiliary building (RAB) inside the boric acid makeup tank (BAMT) cubicle at elevation 13'-6.5". V-2508 & V-2509 are located at the outlet of BAMTs. The maximum opening differential pressure is 16.2 psid. The safety-related function of these valves is to open upon receipt of a SIAS to provide concentrated borated water supply to the charging pumps.

Pressure Locking: There is no severe depressurization postulated for the piping system upstream of these valves on the order of a LOCA or HELB. The most severe depressurization would occur due to changes in boric acid makeup tank level. Therefore, pressure locking due to upstream depressurization is not credible. In regards to thermal expansion of fluid trapped in the bonnet, significant temperature changes at these valves is not postulated because of the low temperatures in the system.

Thermal Binding: Due to the low temperatures in the system, thermal binding is not considered to be credible.

Conclusion: V-2508 and V-2509 are not susceptible to pressure locking or to thermal binding.

**V-2514 "Boric Acid Makeup Bypass to Charging Pumps"**

Description: V-2514 is a 3" Westinghouse flex-wedge gate valve with an SB-00 actuator. The valve is located in the boric acid makeup (BAMT) cubicle at elevation 2'0". The maximum opening differential pressure is 132.2 psid. The valve is normally closed. The safety-related function of V-2514 is open to align the charging pumps to the BAM pumps for an alternate borated water supply required by Technical Specifications.

Pressure Locking: There is no severe depressurization postulated for the piping system upstream of V-2514 on the order of a LOCA or HELB. The most severe depressurization would occur due to loss BAMT level or loss of a BAM pump. Therefore, pressure locking due to upstream depressurization is not credible. In regards to thermal expansion of fluid trapped in the bonnet, significant temperature changes at this valve are not postulated due to the limitation on solution temperature between 55°F and 100°F.

Thermal Binding: Due to the limitation on solution temperature between 55°F and 100°F, thermal binding is not a concern.

Conclusion: V-2514 is not susceptible to pressure locking or thermal binding.

**V-3456 & V-3457 "Shutdown Cooling Heat Exchanger Outlet Valves"**

Description: These valves are 10" Westinghouse flex-wedge gate valves with SB-0 actuators. The valves are located outside the containment building, inside the RAB, in the 2A and 2B safeguards rooms. V-3456 and V-3457 are normally locked closed isolation valves that serve to isolate the SDC heat exchangers from the LPSI system when the SDC HXs are not in use. The safety-related function for these valves is to open to allow warmup and operation of the SDC HXs. The maximum opening differential pressure is 269 psid.

Pressure Locking: For normal SDC system warm-up (and for placing the SDC system in operation), these valves are opened prior to starting the LPSI pumps and before the SDC system is aligned to the RCS. There is no rapid depressurization event upstream or downstream of these valves (e.g., due to a line break) that would require these valves to open. For restoration of SDC HXs events, these valves would be closed and reopened on a loss of CCW to a SDC HX. These valves would be reopened with a LPSI pump running. Therefore, there is no depressurization event postulated in which the valves are relied upon to open. In regards to thermal

expansion of fluid trapped in the bonnet, V-3456 and V-3457 are required to open for warming up the SDC system and for restoring the SDC system to service following isolation of the SDC HXs. For warmup, these valves are opened prior to starting the associated LPSI pump. Therefore, the valves would not be heated prior to opening. For restoration of the SDC HX event, the physical location of the valves prevents them from being exposed to temperature increases in the system.

Thermal Binding: For a loss of CCW to the SDC HXs, these valves could be closed hot and required to open after the system has cooled due to the restoration of CCW or due to ambient conditions. However, for the following reasons, thermal binding is not likely: 1) It is expected that the restoration of CCW to the SDC HXs would be a short evolution (i.e., <30 minutes) and these valves would likely not experience significant cooling in this time frame; 2) V-3456 and V-3457 are controlled in the closed direction by position limit switches (this limits the seating force of the disc in the seats); 3) V-3456 and V-3457 have SB-0 actuators installed on them. SB Limitorque operators have compensating spring packs that absorb inertial closing forces and prevent excessive wedging of the disc into the seat. The installation of compensating spring packs on motor operators reduces the valve seating loads and the potential for thermal binding; 4) The body and disc are identical materials. Therefore, thermal expansion differences would be small and are within the capability of the actuators.

Conclusion: V-3456 and V-3457 are not susceptible to pressure locking and/or thermal binding.

**V-3480 & V-3652 "Shutdown Cooling Isolation Valves"**

Description: These valves are 10" Westinghouse flex-wedge gate valves with SMB-1 actuators. The valves are located in the containment building, inside the secondary shield wall at elevation 39'0" (V-3480) and 30'6" (V-3652), respectively. V-3480 and V-3652 are the in-board (to the RCS) isolation valves that isolate 2A and 2B trains of SDC from the RCS. The maximum opening differential pressure is 277 psid. The safety-related function for these valves is to open to align the RCS to the SDC system in order to cool the RCS from hot shutdown (Mode 4) to cold shutdown (Mode 5).

Thermal Binding: Typically, V-3480 and V-3652 are closed under hot conditions (300°F) when isolating the SDC system during heatup and opened cold (<120°F) due to the valves cooling to ambient conditions. In addition, these valves could be isolated under hot conditions due to an inadvertent isolation of SDC. As a result, the valves could cool if left isolated for a significant period of time due to the distance of the valves from the RCS. Under these conditions, thermal binding could occur. However, it is important to note that thermal binding has not been observed in these valves when the valves are opened to align the SDC system to the RCS during a plant cooldown.

Conclusion: V-3480 and V-3652 are potentially susceptible to pressure locking but not thermal binding. In addition, these valves may be susceptible to an increase in bonnet pressures above maximum RCS pressure due to ambient temperature increase associated with a MSLB inside containment after the valves have become pressurized. These valves required a phase 3 review, the detailed valve specific analysis described in Attachment 1 (see page 1-4), in order to determine if sufficient heat input from containment is available to increase the valve bonnet temperature.

**V-3481, V-3651 & V-3545 "Shutdown Cooling Isolation Valves"**

Description: These valves are 10" Westinghouse flex-wedge gate valves with SMB-1 actuators. The valves are located in the containment building, inside the secondary shield wall at elevation 39'0" (V-3481), 30'6" (V-3651) and 36'3" (V-3545), respectively. V-3481 and V-3651 are the outboard (to the RCS) isolation valves that isolate 2A and 2B trains of SDC system from the RCS. V-3545 is the SDC suction cross-tie isolation valve. The maximum opening differential pressure is 277 psid (V-3481 & V-3651) and 275 psid (V-3545).

The shutdown cooling suction lines are configured such that one of the two isolation valves in each line is powered from the 2A train, while the second isolation valve is powered from the 2B train. The cross-tie valve (V-3545) is powered from the 480V motor control center (MCC) 2AB, which can be aligned to either the 2A or 2B electrical train. This configuration was required to ensure that the SDC system could be aligned to the RCS in the event of a loss of either 2A or 2B train power. Therefore, the safety-related function for these valves is to align the RCS to the SDC system in order to cool the RCS from hot shutdown (Mode 4) to cold shutdown (Mode 5). For V-3545, the safety function is required as a redundant design feature for a loss of electrical power to one of the electrical trains.

Thermal Binding: Typically, V-3481, V-3651 and V-3545 are closed under hot conditions (>300°F) when isolating the SDC system during heatup and opened cold (<120°F) due to the valves cooling to ambient conditions. In addition, these valves could be isolated under hot conditions due to an inadvertent isolation of SDC. As a result, the valves could cool if left isolated for a significant period of time due to the distance of the valves from the RCS. Under these conditions, thermal binding could occur. However, it is important to note that thermal binding has not been observed in these valves when the valves are opened to align the SDC system to the RCS during a plant cooldown.

Conclusion: V-3481, V-3651, and V-3545 are potentially susceptible to pressure locking but not thermal binding. In addition, these valves may be susceptible to an increase in bonnet pressures above maximum RCS pressure due to ambient temperature increase associated with a MSLB inside containment after the valves have become pressurized. These valves required a phase 3 review, the detailed

valve specific analysis described in Attachment 1 (see page 1-4), in order to determine if sufficient heat input from containment is available to increase the valve bonnet temperature.

**V-3517 and V-3658 "Shutdown Cooling Heat Exchanger Inlet Isolation Valves"**

Description: V-3517 and V-3658 are 12" Westinghouse flex-wedge gate valves with SB-0 actuators. The valves are located outside the containment building, inside the reactor auxiliary building, in the 2A and 2B safeguards rooms at elevations -7'10" (V-3517) and -2'8$^{5}/_{8}$" (V-3658). These valves are normally locked closed isolation valves that serve to isolate the SDC heat exchangers from the LPSI system when the SDC HXs are not in use. The safety-related function for these valves is to open to allow warmup and operation of the SDC HXs. The maximum opening differential pressure is 162 psid.

Pressure Locking: For normal SDC system warm-up and for placing the SDC system in operation, these valves are opened after starting the LPSI pumps and before the SDC system is aligned to the RCS. There is no rapid depressurization event upstream or downstream of these valves (e.g., due to a line break) that would require these valves to open. In regards to thermal expansion of fluid trapped in the bonnet, V-3517 and V-3658 are required to open for warming up the SDC system. For warmup, these valves are opened after starting the associated LPSI pump and prior to opening the SDC HX flow control valve. Flow is routed through the SDC HX until the system heats up. Therefore, the valves would not be exposed to temperature increases prior to opening.

Thermal Binding: The most limiting scenario is isolation of V-3517 and V-3658 due to re-alignment of the Safety Injection system after heat up. In this scenario the valves are closed after recirculating the SDC to 150°F. During warmup to place the SDC in service, the valves would be required to open at a temperature <150°F. Thermal binding is not likely because the change in temperature from removal of the SDC system from service to warming the system up is relatively small, and the body and disc are composed of the same material. Therefore, thermal expansion differences would be small. In addition, these valves have operators which have compensating spring packs that absorb inertial closing forces and prevent excessive wedging of the disc into the seat. The installation of compensating spring packs on motor operators reduces the valve seating loads and the potential for thermal binding.

Conclusion: V-3517 and V-3658 are not susceptible to pressure locking and/or thermal binding.

**V-3664 & V-3665 "Shutdown Cooling Isolation Valves"**

Description: These valves are 10" Westinghouse flex-wedge gate valves with SB-0 actuators. The valves are located outside the containment building, inside the RAB at elevation 24'7" (V-3664)

and 25'0" (V-3665), respectively. V-3664 and V-3665 are the containment isolation valves that isolate 2A and 2B trains of SDC. The maximum opening differential pressure is 269 psid. The safety-related functions for these valves is to provide containment isolation and to open to align the RCS to the SDC system in order to cool the RCS from hot shutdown (Mode 4) to cold shutdown (Mode 5).

Pressure Locking: V-3664 & V-3665 are subjected to upstream pressure from the RCS during alignment for shutdown cooling. This scenario assumes that V-3664 & V-3665 are opened following the opening of the upstream shutdown cooling isolation valves. There is no rapid depressurization associated with this scenario. However, if it is assumed that there is leakage past upstream isolation valves V-3664 & V-3665 the line could be pressurized to 335 psig (the SDC relief valve setpoint). However, for the depressurization of the RCS from 350 psia to 275 psia (the permissive setpoint for aligning the RCS to SDC), for MSLB or small break LOCA scenarios, the depressurization is not significantly different from the normal Plant Cooldown scenario. Therefore, it is reasonable to conclude that these valves are not susceptible to pressure locking based the capability of these valves to open for a normal plant shutdown. In regards to thermal expansion of fluid trapped in the bonnet, V-3664 and V-3665 remain closed when the SDC system is warmed-up. However, V-3664 and V-3665 are physically isolated from the flowpath for SDC warm-up.

Thermal Binding: These valves could be closed under hot conditions (i.e., SDC cooling isolated while the RCS is still hot or inadvertent isolation of SDC), and the valve could cool if left isolated for a significant period of time due to the distance of the valve from the RCS. Under these conditions, thermal binding could occur. However, these valves have operators which have compensating spring packs that absorb inertial closing forces and prevent excessive wedging of the disc into the seat. The installation of compensating spring packs on motor operators has been identified as one method for preventing thermal binding. Therefore, V-3664 and V-3665 are not considered to be susceptible to thermal binding.

Conclusion: V-3664 and V-3665 are not susceptible to pressure locking or thermal binding.

**MV-08-12 & MV-08-13 "2C Auxiliary Feed Water (AFW) Pump Steam Admission Valves"**

DESCRIPTION: These valves are 4" Pacific double disc gate valves. The valves are located in the AFW system. The maximum opening differential pressure is 1015 psid. These valves are normally closed and open at high temperature (i.e., operating temperature = 532°F). These valves open upon receipt of an auxiliary feed water actuation signal (AFAS) and provide a flow path from main steam to the 2C AFW pump turbine. In addition, the valves must be capable of operating on demand to initiate 2C AFW flow to the steam generators

to reduce RCS temperature to the entry temperature for initiating the SDC.

Pressure Locking: MV-08-12 and MV-08-13 could experience rapid depressurization upstream of the valve (e.g., MSLB, feedwater line break). However, since these valves are steam valves, the compressibility of the steam in the bonnet precludes this scenario from causing a pressure locked condition. Pressure locking of steam valves occurs due to configurations that permit condensate to collect and drain into the valve bonnet (e.g., vertical pipe runs) with a subsequent temperature increase of the valve bonnet. MV-08-12 and MV-08-13 are installed in horizontal pipe runs with the actuators mounted above the centerline of the pipe. Based upon the configuration of MV-08-12 and MV-08-13, it is unlikely that condensate would collect in their bonnets.

Thermal Binding: Double disc gate valves are not considered susceptible to thermal binding.

Conclusion: MV-08-12 and MV-08-13 are not susceptible to pressure locking or to thermal binding.

# ATTACHMENT 2

# ST. LUCIE UNIT 2

# SUMMARY OF THE

# OPERABILITY ASSESSMENT FOR

# PRESSURE LOCKING OF

# SHUTDOWN COOLING POWER OPERATED

# GATE VALVES V-3480, V-3651, AND V-3652

**EVALUATION**

Although the NRC GL 95-07 does not permit a valve to be excluded from consideration of pressure locking due to lack of occurrence at the specific plant, or valve leakage rate, FPL considers that the actual valve seat leakage and valve historical performance are acceptable for determining valve operability until the final corrective measures are implemented. During the evaluation of the Unit 2 SDC isolation valves (V-3480, V-3651 and V-3652) for the purposes of demonstrating operability, the actual valve seat leakage performance was utilized. The NRC GL did not discuss the exclusion of seat leakage for determining valve operability and this approach does not exclude the valves from further consideration of pressure locking. Additionally, a pressure locking event has not been identified for this Westinghouse valve design (1500 psi class flex wedge gate) on either St. Lucie unit, and none were identified in the review of NUREG-1275[1], Volume 9, Supplement 6 to NRC GL 89-10[2], NRC IN 92-26[3] or INPO SOER 84-07[4].

Valve Leakage Required and Surveillance Data FPL has conservatively calculated that valve seat leakage $\geq$0.004 gpm for V-3480 and V-3652, and that seat leakage >0.011 gpm for V-3651 would reduce pressure in the valve bonnets and the piping between the SDC isolation valves to shutdown cooling entry conditions (~250 psig) within 3 hours following the most limiting pressure locking scenario. The most limiting scenario for pressure locking is a MSLB inside containment. A large break LOCA is not considered limiting because the containment sump recirculation would provide for decay heat removal, and the shutdown cooling isolation valves would not be required. A small break LOCA would result in rapid depressurization, but would not significantly heatup containment.

Valve seat leakage surveillance requirements specified in St. Lucie Unit 2 Technical Specification (TS) 4.4.6.2.3 are satisfied by performing Administrative Procedure 2-0010125A at least once every 18 months. The surveillance test is also required if the unit enters Mode 5 and the test has not been performed in the preceding 9 months. The test is performed with a differential pressure greater than 200 psid across the valve. A review of the completed data sheets for the period from 1990 to 1995 showed that,

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[1] NUREG-1275, Volume 9, "Operating Experience Feedback Report - Pressure Locking and Thermal Binding of Gate Valves"

[2] Generic Letter 89-10, Supplement 6, "Information on Schedule and Grouping, and Staff Responses to Additional Public Questions"

[3] NRC Information Notice 92-26, "Pressure Locking of Motor Operated Flexible Wedge Gate Valves"

[4] INPO SOER Number 84-07, "Pressure Locking and Thermal Binding of Gate Valves"

historically, the observed seat leakage for these valves has been >0.011 gpm. This exceeds the minimum required leakage to reduce bonnet pressure prior to opening the isolation valves following a postulated MSLB.

Basis for Utilizing Test Seat Leakage The valve flex-wedge has a gap between its upstream and downstream discs; the fluid in this gap is hydraulically connected to the bonnet. For the observed seat leakage to occur during the TS surveillance test, the downstream disc must leak through the seat. Seat leakage through this disc allows the bonnet to depressurize during a normal plant cooldown evolution, prior to opening the valves for shutdown cooling operation.

The condition in the valves during normal heatup, operation and cooldown are predicted to be as follows:

1) During the 18-month TS surveillance test, the valves are seat leakage tested with the RCS at approximately 250 psia to obtain a valve differential pressure greater than 200 psid. The observed seat leakage requires that the downstream disc have some leakage.

2) During RCS heatup, the valves are closed with the RCS and shutdown cooling fluid at 270 psig and 300°F. Note that the downstream isolation valves V-3664 and V-3665 on the same piping line but outside containment are also closed at this time.

3) During RCS heatup and steady state operation, the valves cool to ambient temperature, and the differential pressure between the RCS fluid (2250 psia) and bonnet fluid forces the upstream disc wedge away from its seat. The bonnet fluid may pressurize to RCS pressure, either due to the disc wedge being forced away from its seat, or due to leakage through the mating surfaces of the seat and disc wedge.

The upstream valve disc wedge will re-seat when the differential pressure force across the upstream disc is minimized; this occurs when bonnet pressure approaches RCS pressure. If the outboard isolation valves (V-3481 and V-3651) have a lower seat leakage rate than the upstream isolation valves (V-3480 and V-3652), the piping between the valves may also pressurize to approximately RCS pressure.

If a valve's downstream seat leakage is greater than the upstream valve wedge leakage, the bonnet may not pressurize significantly; this could pressurize downstream piping and cause pressure relief valves V-3666 or V-3667 (335 psig setpoint) to lift and discharge into the containment sump. Relief valve discharge could be observed by changes in the containment sump level, by the RCS leakage detection system, or as RCS leakage.

During RCS cooldown the valve bonnet and piping between the valves will depressurize, due to the measured seat leakage through the downstream valve wedge. The time from reactor trip to entering shutdown cooling is typically 8 hours.

4) If a design basis MSLB occurs, the RCS would depressurize to 500 psia in approximately 80 seconds. Plant operators may commence a rapid cooldown to shutdown cooling entry conditions in 3 hours.

Since the valves have a history of minor seat leakage through the upstream and downstream wedges and seats at low differential pressure, it is expected that valve seat leakage would occur under post-MSLB conditions to reduce bonnet pressure. However, the difference between a MSLB cooldown and a normal cooldown is that there is only a 3 hour versus 8 hour cooldown period, and the valves and piping will heatup and pressurize because containment ambient temperature will increase rapidly. Under these conditions, the required valve seat leakage rate required to reduce the pressure in the valve bonnet and piping from RCS pressure to the shutdown cooling system design pressure in 3 hours is 0.0011 gpm for valve V-3651 and 0.004 gpm for valves V-3480 and V-3652.

The required valve seat leakage to the shutdown cooling system is much less than the observed seat leakage rate determined by the TS surveillance test.

To ensure the continued operability of the shutdown cooling isolation valves after Fall 1995 St. Lucie Unit 2 refueling outage (SL2-9), plant personnel verified that the observed seat leakage was at least 0.01 gpm for V-3480 and V-3652, and at least 0.015 gpm for V-3651. This leakage rate provides a 35% margin between measured and required seat leakage.

Basis for Extending Corrective Action Until 1997 Refueling Outage

The planned corrective action was trial implemented on V-3481 during the Fall 1995 SL2-9 refueling outage and will be replicated on the remaining three valves during the next refueling outage. In addition, the planned corrective actions for V-3480 and V-3652 will require a freeze seal and/or a full core off load. To permit better integration of the modifications into the refueling outage activities, the remaining modifications were delayed until the Spring 1997 St. Lucie Unit 2 refueling outage (SL2-10).

Deferring corrective action until the next outage is not a safety issue for the following reasons:

1) The shutdown cooling isolation valves are not required until 3 hours after a postulated accident. By that time, the bonnet pressure and piping pressure will decay to an acceptable value, based on the actual observed valve seat leakage;

2) No incidence of these valves failing to open has ever been identified on either St. Lucie unit. No incidence of pressure locking has been reported to the valve vendor, or listed in the reviewed industry data; and

3) The affected valves would be prioritized as medium priority using NRC GL 89-10 guidelines. For medium priority MOVs, the Nuclear Energy Institute (NEI) guidance recommends that the resources are appropriately applied relative to safety significance and priority of the MOV.