CATEGORY 1

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:9608120270 DOC.DATE: 96/07/31 NOTARIZED: NO DOCKET #
FACIL:50-335 St. Lucie Plant, Unit 1, Florida Power & Light Co. 05000335
50-389 St. Lucie Plant, Unit 2, Florida Power & Light Co. 05000389
AUTH.NAME AUTHOR AFFILIATION
STALL,J.A. Florida Power & Light Co.
RECIP.NAME RECIPIENT AFFILIATION
Document Control Branch (Document Control Desk)

SUBJECT: Responds to RAI concerning GL 95-07, "Pressure Locking & Thermal Binding of SR Power Operated Gate Valves." Summary of requested calculation encl.

DISTRIBUTION CODE: A056D COPIES RECEIVED:LTR 1 ENCL 1 SIZE: 11
TITLE: Generic Ltr 95-07 - Pressure Locking & Thermal Binding of Safety Rela

NOTES:

	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL
	NRR/DRPE/EATON	1	1	PD2-3 PD.	1	1
	WIENS,L.	1	1			
INTERNAL:	FILE CENTER 01	1	1	NRR/EMEB/B	1	1
EXTERNAL:	NOAC	1	1	NRC PDR	1	1
	NUDOCS ABSTRACT	1	1			

CATEGORY 1 DOCUMENT

NOTE TO ALL "RIDS" RECIPIENTS:
PLEASE HELP US TO REDUCE WASTE! CONTACT THE DOCUMENT CONTROL DESK, ROOM OWFN 5D-5(EXT. 415-2083) TO ELIMINATE YOUR NAME FROM DISTRIBUTION LISTS FOR DOCUMENTS YOU DON'T NEED!

TOTAL NUMBER OF COPIES REQUIRED: LTTR 8 ENCL 8

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

July 31, 1996

L-96-191
10 CFR 50.4

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
Request for Additional Information
Response - Generic Letter 95-07

The purpose of this letter is to respond to an NRC request for additional information concerning Generic (GL) 95-07, *Pressure Locking and Thermal Binding of Safety Related Power Operated Gate Valves*. Attachment 1 provides Florida Power & Light Company's (FPL) response to the NRC's request for additional information for St. Lucie Units 1 and 2 and supplements the information provided in our letter L-96-31 dated February 13, 1996. A summary of the requested calculation is provided as Attachment 2. The complete calculation is available on site.

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

Very truly yours,

J. A. Stall
Vice President
St. Lucie Plant

JAS/GRM

Attachments

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

A056
1/1

L-96-191
Attachment 1

REQUEST FOR ADDITIONAL INFORMATION
GENERIC LETTER 95-07

Pressure Locking and Thermal Binding of Safety Related Power Operated Gate Valves

NRC REQUEST 1:

Regarding Unit 1 valves V-1403 and V-1405, Power Operated Relief Valve (PORV) Block Valves, the licensee's submittal states that these valves are 2.5" Velan solid wedge gate valves and discusses previous operating experience in which these valves were used to isolate a leaking PORV when the unit was at 100% power and subsequently successfully opened for low temperature overpressure (LTOP) protection. In addition, the licensee's submittal states that these valves have been modified to close on the limit switch. The staff agrees that (1) past operational experience provides valuable information in determining susceptibility to thermal binding and (2) prevention of excessive closing forces on the valve disk reduces susceptibility to thermal binding. For the purposes of closure of the NRC staff's GL 95-07 review, does the licensee have diagnostic test data which demonstrates the reduction in closing thrust following the completed modifications to change the seating logic from torque switch to limit switch? If so, please provide this information for NRC staff review.

FPL RESPONSE 1:

The test data presented below for the Unit 1 PORV Block Valves V-1403 and V-1405 were obtained as part of the GL 89-10 testing requirements. The data was obtained using the "Votes" diagnostic equipment.

	C16	O9
V-1403		
Pre Limit Switch Modification	14,003	4,133
Post Limit Switch Modification	5,154	2,334
V-1405		
Pre Limit Switch Modification	12,245	5,356
Post Limit Switch Modification	3,184	2,010

The value of Votes data point C16 corresponds to the total thrust (Lb_f) under static conditions in the closing direction and includes

inertial loads. The value of Votes data point 09 corresponds to the pullout or unwedging load (Lb_f) in opening the valve under static conditions.

The test results demonstrate that changing the seating logic from torque switch to limit switch significantly reduced the total thrust in the closing direction with a corresponding significant reduction in the unwedging load.

NRC REQUEST 2:

Regarding Unit 2 valves V-1476 and V-1477, PORV Block Valves, the licensee's submittal states that these valves are 3" Westinghouse flex-wedge gate valves and discusses the potential susceptibility to pressure locking and thermal binding. The licensee's submittal states that these valves will receive only steam, which may be a pressure locking concern due to configurations that permit condensate to collect and drain into the valve bonnet with a subsequent temperature increase of the valve bonnet. Further, the licensee's submittal states that valves V-1476 and V-1477 are oriented in the "upright" position. The NRC staff agrees that valves which experience only steam service and are oriented such that steam condensate cannot become trapped in the valve are not susceptible to thermally induced pressure locking. However, the NRC staff believes that steam will maintain bonnet pressure during an RCS depressurization scenario. Please address this potential susceptibility to depressurization induced pressure locking. Has the licensee completed any calculations regarding (1) the thrust required to overcome pressure locking and (2) the actuator capability? If so, please provide these calculations for our review.

Regarding the potential susceptibility of these valves to thermal binding, the licensee's submittal discusses past operational experience and states that the actuators have Limitorque SB operators which have compensating spring packs that absorb inertial closing forces and prevent excessive wedging of the disk into the seat. Does the licensee have diagnostic test data which demonstrates that the wedging of these valves is not excessive? If so, please provide this information for our review.

FPL RESPONSE 2:

This response is provided in two parts. Part 1 answers the pressure locking question and part two answers the thermal binding question.

Part 1 - Pressure Locking

The St. Lucie Unit 2 PORV Block Valves, V-1476 and V-1477, are 3 inch, 1705 psi Class, flexible wedge Westinghouse gate valves.

FPL Engineering has performed a calculation (A summary of the calculation is provided as Attachment 2.) using the "PRESLOK" computer model developed by Commonwealth Edison. The calculation addresses depressurization induced pressure locking of the PORV Block Valves and compares the predicted unwedging load to the actuator capability at under voltage conditions. In addition, the calculation used the VELAN Valve Corporation formula to predict the pressure locking forces as a comparison. The VELAN formula was developed to predict the additional forces required to overcome hydraulic pressure locking. The analytical methodology and the testing results were presented by VELAN Valve Corporation at the NRC sponsored "Workshop on Gate Valve Pressure Locking and Thermal Binding" held in New Orleans, LA on February 4, 1994. The VELAN presentation is documented in NUREG/CP-0146. The results of the two analytical methods (PRESLOK model and VELAN formula) were in agreement, with a difference of only 4.9%.

The results of this calculation demonstrate that the actuator has sufficient capability to overcome the postulated depressurization induced pressure locking scenario even when reduced voltage conditions are considered.

Part 2 - Thermal Binding

The actuators of St. Lucie Unit 2 PORV Block Valves V-1476 and V-1477 utilize compensating spring packs to absorb the closing inertial forces and prevent excessive wedging of the disk into the seat. The use of compensating spring packs is endorsed in NUREG-1275 as a method to prevent thermal binding.

The test data presented below for St. Lucie Unit 2 PORV Block Valves V-1476 and V-1477 have been obtained as part of the GL 89-10 testing requirements. This data was obtained using the "Votes" diagnostic equipment.

	C14	C16	O9
V-1476	6515	9784	1868
V-1477	4459	7795	2195

The value of Votes data point C14 (Lb_f) is the control switch trip for the limit switch. As discussed in the first response, the value of C16 corresponds to the total thrust (Lb_f) under static conditions in the closing direction and includes inertial loads. The value of Votes data point O9 corresponds to the pullout or unwedging load (Lb_f) in opening the valve under static conditions.

The difference between the C14 and C16 data points is the inertial loading. The maximum stroke time for the PORV Block Valves is 10 seconds. A fast acting valve typically has high inertial loading. The test data demonstrate that the compensating spring packs in the actuator are absorbing the inertial closing forces inherent in a fast stroking valve by preventing a significant increase between the C14 and C16 data points. By limiting the total closing thrust, the unwedging load can be significantly reduced. This is evident by the relatively small unwedging load (O9) measured for these valves.

NRC REQUEST 3:

In Attachment 1 to GL 95-07, the NRC staff requested that licensees include consideration of the potential for gate valves to undergo pressure locking or thermal binding during surveillance testing. During workshops on GL 95-07 in each Region, the NRC staff stated that, if closing a safety-related power-operated gate valve for test or surveillance defeats the capability of the safety system or train, the licensee should perform one of the following within the scope of GL 95-07:

1. Verify that the valve is not susceptible to pressure locking or thermal binding while closed,

2. Follow plant technical specifications for the train/system while the valve is closed,

3. Demonstrate that the actuator has sufficient capacity to overcome these phenomena, or

4. Make appropriate hardware and/or procedural modifications to prevent pressure locking and thermal binding.

The staff stated that normally open, safety-related power-operated gate valves which are closed for test or surveillance but must return to the open position should be evaluated within the scope of GL 95-07. Please discuss if valves which meet this criterion were included in your review, and how potential pressure locking or thermal binding concerns were addressed.

FPL RESPONSE 3:

As part of the review performed in response to NRC GL 95-07, normally open power-operated gate valves that are stroked closed for surveillance testing were evaluated for susceptibility to pressure locking or thermal binding. FPL has identified 32 valves that were potentially susceptible under the above conditions. Following review, these valves were determined to be not susceptible to pressure locking or thermal binding, and to meet the intent of GL 95-07 for the following reasons:

1. There are no pump surveillance tests performed or hydraulic conditions present while stroking the valve that may pressure lock the valve.

2. In the short period of time the valves are stroked, they are not exposed to temperature changes that may cause a thermal binding condition.

3. Past operating history has shown that pressure locking or thermal binding of a valve has not occurred following a quarterly surveillance test.

4. If a valve fails to open after the stroke test, the appropriate action statement is immediately entered per Technical Specifications.

5. After the closing stroke test, the valves are immediately returned to their required normally open position.

Of the valves identified as normally open, only the Unit 1 and Unit 2 PORV block valves can remain closed at power in accordance with the plant Technical Specifications. The above responses to NRC requests 1 and 2 have concluded that the PORV Block valves are not susceptible to the phenomena of pressure locking or thermal binding while in the closed position.

Therefore, FPL has determined that St. Lucie has no normally open power-operated valves which are susceptible to these phenomena during surveillance testing. However, if a condition should occur that prevents the valve from immediately reopening, the appropriate plant technical specification is followed while the valve is closed.

NRC REQUEST 4:

Through review of operational experience feedback, the staff is aware of instances where licensees have completed design or procedural modifications to preclude pressure locking or thermal binding which may have had an adverse impact on plant safety due to incomplete or incorrect evaluation of the potential effects of these modifications. Please describe evaluations and training for plant personnel that have been conducted for each design or procedural modification completed to address potential pressure locking or thermal binding concerns.

FPL RESPONSE 4:

The physical modifications that have been made to eliminate the potential for gate valve pressure locking or thermal binding were reviewed as part of the design process for potential adverse impact on plant operations. The design process includes reviews by plant engineering, operations and maintenance personnel. No adverse impacts were identified for the proposed modifications during the design review process. Additionally, since these physical modifications have been in place, no adverse operational impacts have been experienced.

The St. Lucie Unit 1 Shutdown Cooling Valves V-3480, V-3481, V-3651 and V-3652 were modified during the 1994 refueling outage to increase the actuator capability to overcome potential pressure locking. This was a valve actuator design change and implementation did not require any operator action or training. The appropriate plant documents have been revised to reflect this change. These revisions were accomplished to ensure that the design features which eliminate the potential for gate valve pressure locking are maintained throughout the life of the plant.

The St. Lucie Unit 2 Shutdown Cooling Valve V-3481 was modified during the 1995 refueling outage by drilling a hole in the upstream side of the disk to vent the bonnet. This was a valve internal design change and implementation did not require any operator action or training. The appropriate plant documents have been revised to reflect this change for V-3481 and to prevent the use of any spare undrilled disks in V-3481. These revisions were done to ensure the design features which eliminate the potential for gate

valve pressure locking are maintained throughout the life of the plant. This modification is scheduled to be performed to Shutdown Cooling Valves V-3480, V-3651 and V-3652 during the 1997 Unit 2 refueling outage. An Engineering Operability Assessment has been performed to document the bases and acceptability for deferring these modifications.

The operational configuration of the St. Lucie Unit 2 Shutdown Cooling Crosstie Valve V-3545 was modified from normally closed to normally open during normal power operations. This eliminated the potential of pressure locking. The appropriate plant documents have been revised to reflect this change. No adverse operational impact has resulted from this change. The appropriate training has been conducted in accordance with plant procedures.

Attachment 2
L-96-191

Calculation PSL-2FJM-96-012 Rev. 0 Summary

Purpose

The purpose of this calculation was to quantify the pressure locking forces for the PSL Unit 2 PORV Block Valves under the postulated scenario of RCS pressure trapped in the bonnet following a RCS depressurization event. In addition, the calculation determined if the actuator had sufficient capability to overcome the pressure locking forces considering undervoltage.

Methodology

The calculation utilized two methods to determine the pressure locking forces for PORV Block Valves V-1476 & V-1477. The first method used the "PRESLOK" computer code developed by Commonwealth Edison and verified by the Westinghouse Owners Group. The second method utilized a formula developed by VELAN Valve Corporation. The results were compared with the actuator capability to determine if sufficient capacity was available to overcome the pressure locking forces under the postulated scenario.

The following provides the bases for the use of the analytical methods, the postulated pressure locking scenario, and the conservative assumptions made in the analysis:

Commonwealth Edison validated the "PRESLOK" computer program using test data. The testing was based on a 10 inch 900 lb. class Crane valve, a 4 inch 1500 lb. Westinghouse valve and a 10 inch 300 lb. class Borg-Warner valve. Since the PSL Unit 2 PORV Block Valves are 3 inch, 1705 lb. Class, flexible wedge Westinghouse gate valves, the "PRESLOK" program should produce acceptable results for these valves.

The analytical methodology developed by the Velan Valve Corporation to predict pressure locking forces is based on testing of their 600 lb. -1500 lb. class valves. Velan found that these class valves are of sufficient rigidity that they do not exhibit the "double disc drag" type effect due to flexure of the wedge faces that more flexible valves may have. The PSL Unit 2 PORV Block Valves, V-1476 and V-1477 are 3 inch, 1705 lb. Class, flexible wedge Westinghouse gate valves. They are expected to have wedges at least as rigid as the Velan 600 lb. - 1500 lb. class valves.

Since the Velan methodology is based on the unbalanced load (differential pressure) on the wedge area due to the seat angle and not on proprietary data specific to their valves, their method is applicable to the 1705 lb. class Westinghouse valve.

This analytical methodology and test results were presented by VELAN at the NRC sponsored "Workshop on Gate Valve Pressure Locking and Thermal Binding" held in New Orleans, La. on February 4, 1994. The Velan presentation is documented in NUREG/CP-0146. The valve actual unseating or pullout loads obtained from static diagnostic testing were added to the results from the VELAN formula for conservatism.

The conservatively postulated pressure locking scenario for the PORV Block valves is that steam is entrapped in the bonnet at the maximum design pressure of 2485 psig instead of the normal RCS operating pressure of 2235 psig. In addition, the RCS is depressurized on the upstream side during a design bases event such as a Loss Of Coolant Accident. This scenario is postulated for the one PORV Block Valve that is closed during normal plant operations and may be required to open for "once through cooling" under success path number 4 of PSL 2 Emergency Operating Procedure 2-EOP-15. The worst case scenario that creates the highest pressure locking force within the valve occurs at the lowest RCS pressure, and highest differential pressure across the valve. Although the lowest pressure to establish "once through Cooling" is approximately 155 psig, the calculation was based on a 0 psig RCS pressure and 0 psig downstream of the valve for conservatism. This produces a differential pressure of 2485 psig, which is the highest obtainable differential pressure across the valve.

The "PRESLOK" Commonwealth Edison method requires the closing valve factor as an input to the computer program. This valve factor is normally obtained from test measurements taken during a closing differential pressure (DP) test. However, the PSL Unit 2 PORV block valves can not be DP tested. Since the valve factor from a close DP test is not available, an analysis was performed on the DP test closing valve factors of two valves similar to the PORV block valves. The first was a PSL Unit 2 Westinghouse valve of the same size and similar design. The second valve was an EPRI test valve, also of the same size and design. The valve factor for these valves in the close direction was 0.04 and 0.439 for the PSL Unit 2 and EPRI valve respectively. Based on this analysis, a valve factor of 0.5 was used in the "PRESLOK" calculation for conservatism. This valve factor is consistent with other Generic Letter 89-10 program valves and is in accordance with the instructions provided in FPL Nuclear Engineering Discipline Standard, STD-M-003, "Engineering Guidelines for Sizing and Evaluation of Limitorque Motor Operators".

The valve unseating or pullout load used in this calculation is based on the static diagnostic test of valve V-1477 which had the highest unseating load of the two valves. The value of the measured unseating load was increased by the equipment measurement uncertainty.

PSL Unit 2 PORV block valves V-1476 and V-1477 are controlled by limit switches in both the open and closed direction. The valves also have a torque switch backup in the open direction which is bypassed at 20-25% of the open stroke. Since the torque switch is bypassed for the first 20-25% of the stroke in the open direction, the thrust available to the valve is based on the actuator capability. The actuator capability that was used in the analyses was derated considering undervoltage. The actuator output thrust capability is based on a stem nut coefficient of friction of 0.2 which is consistent with the guidelines of Generic Letter 89-10. This is conservative since the measured static coefficient of friction during the 11/25/95 "Votes" test for valves V-1476 and V-1477 was .04 and .09 respectively.

Results

This calculation used two independent methods to determine the predicted pressure locking force for the postulated depressurization scenario. Both methods concluded that the actuator has sufficient capability (minimum of 14.2% margin) to open the PORV Block Valves even when reduced voltage conditions were considered.

In addition, the results of the two analytical methods were in agreement, with the difference between them only 4.9%.