# CATEGORY 1

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:9907090236 DOC.DATE: 99/06/30 NOTARIZED: NO DOCKET #
FACIL:50-397 WPPSS Nuclear Project, Unit 2, Washington Public Powe 05000397
AUTH.NAME AUTHOR AFFILIATION
COLEMAN,D.W. Washington Public Power Supply System
RECIP.NAME RECIPIENT AFFILIATION
Records Management Branch (Document Control Desk)

SUBJECT: Forwards addl info requested in 990513 ltr to support review of pending response to GL 95-07, "Pressure Locking & Thermal Binding of Safety-Related Power Operated Gate Valves."

DISTRIBUTION CODE: A056D COPIES RECEIVED:LTR 1 ENCL 1 SIZE: 10
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/DLPM/EATON | 1 | 1 | CUSHING,J | 1 | 1 |
| INTERNAL: | FILE CENTER 01 | 1 | 1 | | | |
| EXTERNAL: | NOAC | 1 | 1 | NRC PDR | 1 | 1 |
| | NUDOCS ABSTRACT | 1 | 1 | | | |

CATEGORY 1 DOCUMENT

MICROFILMED

NOTE TO ALL "RIDS" RECIPIENTS:
PLEASE HELP US TO REDUCE WASTE. TO HAVE YOUR NAME OR ORGANIZATION REMOVED FROM DISTRIBUTION LISTS OR REDUCE THE NUMBER OF COPIES RECEIVED BY YOU OR YOUR ORGANIZATION, CONTACT THE DOCUMENT CONTROL DESK (DCD) ON EXTENSION 415-2083

TOTAL NUMBER OF COPIES REQUIRED: LTTR 6 ENCL 6

MP4

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
*P.O. Box 968 • Richland, Washington 99352-0968*

June 30, 1999
GO2-99-121

Docket No. 50-397

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

Gentlemen:

Subject: **WNP-2, OPERATING LICENSE NPF-21**
**RESPONSE TO GENERIC LETTER 95-07, "PRESSURE LOCKING AND THERMAL BINDING OF SAFETY-RELATED POWER OPERATED GATE VALVES" (ADDITIONAL INFORMATION)**

Reference: Letter, dated May 13, 1999, J Cushing (NRC) to JV Parrish (SS), "Supplemental Request for Additional Information (RAI) for the Washington Public Power Supply System Nuclear Project No. 2 (WNP-2) (TAC NO. M93539)"

The staff requested additional information to support review of our pending response to Generic Letter 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power Operated Gate Valves."

The additional information requested in the reference letter is addressed in the attachment. Should you have any questions or desire additional information regarding this matter, please call me or PJ Inserra at (509) 377-4147.

Respectfully,

DW Coleman
Manager, Regulatory Affairs
Mail Drop PE20

Attachment

A056

cc: EW Merschoff - NRC RIV
JS Cushing - NRR
NRC Sr. Resident Inspector - 927N
DL Williams - BPA/1399
PD Robinson - Winston & Strawn

Question 1: Your November 25, 1996, submittal states that the high pressure core spray (HPCS) injection valve, HPCS-V-4, is susceptible to pressure locking, but that pressure locking does not render the valve inoperable because the valve will open after approximately 2.6 seconds after receiving a signal to automatically open. After approximately 2.6 seconds, the HPCS pump develops full discharge pressure and the valve is no longer pressure locked and opens against differential-pressure conditions. Explain how any reduction in actuator capability due to operation at locked rotor was accounted for, any testing that demonstrates that actuator capability will or will not degrade after operating at locked rotor for up to 2.6 seconds and any testing that verifies that the HPCS pump can develop adequate discharge pressure in 2.6 seconds.

Response: Our November 25, 1996, submittal included a conclusion that HPCS injection valve, HPCS-V-4, was capable of performing it's safety function under pressure locking conditions. Our position regarding operability and safety function performance has not changed. However, we have re-evaluated our position regarding valve modification. The cost associated for the additional analysis necessary to respond to the above question is estimated to exceed the cost associated with modifying the valve. Therefore, it has been determined to be more cost-effective to modify valve HPCS-V-4 to preclude a pressure locking condition. The modification is scheduled to be complete during the R-15 refueling outage in the spring of 2001.

Question 2: Your November 25, 1996 submittal states that you are using a hub analysis pressure locking thrust prediction methodology to demonstrate that the reactor core isolation cooling (RCIC) injection valve, RCIC-V-31, and the containment atmosphere control valves, CAC-V-2/6/8/11/13/15/17, will operate during pressure locking conditions.

On April 9, 1997, a public meeting was conducted to discuss the Commonwealth Edison and Entergy Operations, Inc. pressure locking thrust prediction methodologies presented in Generic Letter 95-07 submittals. The minutes of the public meeting were issued on April 25, 1997, and placed in the Public Document Room (Accession No. 9707300022). The minutes of this public meeting indicate the type of information requested by the NRC in order to review and approve pressure locking thrust prediction methodologies.

In order for the NRC to review your hub analysis pressure locking thrust prediction methodology, please provide the following information:

a. Provide the test procedure/results that validated the methodology. Include any information that will help evaluate if your valve is similar to test valves as applicable.

b. Results from pressure locking testing sponsored by the NRC performed by Idaho National Engineering and Environmental Laboratory on a double disk and a flexible wedge gate valve have been placed in the Public Document Room (NUREG/CR-6611). Please discuss if your pressure locking thrust prediction methodology accurately predicted the results of these pressure locking tests. It would be helpful if you discussed whether your pressure locking thrust prediction methodology accurately predicted the results of pressure locking tests performed by Commonwealth Edison that were discussed during the April 9, 1997, public meeting.

c. Discuss the recommended margin between actuator capability and the calculated thrust value when using your pressure locking prediction methodology, any limitations associated with the use of your methodology and any diagnostic test equipment accuracy requirements. Commonwealth Edison Company provided this type of information to the NRC in a letter dated May 29, 1998. This letter is in the Public Document Room (Accession No. 9806040184).

Response: See our response to Question 3 regarding valve RCIC-V-31. See our discussion below for the containment atmosphere control (CAC) valves.

2a. The following procedure was used to validate the WNP-2 model:

1. Determine the predicted loads, ($F_{PL}$).
2. Compare predicted loads to industry tests (see Figures 1-6).
3. Determine bounding model (Equation 2).
4. Determine the degree of WNP-2 predicted load conservatism (see discussion of results).

The required operating loads under pressure locking conditions for CAC-2, 6, 8, 11, 13, 15, and 17 were calculated using the following formula:

$$F_{total} = F_{PL} + F_{unwedging} \qquad \text{Equation 1}$$

where: $F_{PL}$ = Pressure Locking Force

$$F_{PL} = \{[(2 \times P_{bonnet} - P_{up} - P_{down}) \times A_{seat} \times VF_{open}] - [\pi/4 \times D^2_{stem} \times P_{bonnet}]\}$$

$$\text{WNP-2 Model} = 1.36 \times F_{PL} \qquad \text{Equation 2}$$

where = 1.36 is the bounding factor

$P_{bonnet}$: Pressure in the bonnet, psig
$P_{up}$: Pressure upstream, psig
$P_{down}$: Pressure downstream, psig
$A_{seat}$: Area of the seat based on the mean seat diameter, inches$^2$
VF: Valve Factor, dimensionless
$D_{stem}$: Stem diameter, inches

The justification for Equation 2 is based on a comparison of the predicted thrust to that of the measured pressure locking thrusts from testing performed by Commonwealth Edison Company (ComEd) and Idaho National Engineering and Environmental Laboratory (INEL) on flexible wedge gate valves. The tests used in the justification comparison were:

- Crane 10" 900 lb-class (ComEd)
- Westinghouse 4" 1525 lb-class (ComEd)
- Borg-Warner 10" 300 lb-class (ComEd)
- Walworth 6" 600 lb-class (INEL)

Figures 1 - 6 show the results of the predicted pressure locking loads using the WNP-2 model as compared to loads measured during industry testing. In addition, the horizontal axis represents the load predicted by the simple model and the vertical axis represents both the measured load for the industry-tested valves and the value predicted by the WNP-2 model. The comparisons show the WNP-2 model over predicts (in most cases significantly) the actual load for all tests, especially those at higher bonnet pressures. This is expected given that the simplified model conservatively accounts for a disk hub area load (bonnet pressure x the disk hub area x 2) that in reality is not present. This effect is magnified at greater pressures.

Not only does Equation 2 bound the industry data; it also includes significant conservatism due to:

1. Use of high valve factors to calculate the pressure locking loads. The 0.80 valve factors used for the WNP-2 subject valves are conservative when compared to valve factor data for similar valves throughout the industry.

2. Equation 2 does not take credit for the reduction in required thrust resulting from stem extraction. Extracting the stem from the bonnet creates suction in the bonnet and alleviates the pressure locking condition. In their May 29, 1996 response to the NRC, ComEd indicated that their data demonstrates that the pressure in the bonnet can be reduced by as much as 50 psig as initial stem movement takes up the T-head clearance. The postulated maximum expected bonnet pressure for the WNP-2 valves is only 38 psig.

*Figure 1*
*INEL Walworth Pressure Locking Load vs. WNP-2 Prediction*

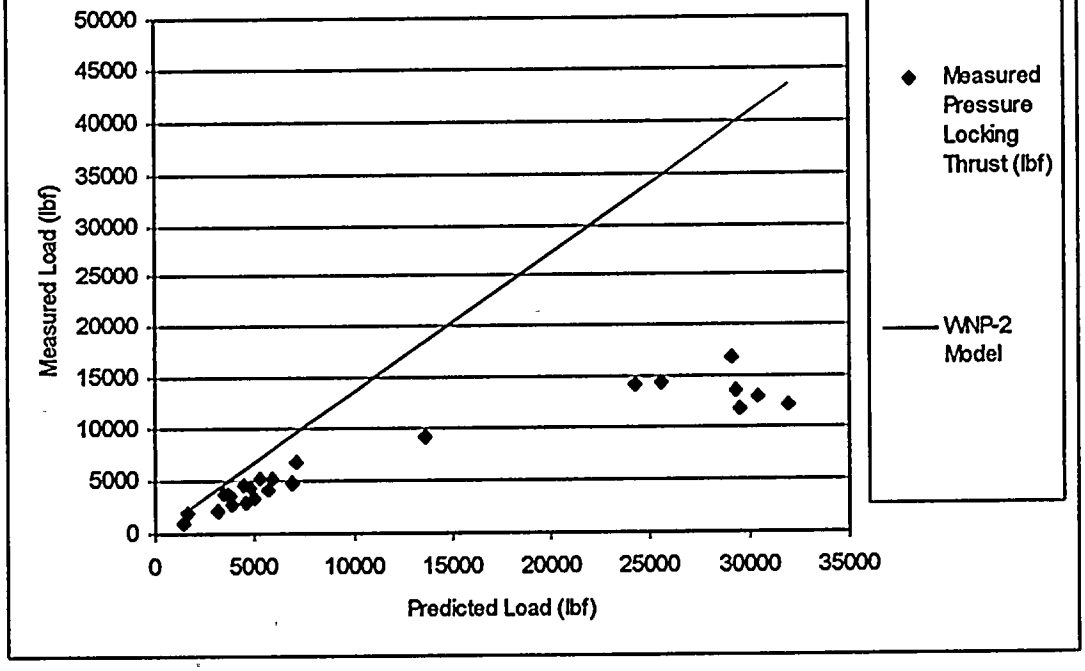



*Figure 2*
*INEL Walworth Pressure Locking Load vs. WNP-2 Prediction (Zoom)*

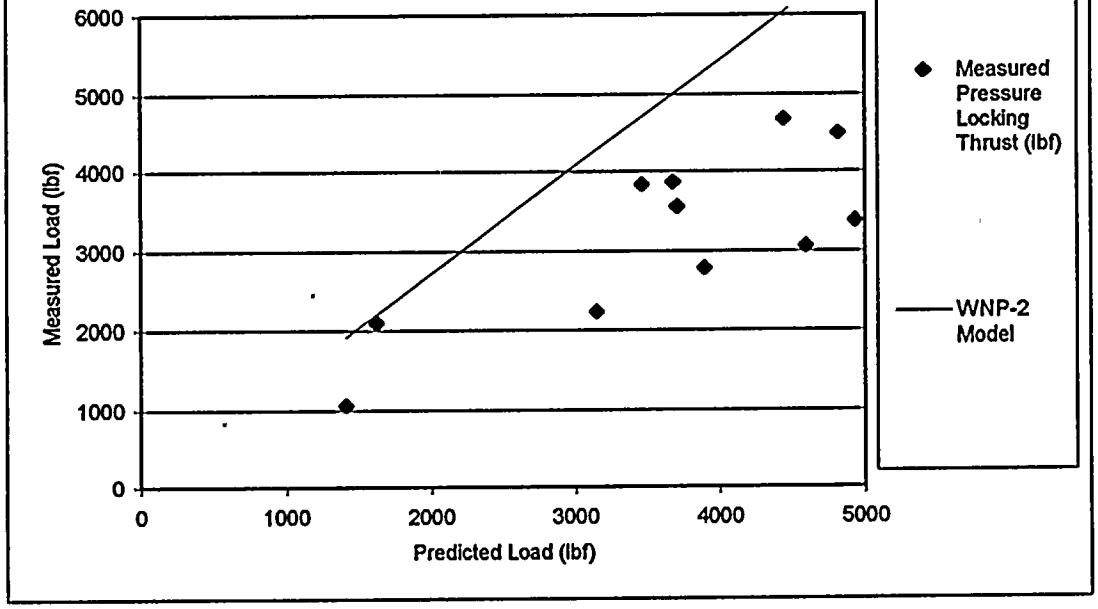


*Figure 3*
*ComEd Borg Warner Pressure Locking vs. WNP-2 Predicted*

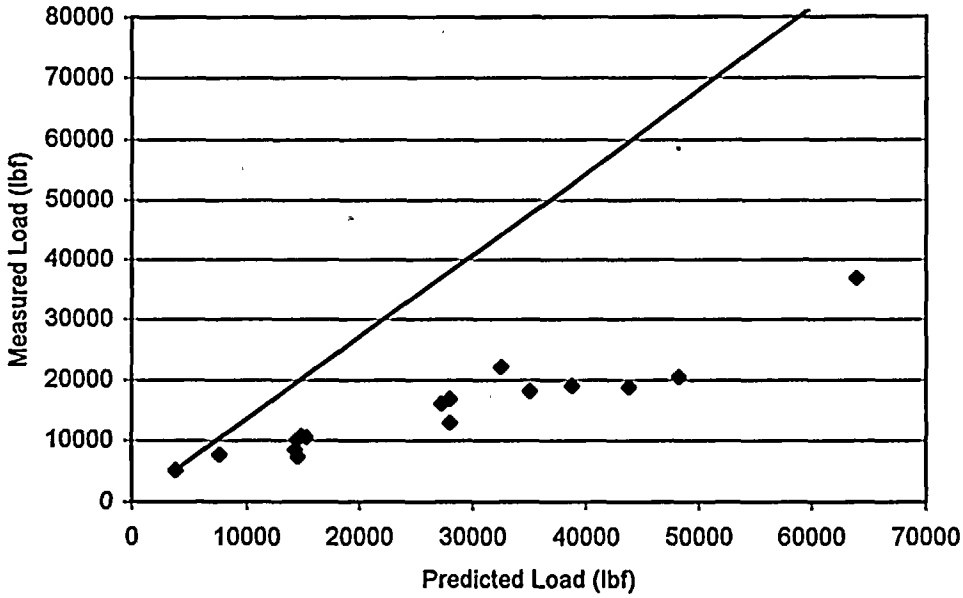



*Figure 4*
*ComEd Borg Warner Pressure Locking vs. WNP-2 Predicted (Zoom)*

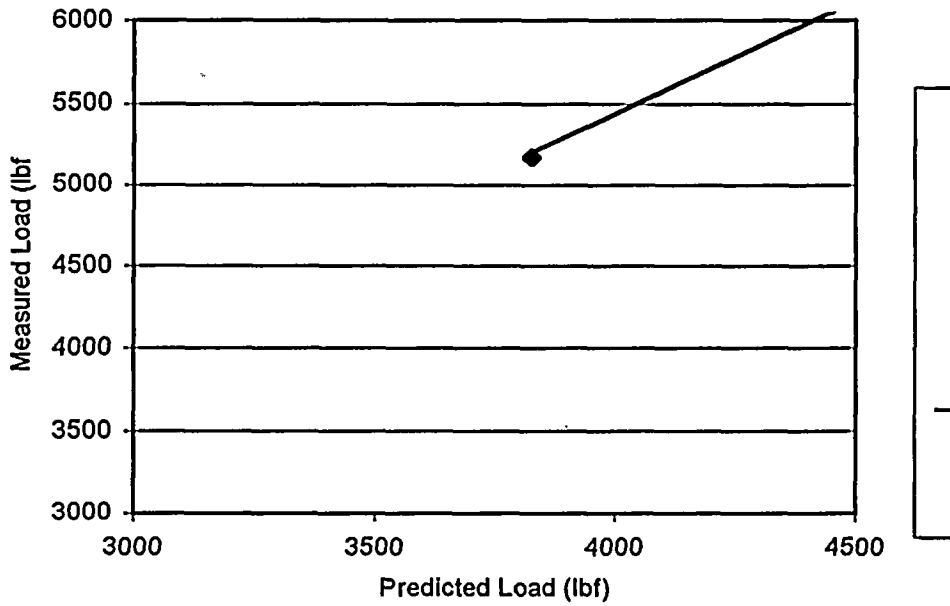


*Figure 5*
*Crane Measured Pressure Locking Loads vs. WNP-2 Predicted*

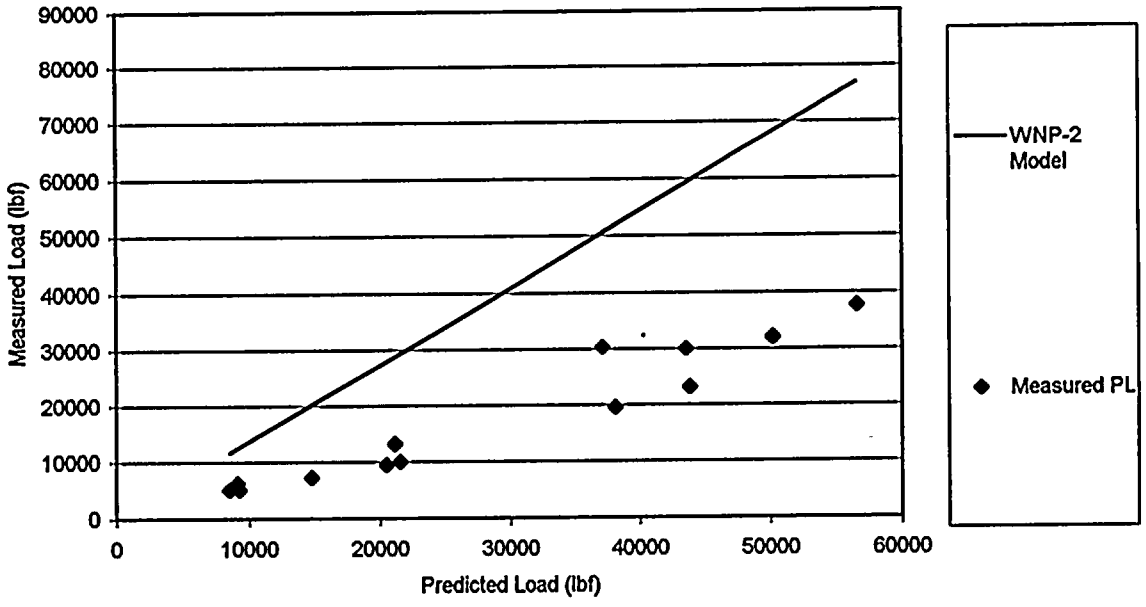
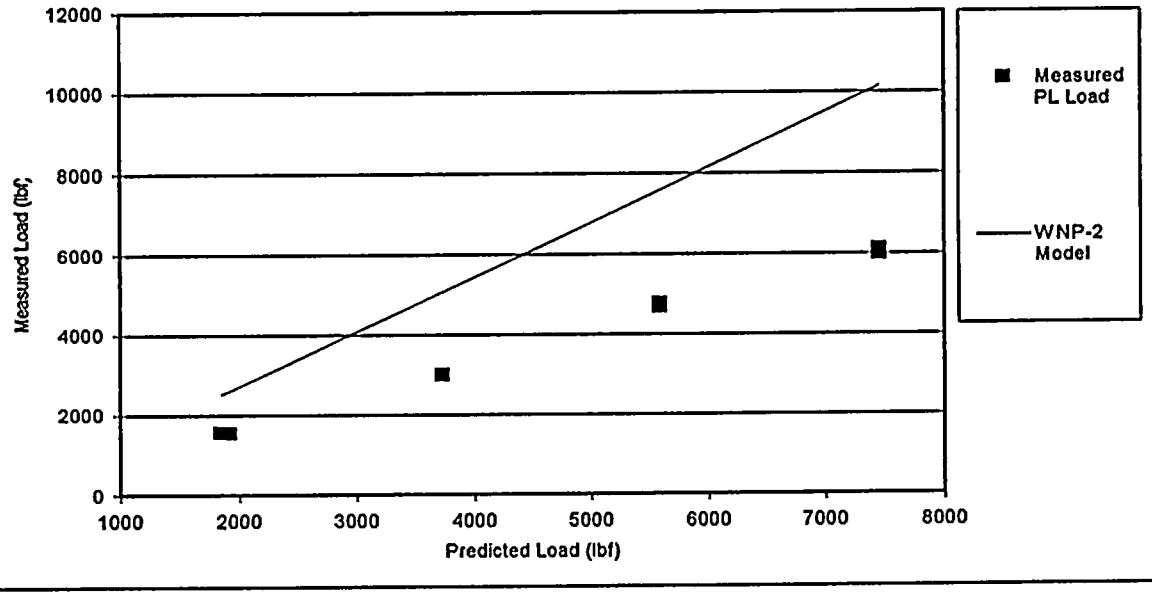



*Figure 6*
*Westinghouse Measured Pressure Locking vs. WNP-2 Predicted*



2b. As discussed in the response to question 2a, the WNP-2 model over predicts pressure-locking loads compared to both the ComEd and INEL data. In addition, the ComEd and INEL valves used to justify the WNP-2 pressure locking method (Equation 2) are appropriate comparisons to the WNP-2 CAC 2, 6, 8, 11, 13, 15, and 17 valves. This is supported by the following observations:

1. Tests performed at ComEd and INEL are for valves of similar size (Westinghouse 4-inch and Walworth 6-inch versus. WNP-2 CAC 4 inch valves) and design (All are flexible wedge style gate valves consisting of two disks connected by a center hub).

2. The Crane and Westinghouse valves tested by ComEd provide an effective comparison due to their more "rigid" bodies (both have a class rating greater than 600 pounds). Since they are made of forged material, the WNP-2 valves are also considered "rigid." Per the results of ComEd and INEL testing, valves with rigid bodies (pressure classes greater than 600 pounds and/or those with forged bodies) will flex less than lighter class or cast valves when subject to pressure locking. This effect results in a comparatively less required thrust to open under pressure locking conditions.

3. The ComEd Borg-Warner valve and the INEL Walworth valve provide a bounding comparison to the WNP-2 CAC valves since they are expected to be more flexible. The Borg-Warner valve was selected for testing because of its class rating (300 pounds) and the Walworth valve was selected for testing specifically because its thinner disks and smaller diameter hub was "more likely to respond to pressure locking loads than a stiffer disk assembly."

2c. The required margin for WNP-2 valves subject to pressure locking is 0%. This requirement is appropriate given the bounding nature of the pressure locking methods and significant conservatism included in the calculations. The WNP-2 calculations include uncertainties such as measurement inaccuracies, unwedging thrust variability, and stem factor degradation (where applicable) in either the required thrust or available capacity determinations. As such, there is no need to include these factors in the margin requirement. The overall impact of these uncertainties on margin is 31-42% depending upon the valve.

Our evaluations conclude that CAC valves 2, 6, 8, 11, 13, 15, and 17 all exceed the margin requirement of 0%. In addition, if credit is taken for the additional DC motor torque that would be available at slower than rated motor speeds, the resulting minimum margin for all the CAC valves is 40%.

Question 3: Your October 15, 1996, submittal states that the RCIC injection valve, RCIC-V-31, is not susceptible to thermal induced pressure locking because the gradual increase of suppression pool temperature that would occur during a small or intermediate break loss of coolant accident (LOCA) would not cause pressure in the bonnet to increase. Describe the temperature increase of RCIC-V-31 that could potentially occur during a LOCA. Discuss if the containment would be initially pressurized to some peak pressure during the LOCA, if the pressure would be trapped in the bonnet of RCIC-V-31 and if the temperature of RCIC-V-31 would increase when the pressure in the bonnet of the valve is at the containment peak pressure. Describe the length and the geometry (vertical, horizontal) of the piping between RCIC-V-31 and the suppression pool.

Response: Our October 15, 1996, submittal concluded the actuator for RCIC injection valve, RCIC-V-31, has sufficient capability to overcome the pressure locking load. Our position regarding operability has not changed. However, we have re-evaluated our position regarding valve modification. The cost associated for the additional analysis necessary to respond to the above question is estimated to exceed the cost associated with modifying the valve. Therefore, it has been determined to be more cost-effective to modify valve RCIC-V-31 to preclude a pressure locking condition. The modification is scheduled to be complete during the R-15 refueling outage in the spring of 2001.

Question 4: Your July 12, 1996, submittal states that normally open, safety-related power-operated gate valves which are closed for test or surveillance, but must return to the open position in order for the train/system to accomplish its safety function were not included in the scope of GL 95-07 but were evaluated for pressure locking and thermal binding. The submittal stated that the majority of the valves require entering the applicable limiting condition for operation (LCO) prior to performing a surveillance that removes the valve from its normally open safety position. Identify any power-operated valves that are susceptible to pressure locking or thermal binding that are closed for surveillance/testing but an LCO is not entered when the valve is closed.

Response: There are no power-operated valves that are susceptible to pressure locking or thermal binding that are closed for surveillance/testing but must return to the open position and where an LCO Action Statement is not entered when the valve is closed.

Our July 12, 1996, submittal stated that the majority of the valves require entering the applicable limiting condition for operation (LCO) prior to performing a surveillance that removes the valve from its normally open safety position. This statement refers to three power operated globe valves that are not susceptible to pressure locking or thermal binding for which the Technical Specification Action Statement is not entered during the surveillance test.