Nuclear Operating Company

South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

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U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

South Texas Project
Units 1 and 2
Docket Nos. STN 50-498, STN 50-499
Response to Request for Additional Information Regarding
Generic Letter 95-07, Dated December 16, 1999

Reference: Request for Additional Information Re: Generic Letter 95-07, Nuclear Regulatory Commission to William T. Cottle, dated December 16, 1999

Pursuant to the request for additional information referenced above, the South Texas Project provides the attached additional information regarding Generic Letter 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves."

If there are any questions, please contact either Mr. P. L. Walker at (361) 972-8392 or me at (361) 972-7902.

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PLW
Attachment: Generic Letter 95-07 Response to Request for Additional Information

A056

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South Texas Project
Units 1 and 2
Generic Letter 95-07
Response to Request for Additional Information

1. Justify use of the 23 psi/°F thermal-induced pressurization rate that was used in pressure locking calculations to determine maximum bonnet pressure for the high head safety injection hot leg isolation valves, 2N121XSI0008A/B/C and 2N122XSI0008A/B/C, the low head safety injection hot leg isolation valves, 1N161XRH0019A/B/C* and 1N162XRH0019A/B/C*, and the residual heat removal pump suction isolation valves 1R161XRH0060A/B/C, 1R162XRH0060A/B/C, 1R161XRH0061A/B/C, and lR162XRH0061A/B/C. Your answer should include the basis for the Westinghouse determination that this is an acceptable thermal induced pressurization rate for use on Westinghouse valves. For example, your explanation should include any test data that was used to validate the 23 psi/°F thermal-induced pressurization rate.

RESPONSE:

*Please note that the identifiers for these valves are 2R161XRH0019A/B/C and 2R162XRH0019A/B/C, respectively.

A Westinghouse Owners Group industry survey of pressurization tests was the basis for the 23 psi/°F thermal-induced pressurization rate used in calculations to determine maximum bonnet pressure. The survey results show a wide range of values of thermal pressurization rates. Analysis of the data used the statistical method of geometric mean to reduce the impact of extreme values. The generic pressurization rate of 23 psi/°F was developed using the mean pressurization rate plus three times the standard deviation. These data show that this pressurization rate is valid as long as the temperature rise is no more than 70°F.

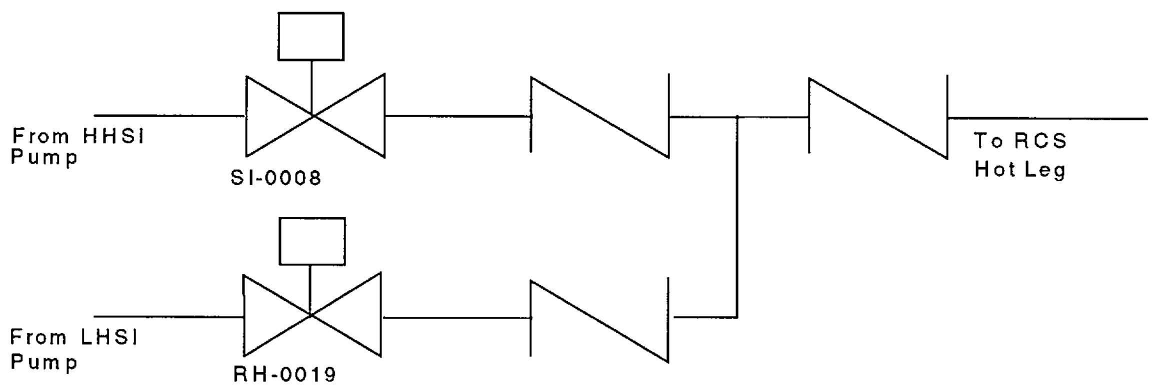
The test data from a Westinghouse valve were excluded from computation of the mean discussed above because the pressurization rate was too low; i.e., it would have resulted in undue bias in the non-conservative direction. Therefore, use of 23 psi/°F for Westinghouse valves is considered conservative. Previous discussions with the reviewer indicated that use of 23 psi/°F may be considered non-conservative with respect to general industry practice; however, the South Texas Project considers this value a prudent and conservative treatment for motor-operated valves having low risk significance.

Disposition of these valves can also be justified with another approach. The safe shutdown condition for the South Texas Project in the event of a forced outage is hot standby. The listed valves are not required for hot standby:

- Valves RH60 and RH61 (residual heat removal) are used for hot shutdown, cold shutdown, and refueling.

- Valves SI08 and the RH19 (high head and low head safety injection isolation valves) are not used for hot standby conditions. These valves are required to open about 5.5 hours following design basis Loss of Coolant Accident (LOCA) conditions. As discussed in question 3 below, these are non-risk significant.

For each train of safety injection to the Reactor Coolant System hot legs, three check valves would have to backleak to jeopardize both the Low Head path (RH-0019) and High Head path (SI-0008).



There are three trains of emergency core cooling for each South Texas Project unit. Therefore, nine valves would have to leak to jeopardize the capability to establish hot leg recirculation.

Therefore, these isolation valves, SI08, RH19, RH60, and RH61, will be removed from the scope of Generic Letter 95-07.

2. Describe the bonnet pressure decay rate used in pressure locking calculations for valves 2N121XSI0008A/B/C and 2N122XSI0008A/B/C (6-inch, 1500-pound Westinghouse flexible wedge gate), and 1N161XRH0019A/B/C* and 1N162XRH0019A/B/C* (8-inch, 1500-pound Westinghouse flexible wedge gate).

   In a letter to the NRC dated May 24, 1996, Commonwealth Edison (ComEd) described bonnet pressure decay test results obtained from a 4-inch, 1500-pound Westinghouse flexible wedge gate valve. The results of this testing demonstrated that one of the factors that affected bonnet pressure decay rate was torque switch setting/closing thrust. In a letter to the NRC dated September 29, 1999, Carolina Power and Light Company described bonnet pressure decay test results obtained from 3- and 10- inch, 1500-pound, Westinghouse flexible wedge gate valves. The results of the ComEd and Carolina Power and Light Company bonnet pressure decay tests differ. Discuss how your bonnet pressure decay rate compares to the ComEd and Carolina Power and Light Company bonnet pressure decay rates. If your bonnet pressure decay rate is less conservative than the bonnet pressure decay rate obtained by Carolina Power and Light Company, then explain why it is acceptable to use your bonnet pressure decay rate.

Discuss if the torque switch setting/closing thrust values for your valves are similar to the test valves' torque switch setting/closing thrust values used to obtain your bonnet pressure decay rate. If applicable, explain how any differences between torque switch setting/closing thrust values between test valves and your valves were accounted for when determining your bonnet pressure decay rate. For example, if the test valve closing thrust value is 13,000 pounds and your valve is set up with a 20,000-pound closing thrust value, then the bonnet pressure decay rates may not be the same.

RESPONSE:

*Please note that the identifiers for these valves are 2R161XRH0019A/B/C and 2R162XRH0019A/B/C, respectively.

The Westinghouse Owners Group provided the basis for the bonnet depressurization rate used in calculations to determine maximum bonnet pressure. However, the South Texas Project is removing these valves from the scope of Generic Letter 95-07 as described on the response to Question 1. Therefore, depressurization rates for these valve bonnets are no longer an issue.

3. Discuss the risk associated with the failure of valves 2N121XSI0008A/B/C, 2N122XSI0008A/B/C, 1N161XRH0019A/B/C*, and 1N162XRH0019A/B/C* to open due to a common mode failure. For example, what is the change in core damage frequency and large early release frequency (if applicable) if the valves fail to open.

RESPONSE:

*Please note that the identifiers for these valves are 2R161XRH0019A/B/C and 2R162XRH0019A/B/C, respectively.

Failure of the above valves to open **does not** have an impact on the core damage frequency or large, early release frequency. These valves support hot leg recirculation which is required to mitigate stratification effects and promote thermal mixing. Switchover to hot leg recirculation occurs approximately 5.5 hours following a loss of coolant accident. Opening the valves is not required for cold leg injection, which is the first means of injecting borated water into the reactor coolant system.

The South Texas Project's Probabilistic Risk Assessment (PRA) model does not credit success of hot leg recirculation for preventing core damage or large, early release. Failure to mitigate stratification or promote thermal mixing will not lead to core damage as defined by the PRA.

4. Describe the testing that was performed to validate the thermal binding methodology used to demonstrate that the pressurizer power-operated relief valve block valves, 1R141XRC0001A/B and 1R142XRC0001A/B, and the RCS normal and alternate charging flow isolation valves, 2R171XCV0003, 2R171XCV0006, 2R172XCV0003, and

2R172XCV0006, are capable of operating during thermal binding conditions. Explain (1) how your valves are similar to the test valves (size, material, manufacturer, model); (2) temperature conditions for your valves and the test valves; (3) the thrust predicted to open the test valves during thermal binding conditions; and (4) the measured thrust that was required to open the test valves during thermal binding conditions. Discuss the thrust requirements for your valves to operate during thermal binding conditions and actuator capability.

RESPONSE:

RCS Normal and Alternate Charging Flow Isolation Valves

The RCS normal and alternate charging flow isolation valves are not required to operate under any thermal binding scenarios. During normal operation, a normal or an alternate charging flow isolation valve is normally open while the other is normally closed. Changes in alignment between the two valves are done at cold shutdown conditions. During the transition from hot standby to cold shutdown, the auxiliary spray valve is opened and the open charging flow isolation valve is closed after the reactor coolant pumps are secured and RCS temperature is between 180 to 185°F.

After pressurizer vapor space temperature is reduced to approximately 250°F, the closed valve is opened and the auxiliary spray valve is closed.

If pressurizer pressure is above 2250 psig, auxiliary spray is placed in service by opening the auxiliary spray valve and closing the open subject valve.

Use of normal or auxiliary spray is considered in the UFSAR Chapter 15 safety analysis only if it results in more severe accident results. No credit is taken for operation of these sprays if they mitigate the results of the accident.

In addition, the subject valves have a small hole drilled in the upstream disk to prevent pressure locking. Therefore, the subject valves are removed from consideration as being susceptible to either Thermal Binding or Pressure Locking and are outside the scope of Generic Letter 95-07.

Pressurizer PORV Block Valves

Design information
The pressurizer PORV block valves are normally-open 3-inch Westinghouse flex wedge gate valves with Limitorque SB-00 operators.

The safety function of the pressurizer PORV block valves is to provide positive shutoff capability in the event a pressurizer PORV becomes inoperative (stuck open) or experiences excessive leakage, and thereby preserves the integrity of the RCS pressure boundary, and facilitates safe shutdown.

The only time the pressurizer PORVs are assumed to operate during an accident is if normal operation results in a more severe RCS transient, i.e., higher peak RCS temperature for a main feedline rupture. Therefore, opening a pressurizer PORV is NOT a requirement for mitigating the effects of an accident.

South Texas Project Technical Specification 3/4.4.4 provides operability requirements for power-operated relief valves.

LIMITING CONDITION FOR OPERATION

3.4.4 Both power-operated relief valves (PORVs) and their associated block valves shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTION:

a. *With one or both PORV(s) inoperable, because of excessive seat leakage, within 1 hour either restore the PORV(s) to OPERABLE status or close the associated block valve(s) with power maintained to the block valves; otherwise, be in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.*

b. *With one PORV inoperable due to causes other than excessive seat leakage, within 1 hour either restore the PORV to OPERABLE status or close the associated block valve and remove power from the block valve; restore the PORV to OPERABLE status within the following 72 hours or be in HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.*

c. *With both PORV(s) inoperable due to causes other than excessive seat leakage, within 1 hour either restore at least one of the PORV(s) to OPERABLE status or close their associated block valve(s) and remove power from the block valves and be in HOT STANDBY within the next 6 hours and HOT SHUTDOWN within the following 6 hours.*

d. *With one block valve inoperable, within 1 hour restore the block valve to operable status or place its associated PORV in closed position; restore the block valve to operable status within 72 hours; otherwise, be in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.*

e. *With both block valves inoperable, within 1 hour restore the block valves to operable status or place the associated PORVs in the closed position; restore at least one block valve to OPERABLE status within the next hour; otherwise, be in at least HOT STANDBY within the next 6 hours and in HOT SHUTDOWN within the following 6 hours.*

The provisions of Specification 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.4.4.1 In addition to the requirements of Specification 4.0.5, each PORV shall be demonstrated OPERABLE at least once per 18 months by:

a. Performing a CHANNEL CALIBRATION on the actuation channel, and

b. Operating the valve through one complete cycle of full travel.

4.4.4.2 Each block valve shall be demonstrated OPERABLE at least once per 92 days by operating the valve through one complete cycle of full travel unless the block valve is closed in order to meet the requirements of ACTION b. or c. in Specification 3.4.4."

Therefore, a pressurizer PORV block valve is closed for one of two causes:

- Cause 1: Inoperable PORV due to excessive seat leakage (action a).
- Cause 2: Inoperable PORV due to causes other than excessive seat leakage (action b or c).

If the pressurizer PORV block valve is closed for Cause 2, power is removed from the block valve and either:

(a) the PORV cannot be repaired, the unit is shutdown, and the PORV block valve will not be required to be opened, or

(b) the PORV is repaired and the block valve reopened before exiting the Limiting Condition for Operation. If the block valve cannot be opened, then either actions "d" or "e" are entered.

Therefore, the pressurizer PORV block valves would not be required to open under the scenarios for Cause 2 discussed above.

If the pressurizer PORV block valve is closed due to excessive seat leakage (Cause 1), power is left on the block valve and the block valve would be expected to be able to open under the conditions of thermal binding.

The South Texas Project has closed the PORV block valves when "hot" several times due to excessive PORV seat leakage and the PORV block valves were subsequently reopened "cold" with no problems. At the time of the closure, the piping between the pressurizer and the inlet to the PORV (including the block valve body) was insulated. Temperature measurements made on the block valve during one PORV valve seat leakage event in 1990 showed the block valve body to be about 310°F. During 1997, the insulation was removed from:

(a) Downstream of the block valve to the PORV (Note: PORV has never been insulated);
(b) Body of the block valve; and
(c) Upstream of the block valve approximately 25".

In addition, two of the excessive PORV seat leakage events happened before the block valve actuator capability was upgraded with a change in gear ratio from 45:1 to 63:1 (140% improvement in actuator degraded voltage capability).

Because the insulation has been removed from the block valve and associated piping, an initial block valve body temperature at closure for excessive seat leakage of 300°F is conservative. The nominal ambient temperature without seat leakage in the vicinity of the block valves is 100 - 110°F, so that use of 100°F as the "cold" temperature is conservative.

The South Texas Project therefore considers the pressurizer PORV block valve to be qualified for use under conditions of thermal binding.

<u>Comparison of Westinghouse Testing to STP Pressurizer PORV Block Valves</u>

The Westinghouse testing was part of the AP600 system qualification tests. The valves were open and closed hot and left overnight to cool down. The following day the valves were opened. Fluid temperatures, valve body temperatures, downstream piping temperatures, opening forces, and closing forces were recorded.

1. <u>Valve similarity</u>
   The valves tested as part of the AP600 system qualification tests were:

   - 8-inch 1500 ANSI Class stainless steel Westinghouse flex wedge gate valve,
   - 4-inch 1500 ANSI Class stainless steel Edward Valves flex wedge gate valve.

   Both valves were manufactured to ANSI B16.34 requirements for wall thickness.

   The pressurizer PORV block valves are 3-inch 1525 ANSI Class stainless steel Westinghouse flex wedge gate valves. The pressurizer PORV block valves were manufactured to ASME Section III Class 1 which includes the use of ANSI B16.34.

   Therefore, the valves tested are similar to the South Texas Project valves.

2. <u>Temperature conditions</u>
   Refer to the following table.

3. <u>Predicted thrust</u>
   Refer to the following table.

4. <u>Measured thrust</u>
   Refer to the following table.

Table of Comparisons: Temperature Conditions and Forces

	Test Valve 4" Edwards	Test Valve 8" Westinghouse	STP 3" Westinghouse
Temperature Conditions	//////	//////	/////
Fluid Temperature	446°F	432 to 550°F	300°F
Body Temperature	142 to 145°F	142 to 295°F	300°F
Ambient	100°F	100 to 125°F	100°F
delta T	Test 1 300°F Test 2 300°F	Test 1 250°F Test 2 225°F Test 3 300°F	200°F
Forces	//////	/////	/////
Average Closing Force Cold (lbs.)	18,000	75,900	16,700
Average Cold Unwedging (lbs.) (a)	Test 1 7,700 Test 2 8,700	Test 1 31,550 Test 2 31,400 Test 3 31,600	Measured Min Max 330 to 6500
Calculated Bounding TB Opening Force (lbs.) (b)	Test 1 26,896 Test 2 26,896	Test 1 50,628 Test 2 45,566 Test 3 70,553	15,200
Total Opening Force Hot (lbs.) (c) = (a) + (b)	Test 1 34,596 Test 2 35,596	Test 1 82,178 Test 2 76,966 Test 3 102,153	Min Max 15,530 to 21,700
Measured Hot Opening Force (lbs.) (d)	Test 1 8,000 Test 2 8,962	Test 1 44,700 Test 2 55,300 Test 3 77,600	NA
Tested Margin (%) 100*[(c)-(d)]/(d)	Test 1 332 Test 2 297	Test 1 83.8 Test 2 39.2 Test 3 31.6	NA
STP Calculated Margin (%)	NA	NA	29

Thrust requirements for valve operation during thermal binding conditions and actuator capability:

Thrust requirements:
As shown in the table, the maximum thrust requirement for the block valves is 21,700 lbs.

Actuator requirements:

- Actuators are SB-00 with a commercial rating of 14,000 lbs. Under the Kalsi actuator uprating program, the actuator thrust rating is 28,000 lbs. for 768 cycles, or 200% of the commercial rating.
- Valve weak link is 33,464 lbs. at a temperature of 200°F.
- Worst case Degraded Voltage Actuator Capability is 28,829 lbs. at 150°F.

Therefore, 28,000 lbs. is used as the actuator rating, so that:

$$\text{margin} = 100 * (28{,}000 - 21{,}700) \div 21{,}700 = 29.0\%$$

5. Your submittal dated September 21, 1999, states that, as long-term corrective action, the valve/actuator application for 1N161XRH0019B* would be evaluated to obtain at least a 20-percent margin. When is the evaluation scheduled to be complete?

RESPONSE:

*Please note that the identifier for this valve is 2R161XRH0019B.

Based on the alternate approach as discussed in response to question 1, the South Texas Project will remove the subject valve from the scope of Generic Letter 95-07. This valve has positive margin and meets the requirements of the Generic Letter 89-10 motor-operated valve program. No additional evaluation is necessary.