Callaway Plant
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UNION ELECTRIC

April 15, 1994

U.S. Nuclear Regulatory Commission
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Enclosed is supplemental information to provide clarification for questions remaining from the April 7, 1994 conference call regarding Callaway's GL 89-10 closure document

1) Additional information on check valve back leakage. Reference Question No. 3.

2) Additional Information on linear extrapolation. Reference Question No. 7.

3) Additional information on butterfly valve margin. Reference Question No. 12.

This information is being sent to you to facilitate further discussion the week of April 18, 1994

Please contact me if you need additional information.

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ADDITIONAL INFORMATION ON CHECK VALVE BACKLEAKAGE

Question 3

The licensee states that credit is taken for operator identification of check valve backleakage. To what extent is such credit taken in determining the design-basis differential pressure for GL 89-10 MOVs?

Conclusion

The generic analysis performed by Westinghouse assumed check valve leakage for a total of 22 valves. Due to Callaway specific design and procedures, the generic operating scenarios are not applicable for 17 of the 22 valves. The 5 valves that the generic study is applicable to requires valve mispositioning in addition to the check valve leakage. Callaway monitors pressure 3 times a day in these lines. If increasing pressure is identified, corrective actions will be implemented.

MOVS WHICH WESTINGHOUSE ASSUMED BACKLEAKAGE

RHR SYSTEM

EJ-HV-8811A & B	CTMT RECIRC SUMP TO RHR PMP
EJ-HV-8809A & B	RHR ACC INJ SUPPLY ISO
EJ-HV-8840	RHR SI SYS HOT LEG RECIRC ISO
EJ-HV-8804A & B	RHR TO CHG AND SI PUMPS ISO
EJ-HV-8716A & B	RHR HOT LEG RECIRC ISO
BN-HV-8812A & B	RWST TO RHR PMP ISO
EJ-FCV-0610/611	RHR MINIFLOW RECIRC

SI SYSTEM

EM-HV-8835	SI PMP TO CL INJ ISO
EM-HV-8821A & B	SI PMP TO CL INJ ISO
EM-HV-8923A & B	RWST TO SI PMP ISO

ACCUMULATORS

EP-HV-8808A,B,C,D	SI ACC TK OUTLET ISO VLV

DISCUSSION

The above list represents the valves which Westinghouse in their generic study WCAP 13097, 'SYSTEM OPERATING BASIS FOR MOTOR OPERATED VALVES', assumed back leakage from the RCS via check valves. Assuming this leakage resulted in a higher design differential pressure than other design conditions. The leakage was assumed to occur over a period of time such that it was within allowable limits, and was not considered a failure. Using the RCS as a pressure source due to this leakage was considered for the initial valve operation but, due to its slow nature, not in subsequent valve movement. In many cases, the subject valve was considered to be mispositioned coincident with the check valve leakage.

The above valves will be separated into two categories. The first group of valves will be MOVs for which Callaway specific design renders the Westinghouse assumed operating condition not applicable to Callaway. The second group are MOVs that Callaway takes credit for identifying the leakage and implementing administrative controls to ensure it is not a pressure source for the valve differential pressure.

See FSAR Section 5.2 for additional discussion.

Group 1, Westinghouse Study Not Applicable Due To Callaway Specific Design And Procedures

EJ-HV-8809A & B, EM-HV-8835, EP-HV-8808A, B, C, D

These seven valves are all normally open with power removed. The Westinghouse scenario assumes in addition to the backleakage that they are either mispositioned closed, or they must open on receipt of a SI signal. With power removed this is not a credible scenario.

EJ-HV-8716A & B, EM-HV-8923A

These three valves are normally open with "Stop and Think" covers to prevent mispositioning. They are identified in Standing Order 93-001R1 as T/S 3.0.3 valves, meaning if they are closed the plant must immediately enter Technical Specification 3.0.3, and commence a plant shutdown. Based on this, it is not a credible scenario at Callaway for these valves to be mispositioned for any length of time, such that they would be required to re-open with a high differential pressure from check valve leakage.

EJ-FCV-0610 & 0611

These RHR miniflow isolation valves are normally open. Callaway's plant alignment is such that if they were mispositoned and check valve leakage occurred, both the upstream and downstream side of the valve would be subject to the same pressure (i.e. no DP created).

EJ-HV-8811A & B

These are the normally closed CTMT recirculation sump to the RHR pump isolation valves. The generic Westinghouse study assumed check valve leakage and then these two MOVs opening on receipt of a SI signal. At Callaway, these valves do not stroke open until the RWST has been depleted. At this point the RHR pumps have been running for some time and check valve leakage is not applicable.

EJ-HV-8804A & B

These are the normally closed RHR to the CCPs and SI pumps isolation valves. Similar to EJ-HV-8811, these valves open after the RWST has been depleted during the swap over to the CTMT recirculation sump. Again, the RHR pumps would have been running for some time, therefore check valve leakage is not applicable. (Note, for both 8811 and 8804, increasing pressure would be identified by the shiftly checks done on the RHR discharge pressure indicator prior to use of the MOV.)

EJ-HV-8840

This valve is the RHR system hot leg recirculation isolation valve. During normal operation it is closed with power removed. The Westinghouse generic study described a scenario in which this valve is to be opened to start hot leg recirculation with the RCS pressure at 1200 psi. This is not a credible scenario at Callaway. Hot leg recirculation at Callaway is implemented 13 hours after initiation of an accident. If for some reason RCS pressure is at 1200 psi, the RHR pumps would have been stopped long before, since they are not capable of injecting at this pressure. This valve would not be opened until RCS pressure is low enough for the RHR system to inject.

Group 2, Westinghouse Study Applicable, Administrative Controls Used

BN-HV-8812A & B

These are the normally open RWST to RHR pump isolation valve. For the Westinghouse generic analysis, the valve would need to be **mispositioned closed**, and then have check valve leakage through 4 valves BB8948, EP8818, EJ8730, and EJ8958. However, if the above conditions were to occur, increasing pressure would be identified by the shiftly check of RHR pump discharge pressure indicator, EJ-PI-614(615). See the attached sheet from Callaway's Control Room logs.

EM-HV-8821A & B

These are the normally open SI pump to the RCS cold leg injection isolation valves. For the Westinghouse generic analysis, the valve would need to be **mispositioned closed**, and then have leakage through check valves BB8948 and EP0010. However, if the above conditions were to occur, increasing pressure would be identified by the shiftly check of the SI pump discharge pressure indicator EM-PI-0919(923).

EM-HV-8923B

This is the normally open RWST to the SI pump B isolation valve. Due to Callaway specific line-up, its counterpart on the A train is a T/S 3.0.3 valve, and has controls to prevent mispositioning. For the Westinghouse generic analysis, the valve would need to be **mispositioned closed**, and then have leakage through check valves BB8948, EP8818 and EM8922B. However, if the above conditions were to occur, increasing pressure would be identified by the shiftly check of the SI pump discharge pressure indicator EM-PI-0923.

Example Action If Leakage Is Identified

This is one action that could be implemented for all 5 of the above valves. However, the actual specific actions will be determined by the system engineer based on the plant conditions at the time the leakage is identified. The identification point for the pressure indicators were selected in order to allow time for actions to be taken.

One action could be to open the normally closed SI test line. This line is used for the periodic surveillance testing of the pumps. Its flow can be routed to the RWST or the Recycle Hold-up Tank. A flow meter could be installed to verify that the check valve leakage remains within allowable limits.

CONTROL ROOM LOGS

DATE ________

MCB	NOMENCLATURE	I.D.	0000	0800	1600	MAX.	MIN.	UNITS
5	Main Steam Header Press	AB PI-507						PSIG
	Main Feedwater Press	AE PI-507						PSIG
	FW Press/Stm Press ΔP	AE PDI-508						PSID
	Main Feedwater Pump A Speed	FC SI-33				5800	(1)	RPM
	Main Feedwater Pump B Speed	FC SI-133				5800	(1)	RPM
	TD AFW Pump Speed Control	FC HIK-313A				(2)		RPM
	Elect. Malfunction/System Fault	(3)						
	Thrust Bearing Wear Ind. Meter					+20 -20		MILS

(1) If Conditions permit while at full power. The pump controller in auto should be rotated Saturday PM shift.

(2) Speed is set to 3850 RPM by Strobe-TACH per OSP-AL-P0002.

(3) This light is indication of Turbine EHC control problems. The light should be verified to be extinguished. If this light is on, check EHC control panel AC119 for the cause of the problem.

MCB	NOMENCLATURE	I.D.	0000	0800	1600	MAX.	MIN.	UNITS
14	Plant Disch B/D & Byp Flow	FI DB-1017				(4)		K GPM
	Cooling Tower B/D Flow	FI DB-1101A						K GPM
	Plant Discharge Bypass Flow	FI DB-1006						K GPM
	Water Trt Inlet Flow	FI DE-3001						K GPM
	Water Trt Clearwell Level	LI DE-3006A						Ft. MS
	Cooling Tower Level	LI DA-3102A				847(5)	840	Ft. MS

(4) Refer to APA-ZZ-01003 Section 9.1 for possible restrictions if this meter is out of service.

(5) For Consistant Chemistry Control of the Cooling Tower Basin. Level should be maintained between 845' and 846'. One foot of free board should be maintained during normal Operating Conditions.

MCB	NOMENCLATURE	I.D.	0000	0800	1600	MAX.	MIN.	UNITS
16	PA01 Bus Voltage	PA EI-1				14.52	12.42	K VOLT
15	NB01 Voltage	NB EI-1				4400	3744	VOLTS
16	PA02 Bus Voltage	PA EI-2				14.52	12.42	K VOLT
15	NB02 Voltage	NB EI-2				4400	3744	VOLTS

MCB	NOMENCLATURE	I.D.	0000	0800	1600	MAX.	MIN.	UNITS
17	RHR Pump B Disch (6)	EJ PI-615				70 PSIG		SAT/UNS
	SI Pump B Disch (6)	EM PI-923				100 PSIG		SAT/UNS
	SI Pump A Disch (6)	EM PI-919				100 PSIG		SAT/UNS
	RHR Pump A Disch (6)	EJ PI-614				70 PSIG		SAT/UNS

(6) These instruments have been identified as indicators of back leakage. When the associated pumps are idle, ensure pressure does not increase above the listed pressure. If action is required to prevent pressure build up above these limits, notify the system engineer.

ADDITIONAL INFORMATION ON LINEAR EXTRAPOLATION

SUBJECT:

QUESTION #7 "HOW IS LINEAR EXTRAPOLATION OF TEST DATA JUSTIFIED?" This information is being provided in addition the discussion provided on pages 4-1 through 4-3 of Callaway's closure document.

CONCLUSION:

The use of extrapolation methods to determine MOV thrust requirements at design basis conditions is supported by the recent testing performed by EPRI. The results of EPRI's testing showed that disc sliding friction coefficients tend to decrease at higher DP values. Thus, the linear extrapolation methodology has been shown to be conservative. Multi-point DP testing performed at Farley and Grand Gulf nuclear plants also support this conclusion.

DISCUSSION:

EPRI has performed DP testing of gate valves under varying conditions: low pressure cold water pumped flow, intermediate pressure pumped flow, high pressure cold/hot water, and high pressure cold water and steam. A summary of the test data has been provided on pages 10 -15 of Attachment 8 to RFR 8746 I. The data shows for all test conditions that the disc sliding friction coefficient (μ) decreases as the DP is increased from a lower DP to higher DP[1]. This reduction in disc friction at higher DPs means that test data taken at lower DPs and extrapolated up will conservatively determine the required thrust to operate at design DP. Thus the extrapolation methodology is conservative.

The multi-point DP testing performed at Farley Nuclear Plant supports linear extrapolation of DP data. The graphs made from the linear regression analysis show that Farley's DP data can be accurately modeled using linear extrapolation. In all cases, the small amount of data scatter from the line of best fit is within the measurement accuracy of the test equipment.

Grand Gulf has performed several DP tests at multiple pressures. Their results also support linear extrapolation. MOV engineers at Grand Gulf have used their DP data to compare various curve fit techniques including linear, exponential, logarithmic, and power. This comparison shows linear regression to be the most appropriate method for modeling valve thrust requirements over a range of DP conditions.

Callaway's limitations on the use of linear extrapolation are given on page 4-1 of the Callaway closure document.

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[1] It should be noted that the Huntsville low DP cold water testing (see page 11 of Att. 8 to RFR 8746 I) was done before the need for preconditioning was determined. Therefore, the rise in disc μ from low to high DP can be attributed to the preconditioning done on the high DP tests.

ADDITIONAL INFORMATION ON BUTTERFLY VALVE MARGIN

Question 12

What margin is applied to butterfly MOVs for periodic verification?
What is justification for static margin for butterfly MOVs?

Conclusion

It is Callaway's intent to handle butterfly MOVs in the same manner as rising stem MOVs. We have DP tested 38 of the 40 valves and set them up in accordance with these test results. 32 of the valves have more than 25% additional margin. Action is planned for the remaining valves, which includes re-DP testing, torque switch adjustment and spring pack replacement. Trending of MOV performance, feedback of butterfly re-DP test results and accommodation of relevant industry issues that may arise will identify any corrective actions that need to be implemented.

Discussion

Actual DP test torque data has been used to set up the butterfly MOVs. Of the five valves which were set up using grouping, three have been DP tested, but at differential pressures below the programmatic level allowing use of the test data without further analysis and justification. Grouping with similar valves was consistent with GL 89-10 Supplement 6.

Use of the DP test approach avoids reliance on required torque values that have been calculated from assumed industry parameters. Therefore, should an industry issue be confirmed regarding calculated predicted torque values being lower than those actually found through testing, Callaway's butterfly MOVs will not be adversely affected.

Setting up to meet the minimum Test Acceptance Criteria provides a measure of margin to allow for possible valve deterioration (i.e. increased torque requirements) during the period before the next test. The inherent margin in the minimum Test Acceptance Criteria results from numerous conservatisms used in the adjustment for test equipment error, component repeatability and selection of "worst case" data points.

Beyond the aforementioned inherent margin, all of the butterfly valves have additional margin above the minimum Test Acceptance Criteria. In fact, 32 of the MOVs have an additional margin of more than 25%. Although there is no formal commitment for additional margin, actions are planned for the remaining eight butterfly MOVs. Two valves are scheduled for re-DP testing. Adjustment of torque switch settings and replacement of spring packs, where appropriate, are planned to increase additional margin.

Trending programs at Callaway provide for monitoring performance information on all GL 89-10 valves every 18 months[1] and feeding this trend data back into the program for analysis, testing and set up of the MOVs. Trending of this data for butterfly valves provides information necessary to detect valve performance degradation, i.e. "aging", so that corrective actions can be implemented if necessary. Programs for monitoring industry events and issues and appropriately feeding this information back into the program are in place. Results of the repeated butterfly DP tests will be analyzed and fed back into the program.

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[1]Data based on 4-1/2 year periodic testing done on a staggered basis.