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JOHN S. KEMPER
SENIOR VICE-PRESIDENT
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November 5, 1987
Docket No. 50-352

Mr. W. R. Butler, Director
Project Directorate I-2
Division of Reactor Projects I/II
U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Dear Mr. Butler:

The purpose of this letter is to provide additional information for Philadelphia Electric Company's November 5, 1986 Application for Amendment of Facility Operating License NPF-37 which requests changes to the Technical Specifications for revision of the Trip Setpoints and Allowable Values for Low Pressure Coolant Injection (LPCI) injection valve differential pressure instrument loops.

The additional information was requested by Mr. Martin of the NRC staff in a letter to Mr. E. G. Bauer, Jr. dated February 19, 1987. The questions are provided, followed by our responses, in the enclosure.

If you have any questions concerning our response or require more additional information, please do not hesitate to contact us.

Very truly yours,

J S Kemper

Enclosure

cc: Mr. W. T. Russell, Administrator, Region 1, USNRC
Mr. Robert Martin, PBAPS Project Manager
Mr. R. J. Clark, LGS Project Manager
E. M. Kelly, LGS Senior Resident Site Inspector

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PHILADELPHIA ELECTRIC COMPANY
RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION DATED FEBRUARY 19, 1987
REVISION OF TRIP SETPOINTS AND ALLOWABLE VALVES FOR LPCI INJECTION VALVE DIFFERENTIAL PRESSURE INSTRUMENT LOOPS

1. QUESTION:

Identify the specific valves and pressure sensors, with references to FSAR drawings, which are the subject of the amendment request.

RESPONSE:

The subject valves are the Low Pressure Coolant Injection (LPCI) valves HV-51-1F017A, B, C, and D. The subject differential pressure sensors are PDT-51-1N058A, B, C, and D. These valves and sensors are shown on FSAR Figure 5.4-13 (sheet 1, coordinate F-7; sheet 2, coordinate F-3). LPCI is a mode of the Residual Heat Removal (RHR) system.

2. QUESTION:

Provide a discussion of the normal operational or accident event scenarios that the valve interlocks are designed to respond to with references to the FSAR as appropriate.

RESPONSE:

The valve interlocks of interest are designed to prevent opening the LPCI injection valves during all normal operational and accident event scenarios when the reactor vessel pressure is above the maximum design pressure of the RHR system piping as discussed in FSAR Section 7.6.1.2. The LPCI injection valves HV-51-1F017A, B, C, and D serve as the interface between the high pressure piping attached to the reactor vessel and the lower pressure piping of the RHR system. The interlock of interest is one of the high pressure/low pressure system interlocks reviewed and approved by the NRC in NUREG-0991: Safety Evaluation Report related to the Operation of Limerick Generating Station, Units 1 and 2, Sections 6.3.3, 7.6.1.2, 7.6.2.1, 7.6.3.

3. QUESTION:

Discuss the relationship of the interlock setpoint (SP) and allowable value (AV) to the licensing basis ECCS analysis with references as appropriate.

RESPONSE:

The relationship between the interlock setpoint, allowable values and the analytical limits is illustrated in Attachment 1 "SETPOINT RELATIONSHIPS".

The licensing basis ECCS analysis, which is described in FSAR Section 6.3.3, was performed using the SAFE code for the LOCA pipe rupture events described in FSAR, Section 15.2.8, 15.6.4, and 15.6.5. The limiting event is the postulated guillotine break of the reactor recirculation system suction line. In the ECCS analysis it is assumed that the interlock is cleared and the injection valve receives a signal to begin to open when the reactor steam dome pressure drops to 300 psig. Further, the analysis conservatively assumes that flow through the valve does not occur until the valve is fully open (a 26 second delay time after the interlock is cleared and the valve is signaled to open).

The interlock design analysis has been performed using a proposed Lower Analytical Limit (LAL) of 53 psid. The Analytical Limit is the value of the sensed process variable prior to or at the point which a desired action is to be initiated to prevent the process variable from reaching the associated safety limit. The value of 53 psid corresponds to a reactor steam dome pressure of 368.9 psig. This reactor steam dome pressure of 368.9 psig provides a margin of 68.9 psi above the value of reactor steam dome pressure of 300 psig, at which the ECCS analysis assumes the injection valve differential pressure interlock is cleared and the injection valve receives a signal to begin to open.

The proposed Lower Allowable Value (LAV), 64 psid, corresponds to a reactor steam dome pressure of 379.9 psig, and includes allowances above the LAL for instrument loop accuracy and calibration errors. The Allowable Value is the limiting value of the sensed process variable at which the trip setpoint may be found during instrument surveillance.

The proposed setpoint of 74 psid, corresponds to a reactor steam dome pressure of 389.9 psig, and incorporates an allowance for instrument loop drift.

4. QUESTION:

Discuss the effects of the proposed change to the SP and AV on the need for revision of the ECCS analysis including any change in the timing of initial flow into the reactor in the event of a LOCA.

RESPONSE:

The proposed changes to the SP and AV will require no changes to the ECCS analysis. As discussed in the response to item 3, above, the proposed changes in the SP and LAV are based on a LAL of 53 psid, which corresponds to a reactor steam dome pressure of 368.9 psig. Since the analysis was done assuming the interlock is cleared and the injection valve receives a signal to begin to open when the reactor steam dome pressure drops to 300 psig, the existing ECCS analysis remains conservative. The timing of injection flow was based on the time delay after reaching the 300 psig value. Therefore, the changes to the SP and LAV have no impact on the timing of initial flow into the reactor assumed in the analysis.

5. QUESTION:

How was the upper analytical limit of 95 psid for differential pressure determined and what is its relationship to the current SP, the proposed SP and AV and the licensing basis ECCS analysis?

RESPONSE:

The Upper Analytical Limit (UAL) of 95 psid, which assures that the LPCI system will not be exposed to excessive reactor pressure, was determined by calculating the differential pressure across the injection valve which corresponds to the maximum design pressure of the most limiting component in the piping system. For Limerick, the limiting component is the RHR heat exchanger, which has a maximum design pressure of 495 psig. This value of 495 psig corresponds to a differential pressure of 106.2 psid across the injection valve. Therefore, the selected value of the UAL of 95 psid has a margin of 11.2 psi to the maximum design pressure.

The Upper Allowable Value (UAV), corresponding to the UAL of 95 psid, is 84 psid and includes allowances for instrument loop accuracy and calibration errors. The SP of 74 psid incorporates an allowance for instrument loop drift.

The relationship between the SP, UAV, and UAL is illustrated in Attachment 1, "SETPOINT RELATIONSHIPS". The UAL is related to the ECCS analysis in that it only assures the low pressure RHR system piping will not be exposed to excessive reactor pressure and possibly damaged by overpressure. This protection is necessary to ensure availability of the RHR system to inject low pressure coolant flow during the LOCA event. The UAL has no other relationship to the ECCS analysis.

6. QUESTION

Discuss quantitatively the margin between the current SP, the proposed SP and the value of the SP assumed in the original ECCS analysis for Limerick.

RESPONSE:

The current setpoint of 78 psid for the injection valve differential pressure interlock corresponds to a reactor steam dome pressure of 393.9 psig. The value of reactor steam dome pressure at which the ECCS analysis assumes the injection valve differential pressure interlock is cleared and the injection valve receives a signal to begin to open is 300 psig. The difference between these two values of reactor steam dome pressure is 93.9 psi, and is allocated in the setpoint determination process as follows (data is taken from the referenced line of Attachment 2):

Total Loop Accuracy:	7 psi*	(line 2e)
Drift:	10 psi*	(line 3a)
Excess Unassigned Pressure Margin:	76.9 psi	(line 4)

* These values also contain margin; 1.04 psi (line 2c) and 5.56 psi (line 3c) respectively.

The proposed setpoint of 74 psid for the injection valve differential pressure interlock corresponds to a reactor steam dome pressure of 389.9 psig. Again, the value of reactor steam dome pressure at which the ECCS analysis assumes the injection valve differential pressure interlock is cleared and the injection valve receives a signal to begin to open is 300 psig. The difference between these two values of reactor steam dome pressure is 89.9 psi, and is allocated in the setpoint determination process as follows (data is taken from the referenced line of Attachment 2):

Total Loop Accuracy:	11 psi**	(line 2e)
Drift:	10 psi**	(line 3a)
Excess Unassigned Pressure Margin:	68.9 psi	(line 4)

** These values also contain margin; 4.27 psi (line 2c) and 5.03 psi (line 3c) respectively.

7. QUESTION:

Discuss the effect of the proposed change on the probability of accident initiating events and the probability of accident event sequences with respect to any impact on the probability of an accident previously evaluated. Also discuss the effect of the proposed change on the consequences of accidents previously evaluated.

RESPONSE:

The LPCI injection valve differential pressure interlock is designed to prevent opening the LPCI injection valves during all normal operational and accident event scenarios when the reactor pressure is above the maximum design pressure of the low pressure RHR piping. The UAL of 95 psid was established as the maximum value of differential pressure across the injection valve for which it would be permissible to open the injection valve and expose the low pressure RHR system piping to the associated reactor steam dome pressure without overpressurizing the most limiting component in the RHR system piping. This UAL is not changed by this modification. Therefore, the existing level of overpressure protection provided for the low pressure RHR system piping is not reduced.

As a result of increasing the calibrated range of the LPCI injection valve differential pressure instrument loop, the accuracy allowance for the instrument loop must be increased by 4 psig. In order to maintain the UAL of 95 psid, the UAV will be decreased from 88 psig to 84 psig to account for the increased accuracy allowance. Likewise, the setpoint will be decreased to 74 psig from 78 psig to account for the unchanged drift allowance of 10 psi.

While the LPCI injection valve differential pressure interlock is designed to prevent opening the LPCI injection valves when reactor pressure exceeds the maximum design pressure of the low pressure RHR system piping, the LPCI injection valves are required to open when the reactor pressure has dropped to below the maximum design pressure of the RHR low pressure piping to pass LPCI flow to the reactor in response to the LOCA pipe rupture events discussed in FSAR Sections 15.2.8 (Feedwater Line Break), 15.6.4 (Steam System Piping Break Outside Primary Containment), and 15.6.5 (Loss of Coolant Accidents (Resulting From Spectrum of Postulated Piping Breaks Within the Reactor Coolant Pressure Boundary) Inside Primary Containment). Consequently, the differential pressure interlock setpoint also has an associated LAV and LAL.

The LAV will be decreased from 68 psig to 64 psig to account for the unchanged drift allowance of 10 psi for the proposed setpoint of 74 psig. The LAL will be decreased from 61 psid to 53 psid to primarily account for the increased accuracy allowance of the differential pressure instrument loop. As discussed in the response to Question #4, the proposed LAL of 53 psid corresponds to a reactor steam dome pressure of 368.9 psig. The setpoint of 74 psig and the LAV of 64 psid were established, considering the drift and accuracy allowances of the differential pressure instrument loop, to clear the interlock prior to reaching the LAL. The ECCS analysis assumes the differential pressure interlock is cleared and the injection valves are signaled to open when reactor steam dome pressure drops to 300 psig; much lower than the reactor steam dome pressure of 368.9 psig associated with the LAL of 64 psid. Therefore, the injection valve differential pressure interlock will continue to clear sooner than was assumed in the ECCS analysis. The signals to open the LPCI injection valves originate from different instrument loops which are not affected by this modification. The timing of initial ECCS flow into the reactor remains unchanged from that previously analyzed.

In summary, the changes to the UAV and SP continue to maintain the existing level of overpressure protection provided for the low pressure RHR system piping, and the changes to SP, LAV, and LAL continue to be more conservative, with excess unassigned margin, than the assumptions used in the ECCS analysis, maintaining the validity and results of the analysis. The timing of initial ECCS flow into the reactor as analyzed in the licensing basis ECCS analysis remains unchanged. We therefore conclude, that the changes associated with this modification do not involve a significant increase in the probability or consequences of any accidents previously evaluated.

8. QUESTION:

Discuss in further detail the type of potential accidents that the differential pressure interlock is designed to protect against and show that the proposed change does not introduce the possibility of a new or different type of accident from any previously analyzed.

RESPONSE:

The LPCI injection valve differential pressure interlock is designed to prevent opening the LPCI injection valves during all normal operational and accident event scenarios when the reactor pressure is above the maximum design pressure of the low pressure RHR piping. The UAL of 95 psid was established as the maximum value of differential pressure across the injection valve for which it would be permissible to open the injection valve and expose the low pressure RHR system piping to the associated reactor steam dome pressure without overpressurizing the most limiting component in the RHR system piping. This UAL is not changed by this modification. Therefore, the existing level of overpressure protection provided for the low pressure RHR system piping is not reduced.

While the LPCI injection valve differential pressure interlock is designed to prevent opening the LPCI injection valves when reactor pressure exceeds the maximum design pressure of the low pressure RHR system piping, the LPCI injection valves are required to open when the reactor pressure has dropped to below the maximum design pressure of the RHR low pressure piping to pass LPCI flow to the reactor in response to the LOCA pipe rupture events discussed in FSAR Sections 15.2.8 (Feedwater Line Break), 15.6.4 (Steam System Piping Break Outside Primary Containment), and 15.6.5 (Loss of Coolant Accidents (Resulting From Spectrum of Postulated Piping Breaks Within the Reactor Coolant Pressure Boundary) Inside Primary Containment). The changes to the associated LAV and LAL continue to allow the injection valve differential pressure interlock to clear sooner than was assumed in the ECCS analysis as discussed in the response to Question #7. The signals to open the LPCI injection valves originate from different instrument loops which are not affected by this modification. The timing of initial ECCS flow into the reactor remains unchanged from that previously evaluated.

The changes to the UAV and SP continue to maintain the existing level of overpressure protection provided for the low pressure RHR system piping, and the changes to SP, LAV, and LAL continue to be more conservative, with excess unassigned margin, then the assumptions used in the ECCS analysis, maintaining the validity and results of the analysis. The timing of initial ECCS flow into the reactor as analyzed in the licensing basis ECCS analysis remains unchanged. There are no hardware or logic changes associated with this modification. The differential pressure interlock will continue to operate in the same manner as prior to the implementation of this modification, while monitoring a larger range of plant conditions. We therefore conclude, that the changes associated with this modification do not introduce the possibility of a new or different type of accident from any previously analyzed.

9. QUESTION:

Identify the currently existing margins of safety and show quantitatively that the proposed SP and AV values do not involve a significant reduction in that margin of safety.

RESPONSE:

There are, in general, four areas of margin of safety inherent in the SP and AV values. These margins are shown for both the current SP and AV, and for the proposed SP and AV, in Attachment 2 "SETPOINT DATA". They are:

(1) margin in the assumed values of instrument loop accuracy and drift (lines 2c and 3c),

(2) the excess unassigned pressure margin between the current/proposed setpoints and the setpoint assumed in the ECCS analysis (line 4),

(3) margin in the form of conservative modeling bias in the ECCS analysis codes themselves (line 6),

(4) margin between the Peak Clad Temperature (PCT) predicted by the ECCS analysis and the PCT safety limit of 2200 degrees F (line 7c).

The total change in pressure margin outside of the ECCS analysis for the proposed SP compared to the current SP is 5.3 psi (line 5). There still remains 68.9 psi of excess unassigned pressure margin (line 4) in the proposed SP and AV, above the value of reactor steam dome pressure of 300 psig, which the ECCS analysis assumes is the value when the differential pressure interlock is cleared and the injection valve is signaled to open. The margins in the ECCS codes and the margin between the ECCS analysis results and the 2200 degree F limit are unchanged. The total change in margin of 5.3 psi, out of total pressure margins of approximately 80 psi in analysis input assumptions, of which 68.9 psi are excess unassigned pressure margins, and several hundred degrees F for PCT, is not significant.

Therefore it is concluded that the proposed changes do not involve a significant reduction in a margin of safety.

10. QUESTION:

Discuss any enhancements of maintenance, surveillance or operational activities which may accrue due to the expansion in the LPCI injection valve instrument loop range.

RESPONSE:

During normal plant shutdown conditions, the differential pressure across the LPCI injection valve can decrease far enough below the present calibrated range (0 to 800 psid) of the differential pressure instrument loop such that the instrument loop detects a signal gross failure and improperly activates a RHR loop out-of-service annunciator in the control room. After this change is implemented, the increased calibrated range (-200 to 800 psid) of the LPCI injection valve differential pressure instrument loop will envelope the anticipated range of differential pressure across the injection valve during normal plant operational and shutdown conditions, thereby eliminating the instrument loop signal gross failure alarm. An actual loop signal gross failure condition will still generate the RHR loop out-of-service annunciator.

11. QUESTION:

Discuss the proposed recalibration of the instrument loops from 0 to 800 psid range to a -200 to 800 psid range with respect to the complexity and reliability of the instrumentation in performing its intended function. This should include discussion of any changes in logic and procedures for recalibration as appropriate.

RESPONSE:

The proposed recalibration of the instrument loops does not increase the complexity or decrease the reliability of the instrumentation in performing its intended safety function. No changes to the interlock control logic are required nor are any changes required to the method for calibration of this type of instrument loop. The calibration procedure for the LPCI injection valve differential pressure instrument loop will be revised to include the increased calibrated range. The existing hardware is designed to be calibrated to the increased range.

ATTACHMENT 1

SETPOINT RELATIONSHIPS

	CURRENT		PROPOSED	
Item	Value(1)	Steam Dome Pressure	Value(1)	Steam Dome Pressure
Upper Analytical Limit	95 psid	N/A	95 psid	N/A
Upper Allowable Value	88 psid	N/A	84 psid	N/A
Setpoint	78 psid	393.8 psig	74 psid	389.9 psig
Lower Allowable Value	68 psid	383.8 psig	64 psid	379.9 psig
Lower Analytical Limit	61 psid	368.8 psig	53 psid	368.9 psig

Notes:

1) Calculated in accordance with NEDC-31336, October 1986, GENERAL ELECTRIC INSTRUMENT SETPOINT METHODOLOGY

ATTACHMENT 2

SETPOINT DATA

Item	Current	Proposed
1. Difference between reactor steam dome pressure corresponding to interlock setpoint and reactor steam dome pressure assumed in the ECCS analysis.	93.9 psig	89.9 psig
2. Accuracies		
a) Assumed loop instrument accuracy	6 psi	10 psi
b) Calculated loop instrument accuracy (note 1)	4.96 psi	5.73 psi
c) Loop instrument accuracy margin (2a-2b)	1.04 psi	4.27 psi
d) Assumed loop calibration accuracy	2 psi	2 psi
e) Total loop accuracy ($\sqrt{(2a)^2+(3b)^2}$)	7 psi	11 psi
3. Drift		
a) Assumed loop drift	10 psi	10 psi
b) Calculated loop drift (note 1)	4.44 psi	4.97 psi
c) Loop drift margin (3a-3b)	5.56 psi	5.03 psi
4. Excess Unassigned Pressure Margin (1-2e-3a) (i.e., margin above and beyond identified margin allocations)	76.9 psi	68.9 psi
5. Total pressure margin outside of ECCS analysis (4+3c+2c)	83.5 psi	78.2 psi
6. ECCS codes modeling bias	Note 2	Note 2
7. Analysis Results		
a) Safety Limit	2200°F	2200°F
b) Calculated	2090°F	2090°F
c) Analysis margin (7a-7b)	110°F	110°F

Notes:

1) Calculated in accordance with NEDC-31336, October 1986, GENERAL ELECTRIC INSTRUMENT SETPOINT METHODOLOGY
2) The models used by General Electric for LOCA analysis have a known conservative modeling bias of several hundred degrees.