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December 04, 1998

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Gentlemen:

Subject: **Docket Nos. 50-361 and 50-362**
Response to the NRC Request for Additional Information to Support Proposed Technical Specification Number NPF-10/15-491, Reactor Coolant System (RCS) Temperature Reduction and Volumetric Minimum Flow Rate (TAC Nos. MA2238 and MA2239)
San Onofre Nuclear Generating Station
Units 2 and 3

References:

1) Letter from James W. Clifford (NRC) to Harold B. Ray (SCE), dated October 30, 1998, Subject: Request for Additional Information on Change to TCold [Reactor Coolant System (RCS) cold leg temperature (T_{cold})] Reduction and RCS Flow Measurement Technical Specification (TAC Nos. MA2238 and MA2239) San Onofre Nuclear Generating Station Units 2 and 3

2) Letter from Dwight E. Nunn (SCE) to the Document Control Desk (NRC), dated June 19, 1998, Subject: Proposed Technical Specification Number NPF-10/15-491, RCS Temperature Reduction and Volumetric Minimum Flow Rate, San Onofre Nuclear Generating Station, Units 2 and 3

This letter provides additional information as requested by the U. S. NRC in reference 1. The Southern California Edison responses to the U. S. NRC's questions are provided as an enclosure to this letter.

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BACKGROUND

By reference 2 SCE submitted Amendment Application Numbers 179 to Operating License NPF-10 and 165 to Operating License NPF-15. These amendment applications requested the following changes:

1) A reduction in the minimum primary Reactor Coolant System (RCS) cold leg temperature (T_{cold}) from 544F to 535F between the 70% and 100% rated thermal power levels.

2) A conversion of the specified RCS minimum flow rate from a "Mass" (i.e., lbm/hr) to a "Volumetric" (gpm) flow basis.

3) Elimination of the maximum RCS flow rate limit.

If you have any questions or would like additional information, please let me know.

Sincerely,

Enclosure

cc: E. W. Merschoff, Regional Administrator, NRC Region IV
J. A. Sloan, NRC Senior Resident Inspector, San Onofre Units 2 & 3
J. W. Clifford, NRC Project Manager, San Onofre Units 2 and 3

ENCLOSURE

The Southern California Edisons Company (SCE)
Tcold Program
Response to NRC Questions

The Southern California Edisons Company (SCE) Tcold Program — Response to NRC Questions

Question 1:

Unlike mass flow rate which is constant in a given loop, the volumetric flow rate is a function of temperature and will therefore be different for a cold leg than for the corresponding hot leg. The Bases for Surveillance Requirement 3.4.1.3 allows the use of a heat balance between the primary and secondary to calculate the flow rate. However, neither the TS nor the Bases for the surveillance requirement state that the flow rate limit applies strictly to the cold leg. Please modify your submittal [the referenced letter] to include such a statement or justify your proposed wording.

Response to Question 1:

The referenced letter is hereby modified by our commitment to add the following to the Bases of Surveillance Requirement 3.4.1.3:

> When the Core Operating Limit Supervisory System (COLSS) is out of service. Reactor Coolant System (RCS) Volumetric Flow rate is determined manually. An evaluation of the heat balance between primary and secondary plant powers is the preferred method. The heat balance involves first determining the RCS mass flow rate and then converting it to volumetric flow rate using the RCS fluid conditions at the discharge of the Reactor Coolant Pumps (RCPs)

Revised pages are provided for your information.

Question 2:

On page 3 [of the referenced letter], you stated "for accident analyses that can be affected by elevated flow rates, a flow rate which is conservatively large compared to baseline measured flow is used." Please provide and justify the flow rate used. In your justification, be sure to provide supporting data regarding the maximum flow that can be provided by the pumps.

Response to Question 2:

The RCS flow rate used in the accident analyses (the accident analyses sensitive to elevated flow rates) is 112 % Qdes, where Qdes = Design Volumetric Flow Rate (396,000 gpm). The bases for the selection of this value are as follows:

1. At the time of initial startup (beginning of cycle (BOC) 1) for San Onofre Nuclear Generating Station (SONGS) 2 and 3, the measured flow rates were as follows:

   SONGS 2: 107.0 % Qdes
   SONGS 3: 106.3 % Qdes.

2. Since the RCPs are essentially constant volume pumps, it is reasonable to expect the RCS flow rates to remain constant at the BOC 1 values except for the effect of increased system hydraulic resistance due to the effect of steam generator (SG) tube plugging. Based on this information, the current maximum flow that the pumps can deliver is expected to be less than 107 % Qdes.

3. The flow rate measurement uncertainty is ≤ 5% Qdes. The methodology and the components of the flow rate uncertainty calculation are as follows:

   The flow is measured in a monthly flow surveillance. The flow measurement uses the calorimetric calculation formula:

   RCS Flow Rate = Secondary Calorimetric Power / Change in Enthalpy across the Core

   The flow uncertainty is calculated or verified as part of the safety analysis. Similar to the flow measurement process the flow measurement uncertainty calculation is based on calorimetric calculation. First, a reference RCS flow is calculated based on the equation shown above. Then each of the inputs that goes into the equation is perturbed based on the uncertainties value (see table 1). This results in a perturbed reference flow rate. This calculation is performed over the entire Limiting Condition for Operation (LCO) range of operating conditions. Finally, the perturbed flow rate and the base flow rate are compared. The differences are determined and statistically evaluated to determined the 95/95 reference flow rate uncertainty. The current calculated values are provided in table 1, and they are less than 5% Qdes. Should these values change, then the reference flow uncertainty analysis is updated and the downstream safety analysis is updated.

Table 1 "Current" Inputs and Results of the Flow Uncertainty Analysis	
Parameter	**Uncertainty**
Power	± 2% (2σ)
Pressurizer Pressure	± 60 psi (2σ)
Cold Leg Temperature	± 3.4 °F (2σ)
Hot Leg Temperature	± 3.4 °F (2σ)
Hot Leg Stratification Bias	1.3 °F
Reactor Coolant Pump Differential Pressure	± 4.14 psi (2σ)
Reactor Coolant Pump Speed	± 3.0 RPM (2σ)
Reference Flow Uncertainty	± 4.95% of design flow (2σ)
COLSS one-sided volumetric flow uncertainty	± 4.5 % uniform

4. Therefore, the current upper volumetric flow rate limit for use in the safety analysis for SONGS 2 and 3 is 112 % Qdes.

Question 3:

Please provide the following information regarding the high pressurizer [pressure] trip value and the main steam safety valve open setpoint used in your analysis of the loss of condenser vacuum event with concurrent single failure. Discuss instrument uncertainties, tolerance, and/or accumulation as applicable. For the main steam safety valves, the technical specification (TS) lift setpoints vary from 1085 psig to 1140 psig. Discuss how this was modeled in your analysis.

Response to Question 3:

Part 1. High Pressurizer Pressure Trip Value

The parameters related to the high pressurizer pressure trip setpoint value that was used in the loss of condenser vacuum plus single failure (LOCV+SF) analysis are given below:

Value used in LOCV+SF analysis	2410 psia
Instrumentation trip setpoint	2375 psia

The analysis value accounts for plant protection system (PPS) cabinet uncertainties and pressure transmitter errors.

For the High Pressurizer Pressure Setpoint, the uncertainties associated with this trip setpoint are established and documented in SO23-944-C50, Plant Protection System (PPS) Setpoint Calculation. The setpoint is established / justified as follows:

Uncertainties taken into consideration are as follows: (all values in PSIA)

I) Analysis setpoint — 2410 Normal (includes LOCV+SF); 2434 Harsh

II) PPS Cabinet Uncertainties

A. Calibration Equipment Error	+/- 1.25
B. Calibration Adjustment Error (setting tolerance)	+/- 6.25
C. Bistable Drift	+ 1.384, -1.724
D. Worst Case Normal Error (Bistable accuracy)	+ 3.3, -4.1

A statistical combination of these factors give us the following:

Calibration Error	+/- 6.25
Periodic Test Error	+ 6.641, -6.981
Maximum Operational Error	+ 7.310, -8.450

III) Process Intrumentation Errors

A. Calibration Equipment Errors	+/- 1.25
B. Calibration Adjustment Errors	+/- 6.25
C. Maintenance and Test Equipment (M&TE) Error	+/- 7.5
D. Measured Drift	+/- 25.0
E. Hysteresis	+/- 2.0
F. Ambient Temperature Error	+/- 9.0
G. Worst Case Normal Temperature Error	+/- 9.0
H. Accident Temperature Error	+/- 50.0
I. Normal Pressure Uncertainty	+/- 2.0
J. Accident Pressure Uncertainty	+ 0.0, - 5.0
K. Radiation Error	+/- 10.0
L. Seismic Uncertainty	+/- 20.0
M. Post Seismic Uncertainty	+/- 5.0
N. Insulation Resistance Error	+ 10.0, -0.0

A statistical combination of these factors give us the following:

Calibration Error	+/- 10.0
Periodic Test Error	+/- 29.41
Worst Case Normal Error	+/- 29.869
Worst Case Normal Error w/Seismic	+/- 35.597
Worst Case Accident Error	+ 68.371, - 63.371

IV) Total Loop Uncertainty (TLU) for Normal with Seismic conditions

This is determined by a statistical combination of the PPS cabinet Maximum Operating Error and the Process Equipment worst case normal error with the seismic uncertainty.

TLU (Normal w/Seismic) + 36.340, -37.480

V) Total Loop Uncertainty (TLU) for Accident conditions

This is determined by a statistical combination of the PPS cabinet Maximum Operating Error and the Process Equipment worst case accident error.

TLU (accident) + 68.827, -64.967

VI) Trip Setpoint and allowable value

Using the methodology for calculating a setpoint with a single side of interest (unidirectional approach to point of interest), the random uncertainty can be reduced by a correction factor of 0.839, with the biases then added in after the correction factor is applied. The setpoint is determined by subtracting the TLU from the analysis setpoint.

Analysis setpoint-Harsh	2434
TLU-Harsh	+49.35, -55.49
Maximum trip setpoint-Harsh	2378.51
Analysis Setpoint-Normal/Seismic	2410
TLU-Normal/Seismic	+30.49, -31.63
Maximum trip setpoint-Normal/Seismic	2378.37
Trip Setpoint with/margin	2375

Part 2. Main Steam Safety Valve Characteristics

Nine main steam safety valves (MSSVs) are included on each of the two main steam lines. The lift setting (in psig) for each MSSV is listed in TS Table 3.7.1-2. The listed values are 1085, 1092, 1099, 1106, 1113, 1120, 1127, 1134, and 1140 psig. The LOCV+SF analysis increases the TS lift settings to account for +2 % opening tolerance and MSSV opening characteristics as follows:

Step 1. Since the CESEC code pressure lift setting is in psia, rather than psig, 15 psi is added to the TS value to convert the lift setting to psia. The value of the lift setting in psia is multiplied by 1.02 to adjust for +2 % opening tolerance. The resulting adjusted MSSV opening setpoints are 1122, 1129.1, 1136.3, 1143.4, 1150.6, 1157.7, 1164.8, 1172.0, and 1178.1 psia.

Step 2. The MSSV characteristics are modeled as indicated in Figure 1. The abscissa of Figure 1 is in units of percent of the TS lift setting in psia. From Figure 1 it is seen that each MSSV is assumed to open to 70% of Full Open area at the adjusted MSSV opening setpoint listed in Step 1 above. After an accumulation of 1 %, each MSSV is assumed to open to 100 % of the Full Open area.

In the LOCV+SF analysis, seven of the nine MSSVs in each steam line reached their opening setpoints and five of these seven reached a full open condition.

Reference:

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FIGURE 1

SONGS UNITS 2&3 MSSV OPENING CHARACTERISTICS, 2% TOLERANCE