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SUBJECT: Responds to concerns noted in NRC 860807 SER. Provides basis for concluding that failure of both SBCS flow transmitters leading to consequences outside FSAR Chapter 15 analysis no longer required to be assumed.

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February 20, 1987

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

Gentlemen:

Subject: Docket Nos. 50-361 and 50-362
San Onofre Nuclear Generating Station
Units 2 and 3

References: 1. NRC to SCE letter dated August 7, 1986, "Safety Evaluation Regarding Control System Failures"

2. SCE to NRC letter dated November 30, 1983

3. SCE to NRC letter dated September 15, 1983

Operating License Conditions 2.C(12) and 2.C(10) for San Onofre Nuclear Generating Station Units 2 and 3 state:

> "By April 1, 1983, SCE shall provide an evaluation, for NRC staff review and approval, of control system failures caused by high energy line break, and by failures of any power sources, sensors or sensor impulse lines which provide power or signals to two or more control systems. Implementation of any corrective action resulting from this evaluation shall be completed on a schedule acceptable to the NRC."

SCE responded to this requirement by letters dated April 1 and 20, 1983. Following many letter exchanges and telephone conversations between SCE and the NRC (see attachment), the NRC issued a Safety Evaluation Report (SER) on August 7, 1986 (Reference 1). The NRC SER stated that SCE's evaluation of control system/High Energy Line Break (HELB) interactions was acceptable except for two concerns listed below:

1) SCE stated (Reference 2) that calculation uncertainties on certain parameters in the HELB analysis were less than those used in the FSAR Chapter 15 analysis. This was justified based on the fact that the FSAR values contained large margin due to conservative allowances to account for unknown events (such as control system HELB) and since this analysis was evaluating a specific scenario, some conservatisms could be removed. Nevertheless, the NRC SER maintained that there is insufficient conservatism to justify the current HELB/control system interaction analyses for a steam line break (SLB) event with steam bypass control system (SBCS) and/or main feedwater control system (MFCS) failure.

A001
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1/1

2) SCE stated (Reference 3) that the steam bypass control system (SBCS) and reactor regulatory system (RRS) malfunctions cannot occur simultaneously during a SLB event due to an interlock (non-safety grade) between the RRS and the SBCS. The interlock precludes a failure in the SBCS from propagating to the RRS and causing the RRS to fail. The NRC found crediting this non-safety grade interlock function to be unacceptable and requested that SCE reanalyze the SLB event assuming simultaneous RRS and SBCS malfunction.

In an effort to respond to these two remaining concerns, SCE performed additional research into the original control systems HELB analysis. As a result of environmental qualification upgrades and plant design changes implemented since the HELB analysis was performed, several of the failures incorporated in the original HELB analysis are no longer required to be assumed. Specifically, the coincident failure of both SBCS flow transmitters or pressure transmitters which led to consequences outside the FSAR Chapter 15 analysis is no longer required to be assumed. Therefore, this SLB event can be removed from consideration. The discussion below provides the detailed basis for this conclusion.

The original HELB analysis evaluated the potential adverse effects on main steam flow control due to HELB. The analyses regarding steam line break event and a SBCS malfunction involved the potential for a post-trip return-to-power due to increased energy removal from the RCS through the turbine bypass valves (TBVs). The MSLB limiting case for the control systems HELB analysis is based on a steam line break inside containment and failure of the main steam isolation valve (MSIV) on the intact steam generator. All other valves receiving a main steam isolation signal (MSIS) are assumed to close. The HELB analysis assumed failure of both steam flow transmitters (FT 1011, FT 1021) in the SBCS. Failure of <u>both</u> steam flow transmitters would result in the generation of a quick opening signal to the TBVs. The analysis determined that both transmitters are inside containment and both would fail during an MSLB inside containment since the Foxboro transmitters were not environmentally qualified (EQ). If the SBCS quick opened the TBVs in combination with a stuck MSIV in the intact steam generator (as assumed in the MSLB case), the results could indicate event consequences outside the bounding FSAR analysis.

Recent design changes to comply with Regulatory Guide 1.97, Rev. 2, have included replacement of the steam flow transmitters with qualified transmitters and placed the instrumentation on the uninteruptable power supply (UPS). These instruments are now on the EQ Master List. Since these transmitters are physically located such that a single SLB in containment could only fail one transmitter due to jet impingement, generation of a quick open signal by the SBCS cannot occur. Therefore the MSLB inside containment analyzed in FSAR Chapter 15 is the bounding event and further analysis is no longer required.

Other components which were analyzed are the steam header pressure transmitters, PIT 8241 and PIT 8239. A coincident failure of both steam header pressure transmitters in the high pressure direction will cause the

TBVs to modulate open. Both of these transmitters are located outside containment and the original analysis assumed they would both fail during an MSLB outside containment since the transmitters were not environmentally qualified. The case of concern is a break in the steam line between the containment penetration and the MSIV with the other MSIV (from the intact steam generator) failing open. The location of the steam line and MSIV for each steam generator is physically separated (in distance) such that the break of concern would not physically impact the opposite pressure transmitter. As a result, since a coincident failure of both steam pressure header transmitters is precluded by physical layout, the Chapter 15 analysis is again bounding and further analysis is not required.

The Automatic Motion Inhibit (AMI) interlock prohibits the SBCS from directing the RRS to initiate control rod motion when the control element drive mechanism control system (CEDMCS) is in the Automatic Sequential (AS) mode. AMI interlock does not operate (and is not acknowledged) when CEDMCS is in the Manual Sequential (MS) mode because automatic control rod motion does not occur in MS mode. The AS mode of operation is provided to allow the RRS to automatically control the rate and direction of Control Element Assembly (CEA) motion. Plants in the past operated with CEAs inserted a slight amount from the All Rods Out (ARO) configuration. This practice was subsequently stopped when it was found that fuel pins could experience cladding damage under certain conditions as a result of this practice. The damage analysis theorized that the fuel was not burned up around the slightly inserted CEA and whenever the RRS caused CEAs to withdraw in high speed, localized power peaks could occur and possibly cause cladding damage. Additionally, the automatic RRS response to minor parameter changes caused the Axial Shape Index to fluctuate unnecessarily. Consequently, SONGS operates under administrative procedures only in the ARO and MS mode. A plant modification to disable the AS mode is to be implemented during the Unit 2 Cycle 4 outage and the current Unit 3 Cycle 3 outage. No changes are being made internal to the SBCS, which generates the AMI signal, or to the RRS. Signals will still be transmitted to CEDMCS from these systems, but they will have no effect since the AS mode will not be able to be selected. Therefore, a malfunction of the SBCS cannot affect CEA withdrawal because the interlock will not propagate a SBCS failure into the RRS.

From the above discussion it can be concluded that:

1. Failure of the SBCS cannot cause motion of the control rods because the plant cannot be operated with CEDMCS in AS mode,

2. Environmental Qualification upgrades prevent simultaneous steam flow transmitter failure thereby preventing TBVs from quick opening, and

3. The SBCS pressure transmitters are separated by distance preventing simultaneous failure (from a SLB) thereby precluding the TBVs from modulating open.

Based on these three items, the original control system/HELB interactions are bounded by the FSAR Chapter 15 analysis and no further evaluation is required.

If you have any questions, please contact me.

Very truly yours,

M O Medford

Enclosures

cc: H. Rood, NRC Senior Project Manager, San Onofre Units 2 and 3
F. R. Huey, NRC Senior Resident Inspector, San Onofre Units 1, 2 and 3

ATTACHMENT

SUMMARY OF CORRESPONDENCE

1. April 1, 1983 - SCE to NRC letter providing SCE's initial response to License Conditions 2.C(12) and 2.C(10) for Units 2 and 3, respectively. The license conditions were partially satisfied by responding to NRC Question 222.43, "Qualification of Control Systems."

2. April 20, 1983 - SCE to NRC letter providing SCE's response to NRC Question 222.44, "Control Systems Failures."

3. June 30, 1983 - NRC to SCE telecopy (informal) requesting additional information addressing (1) multiple control system failures and (2) single failure of any safety related system used to mitigate HELB consequences. Also, additional information regarding RRS and SBCS interaction was requested.

4. September 15, 1983 - SCE to NRC letter responding to the informal June 30, 1983 NRC request for additional information. (Detailed response)

5. September 27, 1983 - Telephone conversation between NRC and SCE. NRC requested SCE to provide the results of an analysis that evaluates the consequences of failure of all control systems that are in the same environment for each HELB considered.

6. September 29, 1983 - Telephone conversation between SCE and NRC providing brief explanation of the methods used to evaluate multiple control system failures due to a single HELB.

7. October 6, 1983 - Telephone conversation between SCE and NRC providing a more detailed explanation of the methods used to evaluate multiple control system failures due to a single HELB. NRC requested additional information concerning any HELB analysis that is not bounded by FSAR Chapter 15 (i.e., any analysis using "Best Estimate Values").

8. November 30, 1983 - SCE to NRC letter providing the information requested by the NRC on October 6, 1983.

9. August 27, 1984 - NRC to SCE letter requesting additional information regarding simultaneous failure of the SBCS and RRS. Also, the NRC requested that the consequences of multiple and single control system failures which could result from each postulated HELB event be reanalyzed or provide additional justification to support the existing analysis.

10. December 17, 1984 - SCE to NRC letter providing respnse to August 27, 1984 request for additional information.

11. August 7, 1986 - NRC Safety Evaluation Regarding Control System Failures. NRC approves SCE's response addressing NRC Question 222.44 "Control System Failures" and again requests reanalysis of HELB events that do not use FSAR values. Also, NRC requests additional information regarding the non-safety related interlock between the SBCS and RRS.