September 23, 2002

Mr. Harold B. Ray
Executive Vice President
Southern California Edison Company
San Onofre Nuclear Generating Station
P.O. Box 128
San Clemente, CA 92674-0128

SUBJECT: SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 2 - STEAM GENERATOR TELEPHONE CALL SUMMARY (TAC NO. MB4659)

Dear Mr. Ray:

On April 14, 2002, the U. S. Nuclear Regulatory Commission (NRC) staff participated in a conference call with the Southern California Edison (SCE) Company to discuss the applicability of the recent steam generator (SG) issue identified at Sequoyah to the San Onofre Nuclear Generating Station (SONGS). The issue at Sequoyah involved not inspecting the lower portion of the tube, within the tubesheet, with a technique capable of detecting circumferential flaws despite finding circumferential flaws in the upper portion of the tube within the tubesheet. SCE requested this conference call to discuss their SG inspection plan for the refueling outage at SONGS, Unit 2 which began on May 20, 2002.

SONGS Unit 2 Inspection Background

In 1991, the licensee started inspecting the hot-leg (HL) expansion transition region near the top-of-tubesheet (TTS) with a rotating pancake coil (RPC) probe. Since 1993, 100 percent of the inservice tubes have been inspected in the HL TTS region with an RPC probe every outage. In 1991, the first axial indication was detected at the expansion transition and was characterized as primary water stress corrosion cracking (PWSCC). In 1993, the first axial PWSCC indication was detected below the expansion transition. In 1996, the first circumferential indication crack was detected below the expansion transition. This was the first outage a RPC probe with a PlusPoint coil was used at SONGS, Unit 2. In October 2000 (the last refueling outage at SONGS, Unit 2), the extent of the RPC inspection at the HL TTS was from 3 inches above the TTS to at least 5 inches below the TTS. The value of 5 inches was determined from a Combustion Engineering (CE) Owners Group technical report that concluded this was the appropriate distance for CE SGs to resist leakage and tube pullout during normal operating or postulated accident conditions. During the October 2000 inspection, the licensee found 21 indications up to 7 inches below the HL TTS (i.e., below the expansion transition region).

Technical Specification Issue

The licensee stated that although they have identified circumferential cracking in the tubesheet below the expansion transition region, they do not plan to inspect with an RPC probe the entire tube within the tubesheet. In addition, although the licensee was aware of the issue raised at Sequoyah, they did not plan to request for a license amendment to modify the inspection region identified in its technical specifications (TSs).

The licensee stated that the SONGS TSs are the same as the Sequoyah TSs in that the required inspection distance is from the tube entrance on the HL to the upper most tube support plate on the cold leg. Several of the differences identified by SCE between SONGS, Unit 2 and Sequoyah are as follows:

- SONGS, Unit 2 SGs are of Combustion Engineering design and Sequoyah's are a Westinghouse design

- SCE has inspected up to 5 inches minimum below the HL TTS with an RPC probe for several outages, whereas spring 2002 was the first time for Sequoyah

- SCE first identified circumferential cracking below the expansion transition region in 1996, whereas spring 2002 was the first time for Sequoyah

The NRC staff made the following observations:

The NRC staff concluded that there appears to be no difference between the issue at Sequoyah and the current situation at SONGS, Unit 2.

Historically, circumferential flaws have primarily occurred at the expansion transition. As a result, the use of techniques qualified for detecting circumferential flaws to inspect other regions of the tube within the tubesheet were not necessary (since there was no operating experience or expectation that they would occur in this region). The presence of circumferential flaws in the expanded region of the tube represents a new degradation mechanism.

Since Appendix B to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50 requires the use of qualified procedures during the performance of nondestructive testing and the TSs require an inspection (a nondestructive test) of the tube for the entire length of the tube within the tubesheet, the NRC staff believes a TSs amendment is warranted if SCE does not plan to inspect the lower part of the tubesheet with an RPC probe.

The NRC staff believes that circumferential flaws in the tubesheet region can pose a safety concern depending on their location with respect to the TTS. If significant circumferential flaws are located near the TTS, the tube could pull out of the tubesheet or the tube may leak during normal operating or postulated accident conditions. If circumferential flaws are located a significant distance below the TTS, the safety significance is reduced since the likelihood of tube pullout from the tubesheet and/or primary-to-secondary leakage is reduced or eliminated. Since the licensee had not demonstrated the necessary distance to preclude tube pullout or leakage, the NRC concluded an amendment was warranted.

The licensee expressed interest in understanding how the NRC staff intends to deal with this issue generically. The staff committed to discuss this issue with NRC management and would schedule a followup call with the licensee in the near future.

APRIL 15, 2002, CONFERENCE CALL

On April 15, 2002, the NRC staff participated in a follow-up conference call with the licensee to discuss the safety basis for continued operation of the SG tubes considering that

circumferential cracking has been detected below the expansion transition. The staff intended to focus the discussion only on the safety basis to understand the licensee's basis for its conclusion that there is no potential for pullout or leakage during a main steam line break (MSLB) when limiting the RPC probe SG inspection to the upper 5 inches of the tube within the tubesheet.

The licensee reiterated details of the SONGS, Unit 2 history of HL TTS inspections and inspection results for the benefit of NRC staff members who did not participate in the April 14, 2002, conference call.

Regarding the basis for the licensee's extent of RPC inspection within the tubesheet, the licensee stated that the technical analyses is found in a proprietary generic document applicable to all CE plants. The distance to resist pullout and leakage for SONGS Unit 2 is 5 inches below the HL TTS including allowances for non-destructive examination uncertainty.

The SGs in the CE plants differ from the Westinghouse SGs in that a stay cylinder connects the tubesheet to the lower channel head. This stay cylinder supports the tubesheet in the event of a steam line break and, therefore, lowers the tubesheet flexure. This is one factor considered in the calculation of the distance to resist pullout and leakage.

The tubes are expanded into the tubesheet in a manner similar to the Westinghouse WEXTEX expansions in that the tubes are explosively expanded for the full-depth of the tubesheet by a process referred to as "explansions."

The licensee stated that the circumferential cracks approximately 4 inches below the TTS are considered leakage candidates but precluded from burst considerations because the tube is expanded within the tubesheet and contacts the tubesheet wall, which prevents burst. Circumferential cracks between the TTS and approximately 4 inches below the TTS are considered for both burst and leakage considerations in the operational assessment.

The licensee briefly discussed the applicability of this issue to SONGS, Unit 3. The licensee stated that circumferential cracking has been found in SONGS, Unit 3. During an inspection in 1999, one circumferential crack was detected approximately 4 inches below the HL TTS.

The NRC staff requested the licensee to submit the CE report to the NRC for staff review to understand the technical bases for the extent of SG inspections. The licensee committed to expediting a version of the report which will only reflect data for SONGS. The CE report addresses SONGS, Units 2 and 3 identically. Following the conference call, the licensee determined it would submit the CE report as part of a license amendment request to modify its TSs. This request was submitted on May 22, 2002.

JUNE 3, 2002, CONFERENCE CALL

On June 3, 2002, the NRC staff participated in a conference call with SCE to discuss the ongoing results of the SG tube inspections conducted for SONGS, Unit 2 during this cycle, Cycle 12 (2C12).

The licensee provided the enclosed slides which addressed the discussion points previously sent by the NRC staff to facilitate the phone conference. As the licensee discussed each slide, minor clarifications were provided to the staff's questions.

On slide 2, the licensee indicates that a mid-cycle exam (2M9) was prompted by PWSCC indications at dented intersections. The licensee further clarified that similar indications were found at prior inspections where tubes were pulled and analyzed.

On slide 8, the licensee stated that the largest hotleg top-of-tubesheet (TSH) circumferential indication was 0.57-inch long and had a maximum depth of 83 percent through-wall (TW). The percent degraded area for all circumferential indications was limited to approximately 20 percent. The circumferential indications below the expansion transition initiated from the inner diameter (ID) whereas those at the expansion transition were either initiated from the ID or the outer diameter (OD). The maximum length of any axial indication at the TSH was 0.32-inch.

The largest volumetric indication was found in the eggcrate region of SG 89. The indication is 71 percent TW and is also a candidate for in-situ pressure testing as shown in Slide 13. Freespan axial indications initiating from the OD were found in the upper bundle region and typically range from 20-30 percent in depth. There are some multiple-axial indications. The deepest indication was 28 percent TW and the largest voltage measured with the PlusPoint probe was 0.25 v. The licensee's preventative repair criteria for tube support wear is 30 percent TW.

The NRC staff raised a concern regarding the recent experience at a plant where the procedure for identifying axial indications near the edges of the tube-support plates (TSPs) were revised. Specifically, the procedure was revised to no longer require confirmation of an outer diameter stress corrosion cracking (ODSCC) indication at the edge of the TSP, on alternate channels. SCE indicated that it still required confirmation for ODSCC indications on 2 channels (but not all 5), and do not require confirmation on alternate channels for PWSCC indications. The licensee indicated that the data analysis criteria is consistent with the qualification procedure used in industry.

If you have any questions or comments regarding this summary, please call me at (301) 415-1445.

Sincerely,

/RA/

Alan B. Wang, Project Manager, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-361 and 50-362

Enclosure: Slides

cc w/encl: See next page

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Docket Nos. 50-361 and 50-362
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