



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
RELATED TO AMENDMENT NO. 149 TO FACILITY OPERATING LICENSE NO. DPR-13

SOUTHERN CALIFORNIA EDISON COMPANY

SAN DIEGO GAS AND ELECTRIC COMPANY

SAN ONOFRE NUCLEAR GENERATING STATION, UNIT NO. 1

DOCKET NO. 50-206

1.0 INTRODUCTION

By letter dated April 6, 1992, Southern California Edison Company, the licensee, requested a 4-month extension to the steam generator inspection interval for the San Onofre Nuclear Generating Station Unit 1 (SONGS 1). The SONGS 1 technical specification requires inservice inspections of the steam generators to be performed at a frequency of not less than 10 nor more than 24 calendar months after the previous inspection. A steam generator inspection was completed at SONGS 1 in March 1988. The licensee subsequently obtained NRC approval to extend the steam generator inspection interval to allow operation until June 1990. In June 1990, the licensee commenced an outage at SONGS 1 which lasted until March 1991. The steam generator tubes were inspected in accordance with Technical Specification (TS) 4.16. The steam generator tube inspection began in August 1990 and was completed on September 7, 1990. Although the steam generator inspection was completed in September 1990, the plant was not returned to power until March 1991 (approximately 6 months later). The plant then operated for approximately 24 days before the unit was shut down to locate and repair steam generator tube leakage which was on the order of 150 gallons per day (gpd). The plant has operated continuously since April 1991, and the licensee has requested an extension of the steam generator inspection interval from 24 months to 28 months to allow operation until January 7, 1993. Notwithstanding this requested extension, SONGS 1 is to be permanently shut down in late 1992 and this amendment does not affect that intent. The licensee provided the technical basis for the steam generator inspection interval extension in a letter dated April 6, 1992 and in a telephone conversation between the licensee and the NRC staff on July 30, 1992.

2.0 EVALUATION

The rate of primary-to-secondary leakage prior to the outage which commenced in June 1990 was approximately 15 gpd. A steam generator tube leak test was subsequently performed (June 1990 to September 1990) to identify the source of the leakage. The leakage was attributed to 13 tubes that exhibited various rates of leakage during the leak test in the hot leg end of the steam generators. Each of these 13 tubes had been previously (prior to this outage)

sleeved. Eddy current (EC) examination of these tubes, which began in August 1990 and ended in September 1990, did not reveal any indications which could be correlated to the leakage in either the sleeved or unsleeved portion of these tubes. It was concluded the leakage was from the region where the sleeve was mechanically roll expanded to the original tube wall. The primary-to-secondary leakage was within the licensing basis for leak-limiting sleeves.

During the September 1990 steam generator inspection, the bobbin coil was used to inspect the non-sleeved portion of the steam generator tubes, the 8x1 and motorized rotating pancake coil probe were used to supplement the bobbin probe, and the magnetically biased and the crosswound probe were used to assess the condition of the sleeves inspected. Subsequent to these inspections, a total of 29 tubes were plugged out of the 3949 tubes (39.5% of available tubes) that were inspected. A breakdown of the 29 plugged tubes is as follows:

- a. 13 leaking sleeves
- b. 6 defects at the top of the cold leg tubesheet
- c. 4 indications of primary side hot leg roll transition cracking
- d. 3 secondary side top of the tubesheet circumferential indications
- e. 2 defects in parent tubing above hot leg sleeves
- f. 1 tube restricting passage of a 0.460" diameter probe

A comparison of the indications identified at the top of the cold leg tubesheet over three fuel cycles indicated little or no growth. Of the 6 pluggable indications identified during the September 1990 inspection, a mean growth rate of 3.8% per cycle was calculated with a maximum growth rate of 7.5% per cycle.

The limited number of tubes affected by primary side roll and roll transition cracking, and the characteristics of the eddy current signals for these tubes indicate that primary side roll and roll transition cracking is progressing slowly.

Three tubes, identified as having circumferential indications of potential intergranular attack (IGA) at or near the top of the hot leg tubesheet, were detected. One tube had an indication of 94% through-wall extending 120 degrees around the tube circumference and 1/4 inch in axial extent. Due to the limited circumferential extent and the limited number of tubes affected (3) out of the large number of tubes inspected and the location of these tubes, adjacent to the previously sleeved tubes, indicates that the progression of IGA is slow.

SONGS 1 returned to power operation in March 1991. After operating 24 days, the unit was shut down due to primary-to-secondary leakage of approximately 150 gpd. A leak test was performed and identified 17 leaking tubes. The leaking tubes and surrounding tubes were eddy current tested and the source of the leakage was attributed to leaking sleeves. These tubes were subsequently plugged. During the course of the eddy current inspection of the leaking tubes and the surrounding tubes, one pluggable indication in each steam generator was identified. These indications, all located between the top of the sleeved portion of the tube and the first tube support plate on the hot

leg side were not identified in the September 1990 inspection primarily due to the technique used to inspect those tubes at that time (September 1990). In the September 1990 outage, sleeved tubes were inspected by inserting the eddy current probe from the cold leg side to the first tube support plate (TSP) on the hot leg side and then the probe was withdrawn from the cold leg side. The remaining portion of the tube was examined from the hot leg side; therefore, the area between the top of the sleeve and the first tube support plate was examined with a smaller diameter probe than could have been used. Due to the location of these additional indications, the licensee enhanced their eddy current data acquisition techniques in the area between the sleeved portions of the tube and the first tube support plate and reexamined all sleeved tubes during the April 1991 outage. The entire scope of the eddy current examinations performed during the April 1991 outage and the results are provided below:

- a. 140 tubes full length - no pluggable indications outside the region between the top of the sleeves and the first tube support.
- b. 860 unsleeved tubes - one pluggable indication in the roll/roll transition area.
- c. 100% of the sleeved tubes in the area between the top of the sleeve and the first hot leg tube support plate - 102 tubes were identified with greater than or equal to 30% through-wall degradation.

The above identified indications were further classified as one of two types:

- a. Type A: 17 indications of this type were identified and plugged. In an analysis of these indications by Westinghouse and other contractors, it was concluded that these indications were volumetric and more typical of wastage indications than crack-like indications. Due to the limited inspection scope and reduced eddy current sensitivity in the area between the sleeved portion of the tube and the first tube support plate during previous outages, only a few of these indications could be traced back to previous outages. However, based on the growth rates from the indications that could be traced back and other wastage/volumetric flaws, it was concluded that the defect growth rate was minimal and that the indications would not pose a safety concern.
- b. Type B: 85 indications of this type were noticed. These appear to be typical of minor wastage. Growth studies show minimal progression of these defects. Due to their small size and minimal growth rate, these defects were not considered to be significant.

During this outage (April 1991), a total of 40 tubes were plugged for the following reasons:

- a. 17 leaking sleeves (1 tube had a Type A indication)
- b. 16 Type A indications
- c. 7 other

1. tube obstruction (5 tubes)
2. distorted roll transition indication (1 tube)
3. 2 sleeves in a single tube (1 tube)

The primary-to-secondary leak rate monitoring program in place at SONGS 1 was enhanced in accordance with NRC Bulletin 88-02, "Detection and Monitoring of Sudden and/or Rapidly Increasing Primary-to-Secondary Leakage." SONGS 1 subsequently reviewed and improved their primary-to-secondary leak rate monitoring program as a result of the issuance of NRC Information Notice 91-43, "Recent Incidents Involving Rapid Increases in Primary-to-Secondary Leak Rate." The current leak rate monitoring program in effect has provisions to evaluate not only the amount of primary-to-secondary leakage but also the rate at which the leak rate is increasing. The rate of primary-to-secondary leakage has been relatively constant since power resumption following the forced outage in April 1991 with two periods of increasing leakage (6 gallons per day increase in a one week interval) being attributed to leaking sleeves. The current rate of primary-to-secondary leakage of 19 gallons per day is consistent with what the licensee has previously experienced.

Based on a review of the licensee's April 6, 1992 submittal, the staff concludes that extension of the steam generator inspection interval to 28 months is acceptable. The licensee's steam generator inspection of September 1990 and as supplemented by the inspection of April 1991, the enhanced primary-to-secondary leak rate monitoring program, the inspection results from the previous inspection, and a comparison of operating conditions from this cycle to the previous cycle (i.e. operating cycle length and chemistry conditions) provide reasonable assurance of continued safe operation of the steam generators during the balance of the requested 28-month cycle.

### 3.0 STATE CONSULTATION

In accordance with the Commission's regulations, the California State official was notified of the proposed issuance of the amendment. The State official had no comments.

### 4.0 ENVIRONMENTAL CONSIDERATION

This amendment involves changes to surveillance requirements associated with steam generators. The amendment involves no significant changes to offsite effluents or in occupational radiation exposure to personnel. The Commission has previously issued a proposed finding that this amendment involves no significant hazards consideration and there has been no public comment on such finding (57 FR 22265). Accordingly, this amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment.

5.0 CONCLUSION

We have concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

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Date: August 26, 1992