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AUTH.NAME AUTHOR AFFILIATION
RAY,H.B. Southern California Edison Co.
RECIP.NAME RECIPIENT AFFILIATION
ZIMMERMAN,R. Region 5, Ofc of the Director

SUBJECT: Summarizes evaluation performed of implications for limited continued operation of feedwater sparger damage.

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Southern California Edison Company

23 PARKER STREET
IRVINE, CALIFORNIA 92718

HAROLD B. RAY
SENIOR VICE PRESIDENT

TELEPHONE
714-458-4400

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June 1, 1990

Mr. Roy Zimmerman, Director
Division of Reactor Safety and Projects
U. S. Nuclear Regulatory Commission
1450 Maria Lane, Suite 210
Walnut Creek, California 94596-5368

Dear Mr. Zimmerman:

Subject: **Docket Nos. 50-361 and 50-362**
Feedwater Sparger Damage
San Onofre Nuclear Generating Station, Units 2 and 3

The purpose of this letter is to summarize the evaluation performed to date by Southern California Edison (SCE) of the implications for limited continued operation of San Onofre Unit 2 of feedwater sparger damage which has been identified during inspection of San Onofre Unit 3 steam generators. We intend to shut down Unit 2 to inspect it for similar damage not later than when Unit 3 has been returned to operation from its ongoing refueling outage, including repair of its sparger damage. This schedule may involve continued operation of Unit 2 until about July 7, 1990.

A detailed Safety Evaluation concerning this period of continued Unit 2 operation is being documented and will be reviewed and approved by the San Onofre Onsite Safety Review Committee by June 5, 1990. The Unit 2 evaluation performed to date is discussed further below.

Possibility of Sparger Damage

The unit is currently operating in Fuel Cycle 5. Operation in this cycle commenced in December 1989, and the steam generators were last inspected during the Cycle 5 refueling outage. Inspection included required eddy-current testing of steam generator tubes and visual inspection above the tubesheet of both steam generators. In addition, ultrasonic testing of the feed nozzle thermal sleeve for one steam generator resulted in personnel entry into, and limited visual inspection of, the area of its feedwater sparger.

No significant tube degradation, debris or evidence of damage was identified during this inspection. (This contrasts

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with visual identification of debris above the tubesheet and obvious evidence of sparger damage which were readily identified during the ongoing inspection of the Unit 3 steam generators.)

Nevertheless, we cannot conclude that sparger damage, either before or following the Cycle 5 refueling outage, has not occurred or that such damage would not have caused debris or other conditions which could affect the Unit 2 steam generators. To the contrary, based on our present understanding of the causes of the damage identified at Unit 3, similar damage must be anticipated at Unit 2. Therefore, the unit will be shutdown for inspection not later than shortly after Unit 3 has returned to service.

Potential Effects of Sparger Damage

SCE has identified the following potential effects of sparger damage:

- Debris-induced damage to steam generator tubes.
- Inability to fully close the blowdown isolation valve due to debris.
- Damage to sparger supports.
- Changes to steam generator flow and temperature distributions.
- Accelerated draining of the feedwater sparger with the potential for subsequent water-hammer.

Debris-Induced Damage to Steam Generator Tubes

The debris resulting from the sparger damage identified in Unit 3 ranges from microscopic erosion particles to small pieces of curved carbon steel plate produced from failure of the sparger wall. Such debris might damage steam generator tubes through repeated impact with peripheral tubes or through wear of tube walls after becoming lodged within the tube bundle.

Review of available information concerning damage of tubes by this kind of debris indicates that significant damage prior to shutdown for inspection is highly unlikely. More importantly, experience has shown that tube damage should result in progressive primary-to-secondary leakage and not in a sudden, large tube failure. (This conclusion includes review of the industry experience of apparently sudden, debris-induced tube failures at Ginna and Prairie Island.)

SCE has experienced wear-induced tube leakage during operation of all three San Onofre units, in connection with tube support fretting. The rate of increase in leakage resulting from debris-induced tube damage would be expected to not exceed that experienced previously from tube support wear.

The condenser air ejector radiation monitor is currently set at a point where it will give a Control Room alarm at a leak rate of 30 gallons per day, with less than a 15 minute delay from the initiation of the leak. Operating personnel have been directed to be particularly alert to possible indications of primary-to-secondary leakage and to immediately commence an expedited shutdown of the unit in the event that the trend of any detected leakage indicates that it will exceed 200 gallons per day within the next 8 hours.

We have also considered whether debris-induced tube damage could result in a tube failure which would increase the consequences of an analyzed accident, such as a Main Steam Line Break (MSLB). This would require that tube damage result in a wall thickness within a very narrow range, such that the tube would not leak prior to the MSLB but would then fail following the accident. This is not considered to be a credible event during the remaining operating period prior to shutdown for inspection. (Also, at the existing very low primary and secondary radioactivity levels, the radiological consequences of tube leakage, or tube failure, are small in comparison with those projected in the FSAR.)

Inability to Fully Close Blowdown Isolation Valve Due to Debris

Based on the relative sizes of passages in the blowdown line and the isolation valve, this is not considered to be a credible event. However, even if it were to occur, the consequences would be bounded by the existing analysis of a tube failure.

Damage to Sparger Supports

One of the probable causes for sparger damage is excessive stress caused by temperature and pressure differences. The support loads resulting from this stress do not exceed design limits, however some evidence of support damage has been experienced previously. SCE has concluded that credible damage of the sparger supports would be minimal and would not adversely affect the safety function of the feedwater sparger.

Changes to Steam Generator Flow and Temperature Distributions

The effects of sparger damage in changing steam generator flow and temperature distributions are still being evaluated. However, it has been concluded that they are not significant to continued operation of the unit prior to the inspection shutdown.

Accelerated Draining of Feedwater Sparger With the Potential for Subsequent Water-Hammer

The sparger is designed to drain slowly following loss of feed flow in order to reduce the potential for a damaging water-hammer when auxiliary feed flow is initiated. But, sparger damage will result in accelerated draining. If it then refills with auxiliary feedwater, the potential is created to rapidly condense steam in the top of the sparger. However, the top-mounted J-tubes minimize the consequences of condensation by providing a large vent area. Also, the sparger was designed to withstand a complete vacuum, and water-hammer tests during startup verified that the feedwater piping can safely withstand this transient.

SUMMARY

In summary, SCE has concluded that San Onofre Unit 2 should be shutdown to conduct inspection of its steam generators for feedwater sparger damage and its effects, and to perform required modifications and repairs as indicated by ongoing work on Unit 3, no later than following the return to service of Unit 3. Limited continued operation of Unit 2 in this case is considered acceptable. In addition, it will allow us to ensure that the causes and required corrective actions are fully understood and developed on Unit 3 prior to being implemented for Unit 2 and that the experience of personnel performing the work is transferred.

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

Sincerely,

Harold B. Ray

HBR:lr
cc: John B. Martin, Regional Administrator, Region V
C. W. Caldwell, NRC Senior Resident Inspector, San Onofre