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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 136 TO PROVISIONAL 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 May 2, 1990, Southern California Edison Company (SCE or the licensee) provided its response to the staff's Safety Evaluation (SE) dated November 21, 1989, related to the emergency diesel generators for San Onofre Nuclear Generating Station, Unit No. 1 (SONGS-1). Additionally, by letter dated June 5, 1990, the licensee requested a change to Provisional Operating License No. DPR-13 and to the Technical Specifications appended to Provisional Operating License No. DPR-13, for operation of San Onofre Nuclear Generating Station, Unit No. 1, in San Diego County, California. The licensee's request was supplemented by letters dated September 26 and September 28, 1990. The license amendment requested that existing requirements pertaining to the emergency diesel generators be relocated from License Condition 3.M to the Technical Specifications.

2.0 DISCUSSION

The NRC staff previously reviewed the licensee's submittals relating to the issue of Transamerica Delaval, Inc. (TDI) emergency diesel engine crankshaft crack propagation and documented the results of that review in a Safety Evaluation (SE) dated November 21, 1989. The SE stated that the licensee: (a) must demonstrate that the eddy current inspection technique is capable of detecting 10 mil deep flaws, (b) must review and revise (as appropriate) its diesel generator oil maintenance procedures, and (c) need not count start-stop cycles with engine speeds less than 200 rpm, if the crankshaft stress levels for this situation remain less than the steady state value.

The licensee submitted its response to the staff's SE in a letter dated May 2, 1990, providing its resolution of the items discussed above. Also, by letter dated June 5, 1990, the licensee submitted Technical Specification Amendment Application No. 183 which would delete existing License Condition 3.M pertaining to the TDI emergency diesel engines and would alternatively include the license condition requirements in the Technical Specifications.

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3.0 EVALUATION

3.1 Eddy Current Inspection

To demonstrate the capability of eddy current inspection to detect 10 mil deep cracks in the TDI diesel crankshaft oil holes, the licensee's contractor, Failure Analysis Associates (FaAA), examined an oil hole in a reference block with six electrical discharge machined (EDM) notches. The notches were machined to simulate artificial flaws with depths of 5, 10 and 20 mils with a length to depth ratio of 6:1 and 2:1. FaAA indicated that the EDM notch would act as a good simulator for an actual fatigue crack and that the eddy current inspection technique is the most sensitive technique for detection of crack-like indications in crankshaft oil holes. The eddy current inspection of the reference block was performed using an FaAA 100R type, radius tip, shielded probe with a sensing spot size of 0.1 inch in diameter with an operating frequency of 2MHz. The test instrument was a smartEDDY 3.0 computer-based portable eddy current instrument.

The staff has reviewed the data compiled by FaAA and submitted as Attachment A to the licensee's letter dated May 2, 1990. The eddy current inspection of the reference block clearly detected all six artificial flaws with high signal-to-noise ratios. Therefore, the staff is satisfied that the eddy current inspection technique is capable of detecting 10 mil deep flaws. The staff's position is contingent on the licensee using equipment that has capabilities similar to the equipment used by FaAA, which has been properly maintained and calibrated, for the TDI diesel generator crankshaft oil hole inspections at SONGS-1. In addition, persons performing eddy current inspection must be qualified in accordance with the licensee's Quality Assurance Program requirements.

3.2 TDI Diesel Oil Maintenance Procedures

The licensee reviewed its TDI diesel oil sampling, testing and analysis procedure and found no evidence that would indicate that the oil used in the TDI diesels would accelerate stress corrosion cracking or the bulk corrosion process. The licensee also requested its contractor, FaAA, to evaluate the quality of oil and oil maintenance practices used at SONGS-1. The licensee submitted FaAA's evaluation as Attachment 4 to its amendment application dated June 5, 1990.

In its report, FaAA indicated that water, acids, and sulfides in oil are known to have a negative effect on the fatigue and fracture properties of the crankshaft materials. FaAA reviewed the TDI operating manual; evaluated the results of oil analyses during the period from March 1988 to November 1989; discussed industrial experience with the licensee's oil manufacturer, Chevron; and performed a literature search to determine the effect of oil impurities on the integrity of the TDI crankshaft.

FaAA found no evidence that would indicate that the crankcase oil used by SONGS-1 would accelerate stress corrosion cracking or bulk corrosion. FaAA concluded that the SONGS-1 sampling and analysis procedures have maintained oil parameters within acceptable limits to prevent the buildup

of acids and water in the oil, and that current crankcase oil maintenance procedures being implemented at SONGS-1 allow detection of significant changes in key oil properties so that any deficiencies may be corrected prior to development of a significant corrosion problem.

The staff has reviewed the licensee's position regarding its TDI diesel oil maintenance procedures and the FaAA evaluation which were submitted by letters dated May 2 and June 5, 1990, respectively. The licensee has addressed the staff's concerns related to TDI diesel oil maintenance and, therefore, the staff is satisfied with the licensee's resolution of this item.

3.3 Limit on Engine Start-Stop Cycles

In its letter to the licensee dated November 21, 1989, the staff concluded that engine start-stop cycles with engine speeds maintained less than 200 rpm may be excluded from the 50 start-stop limit provided that the crankshaft stress level for this situation remained less than the stress level for steady state operation of the diesel. The licensee's consultant, FaAA, evaluated the stresses in the TDI diesel crankshaft for various diesel operating conditions. The results of FaAA's evaluation was included with the licensee's May 2, 1990, submittal. To evaluate stresses at engine speeds below 200 rpm, FaAA performed: (a) steady state haromonic analyses at engine speeds between 120 and 200 rpm (in 10 rpm increments) to determine the effect of dwelling at a particular speed, (b) transient analyses to determine stress levels during the startup portion, and (c) data collection from torsiograph testing during a 200 rpm start. Coastdown response levels representative of a 200 rpm idle speed test were obtained from previous test data and analyses that were performed of the SONGS-1 TDI diesel crankshaft.

The staff has reviewed the evaluation performed by FaAA which addresses this issue. The analyses and test data indicate that stress levels during startup, dwelling and coastdown from 200 rpm are less than the steady state stress level with a 6000 KW load. Therefore, the staff is satisfied with the licensee's resolution of this issue and TDI diesel start-stop cycles with engine speeds maintained less than 200 rpm may be excluded from the limit of 50 start-stop cycles.

3.4 Technical Specification Amendment Application No. 183

Technical Specification Amendment Application No. 183 proposes to delete License Condition 3.L, "Diesel Generators," in its entirety, and relocate the requirements to Section 3.7. "Auxiliary Electric Supply," and Section 4.4, "Emergency Power System Periodic Testing," of the SONGS-1 Technical Specifications. The proposed change permits start-stop cycles associated with engine operation at 200 rpm or less to be excluded from the 50 cycle start-stop limit that was established in the license condition. Although this exception to the start-stop cycle limit was not previously authorized by the license condition, the staff finds this exception to be acceptable as discussed previously in paragraph 3.3 of

this SE. The other license condition requirements will be relocated to the Technical Specifications and will continue to be applicable. Therefore, the changes proposed by Amendment Application No. 183 to Provisional Operating License DPR-13 are acceptable.

3.5 Supplementary Information

The licensee supplemented its amendment application by letters dated September 26 and September 28, 1990. The September 26 letter provided administrative information to facilitate the preparation and coordination of replacement pages for the Technical Specifications, and requested a change to TS Table 4.1.2 to correct an existing error. The request to revise TS Table 4.1.2 was not within the scope of the proposed action that was originally noticed in the Federal Register, however, and the licensee subsequently withdrew its request by its September 28 letter. Therefore, the supplementary information does not alter the action that was originally proposed and noticed in the Federal Register on June 27, 1990 (55 FR 26293).

3.6 Summary

The staff has reviewed the licensee's submittals dated May 2, June 5, September 26 and September 28, 1990, which resolve the remaining issues identified in the staff's SE dated November 21, 1989, relating to the TDI emergency diesel engine crankshaft crack propagation problem. Based on the foregoing evaluation and subject to the conditions described in this evaluation, the staff finds that the licensee's resolution of TDI diesel engine problems is acceptable. Specifically:

1. Eddy current inspection should be capable of detecting 10 mil deep flaws in the oil holes of the SONGS-1 TDI diesel crankshafts.

2. Oil maintenance and surveillance procedures appear adequate for detection of impurities which could result in the acceleration of stress corrosion cracking or bulk corrosion.

3. Start-stop cycles at 200 rpm or less result in stresses below values produced during steady state operation. Hence, start-stop cycles of 200 rpm or less may be excluded from the 50 cycle start-stop limit.

4. The proposed changes to Provisional Operating License DPR-13 which were submitted by Amendment Application No. 183 are acceptable.

4.0 ENVIRONMENTAL CONSIDERATION

This amendment involves changes in a surveillance requirement of a facility component located within the restricted area as defined in 10 CFR Part 20. The staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite and that there is no significant increase in individual or cumulative occupational radiation exposure. 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. 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 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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Dated: November 8, 1990