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

SOUTHERN CALIFORNIA EDISON COMPANY

SAN DIEGO GAS AND ELECTRIC COMPANY

DOCKET NO. 50-206

SAN ONOFRE NUCLEAR GENERATING STATION, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 147
License No. DPR-13

1. The Nuclear Regulatory Commission (the Commission or the NRC) has found that:

   A. The application for amendment by Southern California Edison Company (the licensee) and the San Diego Gas and Electric Company dated May 1, 1992, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, as amended, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C(2) of Facility Operating License No. DPR-13 is hereby amended to read as follows:

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 147, are hereby incorporated in the license. Southern California Edison Company shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance and must be fully implemented no later than 30 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

H. Rood for

Theodore R. Quay, Director
Project Directorate V
Division of Reactor Projects III/IV/V
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: June 29, 1992

ATTACHMENT TO LICENSE AMENDMENT

AMENDMENT NO. 147 TO FACILITY OPERATING LICENSE NO. DPR-13

DOCKET NO. 50-206

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4.4 EMERGENCY POWER SYSTEM PERIODIC TESTING

APPLICABILITY: Applies to testing of the Emergency Power System.

OBJECTIVE: To verify that the Emergency Power System will respond promptly and properly when required.

SPECIFICATION:

A. The required offsite circuits shall be determined OPERABLE at least once per 7 days by verifying correct breaker alignments and power availability.

B. The required diesel generators shall be demonstrated OPERABLE:

1. At least once per 31 days on a STAGGERED TEST BASIS by:

a. Verifying the diesel performs a DG SLOW START[1] from standby conditions,

b. Verifying a fuel transfer pump can be started and transfers fuel from the storage system to the day tank,

c. Verifying the diesel generator is synchronized and running at 6000 kW (+100 kW, -500 kW) for $\geq$ 60 minutes[2],

d. Verifying the diesel generator is aligned to provide standby power to the associated emergency buses,

e. Verifying the day tank contains a minimum of 290 gallons of fuel, and

f. Verifying the fuel storage tank contains a minimum of 37,500 gallons of fuel.

2. At least once per 3 months by verifying that a sample of diesel fuel from the required fuel storage tanks is within the acceptable limits as specified by the supplier when checked for viscosity, water and sediment.

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[1]All diesel starts for testing and surveillance will be slow starts (greater than 24 seconds duration) except for the fast start required by Technical Specification 4.4.F conducted once per 18 months during shutdown and any other fast start required following specific maintenance involving the fast start capability.

[2]Momentary load transients (each 5 seconds or less) are permitted and do not violate the load restrictions.

1. Simulating SISLOP*, and:

a. Verifying operation of circuitry which locks out non-critical equipment,

b. Verifying the diesel performs a DG FAST START from standby condition on the auto-start signal, energizes the emergency buses with permanently connected loads and the auto connected emergency loads** through the load sequencer (with the exception of the feedwater, safety injection, charging and refueling water pumps whose respective breakers may be racked-out to the test position) and operates for $\geq$ 5 minutes while its generator is loaded with the emergency loads,

c. Verifying that on the safety injection actuation signal, all diesel generator trips, except engine overspeed and generator differential, are automatically bypassed.

2. Verifying the generator capability to reject a load of 4,000 kW without tripping. The generator voltage shall not exceed 4,800 volts and the generator speed shall not exceed 500 rpm (nominal speed plus 75% of the difference between nominal speed and the overspeed trip setpoint) during and following the load rejection.

G. Manual Transfer Switches

1. Verify once every 31 days that the fuse block for breaker 8-1181 in MCC-1 for MTS-7 is removed.

2. Verify once every 31 days that MTS-8 is energized from breaker 8-1480B from MCC-4 and the cabinet door is locked, and that breaker 8-1122 from MCC-1 is locked open.

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* SISLOP is the signal generated by a sequencer on coincident loss of voltage on its associated 4160 volt bus (Bus 1C or 2C) and demand for safety injection.

** The sum of all loads on the engine shall not exceed 6,000 kW. However, momentary load transients (each 5 seconds or less) are permitted.

H. Periodic maintenance, surveillance, overhaul and inspection of the required diesel generator shall comply with the following:

1. A diesel engine maintenance and surveillance program as described in the Safety Evaluation related to Amendment No. 123 to this Operating License will be implemented. Changes to this program will be subject to the provisions of 10 CFR 50.59.

2. The frequency of major diesel engine overhaul that is a part of the diesel engine maintenance and surveillance program shall be at least once every ten years. For this overhaul, one engine may be inspected during the refueling outage immediately prior to the ten years and the other engine inspected during the refueling outage immediately following the ten years. Alternatively, both inspections may be performed coincident with the 10-year reactor vessel inservice inspection. The 10-year overhaul interval shall be determined on a calendar basis from the date of completion of the last overhaul.

3. Oil hole locations in journals 7 through 12 on each crankshaft shall be inspected with liquid penetrant. Journal 7 shall be inspected within 200[3] DG SLOW STARTS or their equivalent since the previous inspection. Journals 8 through 12 shall be inspected at each refueling outage or within 70[3] DG SLOW STARTS or their equivalent since the previous inspection, whichever comes first. Indications found shall be evaluated with eddy current testing as appropriate. (A DG FAST START shall be considered equivalent to 1.4 times a DG SLOW START.)

   During each major engine overhaul, the fillets of main journal Nos. 4 through 12 should be inspected together with the oil holes, using liquid penetrant. Indications found shall be evaluated with eddy current testing as appropriate. In addition, these inspections should be performed for the oil holes and fillets in at least three of the crankpin journals at each major engine overhaul.

   If during the oil hole and fillet inspections described above, cracks are found in the oil holes or in other crankshaft surfaces, these findings are to be reported to the NRC within 24 hours. The affected engine is to be considered inoperable and is not to be restored to OPERABLE status until the disposition and/or corrective actions have been approved by the NRC staff.

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[3]Start-stop cycles associated with idle (no load) engine operation at 200 rpm or less need not to be counted toward this limit.

4. Cylinder blocks shall be inspected for "ligament" cracks, "stud-to-stud" cracks and "stud-to-end" cracks as defined in the report[4] by Failure Analysis Associates, Inc. (FaAA) entitled "Design Review of TDI R-4 and RV-4 Series Emergency Diesel Generator Cylinder Blocks" (FaAA Report No. FaAA-84-9-11.1) and dated December 1984. (Note that the FaAA report specifies additional inspections to be performed for blocks with "known" or "assumed" ligament cracks.) The inspection intervals (i.e., frequency) shall not exceed the intervals calculated using the cumulative damage index model in the subject FaAA report. In addition, inspection methods shall be consistent with or equivalent to those identified in the subject FaAA report.

Blocks determined in the future to have "ligament" cracks as the result of the above inspections should be inspected at each refueling outage to determine whether or not cracks have initiated on the top surface, which was exposed because of the removal of two or more cylinder heads. This process should be repeated over several refueling outages until the entire block has been inspected. If after this process has been completed new "ligament" cracks are found, this process should again be repeated. Liquid penetrant testing or a similarly sensitive nondestructive testing technique should be used as appropriate to determine the depth of any cracks discovered.

Whenever diesel generator No. 1 is operated in excess of 4,375 kW for one hour or more, a visual inspection of the right bank cylinder block is to be performed under intense light within 48 hours after engine shutdown to verify the absence of "stud-to-stud" and "stud-to-end" cracks.

If "stud-to-stud" or "stud-to-end" cracks are found, these findings are to be reported to the NRC within 24 hours. The affected engine is to be considered inoperable and is not to be restored to OPERABLE status until the disposition and/or corrective actions have been approved by the NRC staff.

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[4]This report was transmitted to H.R. Denton (NRC), from C.L. Ray, Jr., (TDI Owners Group), by letter dated December 11, 1984.

BASIS:

The normal plant Emergency Power System is normally in continuous operation, and periodically tested. (Ref. 1)

The tests specified above will be completed without any preliminary preparation or repairs which might influence the results of the test except as required to perform the DG SLOW START test set forth in T.S. 4.4.B.1.a. The tests will demonstrate that components which are not normally required will respond properly when required.

DG maintenance, surveillance, overhaul and inspection requirements are intended to ensure the reliability and operational readiness of the diesels for emergency service. The basis for these requirements is discussed in NUREG-1216. (Ref. 2) The maintenance and surveillance program is primarily based on the TDI diesel generator owners group recommendations, as modified by NUREG-1216. The frequency of major engine overhaul conforms to the frequency specified in those recommendations.

The DG design basis load restriction of 6,000 kW is the result of assumptions found in the owners group crack propagation analysis for the crankshafts (Ref. 3). This analysis postulated that the crankshaft initially has stress-induced surface cracks. The analysis then considered the effect of four types of diesel load histories on the growth of these cracks. Each load history consisted of repeated engine start-stop cycles with some steady state operation at full load (6,000 kW) between each start and its stop. Based on predicted crack growth as the result of fast starts only, the analysis recommended an inspection interval of approximately 50 engine start-stop cycles for the crankshafts. Since the analysis assumed DG operation at loads no higher than 6,000 kW, this value became a design basis limit for surveillance purposes.

The inspection interval of 70 start-stop cycles for crankshaft journals 8 through 12 and the inspection interval of 200 start-stop cycles to inspect journal 7 are the result of an updated crack propagation analysis (Ref. 4). This analysis takes into account the fact that fast starts have now almost completely been replaced by slow starts [see Footnote 1 to Technical Specification 4.4(B).1(a)]. This change has resulted in a significant reduction in the torsional stresses that were identified as the root cause of the cracking problem. The updated analysis concludes that an average fast start is 1.4 times as damaging to the crankshaft as an average slow start. That is, 50 fast start-stop cycles are equivalent to 70 slow start-stop cycles.

Crankshaft stresses associated with idle (no load) DG speeds of 200 rpm or less have been found to be less than steady state stresses and so need not be counted toward the limiting number of start-stop cycles that determine the length of the inspection interval (Ref. 5).

DG SLOW STARTS are specified for the monthly surveillances in order to reduce the cumulative fatigue damage to the engine crankshafts to levels below the threshold of detection under a program of augmented inservice inspection. In the event that the DG SLOW START inadvertently achieves steady state voltage and frequency in less than 24 seconds, the surveillance will not be considered a failure and require restart of the diesel generator.

For the monthly surveillances, each DG is loaded to between 5,500 kW and 6,100 kW. The lower of these limits meets or exceeds the total connected design load on either diesel engine. The upper limit is to accommodate load variations above 6,000 kW. However, momentary transients where each transient lasts 5 seconds or less are not subject to the 6,100 kW limit.

Main journals numbered 8 through 12 of the DG crankshafts are the most highly stressed journals during engine operation and are therefore the most susceptible to fatigue-induced cracking. For this reason, the oil hole locations at these main journals are inspected for cracks at least once at every refueling outage. Main journal number 7 is moderately stressed and receives a less frequent inspection. At each 10-year major engine overhaul, the inspection is expanded to include additional oil hole locations and selected journal fillets.

The purpose of inspecting the four cylinder blocks is to assure that these blocks, particularly the block that has degraded Widmanstaetten microstructure, remain free of cracks in the area surrounding the cylinder head stud holes.

The DG requirements and restrictions were initially imposed by the NRC as license conditions. (Ref. 6)

The surveillance requirements for demonstrating the OPERABILITY of the station batteries are based on the recommendations of Regulatory Guide 1.129, "Maintenance, Testing, and Replacement of Large Lead Storage Batteries for

Nuclear Power Plants," February 1978, and IEEE Std 450-1980, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generating Stations and Substations."

Verifying average electrolyte temperature above the minimum for which the battery was sized, total battery terminal voltage on float charge, connection resistance values and the performance of battery service and discharge tests ensure the effectiveness of the charging system, the ability to handle high discharge rates and compares the battery capacity at that time with the rated capacity.

Table 4.4-1 specifies the normal limits for each designated pilot cell and each connected cell for electrolyte level, float voltage and specific gravity. The limits for the designated pilot cells float voltage and specific gravity, greater than 2.13 volts and .020 below normal full charge specific gravity or a battery charger current that has stabilized at a low value, is characteristic of a charged cell with adequate capacity. The normal limits for each connected cell for float voltage and specific gravity, greater than 2.13 volts and not more than .020 below normal full charge specific gravity with an average specific gravity of all the connected cells not more than .010 below normal full charge specific gravity, ensures the OPERABILITY and capability of the battery.

Operating with a battery cell's parameter outside the normal limit but within the allowable value specified in Table 4.4-1 is permitted for up to 7 days. During this 7 day period: (1) the allowable values for electrolyte level ensures no physical damage to the plates with an adequate electron transfer capability; (2) the allowable value for the average specific gravity of all the cells, not more than .020 below normal full charge specific gravity, ensures that the decrease in rating will be less than the safety margin provided in sizing; (3) the allowable value for an individual cell's specific gravity, ensures that an individual cell's specific gravity will not be more than .040 below normal full charge specific gravity and that the overall capability of the battery will be maintained within an acceptable limit; and (4) the allowable value for an individual cell's float voltage, greater than 2.07 volts, ensures the battery's capability to perform its design function.

Verifying required positions for manual transfer switches ensure single failure and environmental interaction requirements are satisfied. The normal alignments for MTS-7 and MTS-8 are MCC-2 and MCC-4, respectively.

REFERENCES:

(1) Supplement No. 1 to Final Engineering Report and Safety Analysis, Section 3, Questions 6 and 8.

(2) NUREG-1216, Safety Evaluation Report Related to the Operability and Reliability of Emergency Diesel Generators Manufactured by Transamerica Delaval, Inc. (August 1986)

(3) Report No. FaAA-84-12-14 (Revision 1.0), Evaluation of Transient Conditions on Emergency Diesel Generator Crankshafts at San Onofre Nuclear Generating Station, Unit 1.

(4) Report No. FaAA-SF-R-90-03-12, Evaluation of Inspection Interval for Emergency Diesel Generator Crankshafts at San Onofre Nuclear Generating Station Unit 1.

(5) Letter dated May 2, 1990, from SCE to NRC, Emergency Diesel Generators.

(6) Amendment No. 123 to San Onofre Unit 1 Provisional Operating License, Issued on April 14, 1989.