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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO.138 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 July 30, 1990, Southern California Edison Company (SCE or the licensee) requested a change to the Technical Specifications (TS) appended to Provisional Operating License No. DPR-13 for operation of San Onofre Nuclear Generating Station, Unit No. 1 (SONGS-1)in San Diego County, California. The licensee's request was supplemented by letters dated August 22 and September 10, 1990. Also, design calculations were submitted on July 30, 1990, in response to the staff's request for information.

As indicated in a Licensee Event Report dated January 7, 1990, a review of test data for the auxiliary feedwater (AFW) system determined that the maximum flow rate through the AFW line flow limiting venturis was above the limit necessary to prevent the possibility of water hammer occurrence. Thus, these venturis are being replaced during the Cycle 11 refueling outage with venturis sized to limit flow below the water hammer limit of 150 gpm. As a result of this replacement, the expected flow rates during various accident and transient conditions may be reduced. This required that the minimum flow rate requirements specified in the basis section for Technical Specification 3.4.3, "Auxiliary Feedwater System," be reduced. The licensee performed analyses for those events that require auxiliary feedwater where the revised minimum flow rate limits were below previously analyzed levels.

In its submittal, the licensee also proposed a change in the applicability section of Technical Specification 3.4.3 to correct an editorial error that was inadvertently inserted by a previous license amendment.

2.0 DISCUSSION

The AFW system design for San Onofre Unit 1 incorporates two redundant trains which meet single failure criteria. Train A consists of a motor driven pump (G-10S) and a turbine driven pump (G-10) and associated valves and interlocks. Train B consists of a motor driven pump (G-10W) and its associated valves and interlocks. There are flow control valves and venturis installed in the AFW discharge lines to each of the three steam generators.

The AFW system is designed to meet both maximum and minimum flow requirements.

The maximum AFW flow requirements are based upon steam generator feedwater ring water hammer, pump run out, core cooldown, and containment pressure considerations. Water hammer considerations limit AFW flow to less than 150 gpm to any steam generator when a steam generator feedwater ring is not covered with water. The minimum AFW flow rates are based on decay heat removal requirements following a postulated loss of main feedwater transient or a main feedwater line break accident. The current minimum AFW flow requirements are: (1) 185 gpm per AFW train with three intact main feedwater lines and pressurized steam generators, (2) 125 gpm per AFW train with two intact main feedwater lines and pressurized steam generators, and (3) 250 gpm per train with two intact main feedwater lines and depressurized steam generators.

On December 28, 1989, during a review of test reports which were generated during startup from the Cycle 10 refueling outage, the licensee determined that the AFW system could, under certain conditions, produce a flow rate to each steam generator that is higher than the maximum flow rate limit of 150 gpm. The licensee's corrective action for this design deficiency is to replace the venturis which are installed in each of the AFW discharge lines. However, resizing the AFW venturis will reduce the AFW flow rates available for plant transients and accidents.

The licensee has completed analyses to verify that the reduced AFW flow rates will be acceptable during worst case accident conditions, and has requested a change to the basis for Technical Specification 3.4.3, accordingly. The proposed change would reduce the minimum AFW flow requirements to 100 gpm per AFW train with two intact main feedwater lines and pressurized steam generators, and to 175 gpm per AFW train with two intact main feedwater lines and depressurized steam generators. The minimum flow of 185 gpm per AFW train with three intact main feedwater lines and pressurized steam generators remains unchanged.

3.0 EVALUATION

3.1 Hydraulic Considerations

The existing AFW system venturis are 3" flanged end, ASME, cavitating venturis located in the 3" AFW lines, downstream of the AFW flow control valves. The licensee stated that the replacement venturis will be identical to the existing venturis in all respects except throat diameter, which will be smaller. Additionally, the following design requirements were provided:

a. Each venturi will pass 140 gpm of 60°F water at an inlet pressure of 1162 psig, with ambient back-pressure.

b. Each venturi will pass no less than 100 gpm of 60°F water at an inlet pressure of 775 psig, with ambient back-pressure.

c. Each venturi will pass at least 55 gpm of 60°F water with a pressure loss of less than 35 psi, when not cavitating.

d. Each venturi will pass at least 62.5 gpm of 60°F water with a pressure loss of less than 45 psi, when not cavitating.

In its submittals dated July 30 and September 10, 1990, the licensee provided revised AFW calculations (Supplements B and C, respectively, to Calculation No. DC-2836) which support the AFW flow venturi resizing and indicate that sufficient margins should be expected which will satisfy the flow rate limits for the analyzed transients and accident conditions. The values for the flow rate limits were supported by revised transient and accident analyses.

The NRC staff reviewed the proposed design requirements for the AFW venturis to verify that the requirements are consistent and support the design basis limits established by the transient and accident analyses. Based on these requirements, the staff reviewed the inputs, assumptions, and calculations used by the licensee to resize the throat diameter such that the resized venturis would be able to pass sufficient flow to satisfy the transient and accident analyses.

In Supplement B of Calculation No. DC-2836, the licensee provided calculations for four throat diameters which would limit AFW line flow rates between 135 and 150 gpm at an inlet pressure of 1160 psig with depressurized steam generators. From these calculations, the licensee selected the recommended size which coincides with a maximum flow rate limit of 140 gpm. In the September 10 submittal, the licensee provided the manufacturer's test data for the new venturis, sized for 140 gpm, and calculations for additional transient conditions. The staff focused its review primarily on the calculations which supported the selection of the venturi throat diameter.

After verifying that the input assumptions used by the licensee were appropriate, the staff conducted an alternate sizing calculation using the equations described in "Flow Measurement Engineering Handbook." The staff results agreed with the throat diameter of 0.366" for this type of venturi, as stated in the manufacturer's data. The use of a 60°F water temperature rather than the 100°F used in the transient and accident analyses was reviewed and found to have a minimal impact on venturi throat diameter. The staff also reviewed the AFW line flow rate calculations used by the licensee to verify that the required minimum AFW flow limits could be met. Since the licensee provided flow test data for each of the three venturis, the staff reviewed the pressure recovery capability of each venturi for non-cavitating operation. Using the expected recovery ratios and appropriate venturi nozzle flow calculations, the staff concluded that the licensee's results for the expected minimum flow rates are acceptable.

The staff noted that the design margin for AFW flow required during the 10 CFR 50, Appendix R plant cooldown analysis (Case 4.11 of Supplement C) was less than 1%. Since the Train B pump, G-10W, is used in this event, the licensee has stated that the operators would monitor the flow rate and open the AFW venturi, FE-3083, bypass valves as needed to maintain the required flowrate. This action would raise the flow margin to 8.6%. Based on the conservative assumptions used in the calculation and the time available for operator action to increase flow, if necessary, the staff finds the licensee's approach acceptable, provided that the licensee verifies that the operating procedures for this event provide the necessary guidance to the operators.

3.2 Accident Analysis Considerations

The minimum AFW flow rate requirements associated with two intact main feedwater lines and various steam generator conditions are based on the results of the main feedwater line break analysis. In support of the reduced minimum AFW flow limits, the licensee submitted the results of its reanalysis of a main feedwater line break considering various break locations and initial power levels. The results of the licensee's reanalysis indicated that the acceptance criteria for these accident cases are met with the reduced AFW flow rates. The staff has reviewed the information submitted by the licensee, and we are satisfied that accident analysis considerations have been adequately addressed. Therefore, in this regard, the licensee's request to credit reduced AFW flow rates in the basis for TS 3.4.3 is acceptable.

3.3 Startup Testing

The licensee has committed to perform startup testing in Mode 5 and in Mode 1 to verify overall system response following replacement of the flow venturis and to verify that the AFW system will satisfy minimum and maximum flow requirements. The staff has reviewed the licensee's plans for conducting startup testing, and we are satisfied in this regard. However, since AFW flow testing can not be performed under accident conditions (e.g., steam generator pressure equal to the first safety valve lift setpoint, etc.), the test data must be extrapolated to determine the minimum and maximum flow rates that would actually exist. Therefore, the staff requires that the licensee submit a summary report of the startup test results for further NRC review. The summary report should include a discussion regarding the accuracy of test data and extrapolated values.

3.4 Technical Specification Applicability Requirements

In its submittal dated August 22, 1990, the licensee requested a change to the wording of the applicability section of Technical Specification 3.4.3. Due to a clerical error that was made when the Technical Specifications were reissued by Amendment No. 130 dated August 21, 1989, the wording was inadvertently changed to state that TS 3.4.3 was applicable to the motor driven auxiliary feedwater pumps when the specification is actually applicable to two motor driven pumps and one turbine driven pump. The change proposed by the licensee would correct this error and restore the wording in the applicability section of TS 3.4.3 which was previously established by Amendment No. 125 dated April 29, 1989. Therefore, the staff finds the proposed change to the Technical Specifications to be acceptable.

3.5 Supplementary Information

Supplementary information was provided by the licensee which was not specifically referenced by the notice of proposed action that was issued in the Federal Register on September 10, 1990 (55 FR 37273).

As discussed in Section 3.4 of this SE, the licensee's August 22, 1990, submittal requested a change to the wording in the applicability section of TS 3.4.3. This change was requested to correct a clerical error that was made when a previous amendment was issued, and the proposed change would restore the correct wording. Therefore, this additional change to the Technical Specification is adminstrative and does not affect the action that was originally proposed and noticed in the Federal Register.

In response to the staff's request, on July 30, 1990, the licensee provided its calculations which were used for sizing the flow venturis for the AFW system. Also, by letter dated September 10, 1990, the licensee provided additional calculations and design information related to the flow venturis. This supplementary information was submitted to facilitate the staff's review of the licensee's request to revise the Technical Specifications and did not alter the action that was originally proposed by the licensee and noticed in the Federal Register.

Therefore, additional noticing was not required as a result of the supplementary information that was provided.

3.6 Summary

The NRC staff has completed its review of the licensee's request related to Amendment Application No. 185, and we find that the action proposed by the licensee is acceptable. However, our approval of the proposed action is contingent upon the considerations discussed in the SE, including:

a. Procedure revisions must be made as discussed in paragraph 3.1.

b. A summary report of the startup test results must be submitted as discussed in paragraph 3.3.

4.0 ENVIRONMENTAL CONSIDERATION

This amendment involves changes in a requirement with respect to the installation or use of a facility component located within the restricted areas as defined in 10 CFR Part 20, or changes a surveillance requirement. 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 categorial 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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