ENCLOSURE 1

SAFETY EVALUATION
RANCHO SECO NUCLEAR GENERATING STATION, UNIT 1
DOCKET NO. 50-312
ADEQUACY OF STATION ELECTRIC DISTRIBUTION SYSTEM VOLTAGES

INTRODUCTION AND SUMMARY

Sacramento Muncipal Utility District (SMUD) was requested by NRC letter dated August 8, 1979 to review the electric power system at Rancho Seco Nuclear Generating Station, Unit 1. The review was to consist of:

a) Determining analytically the capacity and capability of the offsite power systems and onsite distribution system to automatically start as well as operate all required loads within their required voltage ratings in the event of 1) an anticipated transient, or 2) an accident (such as LOCA) without manual shedding of any electric loads.

b) Determining if there are any events or conditions which could result in the simultaneous or, consequential loss of both required circuits from the offsite network to the onsite electric distribution system and thus violating the requirements of GDC 17.

The August 8, 1979 letter included staff guidelines for performing the required voltage analysis and the licensee was further required to perform a test in order to verify the validity of the analytical results. SMUD responded by letters dated October 17, 1979, December 6, 1979, August 1, 1980, February 17, 1981 and April 21, 1982. A detailed review and technical evaluation of the submittals was performed by LLL under

contract to the NRC, with general supervision by NRC staff. This work is reported by LLL in Technical Evaluation Report (TER), "Adequacy of Station Electric Distribution System Voltages, Rancho Seco Nuclear Generating Station, Unit 1, " dated November 10, 1981 (attached). We have reviewed this report and concur in the conclusions that the offsite power system and the onsite distribution system are capable of providing acceptable voltages for worst case station electric load and grid voltages.

EVALUATION CRITERIA

The criteria used by LLL in this technical evaluation of the analysis includes GDC 5 ("Sharing of Structures, Systems, and Components"), GDC 13 ("Instrumentation and Control"), GDC 17 ("Electric Power Systems") of Appendix A to 10 CFR 50; IEEE Standard 308-1974 ("Class 1E Power Systems for Nuclear Power Generating Stations"), ANSI C84.1-1977 ("Voltage Ratings for Electric Power Systems and Equipment - 60 Hz"), and the staff positions and guidelines in NRC letter to SMUD dated August 8, 1979.

ANALYSIS AND TEST FEATURES

SMUD analyzed each offsite power source to the onsite distribution system under maximum and minimum load conditions with the 220 kv grid at maximum and minimum anticipated voltages of 239 kv and 214 kv. The worst case Class 1E equipment voltages occur under the following conditions:

(1) The maximum Class 1E bus voltage occurs when the grid is at maximum anticipated value of 239 kv with minimum auxiliary plant loads and there are no loads on the Class 1E buses.

(2) The minimum steady state Class 1E equipment voltage occurs when the grid is at minimum anticipated value of 214 kv, with the Class 1E 4160 volt buses powered from startup transformer No. 2 and all Class 1E safety equipment is in operation.

(3) The minimum transient Class 1E equipment voltages occur under the conditions of (2) above concurrent with the starting of a condensate pump or the block load starting of the nuclear service air coolers and the nuclear service water pumps.

The licensee has committed to perform voltage verification testing in mid-1982 to verify the results of the voltage analysis. To date SMUD has not performed these tests nor have they outlined their scope. As a minimum the staff requires the following criteria be met:

a. Loading the station distribution buses, including all Class 1E buses down to the 120/208 volt level, to at least 30%;

b. Recording the existing grid and Class 1E bus voltages and bus loading down to the 120/208 volt level at steady state conditions and during starting of both a large Class 1E and non-Class 1E motor (not concurrently).

Note: To minimize the number of instrumented locations (recorders) during the motor starting transient tests, the bus voltage and loading need only be recorded on that string of buses which previously showed the lowest analyzed voltages.

c. Using the analytical techniques and assumptions of the previous voltage analyses, and the measured existing grid voltage and bus loading conditions recorded during conduct of test, calculate a new set of voltages for all Class 1E buses down to the 120/208 volt level.

d. Compare the analytically derived voltage values against the test results.

e. With good correlation between the analytical and test results the test requirements will be met. In general, the test results should not be more than 3% lower than the analytical results; however, the difference between the two when subtracted from the voltage levels determined in the original analysis should never be less than the Class 1E equipment rated voltages.

DESIGN CHANGES AND EVALUATION

As a result of the voltage analysis SMUD has proposed the following design changes:

(1) Change the loading sequence of the diesel generator room supply and exhaust fans from load group two to load group three. This reduces

the severity of the voltage transients during sequential loading. This change has been completed.

(2) Prepare procedure to describe operator action when the grid voltage is less than 218 kv. Standing order 15-79 has been issued.

(3) Change the coils for size 3 starters from 120 volt coils to 480 volt coils.

(4) Change the setpoint of the second level undervoltage relays to 91% of 4160 volts.

(5) Implement technical specification changes to limit plant operation to less than 24 hours when grid voltage is less than 218 kv.

(6) Install an overvoltage alarm to annunciate in the control room when the 4160 volt Class 1E bus voltage exceeds 110% of nominal.

(7) Install circuitry to block automatic start of a condensate pump and modify control circuitry of the upper dome air circulating air fans to reduce voltage starting transients on the Class 1E buses.

(8) Install capacitor banks to improve switchyard voltages.

Upon completion of the above modifications acceptable voltages will be provided to all Class 1E equipment under normal plant operation and accident conditions. However; under the extreme worst case conditions analyzed, i.e. grid voltage between 214 kv and 218 kv, all plant auxiliary equipment running, and all safety equipment starting and running as the result of a LOCA; certain 4160 volt Class 1E motors could be exposed to voltage up to 5% below their design rating. Although this condition has an extremely remote probability of occurrence, if it should occur, the exposure would be of short duration since plant auxiliary and safety equipment loading would normally be immediately reduced to those loads needed for mitigation of the accident by automatic and operator action. Further, to minimize the effects of this extreme occurrence, the licensee has committed to implement technical specifications which will limit plant operation to less than 24 hours, when the grid voltage is less than 218 kv. In addition the licensee has provided an analysis which shows that limited operation of Class 1E equipment under the above condition will result in insignificant degradation over its 40 year life. Based upon the above, we concur with the licensee and find the proposed modifications and technical specification changes acceptable.

CONCLUSIONS

We have reviewed the LLL technical evaluation report and occur in its findings that:

(1) SMUD has provided a voltage analysis to demonstrate that upon completion of the proposed modifications and implementation of technical specification changes Class 1E equipment voltages

will remain within acceptable operating limits for the worst case conditions analyzed.

(2) The ventilation test planned by SMUD, provided they incorporate the methods outlined in the analysis and test features section of this SER, will verify the voltage analysis accuracy.

(3) SMUD's reaffirmation of compliance with GDC 17 requirements is acceptable.

(4) Loss of offsite power to the Class 1E buses, due to spurious operation of the undervoltage relays will not occur with the 200 kv grid in its anticipated operating range.

We, therefore, find the Rancho Seco Nuclear Generating Station, Unit 1 acceptable with respect to the adequacy of station electric distribution system voltages subject to completion of the proposed modifications, technical specification changes, and completion of the verification testing. We will address the verification testing in a supplement to this report.