ENCLOSURE 1

SAFETY EVALUATION
DOCKET NO. 50-206
DEGRADED GRID VOLTAGE PROTECTION FOR
THE CLASS 1E SYSTEM
SAN ONOFRE UNIT NO. 1

INTRODUCTION AND SUMMARY

The criteria and staff positions pertaining to degraded grid voltage protection were transmitted to Southern California Edison (SCE) by NRC Generic Letter dated June 3, 1977. In response to this by letters dated November 4, 1977, August 19, 1981, December 16, 1981, and April 19, 1982, the licensee proposed certain design modifications and changes to the Technical Specifications. A detailed review and technical evaluation of these proposed modifications and changes to the Technical Specifications was performed by LLL, under contract to the NRC, and with general supervision by NRC staff. This work is reported by LLL in "Degraded Grid Protection for Class 1E Power Systems San Onofre Nuclear Generating Plant, Unit 1 (attached). We have reviewed this technical evaluation report and concur in conclusion that the proposed electrical design modifications and Technical Specification changes are acceptable.

EVALUATION CRITERIA

The criteria used by LLL in its technical evaluation of the proposed changes include GDC-17 ("Electric Power Systems") of Appendix A to 10 CFR 50; IEEE Standard 279-1971 ("Criteria for Protection Systems for Nuclear Power Generating Stations"); IEEE Standard 308-1977 ("Voltage Ratings for Electrical Power Systems and Equipment - 60 Hz"); and staff positions defined in NRC Generic Letter to SCE dated June 3, 1977.

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PROPOSED CHANGES, MODIFICATIONS AND DISCUSSION

a. The existing undervoltage protection system design consist of the following:

1. One CV-6 inverse time loss of voltage relay on each 4160 volt Class 1E bus. These relays are set at 88.34% of nominal and when actuated will initiate isolation of their respective bus and also initiate load shedding.

2. Two CV-7 (inverse time) relays on each 4160 volt Class 1E bus with a setpoint of 69% of nominal. For a loss of power on both 4160V buses, these relays will initiate starting of the onsite emergency diesel generators and provide a signal to the sequencer to trip the reactor. For a loss of offsite power coincident with a loss-of-coolant-accident (LOCA), on both 4160 volt Class 1E buses, these relays will isolate the 4160 volt Class 1E buses from the offsite power system, bypass the function of the CV-6 relays, and automatically start the emergency diesel generators, shed the loads of the Class 1E buses, and sequence the ESF loads onto the emergency diesel generators.

3. One CV-7 (inverse time) relay on each 480 volt Class 1E bus set at 68% of nominal. The function of these relays is to protect the Class 1E equipment on these buses from undervoltage or bus fault and to provide a permissive signal to automatically start selected pumps, i.e., screen wash, component cooling water,

and salt water cooling pumps on the redundant Class 1E bus.

b. The following electrical system design modifications and technical specification changes were proposed by SCE:

1. Replace the existing CV-6 inverse time relays on the 4160 volt Class 1E buses with three CV-6 relays arranged in a two-out-of-three coincident logic. The relays will be set with a time dial setting of 2.4, tap voltage of 110 volts (92.5% of 4160 volts) with a potential transformer (PT) ratio of 4200/120. With this setting, the relays setpoints are defined by the voltage/time curve shown in figure 4, Attachment A of the attached Lawrence Livermore Laboratory (LLL) TER. The relay operating time tolerance is ± 5%.

2. A third CV-7 inverse time relay will be added to the existing two CV-7 relays on each 4160 volt Class 1E bus. In addition three instantaneous SV relays will be added in parallel with each of the CV-7 relays. All the above relays will use a two-out-of-three coincident logic. Both sets of relays will be served by the same PT with a ratio of 4200/120. The CV-7 relays will be set with a tap voltage of 93 volts (78% of 4160 volts) and a time dial setting of 1.2. The SV relays are instantaneous plunger type which are adjusted to 113 volts (95% of 4160 volts). The SV relays will be connected in series with the safety injection signal (SIS) contacts on the sequencer. The CV-7 relay setpoints are defined by the voltage/time curve

shown on figure 4, Attachment A of the attached (LLL) TER. The relay operating time tolerance is ± 5%.

With the above modifications, the Class 1E equipment will be protected from degraded voltage or loss of voltage conditions. For sustained voltage degradation below 92.5% of nominal, the CV-6 relays, upon actuation, will provide a signal to initiate disconnection of the 4160 volt Class 1E buses from the offsite power source and initiate load shedding. For sustained voltage degradation (loss of power) below 78% of nominal, the CV-7 relays, which are faster acting in the range of 0% to 78% of nominal than the CV-6 relays, each provide a signal to the sequencerto trip the reactor and start the onsite emergency diesel generators. The Class 1E equipment that is normally running will continue to operate until the CV-6 relays actuate to disconnect the buses and shed the loads.

At this point in time, the Class 1E buses are not automatically reconnected (energized) nor are the Class 1E loads automatically loaded onto the buses. The operator upon receiving an alarm on the loss of power will assess the situation and will determine to either manually connect the Class 1E buses to the second source of offsite power, if available or the running onsite emergency diesel generators.

In the event of a voltage degradation to less than 95% of nominal and a coincident safety injection signal, the SV relays, interlocked with the SI signal, will initiate instantaneous disconnection of the offsite power source, shed the loads, start the onsite emergency diesel generators, and sequence the safety equipment onto the Class 1E buses. Once the

sequencer is initiated, the SV relays will be bypassed. This will prevent tripping of the safety injection loads due to voltage transient induced by starting these large motors. The CV-6 and CV-7 relays are retained to provide continued undervoltage protection. The licensee has provided an analysis which demonstrates that the time delay for the CV-6 and CV-7 relays are sufficient to prevent spurious separation of the Class 1E buses from the onsite emergency diesel generators during the voltage transients caused by starting the safety injection loads.

The licensee has provided additions and changes to the plant technical specifications including the surveillance requirements, allowable limits for the setpoint and time delay and the limiting conditions for operation. An analysis to substantiate the limiting conditions for operation and minimum and maximum setpoint limits were included as part of the modification proposal. The changes and additions to technical specifications have been reviewed by the staff and found acceptable.

CONCLUSIONS

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

(1) The proposed degraded grid modifications will protect the Class 1E equipment and systems from sustained degraded voltage of the offsite power system.

(2) The proposed technical specifications changes are acceptable.

(3) The licensee is retaining the load-shed feature while the onsite sources are supplying the Class 1E buses. Technical specifications have been provided which include the voltage/time curves (minimum and maximum limits) of the load-shed relays. A review of the setpoint values, limits and logic circuitry indicates that there will be no adverse interaction of the onsite power sources with the load-shed feature during load sequencing.

We, therefore find the San Onofre Nuclear Generating Station, Unit 1 acceptable with respect to the degraded grid voltage protection for the Class 1E ac power systems.

ACKNOWLEDGEMENTS

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