SAFETY EVALUATION
SAN ONOFRE UNIT 1
EMERGENCY DIESEL GENERATOR LOAD SEQUENCER DESIGN DEFICIENCY

1.0 INTRODUCTION

On March 2, 1989, the licensee for San Onofre Nuclear Generating Station Unit 1 (SONGS-1) informed the staff of a design deficiency whereby the closure of one emergency diesel generator output breaker energizing its emergency 4KV bus can prevent the closure of the other emergency diesel generator's breaker and energization of its bus when required by a safety injection signal (SIS) coincident with loss of offsite power (LOP). The NRC staff has reviewed the design deficiency and supporting documentation provided by the licensee and finds the licensee's corrective actions acceptable as discussed below.

Upon receipt of a LOP or SIS signal, the SONGS-1 Safeguard Load Sequencing System (SLSS) automatically starts the emergency diesel generators but does not close their output breakers. Emergency safeguards loads are block-loaded on their respective buses on an SIS. Upon receipt of a loss of a bus (LOB) signal, caused by deenergization of either 4160 Vac Bus 1C or 2C, the SLSS automatically starts the corresponding diesel generator but does not close the diesel generator's breaker or load emergency safeguards loads on the deenergized bus. In the event of a SIS signal concurrent with a LOP condition, the SLSS strips certain loads off the emergency buses, starts the emergency diesel generators, closes each diesel generator output breaker (when the diesel generator comes upon the frequency and voltage), and sequences emergency safeguards loads upon their buses.

The LOP signal is developed from two undervoltage relays on each bus by first combining the signals from the two relays on one bus in one-out-of-two logic and then "anding" the resulting signal with the one-out-of-two logic signal from the two relays on the other bus (i.e., both buses must be deenergized before a LOP signal is generated). As stated above, if a LOP condition exists concurrently with a SIS, each diesel generator is started and its output breaker is closed. Should one diesel generator come up to frequency and voltage before the other, its breaker will close and energize its bus first. This in turn resets the LOP signal logic (see the March 2, 1989, deficiency report) and, if the slower diesel generator has not come up to frequency and voltage, prevents closure of its output breaker and energization of its bus. This leaves the plant with only one energized emergency 4kV bus for a SISLOP condition and vulnerable to a single failure.

In a March 17, 1989 letter and in LER 89-004 dated April 3, 1989, the licensee summarized the design deficiency and stated that time delay (12 seconds) relays would be installed in the undervoltage relay circuits to ensure that a train's resetting signal, resulting from its bus

voltage being restored, will be delayed long enough for the other train's output breaker to close. We have reviewed the licensee's design change and find it does eliminate the design deficiency and is acceptable.

Principal Contributor: F. Burrows, Electrical Systems Branch

Date: