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SUBJECT: Forwards response to Generica Ltr 81-04 re emergency procedures & training for station blackout events

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K. P. BASKIN
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August 31, 1981

Director, Office of Nuclear Reactor Regulation
Attention: Mr. Frank Miraglia, Branch Chief
Licensing Branch No. 3
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

Subject: Docket Nos. 50-361 and 50-362
San Onofre Nuclear Generating Station
Units 2 and 3

The NRC's letter dated February 25, 1981 (Generic Letter 81-04), requested a review of current plant capabilities to mitigate a station blackout event and to implement as necessary, emergency procedures and training programs for coping with station blackout events. SCE's letter of June 17, 1981 addressed the concerns identified in Generic Letter 81-04, based upon a preliminary assessment of plant capabilities and indicated that SCE was performing a detailed review of the plant design features to verify that San Onofre Units 2 and 3 are capable of supporting the two hour assumption utilized by the procedures for restoration of AC power. This verification has been completed and a final report addressing each aspect of Generic Letter 81-04 is enclosed.

The Emergency Operating Instruction (EOI), Complete Loss of Offsite Electrical Power, (S023-3-5.4) has been revised incorporating the results of the detailed review of the plant design features and the guidance of Generic Letter 81-04. The Operator License candidates for San Onofre Unit 2 have completed their training relative to the revised EOI.

If you have any questions or comments concerning this matter, please contact me.

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Subscribed on this 31st day of August, 1981.

Very truly yours,
SOUTHERN CALIFORNIA EDISON COMPANY

By ______________________
K. P. Baskin
Manager of Nuclear Engineering,
Safety, and Licensing

Subscribed and Sworn to before me on this 31st day of August, 1981.

Agnes Crabtree
Notary Public in and for the County of Los Angeles, State of California

OFFICIAL SEAL
AGNES CRABTREE
NOTARY PUBLIC - CALIFORNIA
PRINCIPAL OFFICE IN
LOS ANGELES COUNTY
My Commission Exp. Aug. 27, 1982

Enclosures

Response to NRC Generic Letter 81-04
Emergency Procedures and Training for
Station Blackout Events
San Onofre 2&3

NRC Generic letter 81-04, Emergency Procedures and Training for Station Blackout Events, recommended measures to be taken by licensees to ensure that station blackout events can be accommodated. This is part of NRC Unresolved Safety Issue A-44. Specifically, it requested that current plant operations be reviewed to determine the licensees' capability to mitigate a station blackout event. Additionally applicants were to promptly implement, as necessary, emergency procedures and a training program for station blackout events. Review of procedures and training should consider, but not be limited to;

a. The actions necessary and equipment available to maintain the reactor coolant inventory and heat removal with only DC power available, including consideration of the unavailability of auxiliary systems such as ventilation and component cooling.

b. The estimated time available to restore AC power and its basis.

c. The actions for restoring offsite AC power in the event of a loss of the grid.

d. The actions for restoring offsite AC power when its loss is due to postulated onsite equipment failures.

e. The actions necessary to restore emergency onsite AC power. The actions required to restart diesel generators should include consideration of loading sequence and the unavilability of AC power.

f. Consideration of the availability of emergency lighting, and any actions required to provide such lighting, in equipment areas where operator or maintenance action may be necessary.

g. Precautions to prevent equipment damage during the return to normal operating conditions following resotration of AC power. For example, the limitations and operating sequence requirements which must be followed to restart the reactor coolant pumps following an extended loss of seal injection water should be considered in the recovery procedures.

In addition, generic letter 81-04 requested that an assessment of existing and planned facility procedures and training programs be furnished to the NRC for review.

Response

An evaluation was conducted to determine the nuclear steam supply system (NSSS) and balance of plant (BOP) requirements for achieving and maintaining stable plant conditions during a station blackout and achieving cold shutdown following restoration of AC power. The results of this evaluation are provided in response to items (a) through (f) of NRC generic letter 81-04 as follows:

A. Actions necessary and equipment available to maintain the reactor coolant inventory and heat removal with only DC power available.

1. Maintaining reactor cooland inventory:

Under blackout conditions there is no equipment available to increase the reactor coolant inventory, i.e., the loss of AC power prevents the use of the charging pumps. The reactor coolant system (RCS) pressure boundary will remain intact however, and there is no major loss of RCS inventory. Loss of RCS inventory is minimized as follows:

a. RCS letdown flow will be automatically isolated on loss of power.

b. Reactor coolant pump (RCP) controlled bleedoff isolation will be initiated by the operator 30 minutes into the event.

c. The containment isolation valves for the RCS sample lines are normally shut. Should a sample be in progress upon initiation of station blackout, the non-1E powered sample cooler isolation valves will fail shut. The sample lineup will then be secured prior to restoration of power.

d. The main steam isolation valves (MSIV's) and the steam generator continuous blowdown valves must be manually shut from the control room to isolate excessive secondary steam leakage. This will be accomplished by the operator manually initiating a main steam isolation signal (MSIS) at the start of the accident.

2. Maintaining decay heat removal:

Decay heat will be removed by natural circulation utilizing the steam generators as a heat sink. Upon reaching a low level in the steam generators due to the steam losses through the secondary safety valves, emergency feedwater actuation signals (EFAS) will be initiated. The turbine driven auxiliary feedwater pump will automatically start and supply feedwater to both steam generators.

Operator action will be required to complete the following:

a. Manual control of the feedwater flow from the turbine driven pump is required to match feedwater flow to decay heat removal once steam generator level is returned to normal.

b. Manual control of the atmospheric dump valves will be required to maintain secondary steam pressure just below the steam generator safety valve setpoint. This action will minimize the potential for a safety valve to fail open and prevent excessive RCS cooldown.

3. Additional considerations:

a. Required Instrumentation

The following NSSS instrumentation is required to monitor the RCS conditions during station blackout. All required instrumentaion is powered from 1E sources with control room indication available.

- o Pressurizer Level
- o Pressurizer Pressure
- o Cold Leg Temperature (wide range)
- o Hot Leg Temperature (wide range)
- o Steam Generator Level (narrow range)
- o Steam Generator Pressure
- o Neutron Flux Power Level (excore detectors)

b. Loss of Heating, Ventilating, and Air Conditioning (HVAC)

A review of all areas containing safety-related equipment required for shutdown was conducted to determine the effects of a loss of HVAC. The following areas contained a sufficiently high heat load during blackout conditions to warrant a detailed evaluation of the environmental conditions resulting from a loss of HVAC:

- o Containment
- o ESF Switchgear Rooms
- o Auxiliary Feedwater Pump Room

- o Vital Power Distribution Rooms
- o Control Room Panels
- o Control Room Area Panels

The evaluation concluded that the average temperatures attained in these areas are significatnly below those temperatures where equipment availability may be jeopardized. Therefore, no specific operator action to mitigate the effects of a loss of HVAC is required.

Although the average temperatures calculated are satisfactory, local heating of components may still occur. As a precautionary measure, the operator will be required to check the vital bus power supply (VBPS) inverters and the control room cabinet area panels approximately one hour after the initiation of the event. If local over-heating is detected, portable internal combustion engine driven ventilation equipment, available at the site, will be utilized to provide forced air ventilation until emergency HVAC is restored.

c. Natural Circulation Cooldown

The RCS must be maintained near normal operating temperature during the blackout conditions. This requirement exists to:

1. prevent steam bubble formation in areas of the RCS other than the pressurizer.

2. prevent violation of the technical specification shutdown margin (5.15%) due to unavailability of boric acid injection.

Natural circulation cooldown under blackout conditions will not be conducted.

d. Reactor Coolant Pump Seals

Test results have indicated that a loss of component cooling water (CCW) to the RCP's can be sustained for a time period in excess of 24 hours without a loss of RCP seal function.

e. Control Element Drive Mechanisms (CEDM's)

During the blackout, cooling is lost to the CEDM's. The CEDM coils have been designed such that a loss of cooling for periods in excess of two hours will not cause equipment damage.

B. Estimated time available to restore AC power and its basis.

The estimated time available to restore AC power was evaluated based on the following considerations:

1. The time available before reactor coolant reaches saturated conditions.

2. Time available before pressurizer level is lost.

3. The time available before 1E station batteries are depleted.

A review of operating experience indicates that technical specification leakage rates provide a conservative estimate of expected plant conditions during blackout. Based on these leakage rates a blackout duration of at least two hours can be sustained without a loss of subcooled natural circulation or pressurizer level.

A study to estimate the capacities of the Class 1E batteries during a station blackout has been conducted. The Class-1E VBPS inverters will automatically shutdown when battery voltage reaches 105 vdc. This point defines the battery capacity (1.75 volts per battery cell). A blackout duration of at least two hours can be sustained under worst case conditions with no DC load shedding and without a loss of the VBPS inverters.

C. Actions for restoring offsite AC power in the event of a loss of the grid.

Actions for restoring offsite AC power in the event of loss of the grid are specified in System Operating Bulletins and Plant Emergency Operating Instructions. It is reiterated here that the San Onofre Nuclear Generating Station switchyard is a double bus arrangement supplied by both the Southern California Edison (SCE) and San Diego Gas and Electric Co. (SDG&E) grids and connected via six tie lines (four SCE and two SDG&E). The western grid system is considered very stable and capable of handling large faults. Since SCE has over 35 years of continuous sytem operation without a single blackout, the loss of the grid concurrent with the failure of emergency diesel generators to start and handle emergency loads, is considered a highly improbable event.

D. Actions for restoring offsite power when its loss is due to postulated onsite equipment failures.

No single onsite equipment failure can cause a station blackout event.

The actions for restoring offsite AC power are the same as those actions taken in the event of loss of the grid.

E. Actions necessary to restore emergency onsite AC power.

Restoration of emergency onsite AC power requires restoration of a 4.16 kV ESF bus. This will be accomplished automatically by restoration of the grid or availability of a diesel generator.

The primary consideration in returning the plant to normal conditions is to restore power to at least one train of class 1E 4.16 kV switchgear. This will be accomplished by regaining any one of the following AC power sources: Unit 2 reserve auxiliary transformer, Unit 3 reserve auxiliary transformer, either one of two fully redundant and separate diesel generator sets or from the Unit 2 auxiliary transformer following the removal of the disconnect link in the turbine generator isophase bus.

For all power sources identified above (with the exception of the diesel generators) the Class 1E 4.16 kV feeder breakers will sense the return of offsite power and shut automatically. Once a diesel generator set is available, it will attain rated speed and voltage and close its output breaker to its respective 4.16 kV bus.

The diesel generator sets are primed with fuel initially by a DC driven 3/4 horsepower fuel priming pump. These pumps are supplied from the Class 1E batteries.

Air start for the diesels is provided by pressurized air flasks isolated from the diesel by a DC powered solenoid valve. The valves will operate and provide air start capability beyond calculated battery lifetimes.

The diesel generator control relays, breaker closing coils and agastat sequencer timing relays are powered from Class 1E batteries. These devices will be operable beyond calculated battery lifetimes.

Once a diesel generator set is available, the diesel loading sequence identified in FSAR table 8.3-1 will be executed. The 1E station battery chargers will be energized and CVCS charging pumps will have power available immediately after the diesel generator output breaker is shut. With Class 1E DC sources supplied by the diesel and RCS inventory makeup available, the time available to restore offsite power is extended significantly.

Refer to section (G) below for precautions to prevent equipment damage during the return to normal conditions.

F. Availability of emergency lighting and actions required to provide such lighting as necessary.

Fixed emergency 8-hour sealed beam lighting units are provided in all areas required for safe shutdown. These areas include:

1. Auxiliary feedwater pump room

2. Diesel generator local control panel

3. Control room

4. Main steam atmospheric dump valve area

5. Switchgear rooms

6. Electrical penetration area

General area lighting is provided by lighting panels supplied from the non-Class 1E station batteries. This lighting will be available for a minimum of 90 minutes.

During the station blackout the only maintenance areas anticipated are in the vicinity of the diesel generator sets and the main turbine disconnect link in the isophase bus. Available portable lighting will be utilized for any maintenance actions.

G. Precautions to prevent equipment damage during the return to normal conditions following restoration of AC power.

The following events were evaluated to detemine precautions required to prevent equipment damage during the restoration of AC power:

- o inadvertent reactor coolant pump (RCP) restart
- o depressurization of the reactor coolant system (RCS)
- o excessive or uncontrolled RCS cooldown resulting in violation of shutdown margin technical specification limits, cooldown limits or loss of pressurizer level.
- o thermal shock to components

To prevent reenergizing the RCP's without oil lift pressure, the individual RCP breakers must be manually tripped by the operator prior to restoration of offsite power.

Inadvertent depressurization of the RCS was evaluated for an uncontrolled resumption of letdown flow, controlled bleedoff or primary sampling flow.

RCS letdown flow will automatically terminate on loss of non-1E power. Upon restoration of non-1E power, letdown flow will remain isolated.

Controlled bleedoff isolation will be initiated 30 minutes into the event. Restoration of AC power will not automatically reinitiate controlled bleedoff.

Primary sampling lines will remain isolated upon resotration of AC power.

Loss of control of RCS cooldown could result from an inadvertent increase in steam demand upon restoration of power. This is prevented by shutting the main steam isolation valves (MSIV's) as an immediate action upon initiation of station blackout.

There will be no automatic change in steam generator isolation valve position upon restoration of power and control of RCS cooldown will be maintained.

Thermal shock to components can result from the following:

1. Automatic restoration of cooling flow to components which have heated from contact with RCS water or steam flow to the steam generators.

2. Automatic drainage of RCS water or steam from the steam generators into cooler components.

With the RCS and steam generators isolated as described above, only consideration (1) is applicable. The RCP seals, normally cooled by component cooling water (CCW), lose cooling during the station blackout and subsequently heatup. Automatic restoration of full CCW flow to these seals could result in thermal shock. To prevent thermal shock to the RCP seals, CCW supply isolation valves will be manually shut from the control room prior to the restoration of power to the instrument air supply and/or re-energization of the CCW pumps. CCW to the RCP seals will be gradually restored under manual operator control.

Other components normally cooled by component cooling water, chilled water or saltwater cooling are not in direct contact with the RCS water or steam from the steam generators. The rise in temperature in these components is therefore not expected to be significant. Automatic restoration of these cooling systems is not expected to result in thermal shock.

The CEDM shroud area, reactor vessel supports and cavity, the containment penetrations and main steam line forging will lose HVAC during the blackout. Automatic restoration of HVAC will not result in thermal shock to components.

The restoration of AC power will place the plant in a stable condition with further action to restore normal conditions under direct operator control. Emergency procedures and training will be provided to incorporate guidelines under development to conduct plant cooldown.

The precautions and operator actions identified above will preclude equipment damage upon restoration of AC power sources.

With regard to the annual requalification and training program for San Onofre Units 2&3 operators, it has been detemined that such programs include training on all emergency procedures including simulator exercises, to the extent possible, involving the postulated loss of all AC power with decay heat removal being accomplished by natural circulation and the steam-driven auxiliary feedwater system.