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SUBJECT: Forwards responses to Instrumentation & Control Sys Branch Questions 222.41-44 transmitted in NRC 810416 ltr re IE Bulletins 79-22,79-27 & 80-06 & control sys failures. FSAR will be revised to reflect encl responses in next amend.

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September 3, 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 of April 16, 1981 identified four Instrumentation and Control Systems Branch concerns (Questions 222.41-44) to be addressed prior to fuel load. Enclosed please find seven (7) copies (NRC Mail Code B028) of the responses to these questions. The San Onofre Units 2 and 3 FSAR will be revised to reflect these responses in the next amendment.

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

Very truly yours,

Enclosure

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Question 222.41

Loss of Non-Class IE Instrumentation and Control Power System Bus During Power Operation (IE Bulletin 79-27

If reactor controls and vital instruments derive power from common electrical distribution systems, the failure of such electrical distribution systems may result in an event requiring operator action concurrent with failure of important instrumentation upon which these operator actions should be based. This concern was addressed in IE Bulletin 79-27. On November 30, 1979, IE Bulletin 79-27 was sent to operating license (OL) holders, the near term OL applicants (North Anna 2, Diablo Canyon, McGuire, Salem 2, Sequoyah, and Zimmer), and other holders of construction permits (CP), including (name of Plant). Of these recipients, the CP holders were not given explicit direction for making a submittal as part of the licensing review. However, they were informed that the issue would be addressed later.

You are requested to address these issues by taking IE Bulletin 79-27 Actions 1 thru 3 under "Actions to be Taken by Licensees", within the response time called for in the attached transmittal letter, complete the review and evaluation required by Actions 1 thru 3 and provide a written response describing your reviews and actions. This report should be in the form of an amendment to your FSAR (if the FSAR has not already been printed it may be incorported in the original FSAR) and submitted to the NRC Office of Nuclear Reactor Regulations as a licensing submittal.

Response

Although not previously required to formally respond to the concerns of IE Bulletine 79-27, SCE has performed a review of the effects of loss of non-IE instrument and control power during operation of SONGS Units 2 and 3. The scope and results of this review respond to Actions 1 and 2 of IE Bulletin 79-27.

SCE used a three-part approach to systematically review the effect of loss of non-IE power:

(1) Systems analyses

(2) Testing and Modifications

(3) Procedures review

The results of each part are discussed on the following page.

1. Systems analyses

A review was performed on every safety-related elementary circuit for possible IE/non-IE interactions. All modes of system operation were considered, i.e., automatic, manual, etc. The objective of this part of the analysis was to identify unacceptable interactions and correct them.

In addition, individual non-IE bus failures were reviewed to identify and list all the plant equipment and instrumentation that would be affected, and their modes of failure. The objectives of this portion of the analyses were to determine the effect on control room displays and to establish a basis for subsequent procedure changes and training. In all cases, after completion of the modifications described below, it was verified that the plant could safely achieve a cold shutdown condition. These modifications will be completed prior to fuel load on SONGS 2 and 3.

It should be noted that the FSAR addresses as part of the plant design basis single failure of any safety-related component or any train of safety related power including any class IE bus failure. This is documented in exisiting failure modes and effects analyses. Exisiting procedures to bring the plant to a safe cold shutdown condition are consistent with this design. Consequently, Class IE bus failures were not addressed in the above review.

2. Testing and modifications

As result of the safety-related elementary circuit review, two areas of unacceptable interaction with non-IE components were identified. The charging pump controls will be changed to incorporate a 4-position switch to insure that the non-IE control system components are bypassed when operating in the manual mode. The pressurizer IE heater controls were similary modified to provide a bypass of the non-IE control system components when these heaters are operated in the manual mode.

These two changes insure that the charging pumps and IE powered pressurizer heaters can be manually operated to reach cold shutdown using diesel power in the event offsite power is lost.

To provide an additional level of confidence that the analyses described above identified all areas where non-IE power interacted unacceptable with IE systems, the start-up acceptance test procedure to verify safety load group independence (per Reg. Guide 1.41) was reviewed to confirm that this test would be performed in a manner to also verify each load group's independence of non-IE power. This test was performed with applicable non-IE buses deenergized, and acceptable safely system performance was verified.

3. Procedures Review

As a result of the non-IE instrument bus failure review described in item 1, the plant operating instructions were reviewed to verify that the operators were directed to the appropriate control room indications to bring the plant to safe cold shutdown condition in the event of non-IE power failure. On SONGS Units 2 and 3, non-IE power is supplied from a 4 kV source to two seperate instrument buses. Loss of the non-IE 4 kV source is annunciated in the control room. Summarizing, there are three events of interest:

(a) Complete loss of offsite power

In this case both non-IE instrument buses 1 and 2 are lost. As a consequence of losing offsite power, the reactor trips and the turbine trips.

(b) Loss of non-IE instrument bus 1

In this case, loss of the feedwater control system results in turbine trip and reactor trip.

(c) Loss of non-IE instrument bus 2

In this case, upon determination that power has been lost and cannot be recovered by transferring power to the opposite unit, the procedures will direct the operator to manually trip the reactor.

In all of the above three cases, the operating instructions provide the operator with similar directions to achieve safe shutdown: once in hot standby, the operator verifies bus deenergization and refers to the instruction on Emergency Plant Shutdown (S023-3-5.1). This instruction cautions the operator to use IE instrumentation displays in the control room to achieve plant shutdown. IE instrumentation is readily identified by color coding on the name tag which corresponds to safety train designation (i.e., red, yellow, blue or green). OI-S023-3-5.1 also contains diagnostics and corrective actions for degraded power supplies. The control room alarms and indications that alert the operator to loss of vital bus power are displayed on the ESF electrical power mimic panel in the control room. The Class IE power system from the 4 kV diesel buses to the 125 V vital buses are displayed and loss of voltage is annunciated.

The operating instructions described above are considered adequate for safe plant operation. The information from the detailed bus failure analysis described in item (1) above can be used in operator training exercises to define BOP recovery paths for expected failed instrument responses.

In response to Action 3 of IE Bulletin 79-27, IE Circular 70-02 was re-reviewed to include both IE and non-IE power supply inverters. Our original review regarding the IE vital bus power supply (VBPS) inverters concluded that the VBPS inverters have a manual transfer switch and as such perform acceptably and are not subject to the Circular's concerns. No modifications or additional administrative controls are required for the VBPS inverters.

SONGS 2 and 3 utilize non-IE SCI power supply inverters of the type referenced in the Circular to supply power to the plant computer. To date, some difficulty has been encountered due to spurious transfers of the static switch under voltage transients within the specified values. This problem is in a non-safety related application and is being addressed as a non-conformance item. Corrective action to either increase the transfer setpoint or replace the switch will be taken prior to fuel load.

Question 222.42

Engineered Safety Features (ESF) Reset Controls (IE Bulletin 80-06)

If safety equipment does not remain in its emergency mode upon reset of an engineered safgeguards actuation signal, system modificiation, design change or other corrective action should be planned to assure that protective action of the affected equipment is not compromised once the associated actuation signal is reset. This issue was addressed in IE Bulletin 80-06 (enclosed). For facilities with operating licenses as of March 13, 1980, IE bulletin 80-06 required that reviews be conducted by the licensees to determine which, if any, safety functions might be unavailable after reset, and what changes could be implemented to correct the problem

For facilities with a construction permit including OL applicants Bulletin 80-06 was issued for information only.

The NRC staff has determined that all CP holders, as a part of the OL review process are to be requested to address this issue. Accordingly, you are requested to take the actions called for in Bulletin 80-06 Actions 1 thru 4 under "Actions to be Taken by Licensees" Within the response time called for in the attached transmittal letter, complete the review verifications and description of corrective actions taken or planned as stated in Actions 1 thru 3 and submit the report called for in Action 4.

Response

The NRC concern expressed in IE Bulletin 80-06 regards emergency equipment not remaining in its emergency mode following reset of an ESFAS signal. SCE has evaluated the concern with regard to the San Onofre Units 2 and 3 design and the results of the evaluation will be provided in Amendment No. 26 to the San Onofre Units 2 and 3 FSAR which is scheduled for submittal to the NRC in September, 1981.

Question 222.43

Qualification of Control Systems (IE Information Notice 79-22

Operating reactor licensees were informed by IE Information Notice 79-22, issued September 19, 1979, that certain non-safety grade or control equipment, if subjected to the adverse environment of a high energy line break, could impact the safety analyses and the adequacy of the protection functions performed by the safety grade equipment. Enclosed is a copy of IE Information Notice 79-22, and reprinted copies of an August 20, 1979 Westinghouse letter and a September 10, 1979 Public Service Electric and Gas Company letter which address this matter. Operating Reactor licensees conducted reviews to determine whether such problems could exist at operating facilities.

We are concerned that a similar potential may exist at light water facilities now under construction. You are, therefore, requested to perform a review to determine what, if any, design changes or operator actions would be necessary to assure that high energy line breaks will not cause control system failure to complicate the event beyond FSAR analysis. Provide the results of your reviews including all identified problems and the manner in which you have resolved them to NRR.

The specific "scenarios" discussed in the above referenced Westinghouse letter are to be considered as examples of the kinds of interactions which might occur. Your review should include these scenarios. where applicable, but should not necessarily be limited to them. Applicants with other LWR designs should consider analogous interactions as relevant to their designs.

Response:

SCE has initiated a program to confirm that control system failures resulting from High Energy Line Breaks (HELB) do not result in event consequences more adverse than those considered in the FSAR analyses for Chapter 15.

The program subtasks are:

(1) Identification of important (non-safety) control systems, i.e., those systems whose failure or malfunction could adversely affect HELB event consequences.

(2) Determination of adverse failure modes of the important control systems for each HELB event type.

(3) Determination of impacted components whose failure could lead to the control system failure modes identified in Subtask (2)

(4) Qualitative analysis of combined effect of HELB event with control system failure(s).

If acceptable consequences either in terms of being bounded by exisiting FSAR Chapter 15 analyses or being within acceptance criteria guidelines cannot be shown, then event specific quantitative analysis would be performed for those events whose consequences were shown to be unacceptable.

If acceptable consequences cannot still be shown by event specific analysis, then some from of protection will be required. Some possibilities include:

1) Qualification of the component for the expected environment.
2) Relocation of the component to prevent inpact due to the environment.
3) A combination of items 1 and 2.
4) Physical protection (i.e., shields, barriers) to be provided to prevent environmental impact on the component.

Subtask 1 has been completed with all the important non-safety control systems identified. Subtasks 2 and 3 are currently ongoing actions with Subtask 4 to follow completion of subtasks 2 and 3.

Question 222.44

Control System Failures

The analyses reported in Chapter 15 of the FSAR are intended to demonstrate the adequacy of safety systems in mitigating anticipated operational occurrences and accidents. Both Congress and ACRS have raised an issue in this area. Commissioner Ahearne has responded to Congress regarding this issue (Refer to attachment to this enclosure) and part of his response referred to control system reviews to be performed in connections with OL licensing.

Based on the conservative assumptions made in defining these Chapter 15 design-basis events and the detailed review of the analyses by the staff, it is likely that they adequately bound the consequences of single control system failures.

To provide assurance that the design basis event analyses adequately bound other more fundamental credible failures you are requested to provide the following information:

(1) Identify those control systems whose failure or malfunction could seriously impact plant safety.

(2) Indicate which, if any, of the control systems identified in (1) receive power from common power sources. The power sources considered should include all power sources whose failure or malfunction could lead to failure or malfunction of more than one control system and should extend to the effects of cascading power losses due to the failure of higher level distribution panels and load centers.

(3) Indicate which, if any, of the control systems identified in (1) receive input signals form common sensors. The sensors considered should include, but should not necessarily be limited to, common hydraulic headers or impulse lines feeding pressure, temperature, level or other signals to two or more control systems.

(4) Provide justification that any simultaneous malfunctions of the control systems identified in (2) and (3) resulting from failures or malfunctions of the applicable common power source or sensor are bounded by the analyses in Chapter 15 and would not require action or response beyond the capability of operators or safety systems.

Response:

SCE has initiated a program to provide assurance that the Chapter 15 analyses of the FSAR adequately bound the concerns identified in the question.

(1) The following control systems have been identified to impact Chapter 15 analyses:

Feedwater Control System (FWCS)
Turbine Generator Control System (TGCS)
Steam Bypass Control System (SBCS)
Atmospheric Dump Valve Control System (ADVCS)
Boron Control System (BCS)
Reactor Regulating System (RRS)
Control Element Drive Mechanism Control System (CEDMCS)
Pressurizer Pressure Control System (PPCS)
Pressurizer Level Control System (PLCS)

(2) The following common power sources have been identified as supplying power to the control systems listed in item (1):

a. 208/120 VAC (V Alternate Current) distribution panel 2Q0612:
Supplies power to CEDMCS, BCS, TGCS, and RRS.

b. 208/120 VAC distribution panel 2Q065:
Supplies power to CEDMCS, FWCS, SBCS, and the RRS.

c. 480 V MCC (Motor Control Center) distribution panel BO:
Supplies power to 208/120 VAC distribution panel 2Q0612

d. 480 MCC distribution panel 2BX:
Supplies power to 209/120 VAC distribution panel 2Q065

e. 125 VAC (V Direct Current) vital distribution panel 2D1P1:
Supplies power to ADVCS, PLCS and PPCS.

f. 125 VDC vital distribution panel 2D2P1:
Supplies power to ADVCS, PLCS, and PPCS.

(3) The following common sensors and common instrumentation taps/lines have been identified for the control systems listed in item (1):

a. Pressurizer Pressure Signal to RRS, SBCS, and PPCS
b. Main Steam Flow Signal to FWCS and SBCS
c. Common instrumentation tap/line from pressurizer to RRS, PPCS, SBCS, and PLCS (for pressure and level measurement).

(4) A preliminary assessment of the control systems listed in item (1) have indicated that any simultaneous malfunctions of these control systems resulting from failures or malfunctions of the applicable power source (item 2) are bounded by the analyses presented in Chapter 15. Therefore, no action or response beyond the capability of operators or safety systems is required.

Various failure modes of the signals listed in item (3) (fails low, fails high, etc.) were considered. A preliminary assessment of RCS behavior again indicated that malfunctions arising from common sensor or common tap/line failures would not require action or response beyond the capability of operators or safety systems, and are bounded by the analyses of Chapter 15 of the FSAR.

A more in-depth evaluation is currently in progress. Prudent engineering judgement is being used to demonstrate that the Chapter 15 anaylses bound the consequences of control system malfunctions resulting from failures or malfunctions of the applicable common power sources or sensors. If consequences from the qualitative evaluation are not acceptable, then analyses as required will be performed. If consequences from the analyses are still not acceptable, than some provisions, which would eliminate the concerns, e.g., plant operation and operator action would have to be stipulated. The results from the in-depth assessment will be completed prior to fuel load.