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December 29, 1980

Director of Nuclear Reactor Regulation
Attention: D. M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

Subject: Docket No. 50-206
Systematic Evaluation Program
Topics VI-7.B, VI-7.C, VI-10, VII-3, VIII-2, VIII-3
San Onofre Nuclear Generating Station
Unit 1

Your letter dated September 16, 1980, requested additional information regarding the inverters at San Onofre Unit 1 for the subject topics review. Provided as an enclosure is the response to that request. This response addresses the instrument inverters powering Vital Bus 1, 2 and 3 and the inverter powering the Operational Radiation Monitoring System.

If you have any questions regarding this matter, please let me know.

Very truly yours,

K P Baskin

Enclosure

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ENCLOSURE

ITEM 1

Quantify the number of instrument inverters in your plant and for each inverter:

a. identify the inverter and its power supplies; and

b. describe the switching features that are provided to switch inverter power supplies and inverter loads (including synchronization circuits).

RESPONSE

a. The instrument inverters are designated as Inverter No. 1, Inverter No. 2, Inverter No. 3, and Inverter No. 4. The Inverter No. 1, No. 2, and No. 3 are rated 5 kVA and Inverter No. 4 is rated 500 VA.

   The 125V DC Bus No. 1 supplies power to all four inverters. The 125V Battery No. 1 is always connected to the DC Bus No. 1. This DC Bus is also connected to any one of the following power supplies:

   1. 125V DC Battery Charger Set A from 480V switchgear No. 1.

   2. 125V DC Battery Charger Set B from 480V switchgear No. 2.

b. As mentioned in Response 1.a above, all the inverters are connected to 125V DC Bus No. 1. The switching of power supplies to the inverters is provided by switching Battery Chargers A or B to the 125V DC Bus No. 1. Manual switching is provided to switch battery chargers to this bus.

   Inverter No. 1, No. 2 and No. 3 supply power to the 120 V AC Vital Bus No. 1, No. 2 and No. 3, respectively, through automatic transfer switches and the inverter loads are connected to these buses. In case of an inverter failure, the vital bus power supply would be switched automatically to the 120V AC emergency power supply bus by the automatic transfer switch. The emergency bus is energized through a 480/120V single phase transformer. The high side of this transformer is connected through a manual transfer switch to the Motor Control Center No. 2. As an alternate, this transformer may be manually connected to the Motor Control Center No. 1.

   Inverter No. 4 supplies power to the Operation Radiation Monitoring System. In case of inverter failure, the loads are transferred automatically to Regulated Bus No. 4 by an automatic transfer switch. Regulated Bus No. 4 receives power directly from the 120V AC Vital Bus No. 4.

   Synchronization circuits are not provided for the inverter power supplies or the inverter loads.

ITEM 2

Provide the requirements for:

a. testing the transfer path's described in your responses to 1 above, and

b. limiting the number of redundant load groups that may be placed on any maintenance power source during each operating condition.

RESPONSE

a. The battery charger sets A and B are demonstrated operable at least once per seven days. This test is described in Technical Specification Section 4.4D, Emergency Power System Periodic Testing.

The automatic transfer switches connected to the inverter output side are inspected and operated during plant shutdown as a part of inverter inspection and maintenance.

b. No power source is designated as the maintenance power source at San Onofre Unit 1. As indicated in 1b, in the event of inverter failure, the loads would be connected to MCC 2.

The conditions limiting reactor operation due to the unavailability of inverter loads is specified in Technical Specification 3.7, Auxiliary Electrical Supply. It specifies any three of vital buses 1, 2, 3, and 4 and DC Bus No. 1 must be maintained operable to make the reactor critical or maintained critical. Vital Bus No. 4 does not receive power through an inverter.

ITEM 3

Describe the consequence of one or more load groups on a single dc source losing power (e.g., automatic initiation of ECCS, automatic initiation of transfer from ECCS injection made to recirculation mode, loss of indication in the control room, loss of annunciators, loss of plant communications, loss of emergency telephones).

RESPONSE

As indicated in Item 1b, a loss of power to the inverter load groups would result in the automatic transfer of the load groups to the MCC 2 power source. A failure of the dc power source and the simultaneous failure of the inverter automatic transfer switch would result in the loss of the 120V AC bus powered through that particular inverter. The remaining inverter load groups would be automatically connected to MCC 2. As part of a response to IE Bulletin 79-27, provided as an attachment, a Failure Modes and Effects Analysis was performed on the loss of each 120V ac vital bus and the utility bus. That analysis included Vital Busses 1, 2 and 3 which are powered through inverters. The analysis assures that only one bus fails at any one time. The results indicate that the loss of a vital bus or a utility bus will not prevent achieving cold shutdown. In response to an Office of Inspection and Enforcement, Region V request, additional work is being done on the analysis. This work will be available to Region V prior to the startup of Unit 1.

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May 15, 1980

U. S. Nuclear Regulatory Commission
Office of Inspection and Enforcement
Region V
1990 North California Boulevard
Suite 202, Walnut Creek Plaza
Walnut Creek, California 94596

Attention: Mr. R. H. Engelken, Director

DOCKET No. 50-206
SAN ONOFRE - UNIT 1

Dear Sir:

IE BULLETIN 79-27
LOSS OF NON-CLASS 1-E INSTRUMENTATION AND CONTROL POWER SYSTEM BUS DURING OPERATION

Reference is made to your correspondence of November 30, 1979, forwarding IE Bulletin 79-27. Identified therein was the possibility of a failure of class 1-E or non-class 1-E buses supplying power to safety and non-safety related instrumentation and control systems.

Responses to the individual items specified in the Bulletin are listed below:

Item 1 "Review the class 1-E and non-class 1-E buses supplying power to safety and non-safety related instrumentation and control systems which could affect the ability to achieve a cold shutdown condition using existing procedures or procedures developed under item 2 below. For each bus:

(a) Identify and review the alarm and/or indication provided in control room to alert the operator to the loss of power to the bus.

(b) Identify the instrument and control system loads connected to the bus and evaluate the effects of loss of power to these loads including the ability to achieve a cold shutdown condition.

(c) Describe any proposed design modifications resulting from these reviews and evaluations, and your proposed schedule for implementing those modifications."

Response: In response to this item, a Failure Mode and Effects Analysis was performed for each of the four vital buses and the utility bus. The analysis consisted of identifying each load on the bus and analyzing the effect of its loss on the plant. Only one of the five buses is assumed to fail at any one time. These effects were then reviewed to assess their overall impact on the plant's ability to achieve cold shutdown.

Summary of Failure Mode and Effects Analysis

The results of the Failure Mode and Effects Analysis (FMEA) indicate loss of a vital bus or the utility bus will not prevent achieving cold shutdown. Significant effects resulting from the loss of each bus are summarized below:

1. Loss of vital bus 1 results in the loss of normal letdown, numerous false alarms, loss of the Tsat meter and loss of Channel I redundant instrumentation and loss of one power range NIS channel. All reactor coolant flow instrumentation remains operational.

   DISCUSSION - Loss of this bus does not result in the plant failing to meet minimum operational and redundancy requirements for instrumentation powered by the 120 VAC bus system. Excess letdown remains available on loss of vital bus 1.

2. Loss of vital bus 2 results in numerous false alarms, loss of channel II redundant instrumentation and loss of one power range NIS channel. All reactor coolant flow instrumentation remains operational.

   DISCUSSION - Loss of this bus does not result in the plant failing to meet minimum operational and redundancy requirements for instrumentation powered by the 120 VAC bus system.

3. Loss of vital bus 3 results in numerous false alarms and loss of Channel III redundant instrumentation and loss of one power range NIS channel. All reactor coolant flow instrumentation remains operational.

   DISCUSSION - This bus does not result in the plant failing to meet minimum operational and redundancy requirements for instrumentation powered by the 120 VAC bus system.

4. Loss of vital bus 4 results in numerous false alarms, loss of automatic and manual rod control (rods remain tripable), loss of automatic and manual control of steam dump from the Control Room, loss of normal and excess letdown and loss of one power ranger NIS channel.

   DISCUSSION

   Although the rod control system is not operable, the rods are still tripable using a manual trip or through a signal generated from the reactor protection system.

   Loss of Control Room steam dump control does not prevent steam relieving capability because the steam dump system is secondary to the main steam safety valves. However, steam dump system capability will be required to achieve cold shutdown. Therefore, local operation of steam dump valves will need to be initiated, per procedure addressed in item 2.

   On loss of letdown there would still be adequate indication of the RCS level and pressure. The operator could secure charging as required.

5. Loss of the utility bus results in a loss of excess letdown and an increase in Reactor Coolant Pump (RCP) seal injection.

   DISCUSSION - Loss of the utility bus does not isolate normal letdown. Therefore, loss of excess letdown and an increase in RCP seal injection can be accomodated.

Although the failures described above do not prevent achieving cold shutdowns, two design modifications would enhance the operator's control and recognition of plant conditions.

1. Install indicator lights in the control room to alert the operator as to which bus is experiencing a loss of power. This will be completed prior to returning to power at the completion of the current refueling outage.

2. Place the power supply to the solenoid valve of the following valves on separate buses: CV202, CV203, CV204. These three valves are the isolation valves on the three normal letdown orifices. This would prevent complete isolation of normal letdown on loss of one bus. This change will be completed during the next maintenance outage of sufficient duration.

Item 2: "Prepare emergency procedures or review existing ones that will be used by control room operators, including procedures required to achieve a cold shutdown condition, upon loss of power to each class 1-E and non-class 1-E bus supplying power to safety and non-safety related instrument and control systems. The emergency procedures should include:

(a) The diagnostics/alarms/indicators/symptom resulting from the review and evaluation conducted per item 1 above.

(b) The use of alternate indication and/or control circuits whch may be powered from other non-class 1-E or class 1-E instrumentation and control buses.

(c) Methods for restoring power to the bus.

Describe any proposed design modification or administrative controls to be implemented resulting from these procedures, and your proposed schedule for implementing the changes.

Response: We are presently reviewing existing procedures to determine any changes that may be appropriate to accomodate the effects identified in the FMEA. In addition, a new procedure will be developed for the loss of a 120V AC bus which will include the following:

a) The diagnostics/alarms/indicators/symptoms resulting from the loss of a 120V AC bus as developed in Failure Modes and Effects Analysis.

b) The use of alternate indication and/or control circuits which may be powered from other non-class 1-E or class 1-E instrumentation and control buses.

c) Methods for restoring power to the bus.

d) Methods to be used in bringing the plant to a cold shutdown condition.

This new procedure and changes to existing procedures will be implemented prior to return to power at the completion of the current refueling outage.

Item 3: "Rereview IE Circular No. 79-02, Failure of 120 Volt Vital AC Power Supplies, dated January 11, 1979, to include both class 1-E and non-class 1-E safety related power supply inverters. Based on a review of operating experience and your re-review of IE Circular No. 79-02, describe any proposed design modifications or administrative controls to be implemented as a result of the re-review.

<u>Response:</u> Based on the review of IE Circular 79-02, no design modifications or administrative controls are required as the bus arrangement and equipment types used at San Onofre Unit 1 are different than those addressed in the Circular.

Should you have any questions regarding this matter, please contact me.

Sincerely,

H. L. Ottoson

H. L. Ottoson
Manager of Nuclear Operations

Subscribed and sworn to before me this
15th day of May 1980.
Dona Mary Wilcomb

OFFICIAL SEAL
DONA MARY WILCOMB
NOTARY PUBLIC - CALIFORNIA
PRINCIPAL OFFICE IN
LOS ANGELES COUNTY
My Commission Expires June 18, 1981

cc: Director, U. S. Nuclear Regulatory Commission
Office of Inspection and Enforcement