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SUBJECT: Part 21 rept re failure to postulate unavailability of vital dc bus in conjunction w/auxiliary feedwater (AFW) isolation design. AFW isolation logic modified w/Westinghouse involvement. Operation will resume upon completion of mods.

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September 22, 1987

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United States Nuclear Regulatory Commission
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USNRC-DS
1987 SEP 28 A 9:51

SHEARON HARRIS NUCLEAR POWER PLANT UNIT 1
DOCKET NO. 50-400/LICENSE NO. NPF-63
10CFR PART 21 NOTIFICATION

Dear Dr. Grace:

In accordance with 10CFR21.21, Carolina Power and Light Company (CP&L) is hereby providing initial notification of the existence of a defect in the design of the Engineered Safeguard Features Actuation System at the Shearon Harris Nuclear Power Plant. On September 22, 1987, it was concluded that the failure to postulate unavailability of a vital DC bus in conjunction with the auxiliary feedwater isolation design described below constitutes a defect under 10CFR Part 21.

DESCRIPTION OF DEFECT

On-site Nuclear Safety raised a question on the analysis for cases where a loss of the vital DC bus 1B-SB is postulated coincident with a loss of off-site power. It was found that the plant response would be more limiting than that described in the FSAR. This defect led to consideration of three new accident scenarios. Two of the new accident scenarios were reanalyzed and the third scenario required a design change. The new scenarios are as follows:

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Scenario I: The loss of vital DC bus 1B-SB coincident with a loss of off-site power causes loss of one motor driven AFW pump and the turbine driven AFW pump. The current FSAR analysis takes credit for more than one AFW pump.

Scenario II: The inadvertent actuation of a relay causes isolation of AFW flow to one intact steam generator. This is different from the analysis of Chapter 15 of the FSAR.

Scenario III: The loss of vital DC bus 1B-SB coincident with a loss of off-site power allowed the Engineered Safeguard Feature Actuation System to isolate AFW from all three steam generators.

Further discussion is provided below on the features of the design that resulted in Scenario III.

As shown in FSAR Figure 8.1.3-3 (Attachment 1), DC bus 1B-SB is a power supply to the inverters supplying instrument busses SII and SIV. The AC power supply to these inverters is through train B safety-related, diesel generator connectable AC busses. Upon a loss of DC bus 1B-SB, the instrument busses remain powered via the AC input to the inverters. However, this power supply is deenergized upon a postulated loss of off-site power. Emergency power is supplied by the 1B-SB emergency diesel generator; however, it requires DC bus 1B-SB to power the starting air valves, field flashing and breaker control power. Since the DC bus is also postulated to fail, the diesel generator will not be available, and the two instrument busses will deenergize.

Instrument bus SII is the power supply for Process Instrument Cabinet (PIC) 2, and bus SIV is the power supply for PIC 4. In addition, these busses provide power to the Solid State Protection System (SSPS) train B. Upon a loss of power to the PICs, the instrument bistables deenergize to a "fail-safe" position. As shown in FSAR Figure 7.1.1-1 (Attachment 2), the output of these bistables, referred to as Channel II and Channel IV, is input into both trains of solid state logic. The two deenergized PICs provide trip signals to the Train A logic which will respond to the input. This is sufficient to complete the required 2/3 logic even if the valid Channel III input remains untripped.

Shearon Harris Technical Specification 3.3.2 requires the capability to automatically isolate AFW to a faulted steam generator. As shown in FSAR Figure 7.2.1-1 (Attachment 3), this requirement is met by comparing steam generator pressures from instrument channels 2, 3, and 4 using a two out of three logic. The failure of any one channel will not cause inadvertent actuation, and since the bistables deenergize to actuate, the failure of any one channel will not prevent actuation when required. Since the postulated failure of DC bus 1B-SB causes a loss of both channels 2 and 4, the actuation logic for AFW isolation will be made up and AFW isolation will occur for all three steam generators.

The failure of DC bus 1B-SB causes the turbine driven AFW pump to fail since it relies on this power supply for speed control. Since AC power is also unavailable to power the 1B-SB motor driven AFW pump, it is not available. This leaves only the 1A-SA motor driven AFW pump. With only the 1A-SA pump operating, an interlock required by Technical Specification 3.7.1.2 closes the valve in the pump recirculation line to increase the flow available to the steam generators, and there is no remaining flowpath to ensure a minimum flow and protect the 1A-SA pump.

ANALYSIS

Scenarios I & II were the subject of specific review and reanalysis of the FSAR Chapter 15.0 events that required AFW flow to be available. The analysis demonstrated that 430 gpm of AFW flow (capacity of 1 motor driven AFW pump) was sufficient to satisfy FSAR acceptance criteria for Scenario I. For Scenario II, loss of flow to one intact SG, the FSAR acceptance criteria were still satisfied. The same computer codes were utilized with the only change to analysis methodology being the use of the ANSI/ANS-5.1-1979 "Decay Heat Power In Light Water Reactors". The previous FSAR analysis used the 1971 version of this standard. The new decay heat curve is acceptable because it has been reviewed and accepted by the NRC on other dockets (South Texas & Diablo Canyon). The 1971 version was used for LOCA analysis.

With regard to Scenario III, the loss of all AFW on a failure of DC bus 1B-SB coincident with a loss of off-site power is a more limiting single failure than is currently considered in the FSAR Chapter 15 accident analysis.

Based on a detailed review of other Engineered Safeguards Features Actuation Systems, CP&L believes that the same defect does not exist in other plant systems.

The affected protection system was a combined design effort by Ebasco Services, Inc., CP&L's architect/engineer, and Westinghouse Corporation, the NSSS supplier.

CORRECTIVE ACTIONS

The plant was shut down on September 15, 1987 and was taken to mode 4 on September 16, 1987 awaiting results of analyses performed jointly by CP&L and Westinghouse. The plant will remain below mode 3 where the AFW system is not required to be operable until corrective actions are complete.

Reanalysis as described above was completed on September 22, 1987 and reviewed and accepted by the Plant Nuclear Safety Committee as a basis for restart. In parallel, CP&L has modified the AFW isolation logic with Westinghouse involvement to ensure that a single failure will not cause an unanalyzed condition due to inadvertent isolation of AFW to steam generators. The modification changes the channel IV bistables from "deenergize to actuate" to "energize to actuate". This ensures that a single failure of a power supply will not cause inadvertent actuation of AFW isolation function. Thus, the postulated loss of all AFW is prevented. This modification is expected to be complete by September 23, 1987.

With satisfactory completion of the installation and testing of the modification, CP&L has determined that the plant is safe for continued operation. In addition, the analysis for Scenarios I & II demonstrate that the most limiting single failures have acceptable consequences. CP&L therefore plans to resume operation upon completion of the modification and testing.

Yours very truly,

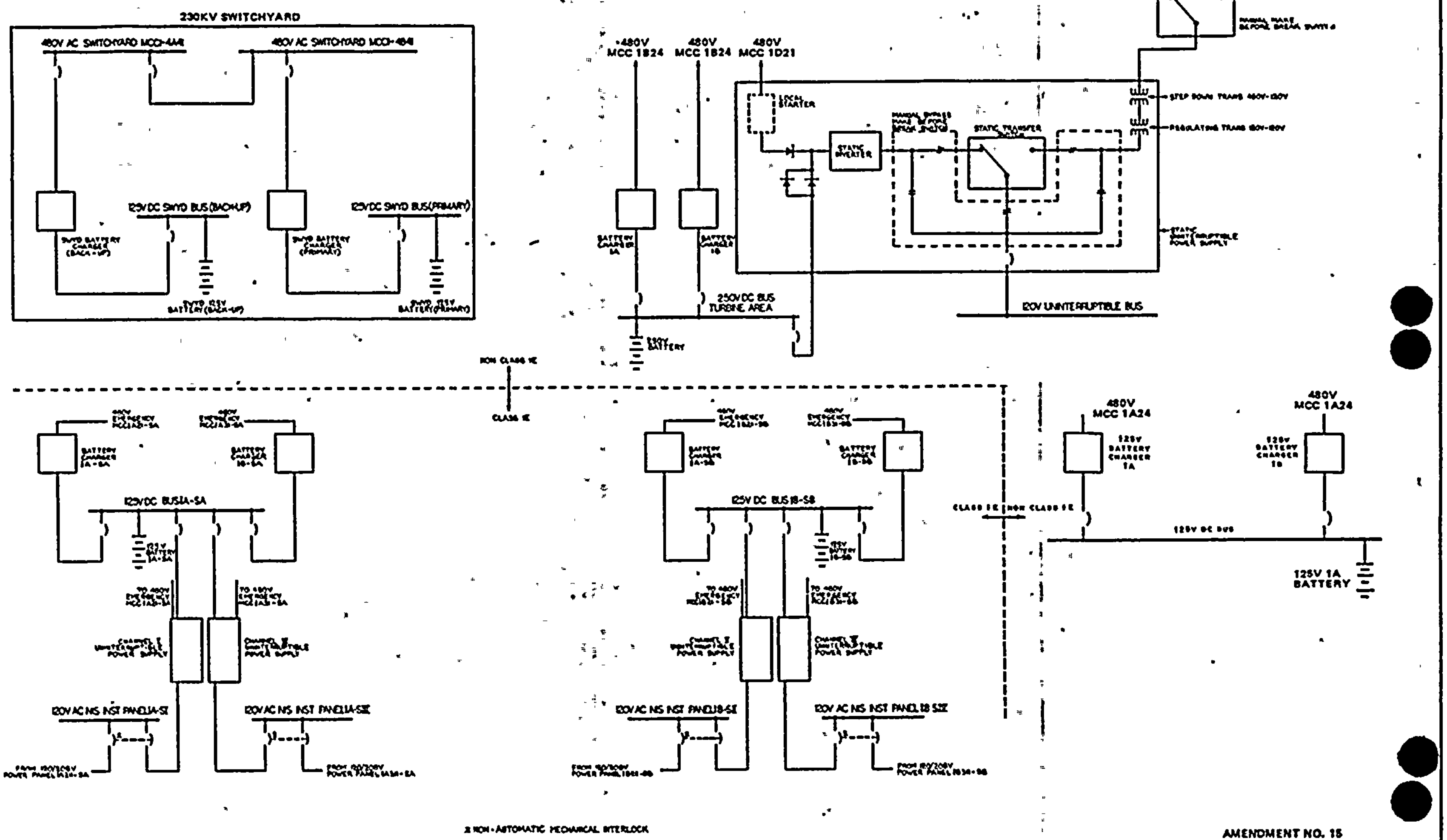
R. A. Watson
Vice President
Harris Nuclear Project

RAW/AJH:dj

Attachments (3)

cc:	Messrs.	B. Buckley (NRR)	w/a
		G. Maxwell (NRC-SHNPP)	w/a
		M. Gagliardi (Ebasco)	w/a
		G. O. Percival (Westinghouse)	w/a
		NRC Document Control Desk	w/a

ATTACHMENT 1



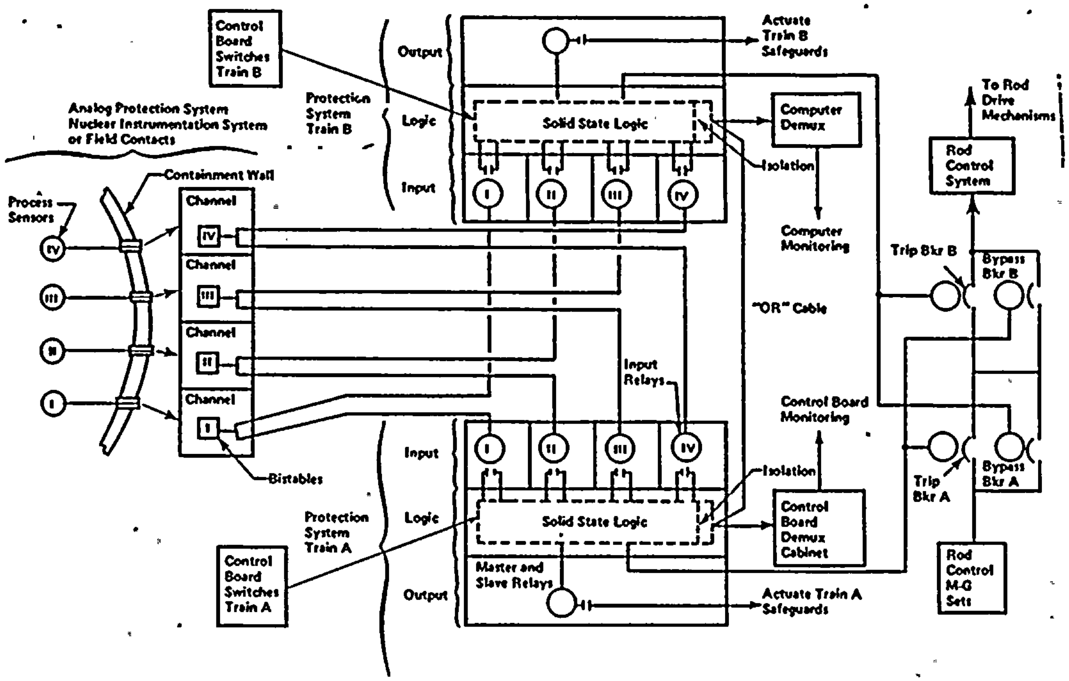
AMENDMENT NO. 15

SHEARON HARRIS NUCLEAR POWER PLANT
Carolina Power & Light Company
FINAL SAFETY ANALYSIS REPORT

125 VOLT D-C, 250 VOLT D-C AND 120 VOLT A-C ONE-LINE DIAGRAM

FIGURE 8.1.3-3

ATTACHMENT 2



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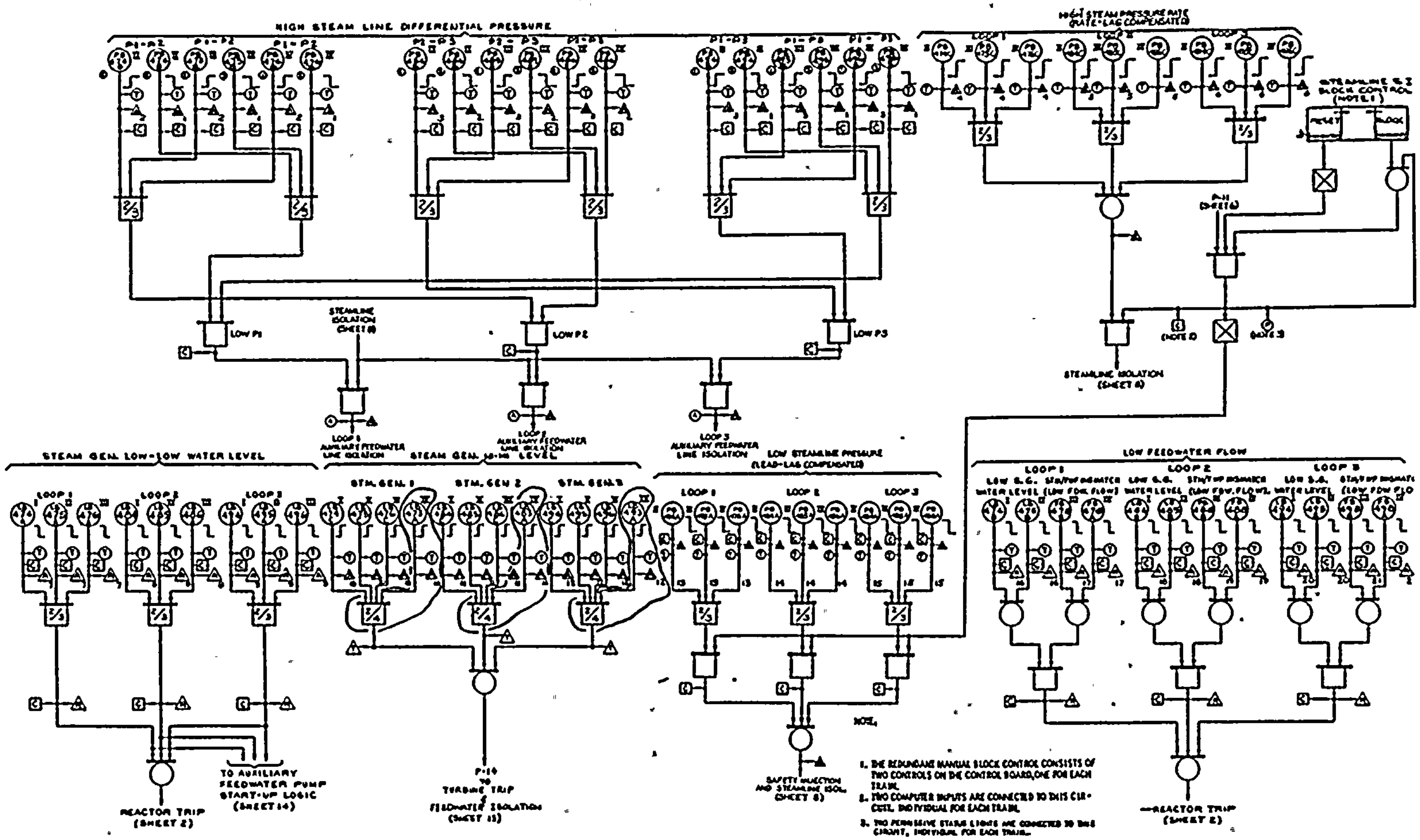
FINAL SAFETY ANALYSIS REPORT

PROTECTION SYSTEM BLOCK DIAGRAM

FIGURE 7.1.1-1

ATTACHMENT 3



1. THE REDUNDANT MANUAL BLOCK CONTROL CONSISTS OF TWO CONTROLS ON THE CONTROL BOARD, ONE FOR EACH TRAIN.
2. TWO COMPUTER INPUTS ARE CONNECTED TO THIS CIRCUIT, INDIVIDUAL FOR EACH TRAIN.
3. TWO PERMISSIVE STATUS LIGHTS ARE CONNECTED TO THIS CIRCUIT, INDIVIDUAL FOR EACH TRAIN.

AMENDMENT NO. 21

SHEARON HARRIS NUCLEAR POWER PLANT
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FINAL SAFETY ANALYSIS REPORT

STEAM GENERATOR TRIP SIGNALS
FIGURE 7.2.1-1
SHEET
7 OF 15