SOUTH CAROLINA ELECTRIC AND GAS CO.
V. C. SUMMER NUCLEAR STATION

10 CFR 50

APPENDIX R COMPLIANCE REVIEW

METHOD OF ANALYSIS

AND

SAFE SHUTDOWN PHILOSOPHY

Enclosure to letter dated September 4, 1985, from Mr. O.W. Dixon, Vice President, Nuclear Operations, SCE&G, to Mr. Harold R. Denton, Director, Office of Nuclear Reactor Regulation

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1.0 INTRODUCTION

1.1 Basis For This Report

During the conduct of the Appendix R audit of the V. C. Summer Nuclear Station (June 3-7, 1985), a number of concerns were expressed by the NRC auditors, as stated in audit report number 50-395/85-26. Subsequently, some of the concerns were discussed in a meeting on July 24 and 25, 1985, between NRR, Region II, and SCE&G. SCE&G has prepared this report to respond to those concerns discussed in the meeting and to provide sufficient information for both NRR and Region II to more completely evaluate the SCE&G programs.

The concerns are in a variety of areas, including the method of analysis used to identify potential deviations, a comparison of the FPER list of equipment with the list of equipment developed during the current review, the method of analysis of the spurious components, philosophy on the use of local fire switches, philosophy on preventing spurious opening of valves, a review of "associated circuits," responses to NRC IE bulletin 85-09, and a time estimate to achieve cold shutdown. For each concern, a conclusion has been reached which represents current SCE&G response to the expressed concern.

This set of responses is being provided in letter form to allow the NRC and, in particular, NRR the opportunity for timely resolution. The same material content will appear in a proposed revision to the V. C. Summer Nuclear Station FPER, currently scheduled for the second quarter of 1986.

1.2 Section Cross-Reference

Because of the length and detail in the audit report, 395/85-26, and the wide ranging discussions that occurred during the July 24-25, meeting between SCE&G, NRR, and Region II Staffs, a cross-reference between the audit, the meeting minutes, and this report is being provided in Table 1.2. This cross-reference is intended to aid the staff in its review and to provide a common basis for structuring its responses.

TABLE 1.2

SECTION CROSS-REFERENCE

APPENDIX R AUDIT SECTION	SECTION IN THIS REPORT	JULY 24-25, 1985 NRR MEETING REQUEST
395/85-26-01	2, 3, 4, 5, 7, 8, 9, 10	Associated circuit analysis, revised plant shutdown scheme
395/85-26-02	5, 6, 8	Fuses, lifted leads, disconnects
395/85-26-07	9	Sampling methodology for common enclosure
395/85-26-08	11	Revised plant shutdown scheme
395/85-26-09	12	Summary of times and steps to clarify the timeline
395/85-26-10	7	Identification of areas that are local control areas
395/85-26-12	13	Emergency 8-hour lighting units
395/85-26-16	Separate letter	Protection of the structural steel of the "M" board
	14	Non-scheduled outage modification performance, non-outage work schedule
	Separate letter	Steam PORV modifications
	Separate letter	Th/Tc modification

2.0 GENERAL METHOD OF ANALYSIS

(Audit Report Item 395/85-26-01, Ref. 5.a. (1))

2.1 Background and Development

As a result of NRC supplemental guidance in regard to 10 CFR 50, Appendix R, and other interpretive documents relating to Appendix R, SCE&G conducted a re-evaluation of the plant in order to show compliance with the supplemental guidance, identify all potential deviations from the supplemental guidance, and take the appropriate corrective action. The following discussion describes the method used for this analysis.

Due to the complex nature of this re-evaluation effort, special procedures were developed for each major activity prior to performance of the actual work. This ensured control of the work and provided a common base of understanding for all parties. It also provided a solid historical basis for future design control.

The re-evaluation effort was carried out in a carefully documented program that ensured that appropriate quality assurance considerations were employed. All proposed plant modifications will be made after an independent 10 CFR 50.59 analysis has been performed.

2.2 Analysis Technique

The re-evaluation effort began in the summer of 1984. The first effort was for SCE&G engineers to independently evaluate plant systems against the 10 CFR 50, Appendix R, requirements for shutdown and to determine the systems needed to facilitate shutdown. Then each system was evaluated to determine what mechanical components (pumps, valves, etc.) and instrument transmitters were needed for shutdown. This work culminated in a Mechanical Equipment List. After extensive review by SCE&G engineers and G/C, Inc., a Master Mechanical Equipment List was developed which formed the basis for the start of the analysis. An Electrical Equipment List was then developed, based on the Master Mechanical Equipment List, itemizing the required electrical equipment (switchgear, MCC's, etc.) needed to operate the identified mechanical components.

The next step was to decide upon the analysis technique to be used. SCE&G determined that two separate analyses were required to adequately determine the ability of the plant to achieve safe shutdown. These analyses were defined as the Compliance Review (CR) and the Normal Control Review (NCR) scenarios. The CR scenario postulates a fire in each area of the plant including the relay room, cable spreading rooms, or control room. Shutdown would then be accomplished using only essential equipment with no restriction on the use of manual operation of components such as valves. Equipment included in this evaluation would be protected against the consequences of a fire if it were needed for safe shutdown for that particular fire location. The NCR scenario postulates a fire anywhere in the plant that does not require evacuation of the control room. Shutdown would be accomplished using the normal control room controls for remote actuation of components.

The intent of the analysis was to determine any particular control schemes which could be degraded due to a fire in a particular location. For these locations, the operating procedure could direct the operator to use local manual control of the equipment. It is SCE&G's position that the CR satisfies the requirements of Appendix R and that the use of local control, at the level of MCC's or the actual component in the case of valves, is not a divergence from the regulation. The NCR scenario is an attempt by SCE&G to enable a more orderly shutdown from the control room when possible. SCE&G believes it is desirable to maximize the control of equipment from the control room for non control room fires, but does not see a

requirement for backfits that are intrusive to safety systems when well reasoned procedures utilizing limited amounts of local control will give assurance that shutdown can be accomplished. Specifically, local control is not considered a "repair" within the context of Appendix R. Also, "free from fire damage" refers to the function of a component or train, not to the ability to have convenient control from the control room. This position on the use of local control is the same as was described and accepted in SSER #3, pp. 9-11, dated Jan. 1982.

2.3 Success Tree Logic

In parallel to the development of the Electrical Equipment List, the Master Mechanical Success Trees were being developed at SCE&G. These success trees define all of the components necessary to achieve safe shutdown with each train of equipment, while showing the various alternative systems and cross-connect possibilities. Each component has its own logic block which details the cable and all additional "support" and "supplemental" equipment needed for operation. Support equipment provides functions such as cooling, air, power, cooling water, etc. Supplemental equipment defines main control board panels, local control panels, termination cabinets, relay panels, etc., required for the function of the required equipment in order to define the complete success tree.

It should be emphasized that these success trees are logic diagrams, as opposed to flow diagrams. Thus, two normally open valves in series, which were required to remain open, were shown as series blocks on the logic diagram. Conversely, two valves in series which were normally closed, at least one of which needed to remain closed for safe shutdown, were shown as parallel items on the logic diagrams. The Master Mechanical Success Trees show only the logic for mechanical components and instrument transmitters.

2.4 Fire Area/Zones

The next step was to update the Fire Protection Evaluation Report (FPER) drawings which had previously identified fire areas. The update consisted of giving the areas and zones unique identifiers and more clearly defining boundaries, particularly for newly defined zones.

2.5 Detailed Analysis

Once the Mechanical Equipment List, Electrical Equipment List, Master Mechanical Success Trees, and Fire Area/Zones were defined, the identification of required cables and support equipment was begun. Each mechanical and electrical component identified on the mechanical and electrical equipment lists was analyzed to determine all required cabling and support equipment. Equipment identified as needed for operation of a safe shutdown component and which was not previously identified in the mechanical or electrical equipment lists were then categorized as supplemental equipment. Cables were traced and categorized. Spurious equipment and cables were included in the analysis and were treated the same as required equipment (see Section 4.0 for a detailed discussion). Appropriate data were input to the computer to create the various computer sorts which were then used as input to the success tree analysis. These sorts identified all safe shutdown equipment and required cables per fire area (CR scenario) and fire zone (NCR scenario).

The identified support and supplemental equipment along with the previously identified electrical and mechanical equipment constituted the basis for the development of the composite equipment list. This list identifies all equipment necessary to bring the plant to hot and cold shutdown and is categorized by whether it is needed for the CR scenario and/or the NCR scenario. A line entry in the composite equipment list readily reveals to which

scenario (CR and/or NCR), to which supplement equipment, and to which phase of shutdown (initiate hot shutdown, maintain hot shutdown, and achieve cold shutdown) each item of safe shutdown equipment applies. This composite equipment list also contains other useful information, such as equipment description, operation status, control location, and type.

Simultaneously with the preparation of the Composite Equipment List, the Composite Success Trees were developed. All identified support and supplemental equipment were inserted into the Master Mechanical and Electrical Success Trees to develop the Composite Success Trees for both the CR and NCR scenarios.

The next effort in the analysis was to analyze the success trees for each fire area and zone in order to determine whether one train of equipment would remain free from fire damage for a fire in that particular area or zone. This was done by taking copies of the success tree diagram and marking one copy for each fire area. When either a component, or a cable supporting a component, or a function shown elsewhere on the success tree was identified as being affected by the fire in the area, that component was marked as unavailable.

After the success tree was marked in this manner for a given fire area, it was reviewed to determine whether an unaffected path existed which could be used for safe shutdown. If an unaffected path was found, it was concluded that one train of equipment was free from fire damage; if no path was found, it was necessary to analyze the diagram to determine the cause of the system failures. These failures were defined as "potential deviations." These "potential deviations" were individually analyzed, given a unique identifier, and documented by fire area. The point in the success tree diagram was annotated by circling the diagram, and the apparent solution was recorded in notes developed during the identification of potential deviations task.

The resolution of these potential deviations involved a more complete evaluation. This evaluation included walkdowns of fire areas to establish the exact location of components and cables, the existence of intervening combustibles, and the adequacy of the existing detection and suppression systems. Each potential deviation was studied in detail and an appropriate resolution was proposed. In many cases, these resolutions consisted of taking credit for existing one-hour-rated conduit and cable tray wraps, the use of existing repair procedures for cold shutdown, or the recognition of existing spatial separation with limited intervening combustibles. Each proposed resolution to a potential deviation was reviewed in detail prior to its final signoff.

Equipment that needed modification to ensure or enhance compliance was identified during the analysis and documented. Requests for plant modifications were developed from these documents and described in the May 29, 1985, letter from SCE&G to Mr. H. R. Denton, NRR.

The next step was the development of Plant Emergency Procedures to bring the plant to stable hot shutdown and cold shutdown conditions. FEP-1.0 and FEP-1.1 are the procedures to be used in the event of a control room evacuation and to bring the plant to cold shutdown within 72 hours. Additional procedures are being developed to provide specific direction for shutdown from the control room in the event of a major fire in general plant areas. These procedures are being based on the results of the analysis including the identified resolutions of potential deviations. These procedures will be revised once all plant modifications have been installed.

The last step was to develop exemption requests based on the identified resolutions of potential "deviations" as described in the May 29, 1985, letter to Mr. H. R. Denton, NRR.

2.6 Conclusion

SCE&G considers that this method of analysis and the resulting documentation provides an adequate demonstration of the compliance of V. C. Summer Nuclear Station to the criteria of 10 CFR 50, Appendix R.

3.0 CHANGES IN SAFE SHUTDOWN EQUIPMENT LIST

(Audit Report Item 395/85-26-01, Ref. 5.a. (1))

3.1 Basis for Changes

As described in Section 2.0, one of the initial tasks in the reanalysis effort was to completely review the systems and equipment that should be used at V. C. Summer Nuclear Station for safe shutdown in the event of a major fire. As a result of this effort, a number of changes have been made to the list of equipment necessary for safe shutdown as presently published in the Fire Protection Evaluation Report (FPER), pages Q1-15 through Q1-22. The significant changes are described in paragraphs 3-2 and 3-3 below. A complete revised equipment list which includes mechanical equipment used for safe shutdown along with instrumentation and supporting electrical equipment will be included in a revision to the FPER, currently scheduled for the second quarter of 1986.

3.2 Equipment Deleted

A comparison of equipment in the new equipment list and equipment list presently in the FPER has shown that the major change to the FPER involves equipment in the chemical and volume control system. Boration was previously to have been accomplished using boric acid tanks, pumps, and associated valves. Equipment formerly listed for boration will either be deleted (boric acide tanks and pumps) or secured to prevent spurioius operation (valves at the volume control tank). Equipment for letdown has also been deleted since this is no longer considered to be required. Boration required for safe shutdown will now be accomplished by taking makeup water from the Refueling Water Storage Tank (RWST), which provides a source of makeup water with 2000 ppm concentration of boric acid to the suction side of the charging pumps.

The appropriate section of the FSAR is excerpted below to demonstrate that the charging pump suction can be aligned to the RWST to provide boration makeup for safe shutdown:

> 9.3.4.3.1 Reactivity Control
>
> "An adequate quantity of boric acid is also available in the refueling water storage tank to achieve cold shutdown." "As backup to the normal boric acid supply, the operator can align the refueling water storage tank outlet to the suction of the charging pumps."

By calculation, SCE&G has shown that the RWST at 2000 ppm Boric Acid, when being used to make up for shrinkage and leakage, provides sufficient shutdown margin to go to cold shutdown.

Table 3.2 provides a list of equipment which has been deleted from the list of safe shutdown equipment as published in the FPER. Notes to the table explain the basis for the deletions.

3.3 Equipment Added

New equipment was also added to the safe shutdown equipment list for a variety of reasons including the following:

1. Equipment for which spurious actuation could be detrimental to safe shutdown, but operation of which is not required for safe shutdown.

2. Equipment to facilitate local control

3. Alternative process instrumentation

4. Alternative mechanical equipment (backup D.G. Fuel Oil Transfer Pumps).

5. Equipment (valving) for cross-connecting "swing" channel equipment.

6. Process valving which was implied by association to equipment and, therefore, not previously explicitly listed

TABLE 3.2

EQUIPMENT DELETED FROM FPER LIST OF SAFE SHUTDOWN EQUIPMENT

COMPONENT	FUNCTION	NOTES
XVG8104-CS	Boric Acid Tank Line Valves to Chg. Pps.	1
XVD8331-CS	Boric Acid Tank Line Valves to Chg. Pps.	1
XVD8329-CS	Boric Acid Tank Line Valves to Chg. Pps.	1
XVD8323A-CS	Boric Acid Tank Line Valves to Chg. Pps.	1
XVG8323B-CS	Boric Acid Tank Line Valves to Chg. Pps.	1
XPP-13A-CS	Boric Acid Transfer Pump	1
XPP-13B-CS	Boric Acid Transfer Pump	1
XVT8152-CS	Letdown Isolation Valve	2
XVB-3110A-SW	Reactor Bldg. Cooling Unit to Ind. Cooler Isolation Valve	3
XVB-3110B-SW	Reactor Bldg. Cooling Unit to Ind. Cooler Isolation Valve	3
XVB-3111A-SW	Reactor Bldg. Cooling Unit to Ind. Cooler Isolation Valve	3
XVB-3111B-SW	Reactor Bldg. Cooling Unit to Ind. Cooler Isolation Valve	3
XVB-3112A-SW	Reactor Bldg. Cooling Unit to Ind. Cooler Isolation Valve	3
XVB-3112B-SW	Reactor Bldg. Cooling Unit to Ind. Cooler Isolation Valve	3
PT-455	PZR Press.	4
PT-455A	PZR Press.	4
PT-456	PZR Press.	4
LT-161	Boric Acid Tank Level	1
LT-161A	Boric Acid Tank Level	1
LT-163	Boric Acid Tank Level	1
LT-163A	Boric Acid Tank Level	1
LT-106	Boric Acid Tank Level	1
LT-168	Boric Acid Tank Level	1

TABLE 3.2 (CON'T)

COMPONENT	FUNCTION	NOTES
NI-36A	Intermediate Range Nuclear Instrument	5
LT-112	VCT Level	5
LT-115	VCT Level	5
LT-470	PZR Relief Tank Level	5
LT-470A	PZR Relief Tank Level	5
FT-150	Low Press Letdown Flow	5
FT-150A	Low Press Letdown Flow	5
FT-122	Charge Flow	6
FT-122A	Charge Flow	6
PT-121	Charging Pressure	6
PT-121A	Charging Pressure	6
FT-110	Emergency Boration	1
FT-110A	Emergency Boration	1
TE-9201	Reactor Building Temp.	6
TE-9203	Reactor Building Temp.	6

NOTES FOR TABLE 3.2

1. Boric acid system not required. RWST is used both as a water source for primary shrinkage and to borate to cold shutdown.
2. Letdown not required for safe shutdown in the event of a fire.
3. Isolation of Industrial Cooling not required when using service water for containment heat removal.
4. RCS wide range pressure transmitters (PT-402, 402A, 403 and 403A) provide equivalent indication.
5. Instruments not required because associated components are not used.
6. Instruments not required to monitor system operation; manual operation surveillance will be used.

4.0 METHOD OF ANALYSIS FOR SPURIOUS COMPONENTS

(Audit Report Item 395/85-26-01, Ref. 5 a. (1))

In the early stages of the analysis SCE&G engineers determined which mechanical components were classified as "spurious" and so annotated the mechanical equipment list.

Spurious operation is defined as inadvertent equipment operation such that safe shutdown may be adversely affected. Valves were classified as spurious if the normal position and safe shutdown position were the same, such that a fire-induced "hot short" would drive the valve into the non-safe shutdown position. Valves were classified as "required" if the normal position and safe shutdown position were not the same, such that the valve must change position to facilitate shutdown. Electrical switchgear breakers were classified as spurious if inadvertent tripping or opening was detrimental to safe shutdown.

Cables associated to the identified spurious equipment were then analyzed to determine if a credible cable failure could cause inadvertent operation. An evaluation was made of the various possible credible cable failure modes, and this evaluation was used as a basis for evaluating the classification of individual cables.

Individual conductors on control elementary diagrams were analyzed with the emphasis on "hot shorts." A "hot short" is actually the contact of a control conductor (under consideration) of one cable with a hot conductor in a second control cable (without grounding) such that a current path is established which could energize electrical devices (relays, solenoids, etc.). Energizing of these devices could in turn cause the spurious operation of the safe shutdown equipment. It should be noted that these hot shorts are actually not short circuits, since only normal current is postulated to flow in lieu of a large fault current as is normally associated with short circuits.

These cables were then classified as spurious and documented in the computer sorts of cable/equipment by fire area (CR) and fire zone (NCR), computer generated cable worksheets, and cable identification packages. "Spurious" cables were treated the same as "required" cables during success tree analysis. (See Section 2.5). Cables identified in the identification of potential deviations task were checked against the computer sorts to determine if they were classified as "spurious." An analysis was then made in the resolution of potential deviations task (See Section 2.5) to prevent tnese spurious cables from adversely affecting safe shutdown. Resolutions of potential deviations for spurious cables resulted primarily in requests for plant modificaitons such as installing local control "fire switches," wrapping cables with one-hour rated fire retardant material, installing second power disconnects, armoring cable, and upgrading existing local control switches.

5.0 PHILOSOPHY ON THE USE OF LOCAL CONTROL SWITCHES ("FIRE SWITCHES")

(Audit Report Item 395/85-26-01, Ref. 5.a.(1) and 395/85-26-02 Ref. 5.a. (1))

5.1 Intended Use

For fires in the control room, relay room, or cable spreading rooms, the control room may need to be evacuated and the shutdown directed from the control room evacuation panel (CREP). In this event, the shutdown will be accomplished using Train "B" equipment with control of individual equipment accomplished at the CREP, at related switchgear and motor control centers, at the diesel generators, and by local manual operation of valves. To facilitate this shutdown, control switches are being added to the switchgear and motor control centers. Also, some existing local control switches are being upgraded (to prevent spurious operation).

Fires in other plant areas do not require control room evacuation, but in some cases, individual control room controls will be disabled. In these cases, an operator will be dispatched from the control room to operate the equipment using the local control switches or to manually operate valves.

5.2 Criteria and Design

For Train "B", these local control switches ("fire switches") will be provided on equipment to be operated in order to initiate hot standby. Local control switches will also be provided for equipment needed to maintain hot standby, if needed to ensure the timeliness of operation, consistent with the SCE&G timeline, or to ensure operator safety. Permanent jumper procedures will be provided for equipment needed only to achieve cold shutdown or not needed in the first 8 hours of shutdown.

In each case, these local controls will consist of two switches. A local transfer switch will be installed to isolate cables identified in the analysis as spurious or capable of disabling control. This transfer switch also connects a second control power supply into the control circuit. A second switch will be provided to start/stop the equipment after isolation takes place. The following regulations will be referenced and shall be considered in the design and testing of the local controls: 10 CFR 50, Appendix R, R.G. 1.22, R.G. 1.47, and NRC generic letter 81-12.

5.3 List of Equipment for Local Control Switches and Jumper Procedures

Table 5.3 lists all equipment where local control and transfer switches ("fire switches") are to be installed, equipment for which jumper procedures are to be used on a permanent basis, and equipment that must only be de-energized via local control without the need of tools and/or materials.

Temporary (interim) jumper procedures will be provided in order to justify continued operation until the local control switches are installed. These procedures perform the same function as the local control switches and in most cases without the need of materials. (i.e., manually trip control power breakers to isolate spurious cables, charge the closing spring if necessary, and then manually close the switchgear breaker via the local control button.)

Equipment that must only be de-energized to preclude spurious operation or inadvertent diesel loading falls under the "existing local control" column. Opening the breaker involves no more than manually tripping the control power breakers and then manually pushing the "trip" button on the switchgear cubicle. This action requires no tools or other materials but

does require an operational procedure which is incorporated into the Fire Emergency Shutdown Procedures.

5.4 Comparison to Previous Submittal

SCE&G's letter to Mr. Harold R. Denton, NRR of May 29, 1985, included a description of proposed modifications for adding local control switches or implementing jumper procedures for a number of components. This list was summarized in the NRC audit report 50-395/85-26, dated August 20, 1985, paragraph 3.a., pg. 6. This original list included those components for which local control was contemplated. With this discussion, SCE&G is confirming its intent to install local control switches as indicated in Table 5.3. This table also involves four additional local control switches. Two of these additional switches are covered by Note 7 to Table 5.3. The other two are covered by Note 5.

TABLE 5.3

LIST OF EQUIPMENT FOR LOCAL CONTROL SWITCHES AND JUMPER PROCEDURES

EQUIPMENT TAG NO.	DESCRIPTION	PERMANENT JUMPER PROC.	PLANNED, LOCAL CONTROL SWITCHES	EXISTING LOCAL CONTROL (FOR TRIPPING)	NOTES (SEE NEXT PAGE)
MFN-97B-AH	Reactor Bldg. "B" Train Cooling Fan		X		2
MFN-97D-AH	Reactor Bldg. "B" Train Cooling Fan		X		2
XEG-1B-DG	"B" Diesel Generator		X	X	1,4
XFN-38B-AH	Chgr. Room Supply Fan "B"	X			3
XFN-45A-AH	DG "B" 50% Supply Fan		X		2,7
XFN-45B-AH	DG "B" 50% Supply Fan		X		2,7
XFN-46B-VL	Charging/SI Pump "B" Room Fan		X		2,7
XFN-49B-VL	RHR/Spray Pump "B" Fan	X			6
XFN-76-VL	ESF1DB Switchgear Room Fan	X			3
XFN-80B-AH	SWPH Supply Fan "B"		X		7
XFN-81B-VL	SW Booster Pump "B" Fan	X			3
XFN-106B-VL	CREP and "B" Speed Switch Room Supply Fan	X			3
XFN-133-VL	Aux. Bldg. "B" Switchgear Room Fan	X			3
XHX-1B-VU	"B" Chiller		X	X	1,4
XPP-1B-CC	CC Pump "B"		X		2
XPP-31B-RH	Residual Heat Removal Pump "B"	X			6
XPP-39B-SW	SW Pump "B"		X		1
XPP-43B-CS	Charging Pump "B"		X		2
XPP-45B-SW	SW Booster Pump "B"		X		2
XPP-48B-VU	Chilled Water Pump "B"		X		2
XSW1DB, U14	Charging/SI Pump "C" Feeder "B"			X	4

TABLE 5.3 (CONT'D)

EQUIPMENT TAG NO.	DESCRIPTION	PERMANENT JUMPER PROC.	PLANNED, LOCAL CONTROL SWITCHES	EXISTING LOCAL CONTROL (FOR TRIPPING)	NOTES
XSW-1DA-ES, U1	Normal Offsite Breaker			X	4
XSW-1DA-ES, U15	Alt. Offsite Breaker			X	4
XSW-1DA-ES, U3	"A" D.G. Breaker			X	4
XSW-1DB-ES, U1	Alt. Offsite Breaker			X	4
XSW-1DB-ES, U16	Normal Offsite Breaker			X	4
XSW-1DB1, U4C	Tie Breaker to XSW1B3			X	4
XSW-1DB-ES, U4	XSW-1EB-ES Feeder Breaker		X		2
XSW-1DB-ES, U6	FDR Breaker R. B. Spray PP 38B			X	4
XSW-1DB-ES, U7	Unit Sub Feeder Breaker		X		2
XSW-1EB-ES, U3	FDR Breaker for Unit Sub 1EB1		X		2
XSW-1DB1-ES, U4B	ESF 480 Unit Sub Main Breaker		X		2
XSW-1DB1, U7B	FDR Breaker R.B. Fan 96B		X		5
XSW-1DB1, U7C	FDR Breaker R.B. Fan 96D		X		5
XSW-1DB2-ES, U4B	ESF 480 Unit Sub Main Breaker		X		2
XSW-1EB1-ES, U4B	ESF 480 Unit Sub Main Breaker		X		2

NOTES FOR TABLE 5.3

1. Existing switch being upgraded; needed to maintain hot standby.
2. Needed to maintain hot standby.
3. Not needed during the first 8 hours.
4. De-energize (open) breaker, no tools needed.
5. De-energize (open) breaker to preclude spurious operation, no tools needed.
6. Needed for cold shutdown only.
7. Designated as a future modification, XFN-46B-VL and XFN-80B-AH are not referenced in the May 29, 1985, letter to Mr. H. R. Denton, NRR.

6.0 RESPONSE TO THE CONCERN OF IE BULLETIN 85-09

(NRR Meeting Item and Audit Report Item 395/85-26-02 Ref. 5.a. (1))

I. E. Information Notice No. 85-09 addresses the potential deficiencies, specifically redundant fusing, in isolation switch design.

All existing isolation switches and planned modifications (where isolation switches are to be installed) will adequately isolate the circuit and will have (or presently do have) redundant fuses such that operability of equipment is maintained to achieve and maintain hot shutdown in accordance with 10 CFR 50, Section III.G.1 and IEB 85-09. With the installation of the redundant fusing the equipment can be operated without fuse replacement or circuit breaker resetting.

7.0 EXTENT OF LOCAL CONTROL FOR FIRES NOT REQUIRING EVACUATION OF THE CONTROL ROOM

(Audit Report Item 395/85-26-01, Ref. 5.a. (1), and Item 395/85-26-10, Ref. 5.a. (3) (c))

The effect of fires in all fire areas of the plant, including the control room, relay room, and cable spreading rooms, has been extensively analyzed. The analysis has emphasized shutdown using only essential equipment with no restriction on the use of manual operation of components, such as valves, and has been termed the Compliance Review (CR) scenario. This philosophy is based on the NRC internal guidance given in SEC-1-83-269, Attachment C, paragraph b.

As part of CR, control circuits for "B" Train shutdown equipment, such as fans and pumps, were traced to the control room evacuation panel (CREP), switchgear, and motor control centers. Control circuits for shutdown equipment, such as fans and pumps, powered by the "A" Train were traced to the control room. Control cables for valves susceptible to detrimental spurious operation were also traced. However, other valves, regardless of their power source, were not included in the control circuit analysis because they will be operated manually. Where necessary, modifications to the plant equipment and/or operating procedures are being implemented to ensure compliance with the latest interpretations of 10 CFR 50, Appendix R.

For fires in the control room, relay room, and cable spreading rooms which require control room evacuation, shutdown control will be directed from the CREP, with equipment operated from the CREP, from switchgears, or locally. Valves will be manually operated by hand wheels or by isolation and venting of control air.

For fires located in plant areas other than the control room, relay room, and cable spreading rooms, the control room will not be evacuated. Shutdown will be directed from the control room, with the majority of equipment being operated from the main control board. Fires in some areas may render some of the control room controls inoperable for the designated train of safe shutdown equipment, while disabling the alternate train of shutdown equipment. In these cases, CR has demonstrated that the designated train of equipment will remain operable and control can be achieved from the CREP, locally from either switchgear or motor control centers, or by manual operation for valves, as required.

As a part of the Normal Control Review (NCR) scenario analysis, all control circuits were traced to the control room for all shutdown equipment, including pumps, fans, and valves. When completed, the NCR scenario will identify exactly which shutdown components will have to be locally controlled. Upon completion of this additional analysis, any local control actions identified will be incorporated in the operating procedures.

However, the CR Scenario has indicated that only fires in a few fire areas would require some components to be manually operated, and this will be a very limited number of components for any one fire area. Table 7.0 is a list of fire areas versus the anticipated extent of local control (electrical and/or manual) based on the results of the CR analysis. An initial version of Table 7.0 was prepared by SCE&G during the audit and is summarized on pages 5 and 6 of the audit report. After completion of the NCR analysis, a final version of the information presented in Table 7.0 will be incorporated in the FPER.

Based on the CR analysis, the following are specific examples of the extent of local control where Table 7.0 indicates that "minor local control" will be required:

a. For fire area AB-1, a fire at the 400' elevation would require local manual operation of the RWST suction valves before charging could be restored, since a fire in this area would locally damage valve cabling. All other equipment and valves would be controlled from the main control board.

b. For fire area IB-25, a fire in the vicinity of the service water booster pump "B" requires the use of service booster pump "A". The power cables for the "A" pump are protected with Kaowool wraps; however, the control cables for a pressure interlock with the main service water pump are not wrapped. Therefore, local manual operation of the pump breaker, including the use of a jumper procedure, will be required for this pump. All other equipment and valves would be controlled from the main control board.

c. Similarly, for a fire in the vicinity of the feedwater regulating valves in fire area IB-25, valve control cables may be affected. Therefore, in this case, it would be necessary to pull fuses in the control board for these valves to ensure that they fail open. Feedwater would then be supplied from the turbine driven pump using the pump local control. All other equipment and valves would be controlled from the main control board.

TABLE 7.0

LIST OF FIRE AREAS VS. ANTICIPATED EXTENT OF LOCAL CONTROL

FIRE AREA	PREFERRED EQUIPMENT TRAIN TO BE USED	ANTICIPATED EXTENT OF LOCAL CONTROL
AB-1	A or B*	Control from Control Room, minor local control
CB-1	A	Control from Control Room, minor local control
CB-2	A	Control from Control Room, minor local control
CB-3	Operator Choice	Control from Control Room, no local control (no Appendix R Equipment or Cable)
CB-4 (Cable Spreading Room)	B	Control Room Evacuation, major local control
CB-5	B	Control from Control Room, minor local control
CB-6 (Relay Room)	B	Control Room Evacuation, major local control
CB-7	Operator Choice	Control from Control Room, no local control (no Appendix R Equipment or Cable)
CB-8	Operator Choice	Control from Control Room, no local control (no Appendix R Equipment or Cable)
CB-9	Operator Choice	Control from Control Room, no local control (no Appendix R Equipment or Cable)
CB-10	B	Control from Control Room, minor local control
CB-11	Operator Choice	Control from Control Room, no local control (no Appendix R Equipment or Cable)
CB-12	A	Control from Control Room, minor local control
CB-13	Operator Choice	Control from Control Room, no local control (no Appendix R Equipment or Cable)
CB-14	Operator Choice	Control from Control Room, no local control (no Appendix R Equipment or Cable)
CB-15 (Cable Spreading Room)	B	Control Room Evacuation, major local control
CB-16	Operator Choice	Control from Control Room, no local control
CB-17 (Control Room)	B	Control Room Evacuation, major local control

*Choice of equipment train depends on the location of the fire within the fire area.

TABLE 7.0 (CONT'D)

FIRE AREA	PREFERRED EQUIPMENT TRAIN TO BE USED	ANTICIPATED EXTENT OF LOCAL CONTROL
CB-18	B	Control from Control Room, minor local control
CB-19	Operator Choice	Control from Control Room, no local control (no Appendix R Equipment or Cable)
CB-20	A	Control from Control Room, minor local control
CB-21	Operator Choice	Control from Control Room, no local control (no Appendix R Equipment or Cable)
CB-22	B	Control from Control Room, no local control
CB-23	A	Control from Control Room, no local control
CB-24	Operator Choice	Control from Control Room, no local control (no Appendix R Equipment or Cable)
DG-1	B	Control from Control Room, no local control
DG-2	A	Control from Control Room, no local control
FH-1	A	Control from Control Room, no local control
IB-1	Operator Choice	Control from Control Room, no local control (no Appendix R Equipment or Cable)
IB-2	B	Control from Control Room, no local control
IB-3	B	Control from Control Room, no local control
IB-4	A	Control from Control Room, no local control
IB-5	B	Control from Control Room, no local control
IB-6	A	Control from Control Room, no local control
IB-7	A or B*	Control from Control Room, no local control
IB-8	Operator Choice	Control from Control Room, no local control
IB-9	A	Control from Control Room, no local control
IB-10	A	Control from Control Room, no local control
IB-11	A	Control from Control Room, no local control
IB-12	A	Control from Control Room, no local control
IB-13	Operator Choice	Control from Control Room, no local control
IB-14	B	Control from Control Room, no local control
IB-15	A	Control from Control Room, no local control
IB-16	B	Control from Control Room, no local control

*Choice of equipment train depends on the location of the fire within the fire area.

TABLE 7.0 (CONT'D)

FIRE AREA	PREFERRED EQUIPMENT TRAIN TO BE USED	ANTICIPATED EXTENT OF LOCAL CONTROL
IB-17	A	Control from Control Room, no local control
IB-18	B	Control from Control Room, no local control
IB-19	A	Control from Control Room, no local control
IB-20	B	Control from Control Room, no local control
IB-21	Operator Choice	Control from Control Room, no local control
IB-22	A	Control from Control Room, no local control
IB-23	B	Control from Control Room, no local control
IB-24	B	Control from Control Room, no local control
IB-25	A or B*	Control from Control Room, moderate local control
IB-26	B	Control from Control Room, no local control
MH-2	A or B*	Control from Control Room, no local control
MH-8	Operator Choice	Control from Control Room, no local control (no Appendix R Equipment or Cable)
MH-9	Operator Choice	Control from Control Room, no local control (no Appendix R Equipment or Cable)
MH-11	Operator Choice	Control from Control Room, no local control (no Appendix R Equipment or Cable)
RB-1	A or B*	Control from Control Room, for hot standby, Reactor Building entry required for "Cold Shutdown"
SWPH-1	B	Control from Control Room, no local control
SWPH-2	A	Control from Control Room, no local control
SWPH-3	A	Control from Control Room, no local control
SWPH-4	A or B*	Control from Control Room, no local control
SWPH-5	A or B*	Control from Control Room, no local control
TB-1	Operator Choice	Control from Control Room, very minor local control
YD-1	Operator Choice	Control from Control Room, no local control
YD-A	Operator Choice	Control from Control Room, no local control

*Choice of equipment train depends on the location of the fire within the fire area.

8.0 PHILOSOPHY ON CONTROLLING SPURIOUS OPERATION OF VALVES

(Audit Report Item 395/85-26-01 and 395/85-26-02, Ref. 5.a. (1) and 5.a. (2) (b))

8.1 General

The possible consequences of the spurious operation of certain valves require that the spurious operation be prevented or corrected on a priority basis. Of immediate concern are the reactor coolant system Hi-Lo pressure boundary valves, other valves which can result in loss of reactor coolant inventory, and valves which can result in uncontrolled steam dumping. For other valves, more time is available for correction of spurious operation.

The reactor coolant system Hi-Lo pressure boundary valves are all 480 volt ac motor operated and cannot spuriously open, since power to the motors has been disconnected during normal plant operation.

The remainder of the valves for which spurious operation must be corrected on a priority basis are air operated and controlled by one or more solenoid valves. For valves controlled by a single solenoid, the valve power must be disconnected and the cabling to the solenoid must be protected with a grounded shield (with sufficient short circuit ampacity). This is necessary to prevent a "hot short" from spuriously operating these valves.

Valves controlled by two or more solenoids, where de-energizing any one solenoid puts the valve in the safe position, only require that the valve power be disconnected. The cabling to the solenoids does not require shielding, since two or more "hot shorts" simultaneously would be required to spuriously operate the valve; and for non-reactor coolant pressure boundary valves, multiple hot shorts are not considered credible.

Similarly, for situations involving two normally closed valves in series (with individual solenoids) where at least one must be kept closed, disconnecting the power to the solenoids is sufficient. Two hot shorts, one to each solenoid, would be required to cause the flow path to be opened.

The required power disconnection will be accomplished in the main control board through a fuse removal procedure. This may appear to be in conflict with the NRC internal guidance provided in SEC-1-83-269, Attachment C, paragraph b. However, the fuses are easily accessible and safely removable; SCE&G considers this equivalent to the operation of switches. A human factors review will be conducted to ensure that the fuses can be easily identified and to ensure the fuse can be removed without tools, or ensure that tools are provided within the control room.

In addition, a secondary means of disconnecting the solenoid power will be provided in a separate fire area, for use in the unlikely event a fire occurs in the control room and requires immediate evacuation. This secondary means of disconnecting power consists of switches which will be installed in the termination cabinets located in the cable spreading room, which is a separate fire area from the main control room. Human factors will also be considered in the design of these switches, to ensure that they can be readily located and opened. In the interim, a wire disconnection procedure equivalent to the switches has been developed (FEP-1.0, Attachment X).

For motor operated valves where sufficient time is available, spurious operation will be controlled by opening the cubicle breaker in the MCC and then manually repositioning the valve locally by operating the hand wheel. The fire emergency safe shutdown procedure,

FEP-1.0, directs the tripping of the MCC cubicle breakers in a timely manner and provides separate instructions to manually reposition valves for which spurious repositioning could be detrimental to safe shutdown.

8.2 Control of Specific Valves

The following is a detailed description of the method of controlling spurious action for each of the valves where time constraints prohibit the use of local manual operation. Table 8.2 also provides a listing of these valves, including notations indicating which are reactor coolant system Hi-Lo pressure boundary valves, and which valves require plant modification as described in t he May 29, 1985, letter to Mr. Harold Denton, NRR:

1. The Reactor Vent Isolation and the Residual Heat Removal Inlet Isolation valves, that have been categorized as HI-LOW reactor coolant pressure boundary valves are three phase 480 VAC motor operated. Three phase to three phase hot shorts of the proper sequence in the motor power supply circuit of these valves are not considered credible. The power supply breakers of these valves are kept open and locked during normal plant operation. Thus spurious operation of these valves cannot occur.

2. The pressurizer PORV's are single solenoid/air operated valves. Spurious activation of the solenoid could result in loss of reactor coolant inventory. These valves will be fully protected from spurious signals, by installing shielded control cables to their solenoids and by disconnecting the power to those solenoids as described in 8.1.

3. The pressurizer Spray Header Isolation valve is located inside the reactor building and is controlled by a single solenoid. Spurious operation of this valve after charging has been restored could result in reactor coolant system depressurization. The location of the valve would require an excessive amount of time for manual correction of spurious actuation. Therefore, spurious actuation will be controlled prior to starting the charging pump, by shielding the solenoid cable and power disconnect as described in 8.1 above.

4. The Main Steam Isolation and the Main Steam Isolation Bypass valves are controlled by two solenoids and fail closed upon loss of power to either of the solenoids, even if the operator controlling solenoid is spuriously energized. Therefore, the use of the power disconnects described in 8.1 is sufficient to prevent these valves from opening.

5. The steam generator PORV's provide the steam dump function for normal plant operation and are controlled by six solenoids each. Two or more solenoids must be spuriously activated to open the valve. Their spurious operation will be controlled in the same manner as described in Paragraph 4 above, upon completion of a control logic change which is being proposed to the NRC staff in a separate report. (Note: This is a change from the modifications described in the May 29, 1985 letter to Mr. Harold R. Denton.)

6. The pair of Excess Letdown Isolation valves and the pair of Letdown Isolation valves are installed in series and closure of either one valve of the pair accomplishes the required isolation. Thus, although single solenoid, these valves require no shielding of cables and will be "failed" closed as described in 8.1.

7. The Normal and Alternate Charging Header Isolation valves are each operated by a single solenoid and normally fail open. Since these valves are in separate charging paths, spurious closure of one valve will not prevent charging. Thus, a single hot short cannot

FEP-1.0, directs the tripping of the MCC cubicle breakers in a timely manner and provides separate instructions to manually reposition valves for which spurious repositioning could be detrimental to safe shutdown.

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1. The Reactor Vent Isolation and the Residual Heat Removal Inlet Isolation valves, that have been categorized as HI-LOW reactor coolant pressure boundary valves are three phase 480 VAC motor operated. Three phase to three phase hot shorts of the proper sequence in the motor power supply circuit of these valves are not considered credible. The power supply breakers of these valves are kept open and locked during normal plant operation. Thus spurious operation of these valves cannot occur.

2. The pressurizer PORV's are single solenoid/air operated valves. Spurious activation of the solenoid could result in loss of reactor coolant inventory. These valves will be fully protected from spurious signals, by installing shielded control cables to their solenoids and by disconnecting the power to those solenoids as described in 8.1.

3. The pressurizer Spray Header Isolation valve is located inside the reactor building and is controlled by a single solenoid. Spurious operation of this valve after charging has been restored could result in reactor coolant system depressurization. The location of the valve would require an excessive amount of time for manual correction of spurious actuation. Therefore, spurious actuation will be controlled prior to starting the charging pump, by shielding the solenoid cable and power disconnect as described in 8.1 above.

4. The Main Steam Isolation and the Main Steam Isolation Bypass valves are controlled by two solenoids and fail closed upon loss of power to either of the solenoids, even if the operator controlling solenoid is spuriously energized. Therefore, the use of the power disconnects described in 8.1 is sufficient to prevent these valves from opening.

5. The steam generator PORV's provide the steam dump function for normal plant operation and are controlled by six solenoids each. Two or more solenoids must be spuriously activated to open the valve. Their spurious operation will be controlled in the same manner as described in Paragraph 4 above, upon completion of a control logic change which is being proposed to the NRC staff in a separate report. (Note: This is a change from the modifications described in the May 29, 1985 letter to Mr. Harold R. Denton.)

6. The pair of Excess Letdown Isolation valves and the pair of Letdown Isolation valves are installed in series and closure of either one valve of the pair accomplishes the required isolation. Thus, although single solenoid, these valves require no shielding of cables and will be "failed" closed as described in 8.1.

7. The Normal and Alternate Charging Header Isolation valves are each operated by a single solenoid and normally fail open. Since these valves are in separate charging paths, spurious closure of one valve will not prevent charging. Thus, a single hot short cannot

prevent charging. Therefore, power disconnects as described in 8.1 will be sufficient to ensure charging.

8.3 Conclusion

SCE&G is confident that the methods described above will control the spurious operation of valves in a safe and timely manner such that the plant will not reach an unrecoverable condition in the event of a major fire.

TABLE 8.2

LIST OF VALVES
(FOR WHICH SPURIOUS OPERATION CANNOT BE CORRECTED BY LOCAL MANUAL ACTION)

VALVE EQUIPMENT NO.	DESCRIPTION	HI-LO PRESSURE BOUNDARY	METHOD TO CONTROL SPURIOUS OPERATION	INCLUDED IN 5/29/85 LETTER TO NRR
XVT-8095A-RC	Reactor Vent Isolation Valve	X	MCC Breaker locked open	Note 1
XVT-8095B-RC	Reactor Vent Isolation Valve	X	MCC Breaker locked open	Note 1
XVT-8096A-RC	Reactor Vent Isolation Valve	X	MCC Breaker locked open	Note 1
XVT-8096B-RC	Reactor Vent Ioslation Valve	X	MCC Breaker locked open	Note 1
XVG-8701A-RH	RHR LP1 Inlet Isolation Valve	X	MCC Breaker locked open	Note 1
XVG-8701B-RH	RHR LP2 Inlet Isolation Valve	X	MCC Breaker locked open	Note 1
XVG-8702A-RH	RHR LP1 Inlet Isolation Valve	X	MCC Breaker locked open	Note 1
XVG-8702B-RH	RHR LP2 Inlet Isolation Valve	X	MCC Breaker locked open	Note 1
IPV-444B-RC	Pressurizer PORV	Note 2	Pull Fuses or Open 2nd Power Disc. and Shield Cables	X
IPV-445A-RC	Pressurizer PORV	Note 2	Pull Fuses or Open 2nd Power Disc. and Shield Cables	X
IPV-445B-RC	Pressurizer PORV	Note 2	Pull Fuses or Open 2nd Power Disc. and Shield Cables	X
XCT-8145-CS	Aux. Spray Line Isolation Valve		Pull Fuses or Open 2nd Power Disc. and Shield Cables	X
IPV-2000-MS	Main Steam PORV - Note 3		Pull Fuses or Open 2nd Power Disc.	X
IPV-2010-MS	Main Steam PORV - Note 3		Pull Fuses or Open 2nd Power Disc.	X

TABLE 8.2 (CONT'D)

VALVE EQUIPMENT NO.	DESCRIPTION	HI-LO PRESSURE BOUNDARY	METHOD TO CONTROL SPURIOUS OPERATION	INCLUDED IN 5/29/85 LETTER TO NRR
IPV-2020-MS	Main Steam PORV - Note 3		Pull Fuses or Open 2nd Power Disc.	X
XVM-2801A-MS	Main Steam LP 'A' Isolation Valve		Pull Fuses or Open 2nd Power Disc.	X
XVM-2801B-MS	Main Steam LP 'B' Isolation Valve		Pull Fuses or Open 2nd Power Disc.	X
XVM-2801C-MS	Main Steam LP 'C' Isolation Valve		Pull Fuses or Open 2nd Power Disc.	X
XVT-2869A-MS	Main Steam 'A' Bypass Isolation Valve		Pull Fuses or Open 2nd Power Disc.	X
XVT-2869B-MS	Main Steam 'B' Bypass Isolation Valve		Pull Fuses or Open 2nd Power Disc.	X
XVT-2869C-MS	Main Steam 'C' Bypass Isolation Valve		Pull Fuses or Open 2nd Power Disc.	X
XVT-8146-CS	Normal Char. Header Isolation Valve		Pull Fuses or Open 2nd Power Disc.	Note 4
XVT-8147-CS	Aux. Char. Header Isolation Valve		Pull Fuses or Open 2nd Power Disc.	Note 4
XVT-8153-CS	Excess Letdown Isolation Valve		Pull Fuses or Open 2nd Power Disc.	X
XVT-8154-CS	Excess Letdown Isolation Valve		Pull Fuses or Open 2nd Power Disc.	X
ILV-459-CS	Letdown Line Isolation Valve - Note 5		Pull Fuses in MCB or in CREP	Note 1
ILV-460-CS	Letdown Line Isolation Valve - Note 5		Pull Fuses in MCB or in CREP	Note 1

NOTES FOR TABLE 8.2

1. These valves were not discussed in 5/29/85 letter, since no plant modifications are required.
2. SCE&G is treating the pressurizer PORV's as reactor coolant system Hi-Lo pressure boundary valves, since spurious operation could result in loss of reactor coolant inventory.
3. SCE&G plans to revise the control logic for the main steam PORV's so that two independent hot shorts would be required for spurious actuation.
4. These valves were added to the list of valves requiring power disconnects, based on a review of the analysis completed subsequent to the 5/29/85 letter to Mr. Harold R. Denton, NRR.
5. There is sufficient time before spurious actuation would lead to an unrecoverable condition to permit the control room evacuation panel (CREP) to be used as a secondary power disconnection location.

9.0 CIRCUITS ASSOCIATED BY COMMON ENCLOSURE

(Audit Report Item 395/85-26-07, Ref. 5.a. (2) (c) and 395/85-26-01, Ref. 5.a. (1))

9.1 General

In NRC generic letter 81-12, one of the concerns raised was the possibility that "cables associated by common enclosure" could be subject to fire-induced faults which would be detrimental to safe shutdown. The concern was that a fire in a specific fire area would be propagated into another fire area by cables lacking adequate overcurrent protection.

Two reports were prepared to demonstrate the adequacy of overcurrent protection. The objective was to demonstrate that adequate overcurrent protection exists for all cables which could be associated by common enclosure.

9.2 Technique

Each report contained a detailed discussion of the plant design criteria and practices which provided all plant cabling with adequate overcurrent protection. In order to demonstrate conclusively that these design criteria and practices were followed, each report also contained an evaluation of the as-built conditions using a statistically valid sampling technique.

The statistical procedure used was suitable to demonstrate a 95% confidence level that 95% of the power circuits have adequate overcurrent protection. The technique and acceptance criteria are similar to those used to demonstrate the adequacy of pipe supports. The procedure employs a hypergeometric distribution, and the sample size was checked to verify that it would be sufficiently large to provide a 95% confidence level. A published table of random numbers was used to select the sample of circuits from a population which was arranged by circuit number in an alphanumeric order by system and sequence (circuit numbers are by system and number designation, i.e., AHJ606X), and then sequentially numbered.

9.3 First Report

For the first report, the statistical evaluation used a population of circuits that included all power cables in the plant, Class 1E associated, and Non-Class 1E. As a practical matter, only power circuits larger than 10 AWG were considered because smaller circuits are not connected to significant sources of fault current. This population size consisted of 1834 circuits from which a random sample of 59 circuits were drawn. Each of the circuits in this sample was then checked to confirm that overcurrent protection based on the project design parameters was provided for the circuit and that this protection was adequate for the cable size. This protection was documented on a worksheet for each circuit. Each circuit was analyzed to determine that the auto-ignition temperature of the cable could not be reached because the device operating time at the available fault current was shorter than the time to auto-ignition. All the circuits in the sample met the requirements for short circuit protection and long term ampacity. This provides 95% confidence that at least 95% of the circuits in the population are provided with overcurrent protection by design. Values of the circuit breaker rating, trip setting, operating time, cable auto-ignition time, and the conclusion of adequacy are all documented in the report.

9.4 Second Report

For the second report, the statistical evaluation used a population limited to Class 1E and 1E-associated circuits (from the IEEE 384 point of view). Since the safe shutdown systems for the V. C. Summer nuclear system are all safety related, and since Non-Class 1E circuits are run in raceways separated from Class 1E and 1E-associated circuits, the Non-Class 1E circuits have no potential of becoming "associated by common enclosure" for the purposes of Appendix R compliance. A large number of circuits such as turbine building welding circuits which have no relevance to safe shutdown were thus eliminated from consideration by this restriction to Class 1E and 1E-associated circuits. The resulting population consisted of 321 power circuits from which a sample of 59 circuits were drawn. The sample circuits were evaluated as described in paragraph 9.3 for short-circuit and overload protection. All the circuits in the sample met the criteria for adequacy, leading to the conclusion that there was 95% confidence that at least 95% of the circuits in the population are provided with overcurrent protection by design. Values of circuit breaker rating, trip setting, operating time, cable auto-ignition time, and the conclusion of adequacy are all documented in the report.

9.5 Conclusion

Based on the results of both analyses, there is verification that the overcurrent design requirements were applied to the plant circuits and that there is a 95% confidence level that 95% of the circuits connected to significant sources of short circuit current are adequately protected against continuous overcurrent and short circuit currents. Consequently, circuits which are associated by common enclosure are adequately protected.

10.0 CIRCUITS ASSOCIATED BY COMMON POWER SUPPLY

(Audit Report Item 395/85-26-01, Ref. 5.a. (1))

10.1 General

Generic letter 81-12 describes a concern that power circuits required for safe shutdown be protected against fire-induced failures of circuits with which they are associated by virtue of the fact that they have a common power source.

10.2 Objective

Circuits identified as AC and DC power supply circuits for the safe shutdown equipment for Appendix R associated by common power supply were analyzed. The equipment reviewed included that required for the "compliance review scenario." The object of the analysis was to demonstrate that equipment served by a common power supply and thereby "associated" was protected from loss of the power supply by coordination of the circuit breaker trip settings with the power supply breaker trip settings. This prevents a fire-related short circuit in an "associated circuit" feeder from tripping the main power supply breaker and, thereby, disconnecting power to the "required circuits."

10.3 Analysis

The method of the analysis was to first identify the source power circuit breakers and their "associated" breakers. After that determination, a simple one-line diagram was prepared identifying the frame size and trip setting of each breaker. From this data and the manufacturer circuit breaker trip characteristic curves, coordination curves were prepared to demonstrate visually the amount of coordination existing between the associated circuit breakers. A complete report of this coordination study was prepared and made part of the Appendix R review documentation.

10.4 Conclusion

The results of the analysis indicated a high degree of coordination between the protective devices for the associated circuits of interest and the main protective devices for required power sources. Several cases for which the degree of coordination was insufficient were identified, and suitable new trip setting values for the circuit breakers were established. Installation and maintenance work requests were initiated to correct these.

This review demonstrated that the circuit breakers were coordinated in accordance with accepted design practices and that required power sources will be adequately protected from fire induced faults on circuits "associated by common power supply."

11.0 RESPONSE TO THE CONCERN OF NRC BULLETIN IEB 84-09 REQUIRING DIRECT READING LEVEL INSTRUMENTS ON ALL TANKS

(Audit Report Item 395/85-26-08, Ref. 5.a. (3) (a) 3)

I.E. Bulletin 84-09 provides guidance for power reactor facilities conducting analyses and/or making modifications to implement requirements of 10 CFR 50, Appendix R.

Attachment 1, I.E.B 84-09, page 6 of 9, dated 2/13/84 and 10CFR 50, Appendix R, Section III L.2.d. require direct reading of process variables necessary to perform and control the reactor shutdown function (including instrumentation needed for level indication on all tanks used). Currently, a direct reading level instrument is not available for the Refueling Water Storage Tank. SCE&G proposes to implement a modification providing a direct reading pressure sensor type level gauge to the RWST.

12.0 TIME CRITICAL SAFE SHUTDOWN FUNCTIONS AND TIME TO COLD SHUTDOWN

(Audit Report Item 395/85-26-01, Ref. 5.a. (1) and Item 395/25-26-09, Ref. 5.a. (3) (b))

12.1 Introduction

One concern associated with Appendix R Compliance is the ability of the shutdown procedures to mitigate possible abnormal system transients on a time scale consistent with not reaching an unrecoverable condition. Also of concern is the ability to achieve cold shutdown within time criteria of Appendix R.

12.2 Primary System Concerns

For the primary coolant system the concern was the need to restore primary coolant makeup. Several potential situations were considered which limit the time available to restore primary makeup. If one power operated relief valve (PORV) spuriously opens, it must be reclosed in time to ensure that sufficient inventory remains to allow for the maximum technical specification leakage until makeup can be restored. Similarly, if the reactor coolant pump seals heat up and warp, causing increased leakage to the levels postulated in WCAP 10541, along with leakage at the technical specification limits, makeup must be restored before the pressurizer empties.

12.3 Secondary System Concerns

For the main steam system, two similar situations were considered. If one of the main steam PORV's spuriously opens, it must be reclosed in time to ensure that the primary shrinkage does not empty the pressurizer. Similarly, with steam relief removing decay heat, an emergency feedwater pump must be started to provide emergency feedwater before the steam generators go dry.

12.4 Time Line

Table 12.4 is a tabulation of these concerns, the maximum time for mitigation, and the time to complete mitigating action. The times to complete these mitigating actions are based on situations requiring control room evacuation and can be correlated with the timeline presented in Figure 12.4. For fires not requiring control room evacuation, the times for mitigation will be significantly less.

Other situations were also analyzed such as the time available to isolate letdown, and these were found to be considerably longer than those considered to be critical.

It should also be noted that the times listed in Table 12.4 represent the times required for mitigation using Procedure FEP-1.0. After completion of the planned modifications to the plant, which will provide local control switches and related facilities as described in the May 29, 1985, submittal, the times for mitigation will be somewhat shorter since the interim (compensatory) jumpering procedures will no longer be required.

12.5 Cold Shutdown

For conditions requiring control room evacuation, fire emergency safe shutdown procedure FEP-1.1 is under development. It is presently estimated that this procedure can achieve shutdown within 40 hours from the start of the event.

For conditions not requiring control room evacuation, fire emergency safe shutdown procedures are to be developed. However, only a few areas of the plant will require repairs to achieve cold shutdown and these repairs are very limited. Therefore, it is anticipated that the plant can be ready to start cool down in significantly less than 72 hours for a fire in any area of the plant.

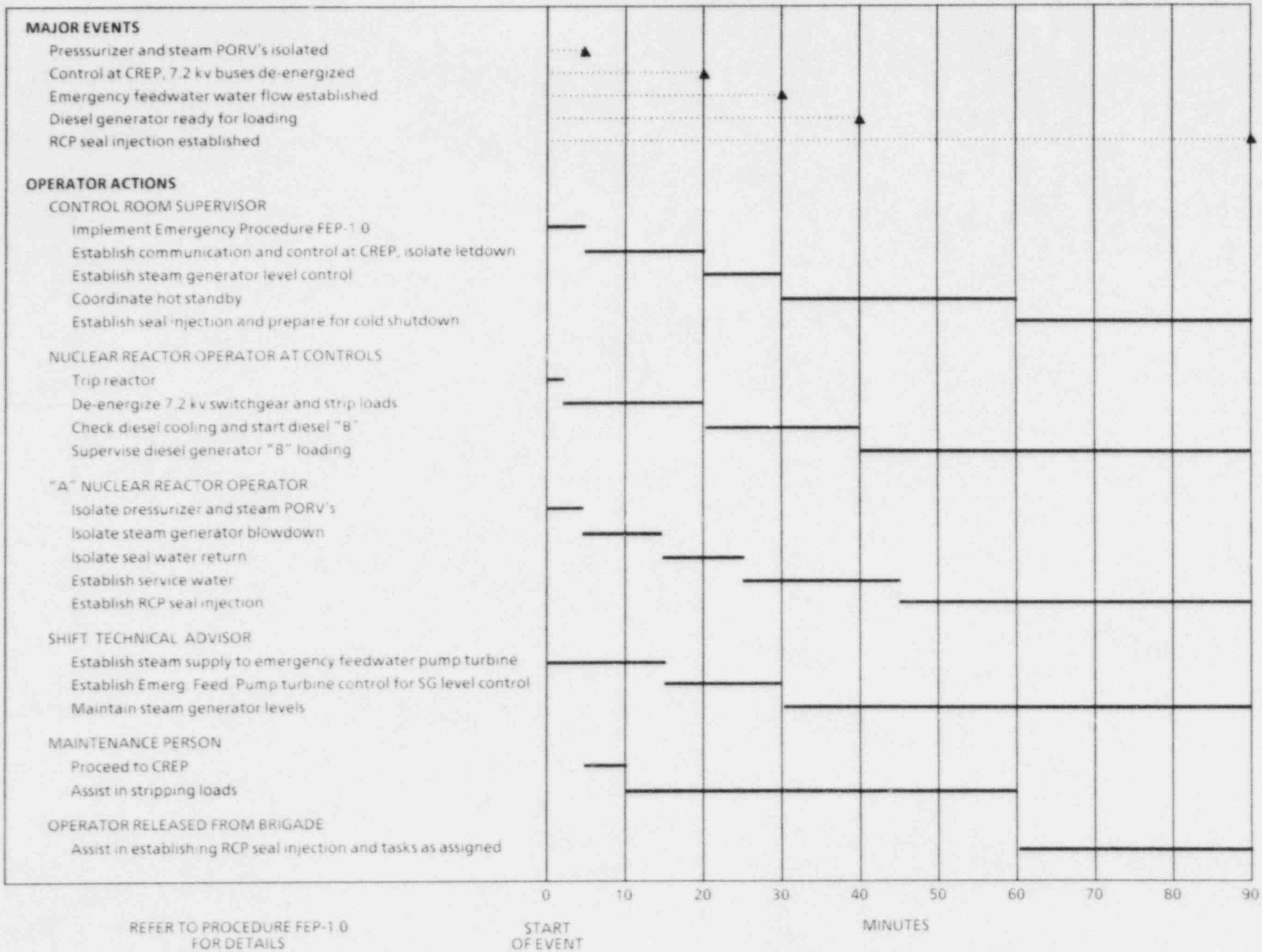
TABLE 12.4

TIME FOR CRITICAL SAFE SHUTDOWN FUNCTIONS

FUNCTIONAL CONCERN	CRITICAL TIME FOR FUNCTIONAL CONCERN	MITIGATING ACTION (PROCEDURE REFERENCE)	TIME TO COMPLETE MITIGATING ACTION
1. PORV spuriously opens	3.0 minutes (to level that provides for 2.2 hours of 3 gpm per pump leakage before pressurizer empties)	Pull fuses in MCB or open switches in cable spreading room (Att. III, Step 1.0) and restore charging (Step 10.0)	Immediate for fuse removal/switch operation and 90 minutes for charging
2. RCP seal leakage above tech. specs	90 minutes (with leakage per WCAP 10541 before pressurizer empties)	Restore charging through seals (Step 10.0)	Approximately 90 minutes or less
3. Primary coolant shrinkage due to spurious opening of main steam PORV	2.7 minutes (before pressurizer empties). Based on conservative Chapter 15 analyses; actual cooldown is expected to be much slower.	Pull fuses in MCB or open switches in cable spreading room (Att. III, Step 1.0)	Immediate for fuse removal/switch operation
4. Steam generator dryout	Greater than 30 minutes (for three steam generators dry with no feedwater starting at low-low level) (NUREG-0611)	Provide feedwater using turbine driven emergency feedwater pump (Att. IV, Step 5.0)	Approximately 25 minutes or less

FIGURE 12.4

OPERATOR TIME LINE



13.0 EMERGENCY LIGHTING

(Audit Report Item 395/85-26-12, Ref. 7)

During the NRC audit, questions were raised about the intention of SCE&G to utilize hand-held lighting as a permanent solution to providing required light levels for a few isolated locations required by our safe shutdown scheme. As a result of discussions at that time and at a subsequent meeting between NRR, Region II and SCE&G on July 23 and 24, 1985, SCE&G now proposes to expand still further the amount of emergency lighting to be added to V. C. Summer Nuclear Station. Table 13.0 summarizes the lighting to be added. The entries marked with an asterisk (*) are additions to the list of additional lighting reviewed by the Region II auditors. With their inclusion, SCE&G will be in full compliance with Section J of Appendix R. Adequate lighting will be provided to perform all required functions including ingress, egress, and operation of components without resort to hand-held lights.

Two comments should be made: One, the yard lighting will be provided to illuminate the external entrances and exits of the affected structures, Turbine Building, Service Water Pumphouse, and Circulating Water Pumphouse. No lighting is planned for general yard areas, since the provision of entrance lights to illuminate doors and stairwells and to serve as guide beacons is sufficient for safe travel between structures. Two, procedures will continue to call for hand-held lighting as a "belt and suspenders" approach to safety.

TABLE 13.0

EMERGENCY LIGHTING ADDITIONS

BUILDINGS/ ELEVATIONS		
AB 388,397	-	4 dual and 2 single lamp assemblies
AB 400	-	1 dual lamp assembly
AB 412	-	2 dual lamp assemblies
West Pen 412	-	1 dual lamp assembly
East Pen 412	-	1 dual lamp assembly
IB 412	-	2 dual and 2 single lamp assemblies
TB 412	-	2 dual and 1 single lamp assembly
*CB 412	-	1 dual lamp assembly
AB 424	-	1 single lamp assembly
IB 424	-	2 dual lamp assemblies
*DG 427	-	1 dual lamp assembly
AB 436	-	5 dual and 1 single lamp assembly
West Pen 436	-	1 dual lamp assembly
East Pen 436	-	1 dual lamp assembly
IB 436	-	3 dual lamp assemblies
*TB 436	-	2 dual and 1 single lamp assembly
IB 463	-	1 dual lamp assembly
*TB 463	-	2 dual lamp assemblies
*CB 463	-	1 dual lamp assembly
*AB 485	-	1 dual lamp assembly
SWPH	-	1 dual lamp assembly
CWPH	-	1 single lamp assembly

STAIRTOWERS		
CB North Stairtower	-	2 dual lamp assemblies
AB North Stairtower	-	3 dual lamp assemblies
AB West Stairtower	-	2 dual lamp assemblies
IB East Stairtower	-	1 dual and 1 single lamp assembly
IB West Stairtower	-	2 dual lamp assemblies

YARD (436')		
*Yard Lighting	-	3 dual lamp assemblies

*Post audit additions to preclude the need for deviation requests.

NOTE: All proposed units are 8-hour battery operated units

14.0 SCHEDULE FOR COMPLETION OF MODIFICATIONS AND COMPENSATORY ACTION TO BE USED UNTIL INSTALLATION

(NRR Meeting Item)

Table 14.0 outlines the schedule of implementation and summarizes compensatory action for planned modification associated with the reanalysis of V. C. Summer Nuclear Station to 10 CFR 50, Appendix R. The modifications have been proposed to resolve Associated Circuits of Concern issues and enhance compliance with the recent Appendix R guidelines set forth in generic letters 81-12, 83-33, 85-01, and other interpretative documents. It should be noted that some modifications listed under the "MRF DESCRIPTION" column are actually combinations of audit open items, while some other modifications listed are more finely broken down. This is only a result of design and construction scheduling in order to efficiently process the modifications.

These plant modifications were identified and developed during the recent reanalysis effort, were described in the May 29, 1985, letter (to Mr. H. R. Denton, NRR), and were reviewed during the NRC audit at the plant site.

Several of the modifications require that the plant be off-line and, therefore, need to be scheduled during outage periods. The first such outage is the second refueling outage, scheduled for the fall of 1985. The short lead time to this outage, along with the need for a controlled approach to assure plant reliability and safe operation, have placed engineering and procurement constraints that preclude completion of most off-line related work during this refueling outage. SCE&G, therefore, will attempt to complete all work by the end of the third refueling outage (as referenced in the chart), scheduled for the spring of 1987. Non-outage work (which can be done during normal operation) is scheduled between now and the third refueling outage. Outage related work will progress as far as possible subject to constraints imposed by adherence to technical specifications and will be completed as quickly as possible taking advantage of any forced (unplanned) outages of sufficient duration.

The COMPENSATORY ACTION column summarizes the actions that have been taken to justify continued operation of the plant until installation. The May 29, 1985, letter to Mr. H. R. Denton of the NRR fully describes all plant modifications and interim compensatory action. Action of a procedural nature will be (or already has been) incorporated into the fire emergency safe shutdown procedures FEP-1.0 and FEP-1.1. A roving fire watch has been initiated to provide assurance that the SCE&G interim procedures will not be subject to a challenge by a significant fire. This fire watch provides surveillance of the general floor areas of all fire areas and fire zones once every two hours except zones completely contained in high-rad, airborne, contaminated, or confined spaces. For a detailed explanation of the roving fire watch, see the June 21, 1985, letter to Dr. J. Nelson Grace of the NRC.

TABLE 14.0

V. C. SUMMER NUCLEAR STATION
SCHEDULE OF MODIFICATION IMPLEMENTATION

NRC AUDIT REPORT ITEM #	MRF DESCRIPTION MRF #	OUTAGE REQ.	ESTIMATES ENGR. COMPL. DATE	ESTIMATES MATERIAL DELIVERY DATE	SCE&G CONST. COMPL. DATE	SUMMARY OF COMPENSATORY ACTION
395/85-26-02 Para 5.a.(1)(a) thru 5.a.(1)(e)	Add 2nd power disconnect for air operated valves 20784-627	Yes	4/86*	4/86*	3rd Refuel (2nd Qtr. '87)	Interim Wire Cutting Procedure
395/85-26-02 Para 5.a.(1)(g)	Add Thyrite protectors to current transformers 20785-584	No	Design Issued	12/85*	4/86	Roving Fire Watch
496/85-26-02 Para 5.a.(1)	Add Fire Switches to 480V switchgear 20786-630	Yes	4/86*	4/86*	3rd Refuel (2nd Qtr. '87)	Interim Jumper Procedure
395/85-26-02 Para 5.a.(1)(f)	Upgrade DG-B Controls 20788-579	Yes	9/22/85*	9/22/85*	2nd Refuel (4th Qtr. '85)	Interim Jumper Procedure
395/85-26-02 Para 5.a.(1)	Add Fire Switches to 7.2kV switchgear 20789-631	Yes	3/86*	3/86*	3rd Refuel (2nd Qtr. '87)	Interim Jumper Procedure
395/85-26-02 Para 5.a.(1)	Upgrade Fire Switch for S.W. Pp. "B" and add Fire Switch for CC Pp. "B" 20790	-	7/86*	11/86*	3rd Refuel (2nd Qtr. '87)	Roving Fire Watch
395/85-26-02 Para 5.a.(1)	Upgrade Chiller B Contr. Transfer Switch 20791-614	No	12/31/85*	12/31/85*	3/1/86	Interim Jumper Procedure
395/85-26-02 Para 5.a.(1)(a) and 5.a.(1)(e)	Armor cables for solenoid valves (see also 20784) 20800-628 20784	Yes	10/19/86*	10/19/86*	3rd Refuel (2nd Qtr. '87)	Interim Wire Cutting Procedure
395/85-26-02 Para 5.a.(1)(h)	Change RC Loop Tu/Te instrumentation to one power train per loop 20801	Yes	To be completed as a resolution to R.G. 1.97 issues (9/86*)	2/87*	3rd Refuel (2nd Qtr. '87)	Operational Procedure

*These are tentative dates and subject to change as detailed planning proceeds.

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TABLE 14.0 (CONTINUED)

V. C. SUMMER NUCLEAR STATION
SCHEDULE OF MODIFICATION IMPLEMENTATION

NRC AUDIT REPORT ITEM #	MRF DESCRIPTION MRF # ________	OUTAGE REQ.	ESTIMATES		SCE&G CONST. COMPL. DATE	SUMMARY OF COMPENSATORY ACTION
			ENGR. COMPL. DATE	MATERIAL DELIVERY DATE		
395/85-26-02 Para. 5.a.(1)(I)	Remove cables DGM21B and DGM22B from tower cable spreading room 20788-579	No	9/22/85*	N/A	2nd Refuel (4th Qtr. '85)	Interim Lead-Lifting Procedure
395/85-26-12	Install additional self-contained emergency lighting units 20840	No	1/1/86*	1/1/86*	2nd Qtr. '86	Existing Emergency Lighting Supplemented by Hand Held Lighting
395/85-26-04	Protect conduits for NI-31/NI-32 or install transfer switch for NI-33 31968	No	12/31/85*	2/86*	1st Qtr. '86	Roving Fire Watch
	Addition of direct reading level gauge for RWST	No	9/86*	9/86*	4th Qtr. '86	Roving Fire Watch
395/85-26-05	Revision of power circuit breaker overcurrent settings for coordination 20846	Yes	9/27/85*	N/A	2nd Refuel (4th Qtr. '85)	Roving Fire Watch
395/85-26-02	Add fire switches to 480V MCC's, XFN-45A-AH, XFN-45B-AH, XFN-46B-VL, XFN-80B-VL 20896	Yes	9/86*	10/86*	3rd Refuel (2nd Qtr. '87)	Interim Jumper Procedure
395/85-26-03	Wrap Tray 3088 31971	No	12/31/85*	2/86*	1st Qtr. '86	Roving Fire Watch
395/85-26-16	Upgrade S.W.B. Pp. 45A barrier (supports) 20895	No	2/86*	3/86*	2nd Qtr. '86	Roving Fire Watch
395/85-26-02 Para. 5.a.(1)(b)	Change M.S. PORV control logic to pre-1980 design (IPV-2000, 2010, 2020-MS)	No	9/86*	N/A	4th Qtr. '86	Interim Valve Cutting Procedure
-	Upgrade the FPER	No	6/86*	N/A	2nd Qtr. '86	-

*These are tentative dates and subject to change as detailed planning proceeds.

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