APPENDIX 9A

APPENDIX R COMPARISON

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HOPE CREEK GENERATING STATION

APPENDIX R COMPARISON

INTRODUCTION

This report responds to the NRC letter to Mr. R. L. Mittl of PSE&G, dated October 15, 1981, requesting Hope Creek to compare its fire protection program to Appendix R of 10CFR50, specifically identifying and justifying any deviations from Appendix R.

The comparison to NRC Generic Letter 81-12 with clarifications, dated March 25, 1982, is included.

This report is an item by item comparison of the Hope Creek fire protection program to both of the above documents. The specific paragraphs of the guidelines have, in some cases, been divided into sentences or paraphrased for ease in providing responses.

The fire protection evaluation report that PSE&G submitted to the NRC, on October 21, 1977, has not been updated and resubmitted since the basis for the report, Appendix A to BTP APCSB 9.5-1, has been deleted. The Branch Technical Position CMEB 9.5-1 has incorporated the Appendix A guidelines, which are included in Standard Review Plan 9.5.1, Revision 3.

III. Specific Requirements

III.A. Water Supplies for Fire Suppression Systems

III.A.1. Two separate water supplies shall be provided to furnish necessary water volume and pressure to the fire main loop.

Response:

Comply. The Hope Creek fire protection water supply is from two dedicated 100 percent capacity 350,000 gallon fire water storage tanks, of which 328,000 gallons is dedicated to fire protection. (See FSAR Section 9.5.1.2.3.1)

III.A.2. Each supply shall consist of a storage tank, pump, piping, and appropriate isolation and control valves.

Response:

Comply. (See FSAR Sections 9.5.1.2.3.1 and 9.5.1.2.3.2.)

III.A.3. These supplies shall be separated so that a failure of one supply will not result in a failure of the other supply.

Response:

Comply with intent. The fire water supply tanks are valved such that failure of one tank will not result in failure of the other tank. (See FSAR Section 9.5.1.2.3.1)

III.A.4. Each supply of the fire water distribution system shall be capable of providing, for a period of 2 hours, the maximum expected water demands as determined by the fire hazards analysis

for safety-related areas or other areas that present a fire exposure hazard to safety-related areas.

Response:

Comply. The largest system water demand plus hose allowance can be provided for 2 hours.

III.A.5. Requirements for ensuring minimum water volume when storage tanks are used for combined service water/fire water uses.

Response:

Comply. The fire water storage tanks provide both fire protection water and boiler blowdown/demineralizer makeup water. Piping routed outside the storage tank allows boiler blowdown/demineralizer makeup water usage only above the 328,000 gallon level.

III.A.6. Requirements for other water systems used as sources of fire protection water.

Response:

Not applicable. No other systems are used as a source of fire protection water.

III.B. Sectional Isolation Valves

Sectional isolation valves such as post indicator valves or key operated valves shall be installed in the fire main loop to permit isolation of portions of the main fire main loop for maintenance or repair without interrupting the entire water supply.

Response:

Comply. Post indicator valves provide sectionalized control and isolation of portions of the fire main loop. See FSAR Section 9.5.1.2.3.3.

III.C. Hydrant Isolation Valves

Valves shall be installed to permit isolation of outside hydrants from the fire main for maintenance or repair without interrupting the water supply to automatic or manual fire suppression systems in any area containing or presenting a fire hazard to safety-related or safe shutdown equipment.

Response:

Comply. Hydrants are provided with a key operated gate valve with a curb box. See FSAR Section 9.5.1.2.3.3.

III.D. Manual Fire Suppression

III.D.1. Standpipe and hose systems shall be installed so that at least one effective hose stream will be able to reach any location that contains or presents an exposure fire hazard to structures, systems, or components important to safety.

Response:

Comply. All normally accessible areas of the plant can be reached by at least one effective hose stream. See FSAR Section 9.5.1.2.9.

III.D.2. Access to permit effective functioning of the fire brigade shall be provided to all areas that contain or present an exposure fire hazard to structures, systems, or components important to safety.

Response:

Comply. There are no areas that do not have access for fire brigade functioning.

III.D.3. Standpipe and hose stations shall be inside pressurized water reactor (PWR) containments and boiling water reactor (BWR) containments that are not inerted.

Response:

Not applicable. The HCGS drywell is inerted. Therefore, there are no standpipes or hose stations inside the drywell.

III.D.4. For BWR drywells, standpipe and hose stations shall be placed outside the drywell with adequate lengths of hose to reach any location inside the drywell with an effective hose stream.

Response:

Comply. Standpipe with hose stations have been provided. See FSAR Section 9.5.1.2.18.

III.E. Hydrostatic Hose Tests

Fire hose shall be hydrostatically tested at a pressure of 150 psi or 50 psi above maximum fire main operating pressure, whichever is greater. Hose stored in outside hose houses shall be tested annually. Interior standpipe hose shall be tested every three years.

Response:

Comply. Details of procedures are described in the HCGS Fire Protection Surveillance and Periodic Test Program, NC.FP-AP.ZZ-0005(Q).

III.F. Automatic Fire Detection

Automatic fire detection systems shall be installed in all areas of the plant that contain or present an exposure fire hazard to safe shutdown safety-related systems or components. These fire detection systems shall be capable of operating with or without offsite power.

Response:

Comply. All plant areas with a combustible loading greater than 8000 Btu/ft^2 that present an exposure fire hazard to safe shutdown systems or components have automatic fire detection systems that are capable of operating with or without offsite power. See FSAR Section 9.5.1.2.15.

III.G. Fire Protection of Safe Shutdown Capability

III.G.1a. Fire damage shall be limited so that one train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station is free of fire damage.

Response:

Comply. A fire hazard analysis has been performed on all areas of the Auxiliary Building, Reactor Building and Intake Structure. At least one train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station was shown to be free of fire damage for each fire area therein. See specific exemptions requested to Appendix R, Section III.G and the corresponding deviations granted by the NRC to BTP 9.5-1 in Section 9A.6.

III.G.1b. Fire damage shall be limited so that systems necessary to achieve and maintain cold shutdown from either the control room or emergency control station can be repaired within 72 hours.

Response:

One train of cold shutdown equipment will remain free of fire damage or will be available for use with repairs.

III.G.2. Where redundant safe shutdown cable and equipment, including associated non-safety circuits that could prevent operation or cause maloperation due to hot shorts, open circuits, or shorts to ground, are located in the same fire zone outside of containment, separation of redundant trains shall be provided as follows:

a. Fire barrier having a 3 hour rating including supporting steel, or

b. Separation by not less than 20 feet horizontal distance plus automatic suppression and detection, or

c. Fire barrier having a 1 hour rating plus automatic suppression and detection.

Response:

The response to this guideline is located in Item 1 of the responses to the NRC Generic Letter 81-12, which follows these Appendix R responses. See specific exemptions requested to Appendix R, Section III.G and the corresponding deviations granted by the NRC to BTP 9.5-1 in Section 9A.6.

III.G.2.d,e&f. Alternative means of providing fire protection inside non-inerted containments.

Response:

Not applicable. The HCGS primary containment is inerted.

III.G.3a,b. Provision of alternative or dedicated shutdown capability in certain fire areas plus a fixed fire suppression system.

Response:

The response to this item is given in Item 2 of the responses to the NRC Generic Letter 81-12 which follows these Appendix R responses. See specific exemptions requested to Appendix R, Section III.G and the corresponding deviations granted by the NRC to BTP 9.5-1 in Section 9A.6.

III.H. Fire Brigade

Requirements for the onsite fire brigade.

Response:

Comply. HCGS will comply with the fire brigade organization training and equipment requirements of BTP CMEB 9.5-1, Revision 2, and Appendix R to 10CFR50. The detail discussion of fire brigade organization and equipment is provided in FSAR Section 9.5.1.5.2

III.I. Fire Brigade Training

Requirements for training of fire brigade members.

Response:

Comply. The training program is provided in FSAR Section 9.5.1.5.2.

III.J. Emergency Lighting

Emergency lighting units with at least an 8-hour battery power supply shall be provided in all areas needed for operation of safe shutdown equipment, and in access and egress routes thereto.

Response:

Comply. Eight-hour battery powered lighting is provided for safe shutdown operating areas and access and egress routes.

III.K. Administrative Controls

Establishment of administrative controls to minimize fire hazards.

Response:

Comply. HCGS will comply with the administrative controls requirements of Branch Technical Position (BTP) CMEB 9.5-1, Revision 2, and Appendix R to 10CFR50. The administrative controls procedure is provided in FSAR Section 9.5.1.5.3

III.L. Alternative and Dedicated Shutdown Capability

III.L.1a. The alternative or dedicated shutdown capability provided for a specific fire area shall be able to achieve and maintain subcritical reactivity conditions in the reactor, maintain reactor coolant inventory, achieve and maintain hot shutdown conditions, achieve cold shutdown conditions within 72 hours, and maintain cold shutdown conditions thereafter.

Response:

Comply. The areas for which alternative shutdown capability is provided are listed in Table 1 of the attached responses to NRC Generic Letter 81-12. The reactor shutdown is the same as a normal shutdown from the main control room, but will use controls and instrumentation located at the remote shutdown facility, the diesel generator control panels, and at equipment operating areas.

III.L.1b. During the postfire shutdown, the reactor coolant system process variables shall be maintained within those predicted for a

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containing the RCIC, HPCI, RHR, SACS, and for the diesel areas containing diesel generators, and safe shutdown electrical equipment rooms.

Ventilation for the Reactor Building safe shutdown equipment areas is provided by unit coolers in each pump room. Ventilation for diesel generator rooms, and diesel area Class 1E battery rooms is provided by the Auxiliary Building Diesel Generator Area Heating, Ventilation, and Cooling System. Both the Reactor Building Equipment Area Cooling Systems (EACS) room coolers, and the Diesel Area Ventilation System coolers are locally controlled and will automatically start on a high room temperature.

Separation for the power to the unit cooler fans and the cooling water circuit is maintained such that, for any given fire, only one safe shutdown division will be affected by the loss of the supporting ventilation systems.

III.L.3. The shutdown capability for specific fire areas may be unique for each such area, or it may be one unique combination of systems for all such areas. In either case, the alternative shutdown capability shall be independent of the specific fire area(s) and shall accommodate postfire conditions where offsite power is available and where offsite power is not available for 72 hours. Procedures shall be in effect to implement this capability.

Response:

Comply. The cable from the remote shutdown panel (RSP) to safe shutdown equipment and process instrumentation cable routing have been verified to be independent of the specific fire areas requiring remote shutdown. The RSP control and instrumentation is available whether offsite power is available or not. Procedures are in effect to implement this capability.

III.L.4.a. If the capability to achieve and maintain cold shutdown will not be available because of fire damage, the equipment and systems comprising the means to achieve and maintain the hot shutdown condition shall be capable of maintaining such conditions until cold shutdown can be achieved.

Response:

Not applicable. The Fire Hazard Analysis has shown that one train of cold shutdown equipment will always be available for use without repairing fire damage.

III.L.4.b. If such equipment and systems will not be capable of being powered by both onsite and offsite electric power systems because of fire damage, an independent onsite power system shall be provided. The number of operating shift personnel, exclusive of fire brigade members, required to operate such equipment and systems shall be onsite at all times.

Response:

Not applicable. The capability to achieve cold shutdown will be available without repairing fire damage.

III.L.5. Equipment and systems comprising the means to achieve and maintain cold shutdown conditions shall not be damaged by fire; or the fire damage to such equipment and systems shall be limited so that the systems can be made operable and cold shutdown can be achieved within 72 hours.

Material for such repairs shall be readily available onsite and procedures shall be in effect to implement such repairs.

If the equipment and systems comprising the means to achieve and maintain cold shutdown conditions (and which are used prior to 72 hours after the fire) will not be capable of being powered by

both offsite and onsite power systems because of fire damage, an independent onsite power system shall be provided.

Response:

Not applicable. The cold shutdown equipment and systems comply with Section III.G.2 separation or III.G.3, unless a specific exemption is requested in Section 9A.6. Therefore, one train of equipment will remain free of fire damage, and no repairs are postulated.

III.L.6. Shutdown systems installed to ensure post fire shutdown capability need not be designed to meet Seismic Category I criteria, single failure criteria, or other design basis accident criteria, except where required for other reasons.

Response:

Comply. The safe shutdown systems are designed commensurate with their importance to safety and other safety requirements.

III.L.7. Isolation of safe shutdown equipment and systems from associated non-safety circuits.

Response:

Comply. The response to this guideline is given in Item 2, Associated Circuits of Concern (a through c) of the NRC Generic Letter 81-12 which follows these Appendix R responses.

III.M. Fire Barrier Cable Penetration Seal Qualification

The acceptance criteria for the tests shall include the 3 items listed below:

Response:

Comply. The penetration seals are qualified by tests that are comparable to tests used to rate fire barriers.

III.M.1. The cable fire barrier penetration seal has withstood the fire endurance test without passage of flame or ignition of cables on the unexposed side for a period of time equivalent to the fire resistance.

Response:

Comply. The seals are tested in accordance with the guidelines in BTP CMEB 9.5-1, Revision 2, Section 5.a.3.(a).

III.M.2. The temperature levels recorded for the unexposed side are analyzed and demonstrate that the maximum temperature is sufficiently below the cable insulation ignition temperature.

Response:

Comply. The temperature testing and records are in accordance with SRP 9.5-1, Revision 2, Section 5.a.3.(b).

III.M.3. The fire barrier penetration seal remains intact and does not allow projection of water beyond the unexposed surface during the hose stream test.

Response:

Comply. The material used is in accordance with SRP 9.5-1, Revision 2, Section 5.a.3.(c).

III.N. Fire Doors

Fire doors shall be self-closing, or provided with closing mechanisms, and shall be inspected semiannually to verify that automatic hold open, release, and closing mechanisms and latches are operable.

Response:

Comply.

a. Fire doors which are not electrically supervised or kept locked closed are inspected daily to verify they are in the proper position, and in the case of doors equipped with automatic hold open and release mechanisms, to verify the door is clear of obstructions.

b. Unsupervised fire doors which are kept locked closed are inspected weekly to verify they are in the closed position.

c. Fire doors and associated hardware are inspected semi-annually for operability.

d. Safety-related areas which are protected by total flooding carbon dioxide suppression systems have electrically supervised self-closing fire doors.

III.O. Oil Collection System for Reactor Coolant Pump

The reactor coolant pump shall be equipped with an Oil Collection System if the containment is not inerted during normal operation.

Response:

Not applicable. The HCGS containment is inerted during normal operation.

FIRE HAZARD ANALYSIS

The following criteria and methodology were used in the fire hazard analysis.

9A.1 GENERAL CRITERIA

Criteria and assumptions used to evaluate the effects of postulated fires in areas, systems, components, and equipment required for safe shutdown for the HCGS fire hazard analysis.

9A.1.1 Only one fire is assumed to occur within the plant at any given time.

9A.1.2 The spread of a fire is assumed to be limited to the fire area in which the fire originates. A fire area is that portion of a structure that is separated from other areas by boundary fire barriers having 3-hour ratings, except that the following conditions are permissible:

1. A fire barrier between adjacent fire areas may contain features having ratings of less than 3 hours, provided that the combustible loading on both sides of the fire barrier is low and that potentially only minor quantities of heat and smoke could pass through the barrier.

2. A larger fire area may be subdivided into two regions that are treated independently in the safe shutdown analyses, if a 20-foot-wide combustible free zone is provided between the two regions.

A fire area is made up of a single room or group of rooms. Rooms are identified on the Architecture GENERAL PLANT FLOOR PLAN drawings A-0201-0 through A-0208-0.

9A.1.3 The combustible material associated with the equipment and cable is identified, and the total heat release is calculated

based on the total inventory of the combustibles. The heat of combustion for the Ethylene Propylene Rubber (EPR), individual conductor, insulation is 10,000 Btu/lb. The EPR is wrapped in a Hypalon jacket to make a control or instrument cable. The Hypalon has a heat of combustion of 8100 Btu/lb. NRC tests documented in, "Program Plan for the Evaluation of the 20-foot Separation Criteria", Appendix 4, dated 2/17/82, have demonstrated a 50 percent total burn efficiency. We have assumed that all cable insulation has a heat of combustion of 10,000 Btu/lb. Therefore, with a 50 percent efficiency, the equivalent heat of combustion used for HCGS cable insulation is 5,000 Btu/lb. The heat of combustion for battery cases is 13,310 Btu/lb, and for carbon absorber media 14,800 Btu/lb. Lube oil and diesel fuel oil heat of combustion is taken as 20,000 Btu/lb (148,000 Btu/gal). The heat of combustion of fiberglass reinforced plastic (FRP) is 12,250 Btu/lb. The heat of combustion used for paper is 8000 Btu/lb. The equivalent fire severity in minutes is extracted from NFPA FIRE PROTECTION HANDBOOK for an equivalent wood fire, i.e., 6 minutes for each 8000 Btu per square foot.

9A.1.3.1 All cable trays are assumed to be filled to the maximum permissible amount. In all cases the actual cable combustible is less than that assumed.

9A.1.4 All components affected by a postulated fire are assumed to be inoperable or misoperated, i.e., hot short, whichever is worse.

9A.1.5 In evaluating the effects of postulated transient and/or in situ exposure fires on safe shutdown equipment and raceways, the following set of assumptions are used.

a. There is a loss of offsite power (LOP) or not, whichever is worse for alternate shutdown capability from Remote Shutdown Panel or if LOP is caused by fire while shutting down from Control Room. Offsite power may be unavailable for as long as 72 hours after the occurrence of a fire.

b. There will be no random single failures (other than a single fire and its effects). All equipment not affected by a fire and LOP are assumed to be working normally.

c. Plant accidents and severe natural phenomena are not assumed to occur concurrently with a postulated fire.

d. The main control room is the preferred shutdown location.

e. Q listed, 1E equipment and controls are preferred for hot and cold shutdown.

f. Spurious operation caused by hot shorts, open circuits or shorts to ground is considered, unless it can be shown in the analysis that such spurious operation will not occur. For spurious signals the following guidelines apply as stated in Generic Letter 85-01.

    1. The safe shutdown capability should not be adversely affected by any one spurious actuation or signal resulting from a fire in any plant area; and

    2. The safe shutdown capability should not be adversely affected by a fire in any plant area which results in the loss of all automatic function (signals, logic) from the circuits located in the area in conjunction with one worst case spurious actuation or signal resulting from the fire; and

    3. The safe shutdown capability should not be adversely affected by a fire in any plant area which results in simultaneous spurious actuation of all valves in high-low pressure interface lines.

9A.1.5.1 The systems that are relied on for achieving safe shutdown from the Remote Shutdown Locations must be capable of

bringing the plant to cold shutdown conditions within 72 hours after the occurrence of a fire.

9A.1.5.2 For any shutdown method that is selected for use after a fire, the systems necessary to achieve and maintain hot shutdown conditions must remain free of fire damage. The systems necessary to achieve and maintain cold shutdown conditions (but not hot shutdown conditions) may be permitted to sustain fire damage, provided that the systems can be repaired within 72 hours.

9A.1.5.3 The types of repair actions that are permitted for cold shutdown systems include replacement of cabling and removal or replacement of fuses. The use of clip leads on replacement cables is not permitted, which means that hard wired terminal lugs must be used. Replacement materials to be used in the repair actions must be stored onsite and written procedures governing the performance of the repairs must be implemented.

9A.1.5.4 Manual operation of valves, circuit breakers, and hand switches is not considered to be a repair action and may be utilized in exercising control over hot shutdown systems as well as cold shutdown systems.

9A.1.6 Manual firefighting techniques only are required for the control room, since the control room is constantly staffed and an alternate shutdown method exists.

9A.1.7 An exposure fire within the primary containment is not credible since the containment is inerted during normal operation.

9A.1.8 Allowable transient combustible loads are quantified in the NBU administrative procedure controlling the fire protection program. The transient combustible loads shown in the individual Fire Hazard Tabulation Sheets in Tables 9A-6 through 9A-84 are transients which are routinely expected (i.e. the quantity of oil required to refill a lubricating (hydraulic oil

reservoir). Permanent storage areas for the fiberglass ladders have been established inside the Power Block at various elevations. Combustible loads for the ladders in the storage areas have not been included in the table for each fire area because of the small amount of combustible material involved, and because the ladders may be removed and used at other locations. The use of ladders in other areas throughout the plant is controlled as a transient combustible as described above. Calculations of combustible loadings and fire severity have been done assuming each storage area contains its maximum complement of ladders. These calculations reveal that the increase in combustible loading is within the design capability of the existing fire protection features for each area. Typically the fire severity increases by only a few seconds, and in no case exceeds two minutes for any room. Additional transient combustible loads have been generically considered, in quantities limited to those stated in the above referenced station administrative procedure. In all cases, the Fire Hazards Analysis remains acceptable, including the maximum allowable transient combustible loads, except for certain specified areas. These specific areas are shown with lower limits in the station administrative procedure, which results in an acceptable Fire Hazards Analysis.

9A.2 ELECTRICAL CRITERIA

Criteria used for electrical cable separation of safe shutdown cabling and associated circuits for the HCGS fire hazard analysis.

9A.2.1 Cables in conduit and metal covered tray are not considered to be combustible since the metal provides a barrier as described in IEEE-384-1981. The cables, however, are assumed to be affected by the fire.

9A.2.1.1 Metal clad, armor clad, flexible conduit, Heliax and Radiax cables are considered as a negligible combustible and are not considered as an intervening combustible or to contribute to the fire area combustible loading.

9A.2.2 Cable initiated fires are not credible.

9A.2.3 The main steam safety relief valves remote actuation are all powered from Division II. All 14 valves are on electrical channel B with the 5 ADS valves additionally powered from channel D. Reference has been made in the Fire Hazard Analysis that redundant division I cable and equipment is used for safe shutdown. The channel B and channel D cable routing are separated such that a single fire outside the MCR, CER or CSR is not likely to affect both channel B and D relief valves. Therefore, relief valve use should be available from the MCR for Division I safe shutdown method I for fires outside the MCR, CER,

or CSR. However, HPCI steam consumption is sufficient to depressurize for Method I if no Safety Relief Valves are available.

9A.2.4 There are no associated circuits of concern as defined by generic letter 81-12 and its clarification letter. All circuits, either safety-related or non-safety-related, are protected by coordinated protection devices, e.g., fuses, circuit breakers, etc. This ensures that the redundant power sources are protected from a fire caused fault in an associated circuit. Refer to Figures 9A-14 through 9A-31 for protective device coordination curves.

9A.2.4.1 High impedance faults have been considered for all associated circuits located in the fire area of concern.

9A.2.5 High-low pressure interface redundant isolation valves and associated cabling (power and control) are reviewed to assure adequate physical and electrical separation so that fire induced failures of the cables (hot short, open circuits, or short to ground) will not cause maloperation or result in a loss-of-coolant accident (LOCA).

9A.2.6 Circuits of equipment, and/or components whose spurious operation would affect the capability to shut down, are provided with means to isolate the equipment from the fire area by the following means:

a. Provide a means to isolate the equipment and/or components from the fire area prior to the fire, i.e., open circuit breakers

b. Provide electrical isolation that prevents spurious operation. Potential isolation devices that include circuit breakers, fuses, control switches, isolation relays, and fiber optic couplers

c. Provide a means to detect spurious operations and then procedures to defeat the maloperation of equipment. Modifications must be achievable prior to the maloperation causing an unrecoverable plant condition.

9A.2.7 An open current transformer (CT) secondary lead has been considered and is not a credible safe shutdown concern.

9A.3 REFERENCE DOCUMENTS

9A.3.1 NRC Generic Letter 81-12 with clarifications

9A.3.2 Appendix R to 10CFR50 Fire Protection Rule

9A.3.3 Fire Protection Handbook, Fourteenth Edition

9A.3.4 Clarification of generic issues, SECY-83-269

9A.3.4 Generic Letter 85-01

9A.4 METHODOLOGY FOR THE FIRE HAZARD ANALYSIS

9A.4.1 The HCGS Fire Hazard Analysis, as required by Section II.B of Appendix R to 10CFR50, used the systematic fire area approach described below.

9A.4.1.1 The first step involved the selection of an appropriate fire area for evaluation. Individual rooms were grouped together to create fire areas so that the majority of the safe shutdown cable and equipment were of one division.

9A.4.1.2 A list of systems required to shutdown the plant was developed. From these systems a list of components required to operate to achieve safe shutdown or whose spurious actuation could affect safe shutdown was developed. These components are listed in Table 9A-2 by system. The table also lists the electrical power division, mechanical shutdown division, room number the

component is located in and piping and instrument diagram the component can be found on. Not included in the table are passive components such as piping, check valves, heat exchangers, rupture disks, manual valves, etc, which can not spuriously change state. Also not included are branch lines whose spurious operation will not affect safe shutdown operation of the system.

9A.4.1.2.1 Table 9A-3 is a list of the same components from Table 9A-2 sorted by fire area with the shutdown method added for each fire area.

9A.4.1.2.2 A list of valves whose spurious operation could affect safe shutdown or cause a LOCA through a high-low pressure interface was then developed. These valves are summarized in the response to Generic Letter 81-12, Item 2.1b and 2.2a, respectively and are included in Tables 9A-2 and 9A-3.

9A.4.1.2.3 A single fire or inadvertent operation of any Fire Protection System in safety-related areas was also analyzed and will not prevent safe shutdown of the plant. Automatic preaction or wet pipe sprinkler systems located in safety-related areas are of the type that have fusible heads. These systems cannot be actuated in the absence of a significant heat source in the vicinity of the sprinkler heads. For safety-related areas where manual deluge systems are located, the safety-related equipment has been designed such that operation of the deluge system will not prevent operation of the equipment for safe shutdown.

Automatic preaction sprinkler systems serving safety-related equipment have an arrangement (normally closed deluge valve, air supervised piping and closed sprinkler heads) to preclude a single fire protection system failure from causing a malfunction of safety-related equipment.

9A.4.1.2.4 The automatic CO_2 systems serving safety related areas have seismically qualified components to avoid inadvertent discharge of medium during a seismic event. The worst inadvertent

operation of a single CO_2 system will affect only a single channel of equipment, i.e. 1 diesel room or 1 diesel fuel oil storage tank room. Inadvertent operation of the control equipment mezzanine CO_2 system will not affect the electrical cable or shutdown capability from the MCR or RSP.

9A.4.1.3 All the Class 1E raceways within the fire area boundaries are highlighted by color on raceway drawings. Channels A, B, C and D are colored green, purple, blue and orange, respectively. Computer printouts of the cable associated with each 1E raceway, for each fire zone within a fire area are made.

9A.4.1.4 With the above, a detailed analysis is made of the fire area. A check is made to make sure that enough equipment in Table 9A-2 is available for safe shutdown. The majority and minority cable Division for each area is identified. The Division associated with the majority cable is assumed to be lost due to the fire. The minority division is assumed to be used for shutdown.

The equipment associated with the minority cables in that area are then analyzed for spurious operation, misoperation or failure to operate, whichever is worse, and its subsequent effects on safe shutdown.

9A.4.1.5 The possibility of fire spreading from one area to another is analyzed. If the walls, floor, ceiling, doors or penetrations are rated less than three hour barriers, then the fire's influence is assumed to extend into the adjacent area. Cable and equipment within this adjacent zone of influence is analyzed for spurious operation and the effects on safe shutdown. The results of this analysis is presented in Section 9A.6.

9A.4.1.5.1 A wall, ceiling or floor is considered fire rated if it is designed to maintain its integrity when exposed to a standard fire test. Each element of a barrier including doors, penetrations and hatches that penetrate the barrier, as well as

structural elements supporting it, are qualified to meet the fire resistance rating of the barrier by standard fire tests as identified in BTP CMEB 9.5-1, ASTM E-119, and ASTM E-814, as appropriate. Deviations are identified in Section 9.5.1 and 9A.6.

9A.4.1.6 The effects on safe shutdown for a fire area are arrived at by reviewing the effects of fire on safe shutdown equipment and cable in that fire area. The shutdown method used in the analysis for each fire area is stated in Section 9A.6. If any deviations from the stated method, fixes or manual actions are assumed for cold shutdown they are stated there. The effects of fire on safe shutdown and combustible loading in each fire area are written up in the Fire Hazard Analysis Tabulation and Summary Tables starting at Table 9A-6. For fire areas made up of more than one room, the analysis assumed the equipment and cable for all rooms were affected by the fire, i.e., the walls within the fire area boundary were considered not to exist. Fire Hazard Analysis Tabulations are provided for each room within the fire area. The parameters listed in 9A.4.2 are included on these sheets.

9A.4.1.7 The Fire Hazard Analysis summary Table 9A-1 lists by room, the description of the room, the safe shutdown equipment and cable. In addition, the amount of combustibles, fire load in Btu/ft^2, fire detection and suppression features, are listed.

9A.4.1.8 Lube oil is stored in fireproof cabinets in selected locations throughout the plant. Each location contains no more than three cabinets, each of which contains no more than 120 gallons, in accordance with NFPA 30, Section 4.3.1. The cabinets are administratively controlled via locked cages.

9A.4.2 <u>FIRE HAZARD ANALYSIS TABULATION SHEET PARAMETERS</u>

The Fire Hazard Analysis tabulation sheets contain the following information:

9A.4.2.a. Fire area number, room number, room name, building and floor elevation.

9A.4.2.b. Safe shutdown equipment and components in each room including:

1. Cable trays and conduit

2. Panels

3. Mechanical components such as pumps and fans

4. Instrumentation racks and controls.

The mechanical safe shutdown division is listed for each of the above equipment and components. Non-safe shutdown cable or equipment are sometimes listed for information only.

9A.4.2.c. Combustible materials present. Materials are listed as follows:

1. Cable insulation in pounds

2. Lube oil in gallons

3. Other. This category includes combustibles such as battery cases, paper, etc

4. Transient. This category allows for the combustibles that may be temporarily stationed in a fire zone due to maintenance. See Section 9A.1.8.

9A.4.2.d. Room area, ft^2

9A.4.2.e. Equivalent fire severity given in minutes of burn. Refer to Section 9A.1.3.

9A.4.2.f. Fire detection types

9A.4.2.g. Fire suppression types

9A.4.2.h. Emergency lights

9A.4.2.i. Construction. All walls, floors and ceilings enclosing a room are listed to show fire rating. In addition, the fire rating of doors, hatches, and other penetrations are listed. Refer to Section 9A.4.1.5.1 for explanation of rated or unrated walls, ceiling or floor.

9A.4.2.j. Effects of fire on safe shutdown. The effects of fire on safe shutdown for each fire area are stated per Section 9A.4.1.6. For areas with more than one room, the effects of fire on safe shutdown are stated on the Fire Hazard Analysis Tabulation Summary for that fire area. For individual rooms within a larger fire area, the effects of fire on safe shutdown is stated on the Fire Hazard Analysis Tabulation for that room and is for the equipment within that room only. This room effect would be a subset of the effects of fire for the entire fire area. Safe shutdown methods assumed for the analysis are listed below. Other combinations of equipment can be used for safe shutdown and if used are stated explicitly in the analysis.

9A.5 SAFE SHUTDOWN METHODS

Various plant systems, both safety-related, and non-safety-related, could be used in a wide variety of combinations to achieve plant shutdown; however, it is necessary to define a limited number of shutdown methods that involve specific combinations of systems and components, in order to facilitate a detailed analysis of the potential effects of postulated fires on the shutdown methods.

Two of the shutdown methods (designated as methods I and II) are operable using controls that are located primarily in the control

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9A.5.2 Shutdown Method II

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9A.5.3 Remote Shutdown Method

9A.5.4 Spurious Signal Analysis Results

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9A.5.5 Cold Shutdown Capabilities

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9A.6 FIRE AREAS AND EXEMPTION REQUESTS

Fire areas for the purposes of comparing HCGS to 10CFR50 Appendix R requirements are defined below. Deviations are noted from the definition of fire area given in Generic Letters 83-33 and 85-01. Since HCGS was requested to identify and justify any deviations from Appendix R, where HCGS fire protection program deviates an exemption is requested below. The exemption request is based on specific fire hazard analysis and effects on safe shutdown discussed with each deviation. A cross-reference between fire area and room numbers is given in Tables 9A-4 and 9A-5. The fire area boundaries are shown on Plant Drawings M-5119 through M-5124. Additional information for specific fire zones (architectural rooms) within the fire area and Fire Area Summary can be found in the Fire Hazard Analysis Tabulation Sheets, Tables 9A-6 through 9A-102. Also refer to the Fire Protection and Detection Plan drawings for different plant elevations, Plant Drawings M-5001 through M-5012.

The plant is broken down into the following general fire areas, which are further defined in the sections indicated:

TB1. Turbine Building, 9A.6.1

AB3. Auxiliary Building, Radwaste Area, 9A.6.2

AB2. Electrical Access Area Division II, 9A.6.3

AB1. Electrical Access Area Division I, 9A.6.4

CD1- Auxiliary Building Control and Diesel Areas, 9A.6.5 CD85

RB7. Reactor Building Drywell, 9A.6.6

RB5. Reactor Building elevation 132 and above, 9A.6.7

RB1. Reactor Building Division I, 9A.6.8

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9A.6.1 TURBINE BUILDING, FIRE AREA TB1

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9A.6.2 RADWASTE AREA, FIRE AREA AB3

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area. This area is defined by fire barriers except as follows:

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9A.6.2.1 Exemption Requests

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9A.6.2.2 Shutdown Method

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9A.6.3 ELECTRICAL ACCESS AREA DIVISION II, FIRE AREA AB2

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9A.6.3.1 Exemption Requests

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9A.6.3.2 Shutdown Method

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9A.6.4 ELECTRICAL ACCESS AREA DIVISION I, FIRE AREA AB1

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9A.6.4.1 Exemption Requests

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9A.6.4.2 Shutdown Method

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9A.6.5 AUXILIARY BUILDING, CONTROL AND DIESEL FIRE AREAS, FIRE AREAS CD1 THROUGH CD85

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9A.6.5.1 Exemption Requests

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9A.6.5.2 Shutdown Method

9A.6.6 REACTOR BUILDING DRYWELL, FIRE AREA RB7

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9A.6.6.1 Exemption Request

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9A.6.6.2 Shutdown Method

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9A.6.7 REACTOR BUILDING ELEVATION 132 AND ABOVE, FIRE AREA RB5

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9A.6.7.1 Exemption Request

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9A.6.7.2 Shutdown Method

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9A.6.8 REACTOR BUILDING DIVISION I, FIRE AREA RB1

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9A.6.8.1 Exemption Request

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9A.6.8.2 Shutdown Method

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9A.6.9 REACTOR BUILDING DIVISION II, FIRE AREA RB2

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9A.6.9.1 Exemption Requests

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9A.6.9.2 Shutdown Method

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9A.6.10 REACTOR BUILDING TORUS ROOM, FIRE AREA RB3 (NORTH AND SOUTH)

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9A.6.10.1 Exemption Request

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9A.6.10.2 Shutdown Method

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9A.6.11 REACTOR BUILDING MAIN STEAM TUNNEL, FIRE AREA RB4

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9A.6.11.1 Exemption Requests

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9A.6.11.2 Shutdown Method

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9A.6.12 TECHNICAL SUPPORT CENTER, FIRE AREA RB6

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9A.6.12.1 Exemption Request

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9A.6.12.2 Shutdown Method

9A.6.13 REMOTE SHUTDOWN PANEL ROOM, FIRE AREA AB4

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9A.6.13.1 Exemption Request

9A.6.13.2 Shutdown Method

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9A.6.14 SERVICE WATER INTAKE DIVISION I, FIRE AREA IS1

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9A.6.14.1 Exemption Request

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9A.6.14.2 Shutdown Method

9A.6.15 SERVICE WATER INTAKE DIVISION II, FIRE AREA IS2

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9A.6.15.1 Exemption Request

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9A.6.15.2 Shutdown Method

9A.6.16 TRAVELING SCREEN MOTOR ROOM, FIRE AREA IS3

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9A.6.16.1 Exemption Request

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9A.6.16.2 Shutdown Method

9A.6.17 MISCELLANEOUS AREAS, NO FIRE AREA DESIGNATION

9A.7 WALKDOWN VERIFICATION

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9A.8. FIREPROOFING PROGRAM

9A.8.1 Steel Supporting BTP 9.5-1 Fire Barriers

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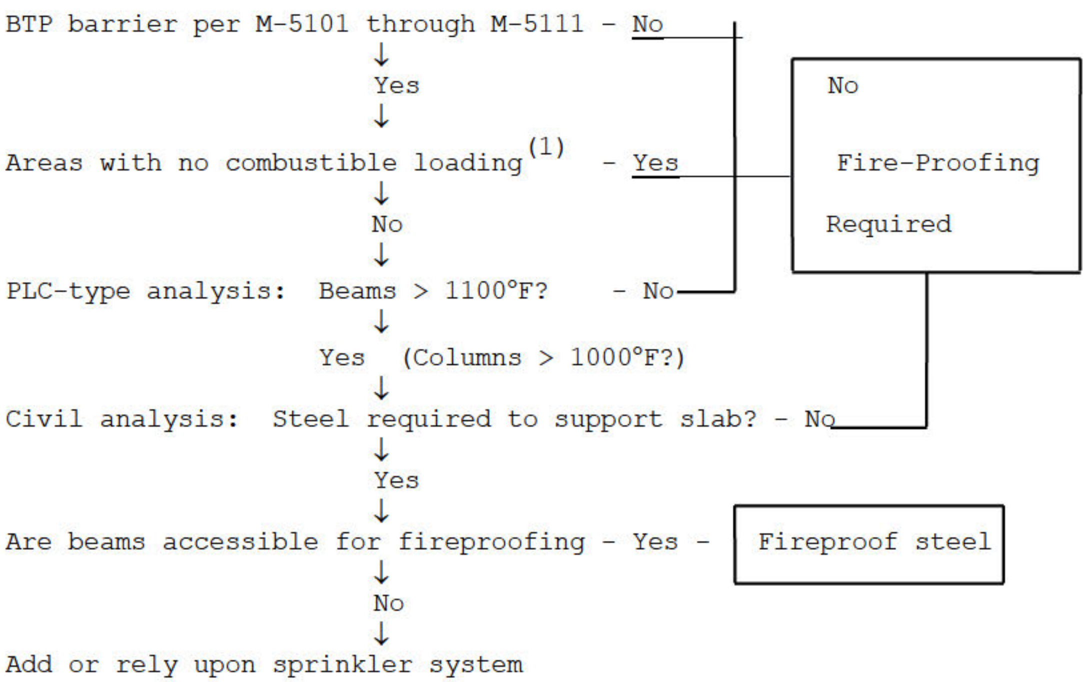
Support steel which exceeds 1100°F (1000°F for columns) is assumed to carry no load. Based on this assumption the structural capability of the fire barrier is determined assuming support by the remaining support steel, if any, and a room temperature as determined by the PLC analysis. The results of this analysis will determine those structural steel components required to be protected in order to support the fire barrier. No credit is taken for manual firefighting in reducing fire temperatures or duration. Beams (or columns) thus identified are fireproofed or if fireproofing is not possible, an automatic suppression system is relied on.

9A.8.2 Steel Not Supporting BTP 9.5-1 Fire Barriers

For steel that does not support BTP 9.5-1 fire barriers, the fire brigade action is assumed to reduce both the duration and temperature of a postulated fire. In addition, the fire is assumed to affect equipment or circuits on the floor above the fire. No fireproofing is provided on these barriers, which are rated primarily for code and insurance purposes.

9A.8.3 Fireproofing Flow Chart

The fireproofing flow chart presented below reiterates the program presented in Sections 9A.8.1 and 9A.8.2.



(1) This step is not applicable to Safe Shutdown Divisional Separation Barriers.

9A.8.4 Fireproofing Program Results

Architectural Drawings A-0241-0 through A-0248-0 categorize the fireproofing, or lack thereof, in rooms that contain exposed structural steel which supports BTP CMEB 9.5-1 fire barriers as follows:

a. Room contains steel not fireproofed or partially fireproofed because of a PLC analysis.

b. Room contains steel not fireproofed or partially fireproofed because of a civil/structural analysis.

c. Room contains steel not fireproofed because of a combination of PLC and civil/structural analyses.

d. Room contains steel not fireproofed because of inaccessibility and an automatic suppression system is relied on.

e. Room with steel fireproofed (complies with BTP).

In addition, rooms containing negligible combustible loading will not have exposed structural steel fireproofed. For example, an unoccupied or abandoned Unit 2 area, or a stairwell, would fit into this category. This only applies to barriers which do not separate safe shutdown divisions.

All other rooms not categorized on the Drawings do not support BTP fire barriers and do not require fireproofing.

9A.8.5 The Drawings described in 9A.8.4 show deviations from the BTP. Individual deviations are not repeated in the specific fire areas deviation (exemption) requests.

Comparison of HCGS to NRC Generic Letter 81-12 With Clarification Dated March 25, 1982

Request for additional information concerning design modification to meet the requirements of Section III.G.3 of Appendix "R".

1. Identify those areas of the plant that will not meet the requirements of Section III.G.2 of Appendix R and either alternative shutdown or an exemption from the requirements of Section III.G.2 of Appendix R will be provided. Additionally, provide a statement that all other areas of the plant are or will be in compliance with Section III.G.2 of Appendix R.

Response:

Section 9A.6. identifies all fire areas for which a deviation from Appendix R, Section III.G.2 or III.G.3 are requested. All other areas of the plant are or will be in compliance with Section III.G.2 of Appendix R.

Section 9A.6. also provides a fire hazard analysis justifying the alternative fire protection configuration.

TABLE 1

FIRE AREA FOR WHICH ALTERNATE SHUTDOWN IS USED AND COMPLIANCE WITH APPENDIX R, SECTION, III.G.3 OR DEVIATIONS REQUESTED

Fire Area	Description	Meets III.G.3	Deviations Requested	Suppression Deviation Only

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<u>SYSTEM</u>

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Drawing	FSAR Figure

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Typical electrical schematic drawings for remote shutdown panel 10C-399 devices are as follows:

Drawing	FSAR Figure

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Response:

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1.e.1 Hot Shutdown

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1.e.2. Cold Shutdown

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1.h. Provide Technical Specifications of the surveillance requirements and limiting conditions for operation for that equipment not already covered by existing Technical Specifications. For example, if new isolation and control switches are added to a shutdown system, the existing Technical Specification surveillance requirements should be supplemented to verify system/equipment functions from the alternate shutdown station at testing intervals consistent with the guidelines of Regulatory Guide 1.22 and IEEE-338. Credit may be taken for other existing tests using group overlap test concepts.

Response:

Surveillance requirements and limiting conditions are provided in FSAR Chapter 16, Technical Specifications.

1.i. For new equipment comprising the alternate shutdown capability, verify that the systems available are adequate to perform the necessary shutdown function. The functions required should be based on previous analyses, if possible (e.g., in the FSAR), such as a loss of normal ac power or shutdown on Group 1 isolation (BWR). The equipment required for the alternative capability should be the same or equivalent to that relied on in the above analysis.

Response:

The equipment comprising the alternative shutdown capability is our original design and has had the same analysis as other equipment commensurate with its safe shutdown function.

The shutdown functions required are listed below:

1. Sufficient capability will be provided at the RSP to bring the plant to cold shutdown.

2. The system will provide capabilities to achieve hot shutdown after sustaining a single failure, as described in NRC Standard Review Plan 7.4-III, during Category 1 events.

3. Category 1 events include all events which may cause evacuation of the main control room without damage to the equipment located at the main control room and control equipment room.

   Category 2 events include such hazards as a fire that may render the equipment in the main control room, CSR, and CER inoperable and thereby prevent a safe shutdown from the MCR.

   In the event that offsite power is lost, the standby diesel generators (SDGs) will start automatically. They can also be started manually from the local diesel generator diesel panel, at Elevation 130 in the diesel area of the Auxiliary Building, by operator action.

   The application of single failure criteria during Category 2 events considers the first failure as the malfunction of any or all ECCS automatic control capabilities located in the MCR. No additional failures, of the components or the equipment within the RSF, are postulated.

1.j. Verify that repair procedures for cold shutdown systems are developed and material for repairs is maintained on site. Provide a summary of these procedures and a list of the material needed for repairs.

Response:

We are not relying on repair procedures for cold shutdown equipment since one redundant safe shutdown train will remain free of fire damage.

Item 2, Associated Circuits of Concern

The following defines the three types of associated circuits considered in the overall review.

a. Type A associated circuits of concern are those circuits which have physical separation less than that required by Section III.G.2 of Appendix R and a common power source with the shutdown equipment (redundant or alternative) and the power source is not electrically protected from the circuit of concern by coordinated breakers, fuses, or similar devices.

b. Type B associated circuits of concern are those circuits which have a physical separation less than that required by Section III.G.2 of Appendix R and a connection to circuits of equipment whose spurious operation would adversely affect the shutdown capability (e.g., RHR/RCS isolation valves, ADS valves, instrumentation, etc).

c. Type C associated circuits of concern are those circuits which have a physical separation less than that required by Section III.G.2 of Appendix R and a common enclosure (e.g., raceway, panel, junction) with the shutdown cables (redundant and alternative) and,

    1. are not electrically protected by circuit breakers, fuses or similar devices, or

    2. will allow propagation of the fire into the common enclosure.

FIRE AREA APPROACH

For each fire area where an alternative or dedicated shutdown method, in accordance with Section III.G.3 of Appendix R is provided, the following information is required to demonstrate that associated circuits will not prevent operation or cause maloperation of the alternative or dedicated shutdown method:

1a. Provide a table that lists all the power cables in the fire area that connect to the same power supply of the alternative or dedicated shutdown method and the function of each power cable listed (i.e., power for RHR pump).

Response:

There are no safe shutdown power cables in the fire areas for which alternative shutdown is provided. The cables in these areas are either control or instrumentation. Therefore, a table is not included.

1b. Provide a table that lists all the cables in the fire area that were considered for possible spurious operation which would adversely affect shutdown and the function of each cable listed.

Response:

HCGS maintains Appendix R separation between the two shutdown trains. If a fire occurs in the first train, safe shutdown Division I, the second train, safe shutdown Division II, is fully capable of cold shutdown, independent and unaffected by any damage, maloperation or spurious operations in the first train. Similarly, if a fire occurs in the second train, the first train is fully capable of cold shutdown. The only common juncture between the two shutdown trains are the control areas listed in Item 1 of these responses. If a fire occurs in these areas, transfer switches located at the RSF will isolate the second shutdown train from any damage upstream of these switches;

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TABLE 9A-103

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TABLE 9A-104

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Figure F9A-1 intentionally deleted.

Refer to Plant Drawing E-6604-0 SH 1 in DCRMS

Figure F9A-2 intentionally deleted.

Refer to Plant Drawing E-6604-0 SH 3 in DCRMS

Figure F9A-3 intentionally deleted.

Refer to Plant Drawing E-6604-0 SH 4 in DCRMS

Figure F9A-4 SH 1-2 intentionally deleted.

Refer to Plant Drawing E-0217-0 sheets 1 and 6 in DCRMS

Figure F9A-5 intentionally deleted.

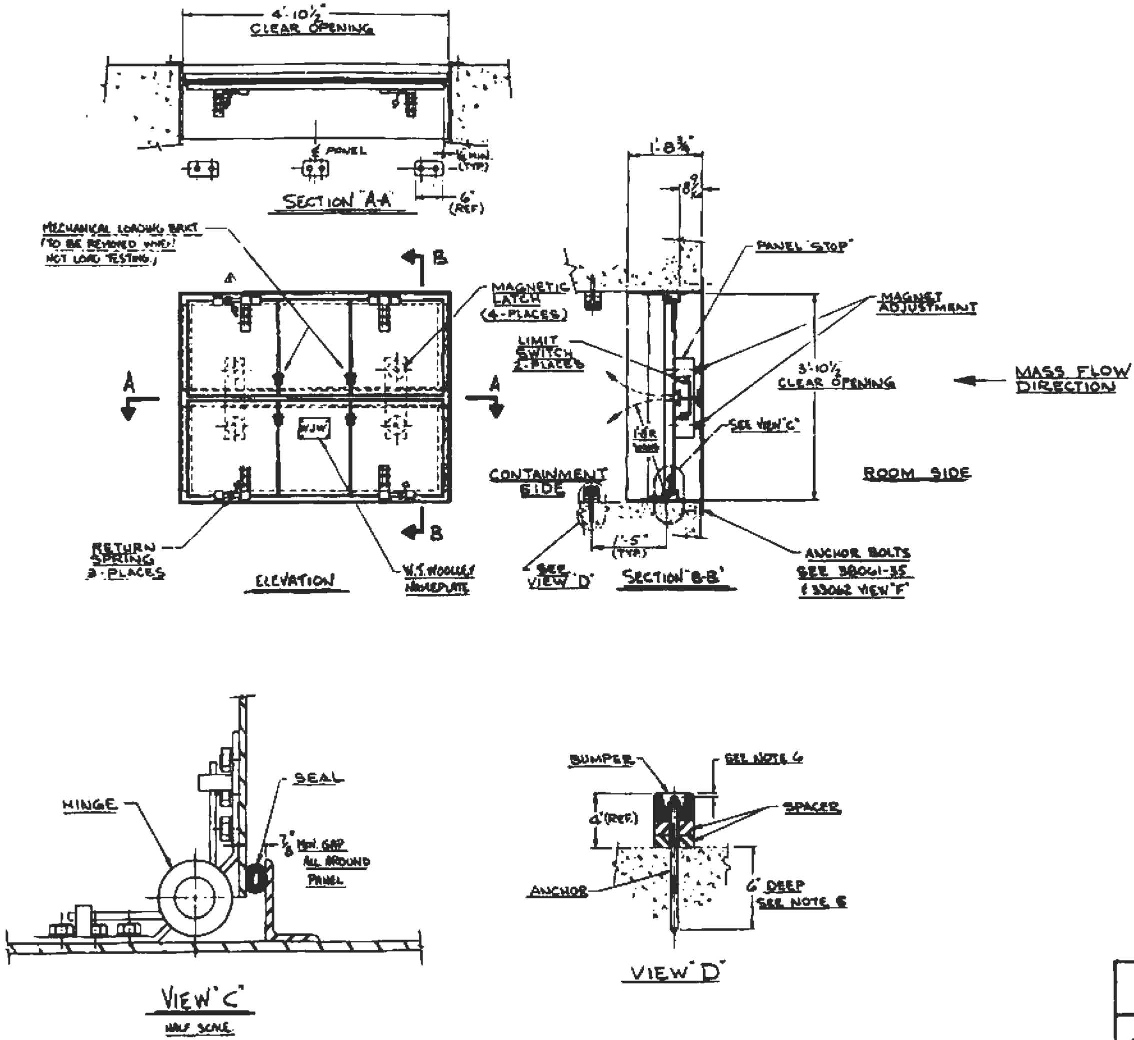
Refer to Plant Drawing E-0219-0 sheet 2 in DCRMS

Figure F9A-6 intentionally deleted.

Refer to Plant Drawing E-6603-0 in DCRMS

Figure F9A-7 intentionally deleted.

Refer to Plant Drawing E-0085-0 in DCRMS



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APRIL 11, 1988

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
HOPE CREEK NUCLEAR GENERATING STATION

PRESSURE RELIEF BLOWOUT PANEL – RCIC

UPDATED FSAR — FIGURE 9A-8

Security Related Information
Text withheld Under 10 CFR
2.390

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
HOPE CREEK NUCLEAR GENERATING STATION

PRESSURE RELIEF BLOWOUT
PANEL – RHR AND HPCI

UPDATED FSAR

FIGURE 9A-[illegible]

Security Related Information
Text withheld Under 10 CFR 2.390

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
HOPE CREEK NUCLEAR GENERATING STATION

REACTOR BUILDING P.T. EQUIPMENT
ACCESS PANEL ELEV., SECTION &
DETAILS SACS ROOM

UPDATED FSAR

FIGURE 9A.13

Security Related Information
Text withheld Under 10 CFR 2.390

PUBLIC SERVICE ELECTRIC AND GAS COMPANY HOPE CREEK NUCLEAR GENERATING STATION
OUTLINE PRESSURE TIGHT DOOR
UPDATED FSAR   Sheet 1 of 2 FIGURE 9A-11

Security Related Information Text withheld Under 10 CFR 2.390

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
HOPE CREEK NUCLEAR GENERATING STATION

OUTLINE PRESSURE TIGHT DOOR

UPDATED FSAR

Sheet 2 of 2
FIGURE 9A-11

SECURITY - RELATED
INFORMATION WITHHELD
UNDER 10 CFR 2.390

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PSEG NUCLEAR, L.L.C.
HOPE CREEK NUCLEAR GENERATING STATION

LOWER CONTROL EQUIPMENT ROOM,
ELEVATION 102' 0"

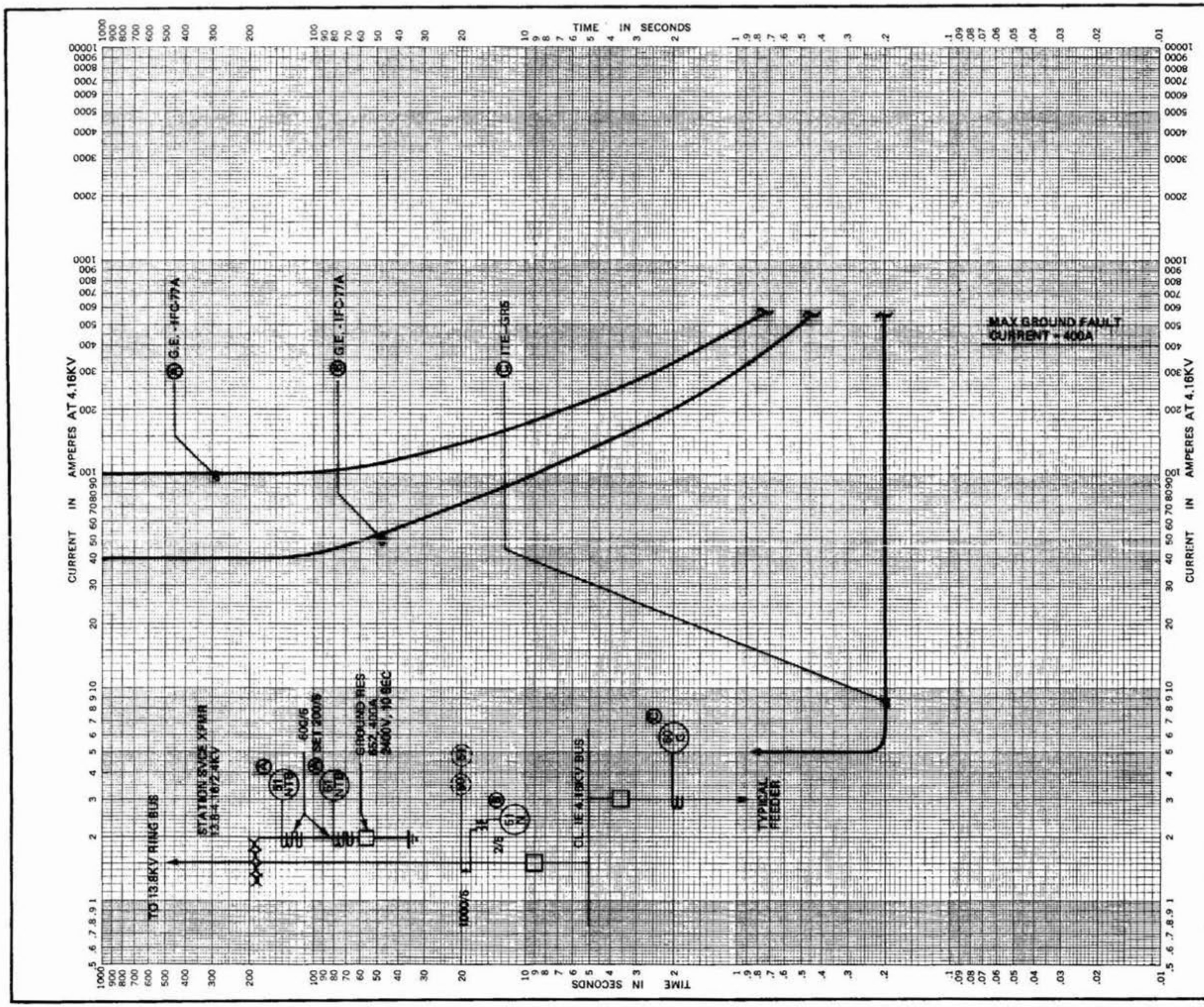
Updated FSAR

Fig. 9A-12

SECURITY - RELATED
INFORMATION WITHHELD
UNDER 10 CFR 2.390

REVISION 0
APRIL 11, 1988

PSEG NUCLEAR, L.L.C. HOPE CREEK NUCLEAR GENERATING STATION
UPPER CONTROL EQUIPMENT ROOM, ELEVATION 163' 6"
Updated FSAR Fig. 9A-13



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APRIL 11, 1988

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
HOPE CREEK NUCLEAR GENERATING STATION

CLASS IE 4.16KV SYSTEM – GROUND RELAY COORDINATION

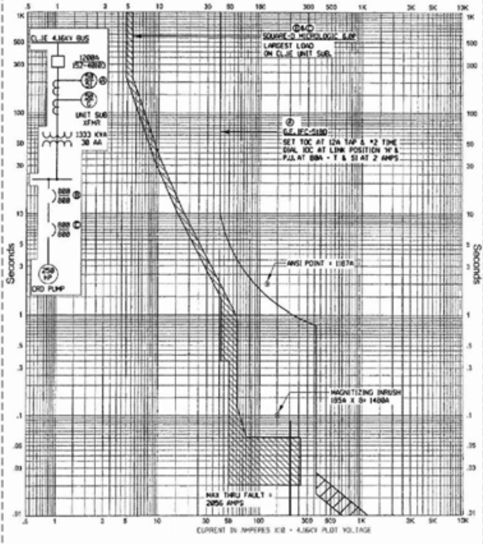
UPDATED FSAR

FIGURE 9A-14

FIGURE DELETED

Revisson 19, Nov 5, 2012

PSEG Nuclear, LLC HOPE CREEK NUCLEAR GENERATING STATION	Hope Creek Nuclear Generating Station CLASS 1E 4.16KV BUS-UNIT SUBSTATION TRANSFORMER FEEDER COORDINATION
	Updated FSAR Figure 9A-15



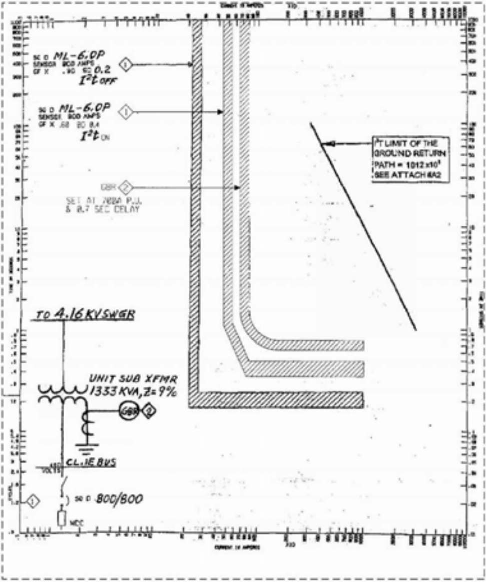
Revision 15, October 27, 2006

PSEG Nuclear, LLC HOPE CREEK NUCLEAR GENERATING STATION	Hope Creek Nuclear Generating Station CLASS 1E 4.16KV BUS UNIT SUBSTATION TRANSFORMER FEEDER COORDINATION
	Updated FSAR Figure 9A-15A

FIGURE DELETED

Revision 19, Nov 5, 2012

PSEG Nuclear, LLC HOPE CREEK NUCLEAR GENERATING STATION	Hope Creek Nuclear Generating Station CLASS 1E 480V LOAD CENTER GROUND RELAY COORDINATION
	Updated FSAR Figure 9A-16



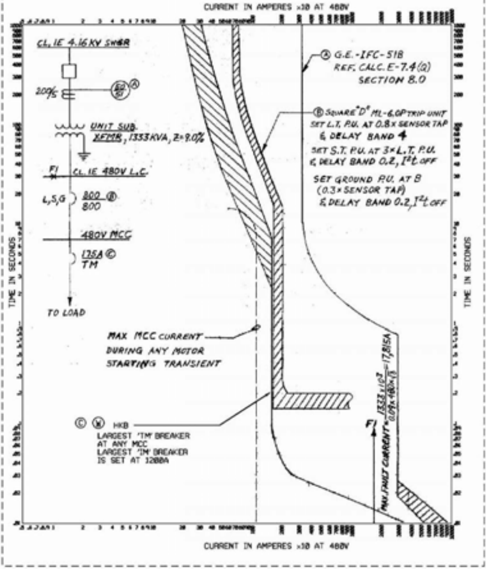
Revision 15, October 27, 2006

PSEG Nuclear, LLC HOPE CREEK NUCLEAR GENERATING STATION	Hope Creek Nuclear Generating Station CLASS 1E 480V LOAD CENTER GROUND RELAY COORDINATION
	Updated FSAR — Figure 9A-16A

FIGURE DELETED

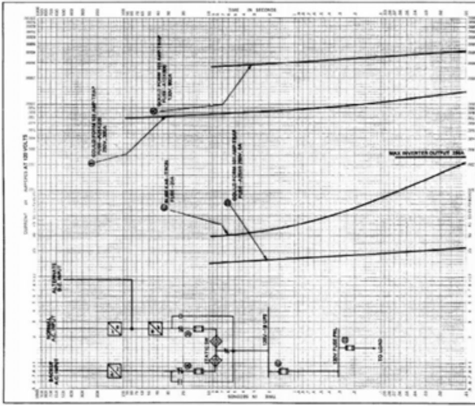
Revision 19, Nov 5, 2012

PSEG Nuclear, LLC HOPE CREEK NUCLEAR GENERATING STATION	Hope Creek Nuclear Generating Station CLASS 1E 480V LOAD CENTER MCC FEEDER COORDINATION Updated FSAR Figure 9A-17



Revision 15, October 27, 2006

PSEG Nuclear, LLC HOPE CREEK NUCLEAR GENERATING STATION	Hope Creek Nuclear Generating Station CLASS IE 480V LOAD CENTER MCC FEEDER - COORDINATION Updated FSAR — Figure 9A-17A



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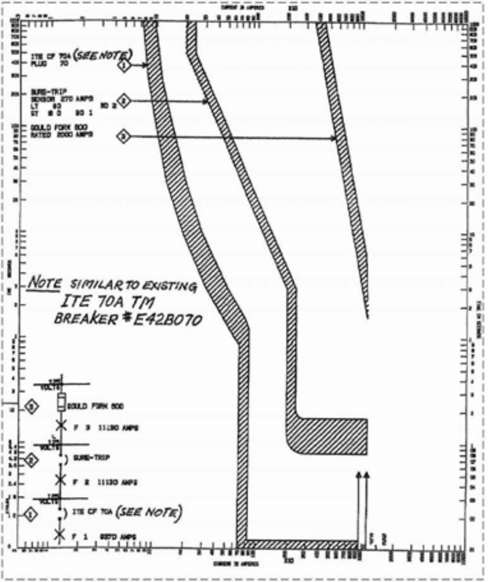
PUBLIC SERVICE ELECTRIC AND GAS COMPANY
HOPE CREEK NUCLEAR GENERATING STATION

120V UPS
SYSTEM FUSE COORDINATION

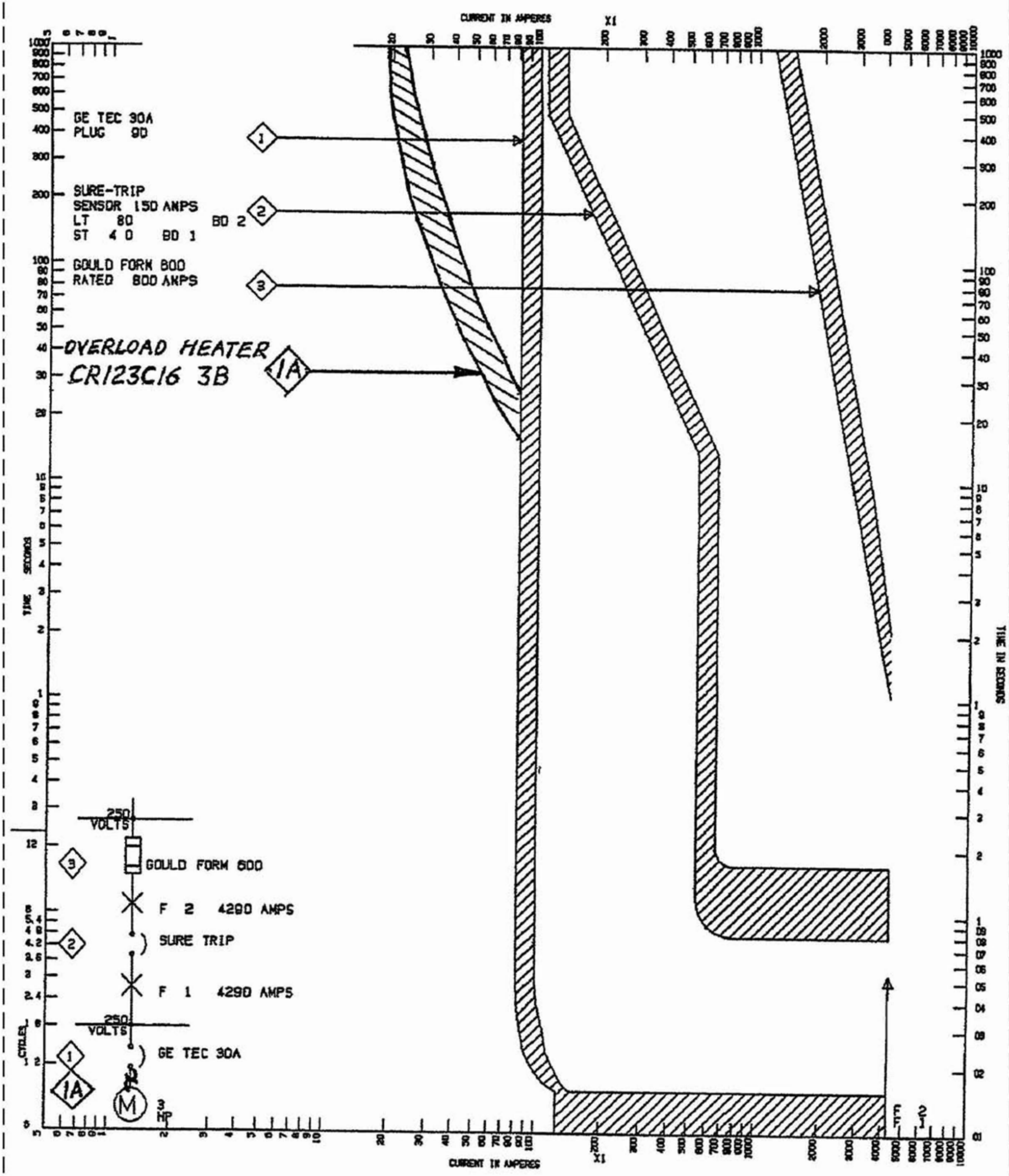
UPDATED FSAR

FIGURE 8A-18



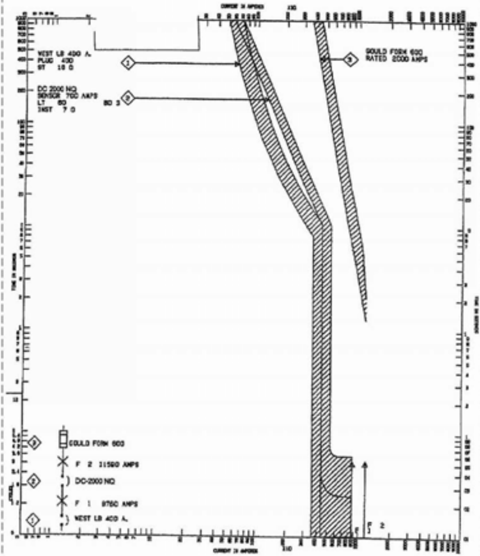
Revision 18, May 10, 2011

PSEG Nuclear, LLC HOPE CREEK NUCLEAR GENERATING STATION	Hope Creek Nuclear Generating Station CLASS IE 125V DC SWGR-DISTR. PANEL COORDINATION Updated FSAR — Sheet 1 of 3 Figure 9A-19



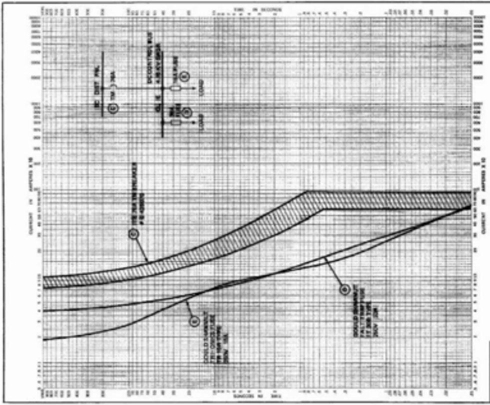
Revision 18, May 10, 2011

PSEG Nuclear, LLC HOPE CREEK NUCLEAR GENERATING STATION	Hope Creek Nuclear Generating Station CLASS IE 250V DC SWGR-RCIC MCC FEEDER
	Updated FSAR — Sheet 2 of 3 — Figure 9A-19



Revision 18, May 10, 2011

PSEG Nuclear, LLC HOPE CREEK NUCLEAR GENERATING STATION	Hope Creek Nuclear Generating Station CLASS IE 125V DC SWGR-BATTERY CHARGER
	Updated FSAR — Sheet 3 of 3 — Figure 9A-19



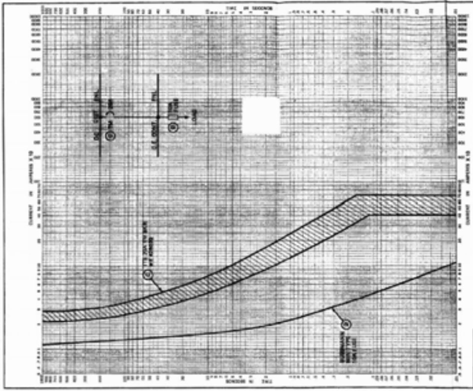
REVISION

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
HOPE CREEK NUCLEAR GENERATING STATION

CLASS IE 125V DC DIST. PNL – 4.16KV
SWGR BKR/FUSE COORDINATION

UPDATED FSAR

FIGURE 8A-20



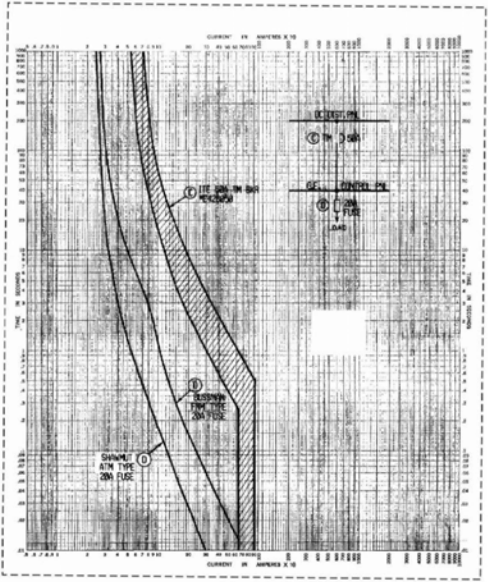
Revision [illegible]
September [illegible]

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
HOPE CREEK NUCLEAR GENERATING STATION

CLASS IE 125V DC DIST. PNL – GE CONTROL PNL BKR/FUSE COORDINATION

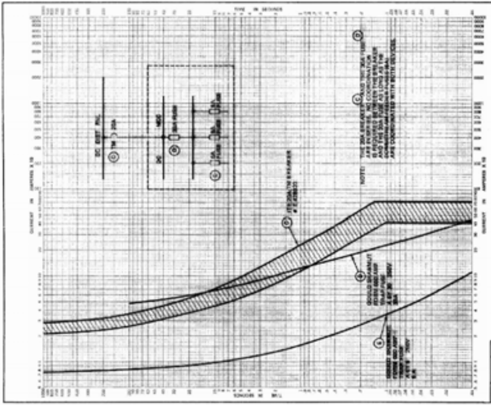
UPDATED FSAR

Sheet 1 of 2
FIGURE 8A-21



Revision 16, May 15, 2008

PSEG Nuclear, LLC HOPE CREEK NUCLEAR GENERATING STATION	Hope Creek Nuclear Generating Station CLASS 1E 125V DC DIST. PNL - GE CONTROL PNL BKR/FUSE COORDINATION
	Updated FSAR — Figure 9A-21 sh. 2 of 2



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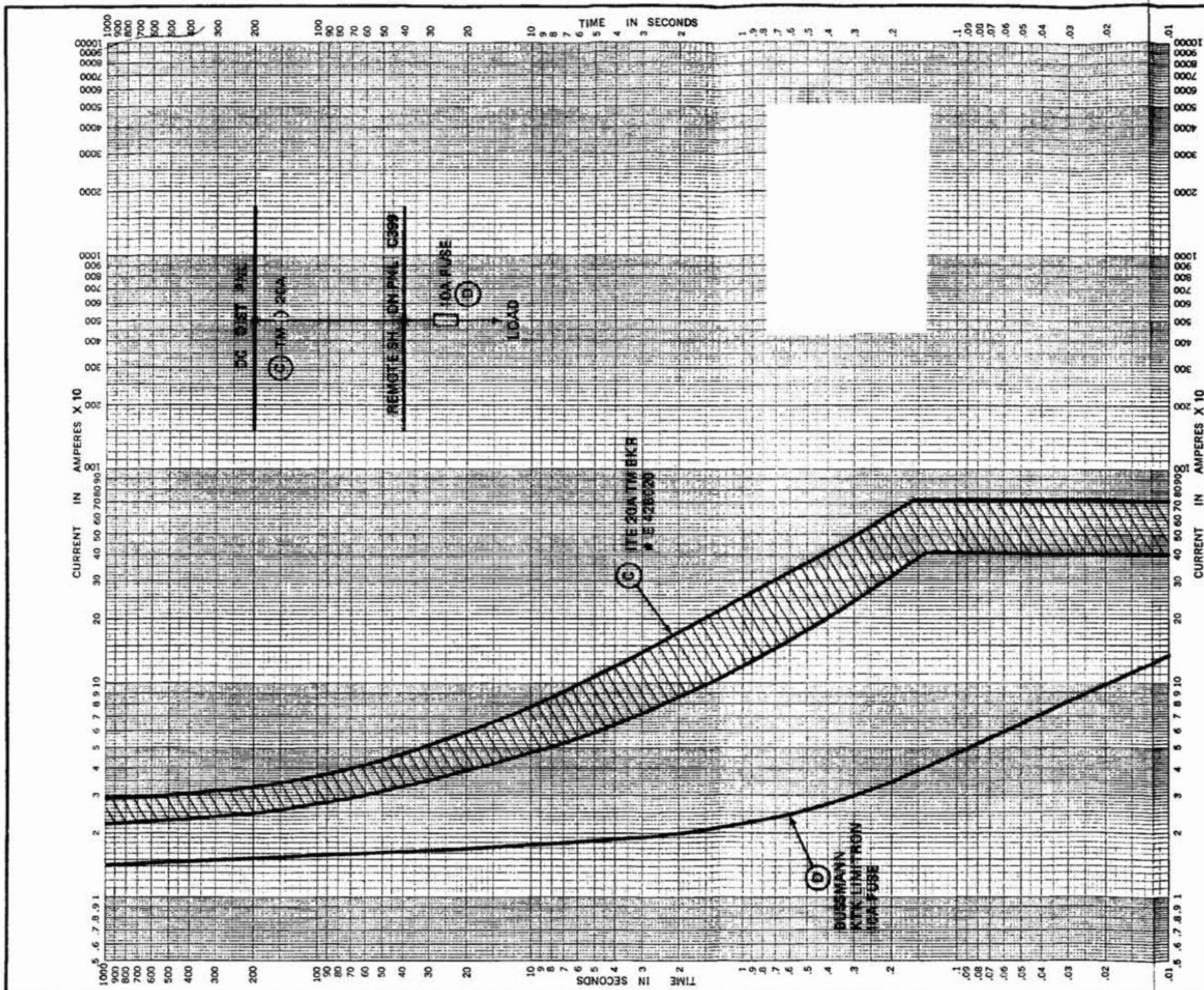
APRIL 11, 1988

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
HOPE CREEK NUCLEAR GENERATING STATION

CLASS IE 125V DC DIST. PNL – DC MCC BKR/FUSE COORDINATION

UPDATED FSAR

FIGURE 8A-22



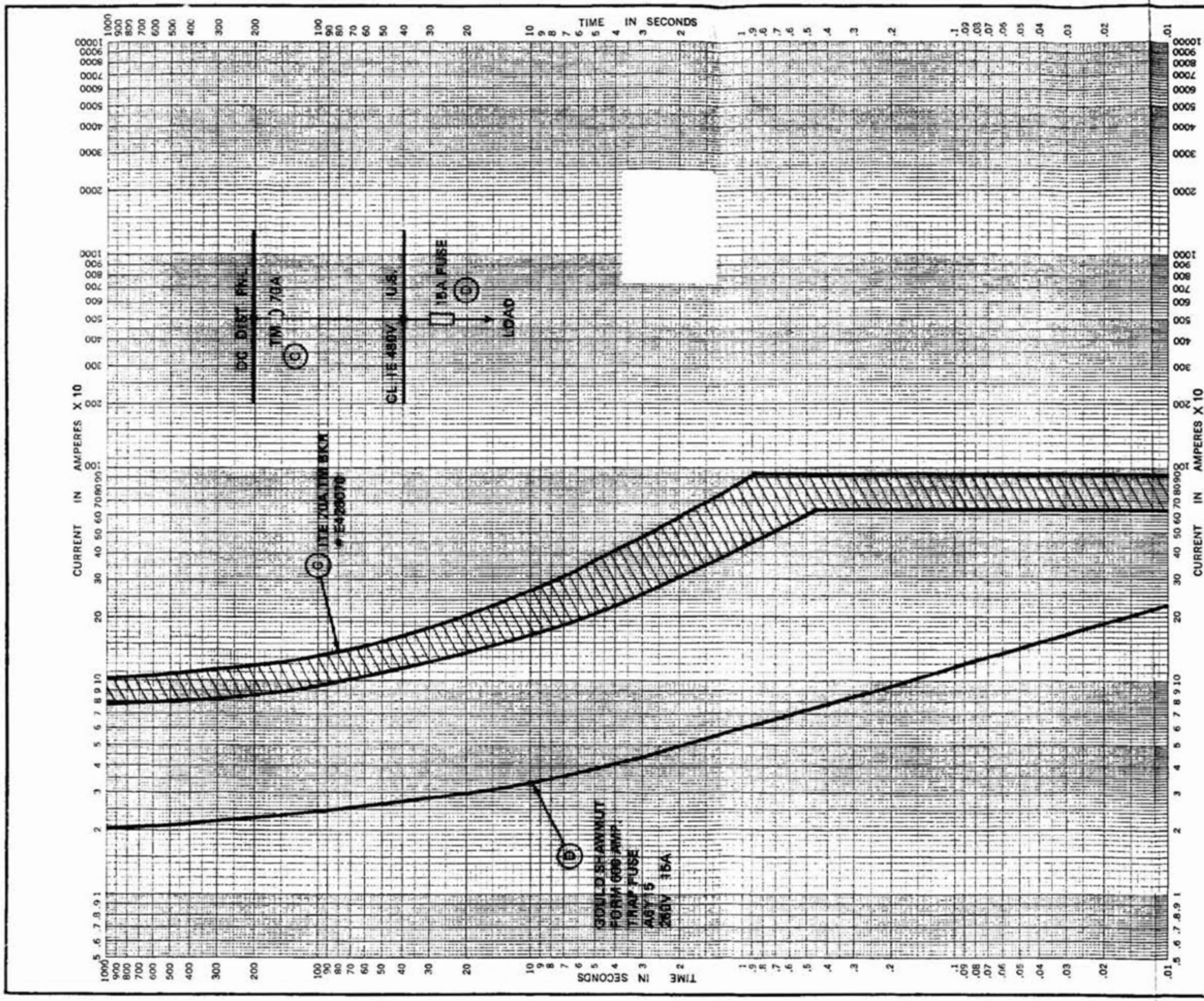
Revision 8
September 25, 1996

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
HOPE CREEK NUCLEAR GENERATING STATION

CLASS IE 125V DC DIST. PNL – REMOTE SHDN PNL 10C399 BKR/FUSE COORDINATON

UPDATED FSAR

FIGURE 9A-23



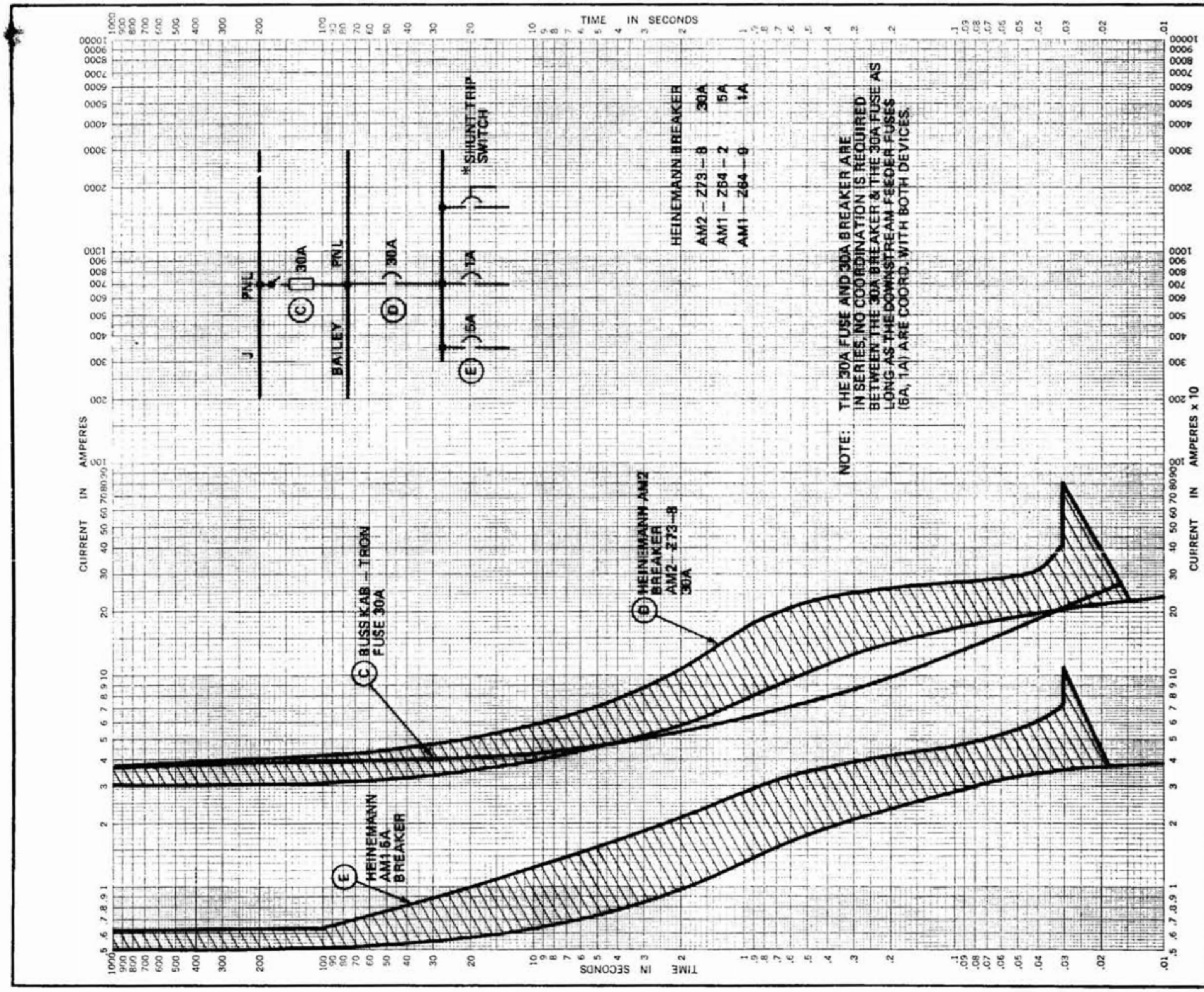
Revision 8
September 25, 1996

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
HOPE CREEK NUCLEAR GENERATING STATION

CLASS IE 125V DC DIST. PNL – 480V SUBSTATION BKR/FUSE COORDINATION

UPDATED FSAR

FIGURE 9A-24



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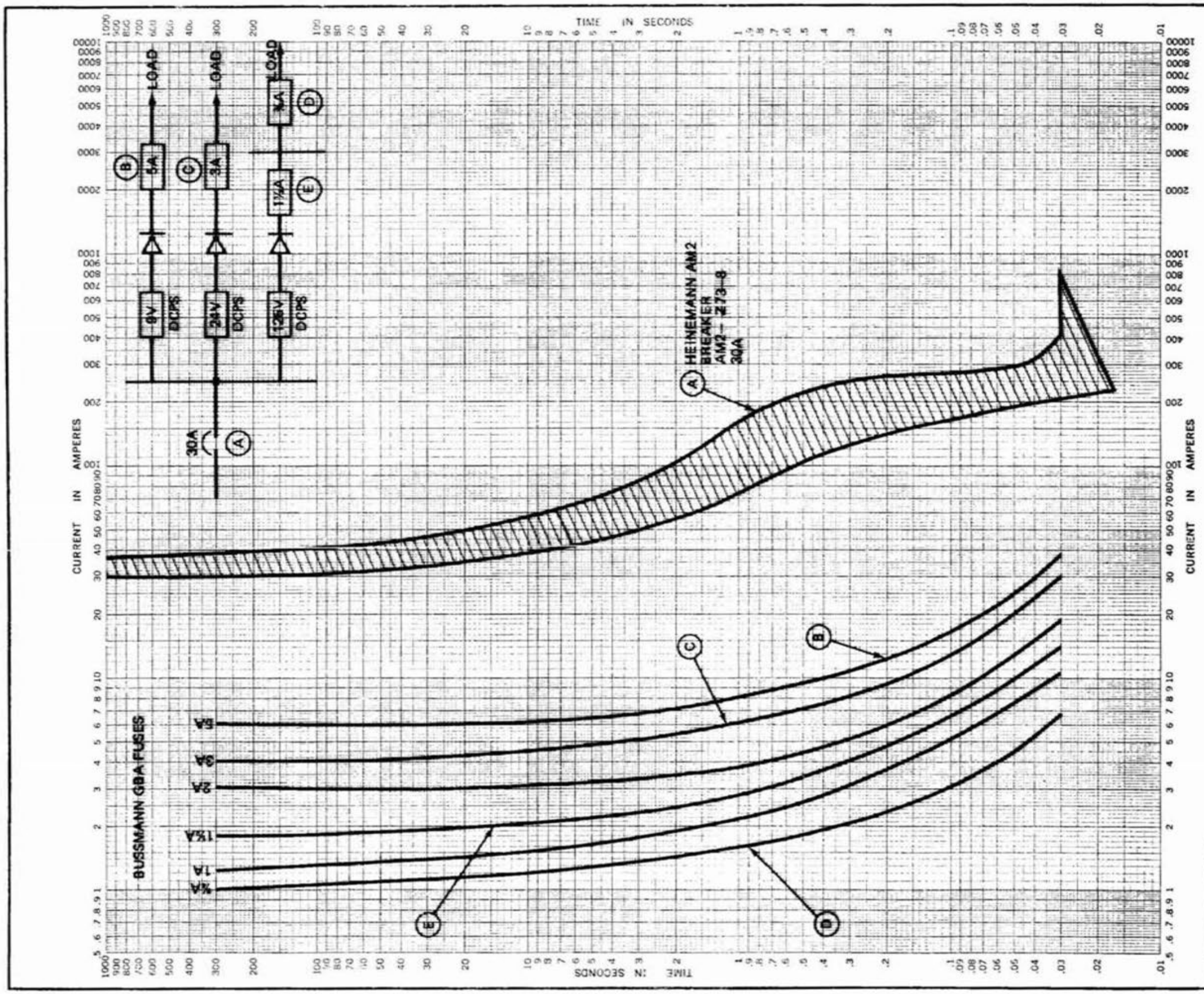
APRIL 11, 1988

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
HOPE CREEK NUCLEAR GENERATING STATION

CLASS IE 120V AC J PNL – BAILEY DIGITAL/ANALOG PNL FUSE/ BREAKER COORDINATION

UPDATED FSAR

FIGURE 9A-25



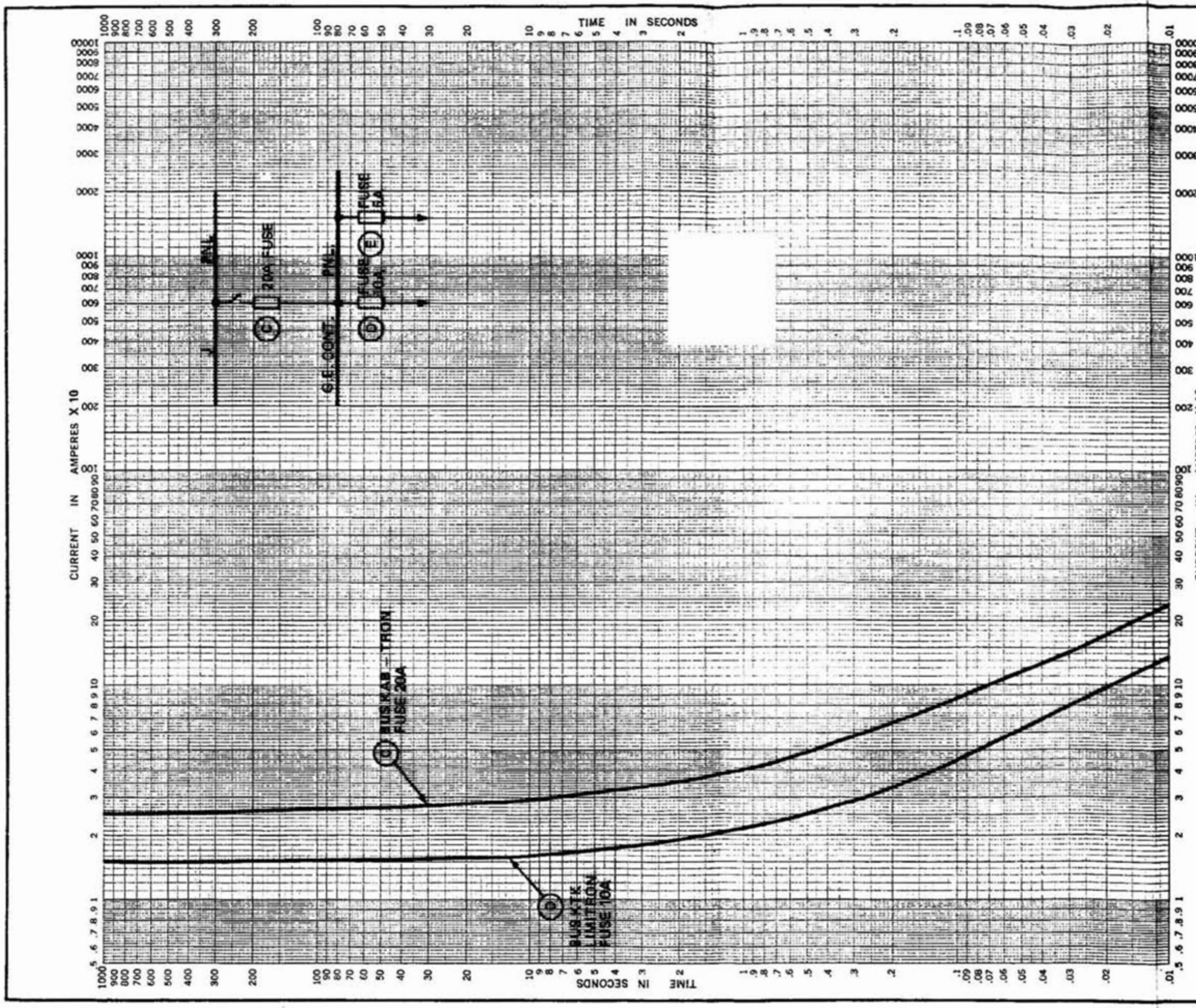
REVISION 0
APRIL 11, 1988

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
HOPE CREEK NUCLEAR GENERATING STATION

CLASS IE 120V AC J PNL – BAILEY DIGITAL/ANALOG PNL BREAKER/ FUSE COORDINATION

UPDATED FSAR

FIGURE 9A-26



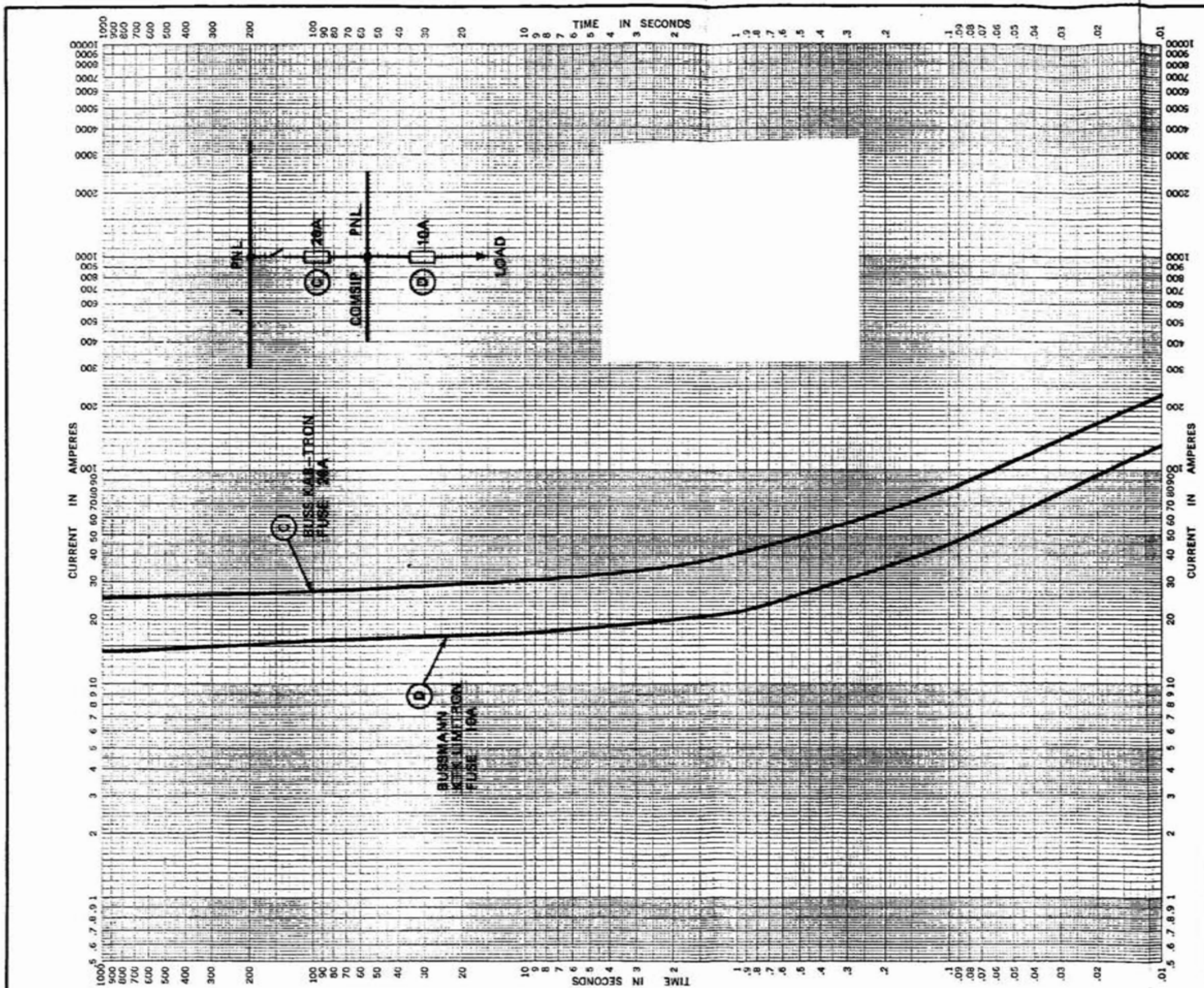
Revision 8
September 25, 1996

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
HOPE CREEK NUCLEAR GENERATING STATION

CLASS IE 120V AC J PNL – GE CONTROL PNL FUSE/FUSE COORDINATION

UPDATED FSAR

FIGURE 9A-27

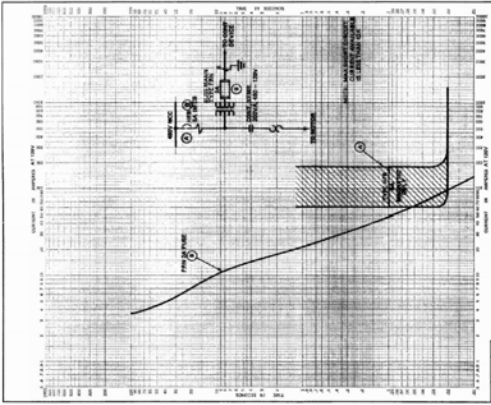


Revision 8
September 25, 1996

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
HOPE CREEK NUCLEAR GENERATING STATION

CLASS IE 120V AC J PNL – COMSIP PNL FUSE/FUSE COORDINATION

UPDATED FSAR **FIGURE 9A-28**



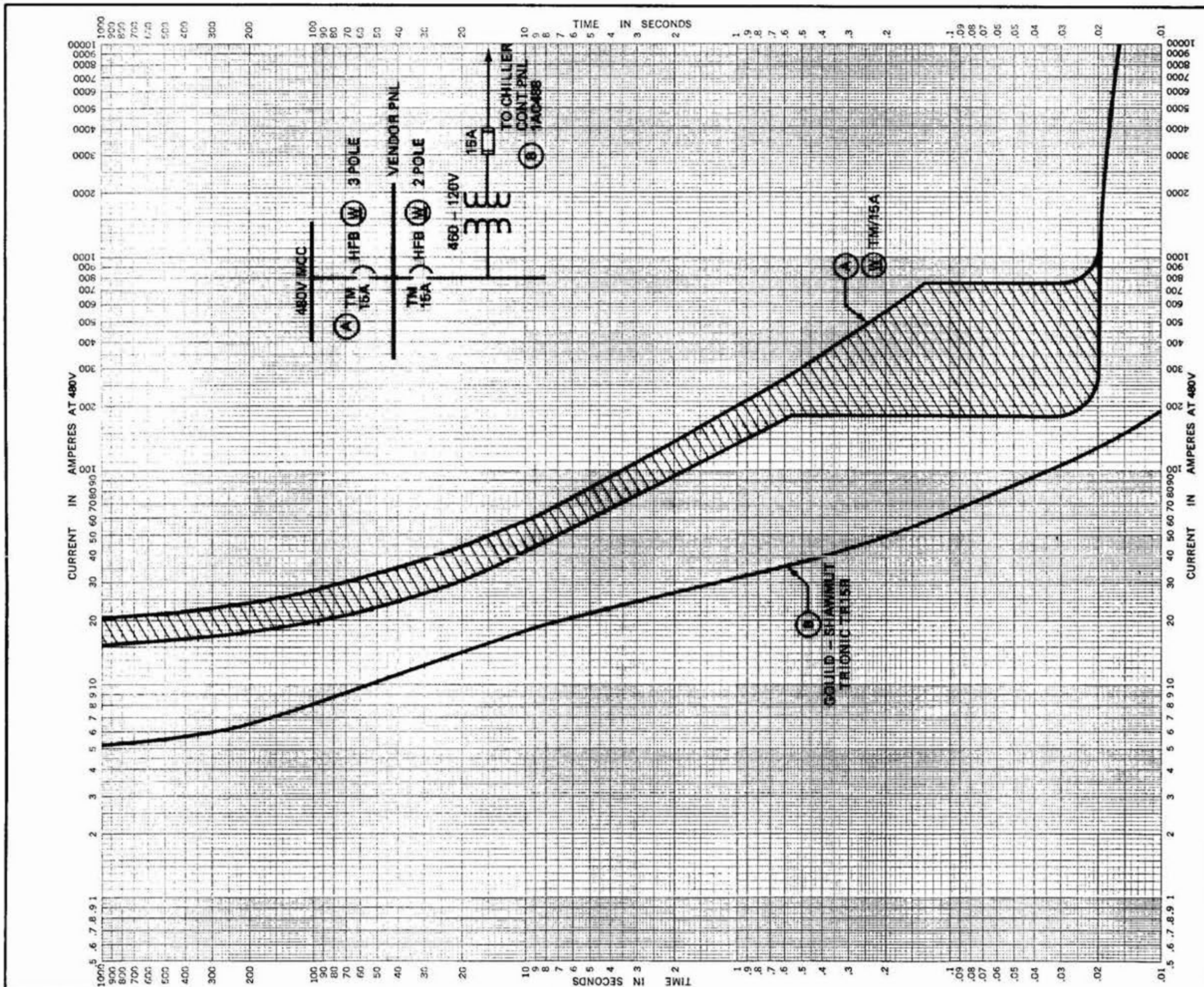
REVISION 8
APRIL 11,

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
HOPE CREEK NUCLEAR GENERATING STATION

480V MCC IN CIRCUIT BREAKER (MIN) RATINGS/CONTROL TRANSFORMER SECONDARY FUSE COORDINATION

UPDATED FSAR

FIGURE 8A-20



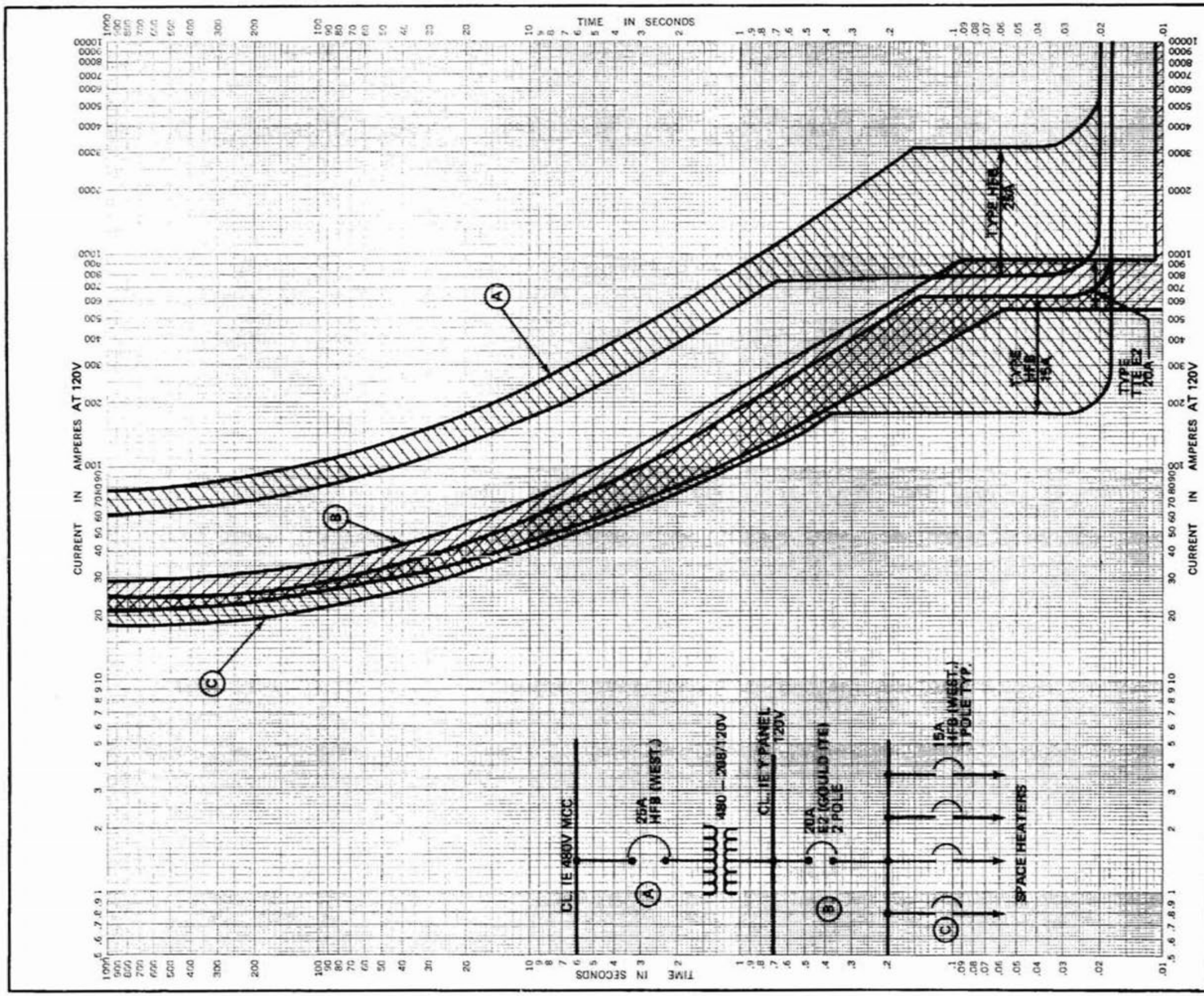
REVISION 0
APRIL 11, 1988

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
HOPE CREEK NUCLEAR GENERATING STATION

480V MCC TM CIRCUIT BREAKER/ CONTROL TRANSFORMER (VENDOR) SECONDARY FUSE COORDINATION (CHILLER CONTROL PNL – M-723)

UPDATED FSAR

FIGURE 9A-30



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PUBLIC SERVICE ELECTRIC AND GAS COMPANY
HOPE CREEK NUCLEAR GENERATING STATION

CLASS IE 480V MCC TO Y PNL & MISC. DEVICES COORDINATION

UPDATED FSAR

FIGURE 9A-31

Figure F9A-32 intentionally deleted.

Refer to Plant Drawing M-5112 in DCRMS

Figure F9A-33 intentionally deleted.

Refer to Plant Drawing M-5113 in DCRMS

Figure F9A-34 intentionally deleted.

Refer to Plant Drawing M-5114 in DCRMS

Figure F9A-35 intentionally deleted.

Refer to Plant Drawing M-5115 in DCRMS

Figure F9A-36 intentionally deleted.

Refer to Plant Drawing M-5116 in DCRMS

Figure F9A-37 intentionally deleted.

Refer to Plant Drawing M-5117 in DCRMS

Figure F9A-38 intentionally deleted.

Refer to Plant Drawing M-5118 in DCRMS

Figure F9A-39 intentionally deleted.

Refer to Plant Drawing M-5119 in DCRMS

Figure F9A-40 intentionally deleted.

Refer to Plant Drawing M-5120 in DCRMS

Figure F9A-41 intentionally deleted.

Refer to Plant Drawing M-5121 in DCRMS

Figure F9A-42 intentionally deleted.

Refer to Plant Drawing M-5122 in DCRMS

Figure F9A-43 intentionally deleted.

Refer to Plant Drawing M-5123 in DCRMS

Figure F9A-44 intentionally deleted.

Refer to Plant Drawing M-5124 in DCRMS

APPENDIX 9B

DESIGN, ANALYSIS AND CONSTRUCTION

OF SPENT FUEL STORAGE RACKS

9B.1 SCOPE

This appendix describes the design, analysis and construction of the spent fuel racks.

9B.2 DESCRIPTION OF SPENT POOL AND RACKS

Section 9.1.2.2 contains a description of the spent fuel storage facility including the high density spent fuel storage racks. The spent fuel racks are of free standing design and are not attached to either the fuel pool wall or the fuel pool liner plate. Plant Drawings P-0011-0 and P-0047-1 show the spent fuel pool in relation to other plant structures. Figures 9.1-3 and 9.1-4 show details of the spent fuel racks.

The spent fuel racks are designed to withstand the postulated drop of a fuel bundle. Section 9.1.5 contains a description of the overhead heavy load handling systems for the Reactor Building polar crane including figures showing load paths for the crane.

9B.3 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS

All parts of the spent fuel racks, except the adjusting screws in the feet of each module and the poison material, are made from ASTM A240, Type 304L stainless steel. The adjusting screws are made from ASTM A564, Type 630 stainless steel. Boral is the poison material.

Design, fabrication and installation of the spent fuel racks are performed based upon Subsection NF requirements of Reference 9B-1 for Class 3 component supports.

9B.4 SEISMIC AND IMPACT LOADS

The seismic input for the spent fuel racks consists of floor response spectra for the spent fuel pool slab. Floor response spectra are developed from ground response spectra which comply with the requirements of Regulatory Guides 1.60 and 1.61. Acceleration time histories are developed for two horizontal directions and one vertical direction from the floor response spectra. These three time histories are imposed simultaneously. The peak responses from each direction are combined by square root of the sum of the squares in accordance with Regulatory Guide 1.92.

Impact loads due to fuel rattling are calculated using methods described in Section 9B.6. Impact loads are considered for local as well as overall effects on the rack design.

9B.5 LOADS AND LOAD COMBINATIONS

Loads and load combinations are in agreement with Table 1 of Reference 9B-2. Thermal effects are included by using decreased material properties at the applicable temperature level. Since the racks are free standing, there are no thermal stresses.

9B.6 DESIGN AND ANALYSIS PROCEDURES

Each fuel rack is idealized as a 3D finite element model using the ANSYS computer program. Figure 9B1 shows a five canister portion of a rack. The canisters and bottom grid plate are modeled with plate elements. The perimeter bar, which secures the canisters at the top, and the stiffening bars for the grid plate are modeled with beam elements. The thin stainless steel wrapper containing the neutron absorber and the stainless steel panels used to close off the alternate cavities are not modeled but their masses are included. The fuel assemblies are modeled as beam elements.

Figure 9B-2 shows a double rack model in schematic form. 3D interface elements are used to represent the fuel to canister

clearance as well as the rack to rack gap. These nonlinear elements reproduce forces due to fuel rattling and possible rack to rack interaction. 3D gap elements with material properties based on the interface friction coefficients are used to simulate the corner supporting feet which may slide or lift off the pool floor. Two bounding values of friction coefficient (0.2 and 0.8) are used in order to identify the most critical conditions for sliding and for maximum reactions at the support feet.

Structural damping coefficients of 2 percent for OBE and 4 percent for SSE are used, except that impact damping of 10 percent of critical is used for the gap elements since impact dissipates substantial amounts of energy. With 20 feet of submergence, sloshing effects are negligible and therefore are neglected. Fluid damping effects are also neglected. To simulate the immersion effects, all the internal water entrapped within the rack envelope is added to the horizontal mass. The external water between adjacent racks is modeled using the hydrodynamic coupling element shown in Figure 9B-2.

A parametric study, which considers varying amounts of fuel in a single rack, is conducted to determine which of the following conditions should be considered in order to maximize the seismic response of the racks.

1. Rack empty

2. Rack one-third full

3. Rack two-thirds full

4. Rack full

For the partially loaded conditions, eccentricity of the fuel on one side of the rack is considered.

9B.7 STRUCTURAL ACCEPTANCE CRITERIA

Allowable stresses are in agreement with Table 1 of Reference 9B-2. Stress levels for beam elements comply with the requirements of Appendix XVII to Reference B-1. Stress levels for plate elements comply with rules for plate and shell type supports since stress fields in these components are biaxial.

The spent fuel pool is capable of withstanding, without adverse deformation, the maximum loads at the location of the rack feet. For the load drop condition, local permanent deformation possibly requiring repair is permissible provided that overall stresses do not exceed values permitted for Level D service limits and the resulting deformation does not permit the fuel configuration K_{eff} to exceed 0.95.

9B.8 MATERIALS, QUALITY CONTROL AND SPECIAL CONSTRUCTION TECHNIQUES

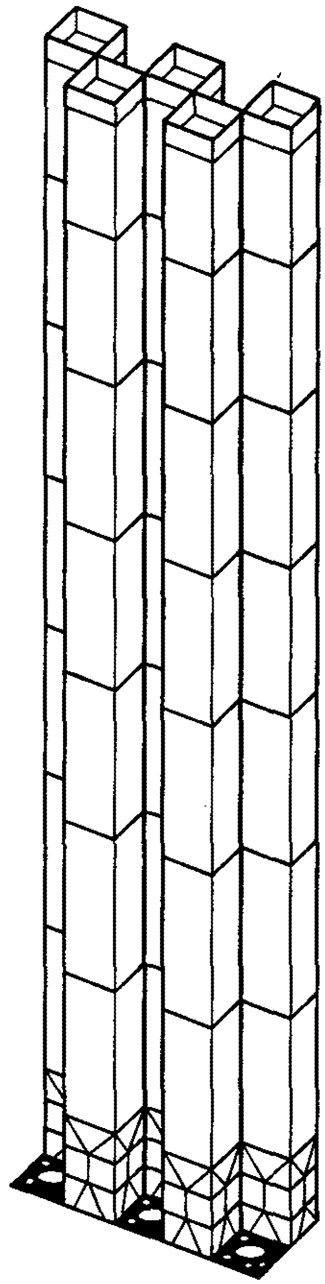
Materials are described in Section 9B.3. Quality control procedures for materials, fabrication and design control and verification comply with ANSI N45.2. Conventional construction methods are used.

As described in Section 9.1.2.2.2.2, approximately 25 percent of the total spent fuel storage capacity will be provided by racks installed prior to initial plant operation. The remaining racks will be installed later. The initially installed racks are generally located at the north end of the spent fuel pool. Therefore, the additional racks can be installed later without being transported over existing racks which contain spent fuel.

9B.9 REFERENCES

9B-1 ASME Boiler and Pressure Vessel Code, Section III, Division 1, 1980 Edition, Summer 1982 Addenda.

NRC NUREG-0800, SRP Section 3.8.4, Appendix D, Rev. 0 July 1981.



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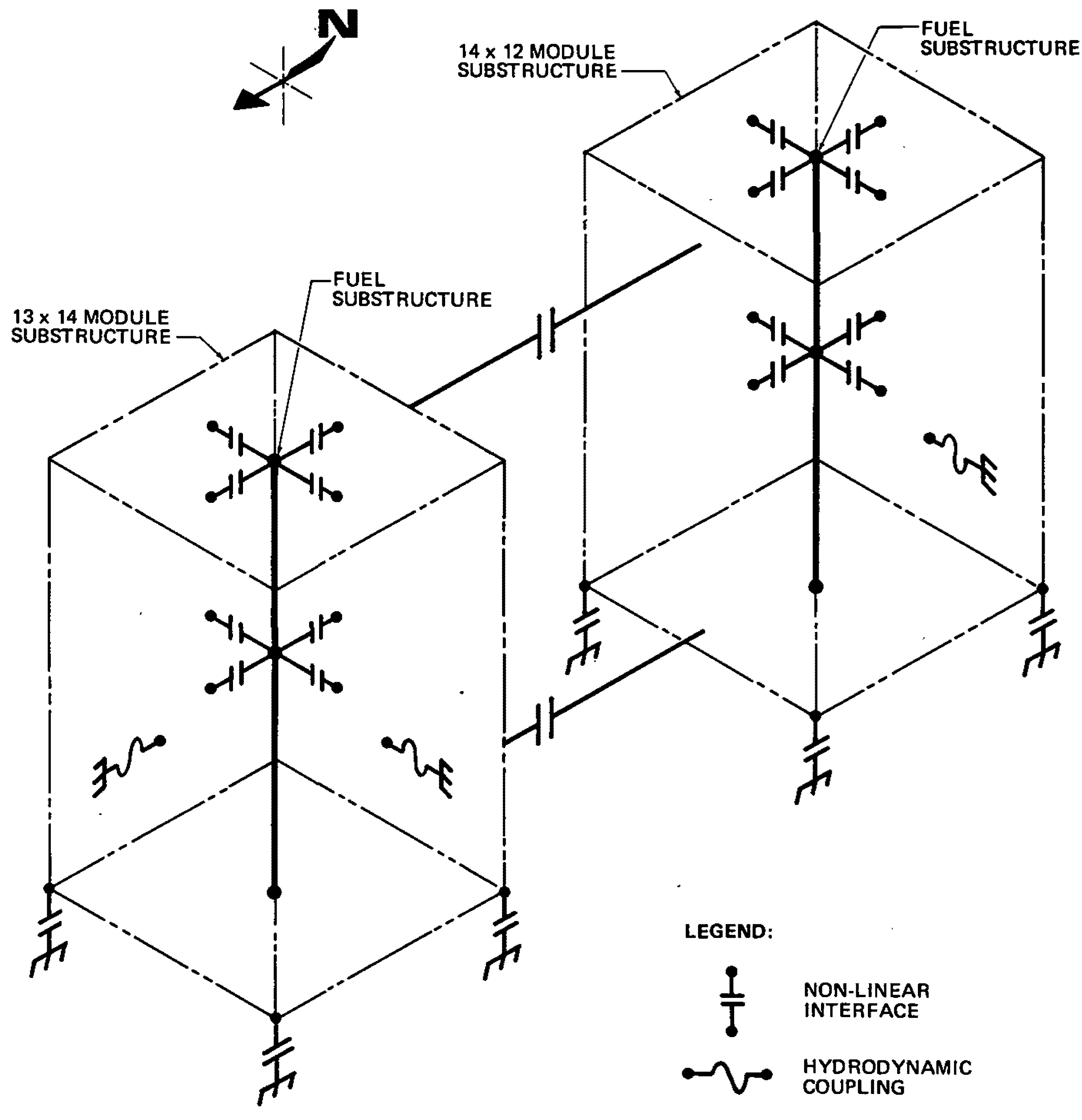
HOPE CREEK NUCLEAR GENERATING STATION

MODEL FOR CANISTER AND
PORTION OF BOTTOM GRID

UPDATED FSAR

FIGURE 9B-1



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DOUBLE RACK MODEL FOR DETAILED SEISMIC ANALYSIS ON FUEL/RACK AND RACK/RACK INTERACTION

UPDATED FSAR

FIGURE 9B-2