the charging pumps, pressurizer level can be controlled. During any time when the charging pumps are shut off, RCP seal degradation would be prevented by reactor coolant flowing past the thermal barrier heat exchanger, which is cooled by CCW flow, and out of the RCP seals. This would also remove water injected into the RCS that may have caused an increase in pressurizer level.

(5) *Safety Support Systems* - In order for the above equipment to perform its intended safety function, it must have power and be cooled. Heat removal can be accomplished via the CCW and ASW systems. The CCW system removes heat from the lube oil and seals of the engineered safety feature (ESF) pumps. The ASW removes heat from the CCW system and rejects it to the ultimate heat sink. Both the CCW pumps and the ASW pumps can be started from the hot shutdown panel. Although the CCW and ASW pumps are normally in operation and are designed to auto-start, pump controls at the hot shutdown panel ensure that the pumps are available in the event that they do not start automatically.

To ensure that power is available to ESF equipment, emergency diesel generators (EDGs) are available to supply power in the event that offsite power is unavailable. Although the EDGs should auto-start during a loss of offsite power, local manual controls for diesel starting and control provide additional assurance that power will be available to the ESF equipment required to establish and maintain hot safe shutdown (MODE 3) conditions.

(6) *Additional Controls Provided for Operational Convenience* - Controls are also provided at the hot shutdown panel to manipulate charging flow, the 10 percent steam dump valves, the containment fan cooler units, the pressurizer heaters, the pressurizer power operated relief valves, and the letdown orifice isolation valves. Controls are provided at the dedicated shutdown panel for pressurizer auxiliary spray. These controls are provided as an operational convenience.

The above evaluation demonstrates that the reactor can be maintained in a safe condition.

7.4.2.1.4 Process Control System

The PCS performs the same design functions as the original PCS. Some of the instrumentation and control functions described in this chapter are processed by the PCS. References 3 through 52 were used for design, verification, validation, and qualification of all or portions of the safety related PCS hardware and software (encompassing Triconex components, manual/auto hand stations, signal converters/isolators and loop power supplies).

7.4.2.2 Equipment, Services, and Approximate Time Required After Incident that Requires Hot Shutdown (MODE 4)

(1) *AFW pumps* - required if main feedwater pumps are not operating. For loss of plant ac power, the turbine-driven AFW pump starts automatically within 1 minute (refer to Section 6.5).

(2) *Reactor containment fan cooler units* - within 15 minutes (refer to Section 6)

(3) *EDGs* - loaded within 1 minute (refer to Section 8.3).

(4) *Lighting in the areas of plant required during this condition* - immediately (refer to Section 8.3).

(5) *Pressurizer heaters* - within 8 hours (refer to Section 5.5.9).

(6) *Communication network* - to be available for prompt use between the hot shutdown panel area and the following areas:

   (a) Outside telephone exchange

   (b) Boric acid transfer pump

   (c) EDGs

   (d) Switchgear room

   (e) Steam relief valves

   (f) Dedicated shutdown panel

7.4.2.3 Equipment and Systems Available for Cold Shutdown (MODE 5)

(1) Reactor coolant pump (not available after loss of offsite power; refer to Section 5.5.1)

(2) Auxiliary feedwater pumps (refer to Section 6.5.3.5)

(3) Boric acid transfer pump (refer to Section 9.3.4)

(4) Charging pumps (refer to Section 9.3.4)

(5) Containment fan coolers (refer to Section 9.4.5)

(6) Control room ventilation (refer to Section 9.4.1)

(7) Component cooling pumps (refer to Section 9.2.2)

(8) Residual heat removal pumps (refer to Section 5.5.6)[a]

(9) Vital MCC and switchgear sections (refer to Section 8.3)

(10) Controlled steam release and feedwater supply (refer to Section 7.7 and Section 10.4)

(11) Boration capability (refer to Section 9.3.4)

(12) Nuclear instrumentation system (source range and intermediate range; refer to Sections 7.2 and 7.7)[a]

(13) Reactor coolant inventory (charging and letdown; refer to Section 9.3.4)

(14) Pressurizer pressure control including control for pressurizer power-operated relief valves, heaters, and spray (refer to Sections 5.5.9 and 5.5.12)[a]

(15) 10 percent atmospheric dump valves (refer to Section 10.4.4)

7.4.3 SAFETY EVALUATION

7.4.3.1 General Design Criterion 3, 1971 – Fire Protection

The instrumentation and control systems required for safe shutdown (MODE 3) are designed to the fire protection guidelines of Appendix A to Branch Technical Position APCSB 9.5-1. The instrumentation and control systems required for safe shutdown are located physically in multiple areas of the plant. Appendix 9.5B, Table B-1 provides a summary of the evaluation of PG&E's compliance with Appendix A to BTP APCSB 9.5-1 and is organized by commitment. Appendix 9.5A provides the fire hazards analysis and is organized by fire zone.

7.4.3.2 General Design Criterion 11, 1967 – Control Room

The instrumentation and control functions required for safe shutdown (MODE 3) are located in the control room. Redundant instrumentation and controls are located on the hot shutdown panel, switchgear, and on the dedicated shutdown panel for the purpose

[a] Instrumentation and controls for these systems would require some modifications so that their functions may be performed from outside the control room. Note that the reactor plant design does not preclude attaining the cold shutdown condition from outside the control room. An assessment of plant conditions could be made on a long-term basis (a week or more) to establish procedures for making the necessary physical modifications to instrumentation and control equipment in order to attain cold shutdown. During such time, the plant could be safely maintained in the hot shutdown condition.

of achieving and maintaining a safe shutdown in the event an evacuation of the control room is required.

These controls and the instrumentation channels, together with the equipment and services that are available for both hot and cold shutdown, identify the potential capability for cold shutdown of the reactor, subsequent to a control room evacuation, through the use of suitable procedures.

In the unlikely event that access to the control room is restricted, the plant can be safely maintained at safe shutdown (MODE 3), and until the control room can be reentered, by the use of the monitoring indicators and the controls listed in Section 7.4.2. These indicators and controls are provided on the hot shutdown panel, the dedicated shutdown panel, or local area panel as well as inside the control room.

7.4.3.3 General Design Criterion 12, 1967 – Instrumentation and Control Systems

The safety evaluation of the maintenance of a shutdown with the systems described in Section 7.4.2 and associated instrumentation and controls has included consideration of the accident consequences that might jeopardize safe shutdown (MODE 3) conditions. The germane accident consequences are those that would tend to degrade the capabilities for boration, adequate supply of auxiliary feedwater, and decay heat removal.

The results of the accident analyses are presented in Chapter 15. Of these, the following produce the most severe consequences that are pertinent:

(1) Uncontrolled boron dilution

(2) Loss of normal feedwater

(3) Loss of external electrical load and/or turbine trip

(4) Loss of all ac power to the station auxiliaries

It is shown by these analyses that safety is not adversely affected by the incidents with the associated assumptions being that the instrumentation and controls indicated in Section 7.4.2 are available to control and/or monitor shutdown. These available systems allow the maintenance of safe shutdown (MODE 3) even under the accident conditions listed above that would tend toward a return to criticality or a loss of heat sink.

A plant design evaluation was performed by PG&E to identify the safe shutdown equipment that could be susceptible to loss of function due to the environmental conditions resulting from moderate-energy line breaks. Equipment modification such as spray barriers, terminal box cover gasket, and piping enclosures were designed and

installed as required to preclude any loss of function in the event of a moderate-energy line break.

Additional information concerning protection of equipment from the effects of postulated piping ruptures is presented in Section 3.6.

7.4.4 REFERENCES

1. Deleted in Revision 21.

2. Technical Specifications, Diablo Canyon Power Plant Units 1 and 2, Appendix A to License Nos. DPR-80 and DPR-82, as amended.

3. IEEE Standard 279-1971, Criteria for Protection Systems for Nuclear Power Generating Stations, Institute of Electrical and Electronics Engineers, Inc.

4. IEEE Standard 308-1971, Criteria for Class 1E Power Systems for Nuclear Power Generating Stations, Institute of Electrical and Electronics Engineers, Inc.

5. IEEE Standard 323-2003, Qualifying Class 1E Equipment for Nuclear Power Generating Stations, Institute of Electrical and Electronics Engineers, Inc.

6. IEEE Standard 336-1971, Installation, Inspection, and Testing Requirements for Power, Instrumentation, and Control Equipment at Nuclear Facilities, Institute of Electrical and Electronics Engineers, Inc.

7. IEEE Standard 338-1971, Criteria for the Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems, Institute of Electrical and Electronics Engineers, Inc.

8. IEEE Standard 344-1987, Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations, Institute of Electrical and Electronics Engineers, Inc.

9. IEEE Standard 384-1974, Criteria for Independence of Class 1E Equipment and Circuits, Institute of Electrical and Electronics Engineers, Inc.

10. IEEE Standard 730-1998, Software Quality Assurance Plans, Institute of Electrical and Electronics Engineers, Inc.

11. IEEE Standard 828-1990, Software Configuration Management Plans, Institute of Electrical and Electronics Engineers, Inc.

12. IEEE Standard 829-1983, Software Test Documentation, Institute of Electrical and Electronics Engineers, Inc.

13. IEEE Standard 830-1993, Recommended Practice for Software Requirements Specifications, Institute of Electrical and Electronics Engineers, Inc.

14. IEEE Standard 1008-1987, Software Unit Testing, Institute of Electrical and Electronics Engineers, Inc.

15. IEEE Standard 1012-1998, Software Verification and Validation, Institute of Electrical and Electronics Engineers, Inc.

16. IEEE Standard 1016-1987, Recommended Practice for Software Design Descriptions, Institute of Electrical and Electronics Engineers, Inc.

17. IEEE Standard 1016.1-1993, Guide to Software Design Descriptions, Institute of Electrical and Electronics Engineers, Inc.

18. IEEE Standard 1059-1993, Guide for Software Verification and Validation Plans, Institute of Electrical and Electronics Engineers, Inc.

19. IEEE Standard 1074-1995, Developing Software Life Cycle Processes, Institute of Electrical and Electronics Engineers, Inc.

20. IEEE Standard 1233-1998, Guide for Developing System Requirements Specifications, Institute of Electrical and Electronics Engineers, Inc.

21. IEEE Standard C62.41-1991, Recommended Practice for Surge Voltages in Low Voltage AC Power Circuits, Institute of Electrical and Electronics Engineers, Inc.

22. IEEE Standard C62.45-1992, Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and less) AC Power Circuits, Institute of Electrical and Electronics Engineers, Inc.

23. IEEE Standard 7-4.3.2-2003, Digital Computers in Safety Systems of Nuclear Power Generating Stations, Institute of Electrical and Electronics Engineers, Inc.

24. EPRI TR-106439, Guideline on Evaluation and Acceptance of Commercial-Grade Digital Equipment for Nuclear Safety Applications, Electric Power Research Institute, October, 1996.

25. EPRI TR-102323 Rev. 3, Guidelines for Electromagnetic Interference Testing in Power Plants, Electric Power Research Institute, November 2004.

26. EPRI TR-107330, Generic Requirements Specification for Qualifying a Commercially Available PLC for Safety-Related Applications in Nuclear Power Plants, Electric Power Research Institute, December 1996.

27. EPRI TR-102348 Rev. 1, Guideline on Licensing Digital Upgrades, Electric Power Research Institute, March 2002.

28. Regulatory Guide 1.100 Rev. 2, Seismic Qualification of Electrical and Mechanical Equipment for Nuclear Power Plants, USNRC, June 1988.

29. Regulatory Guide 1.105, Rev. 3, Setpoints for Safety-Related Instrumentation, USNRC, December 1999.

30. Regulatory Guide 1.152, Rev, 1, Criteria for Digital Computers in Safety Systems of Nuclear Power Plants, USNRC, January 1996.

31. Regulatory Guide 1.168, Verification, Validation, Reviews and Audits for Digital Computer Software Used in Safety Systems of Nuclear Power Plants, USNRC, February 2004.

32. Regulatory Guide 1.169, Configuration Management Plans for Digital Computer Software Used in Safety Systems of Nuclear Power Plants, USNRC, September 1997.

33. Regulatory Guide 1.170, Software Test Documentation for Digital Computer Software Used in Safety Systems of Nuclear Power Plants, USNRC, September 1997.

34. Regulatory Guide 1.171, Software Unit Testing for Digital Computer Software Used in Safety Systems of Nuclear Power Plants, USNRC, September 1997.

35. Regulatory Guide 1.172, Software Requirements Specifications for Digital Computer Software Used in Safety Systems of Nuclear Power Plants, USNRC, September 1997.

36. Regulatory Guide 1.173, Developing Software Life Cycle Processes For Digital Computer Software Used in Safety Systems of Nuclear Power Plants, USNRC, September 1997

37. Regulatory Guide 1.180, Rev. 1, Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems, USNRC, October 2003.

38. Regulatory Guide 1.22, Periodic Testing of Protection System Actuation Functions, USNRC, February 1972.

39. Regulatory Guide 1.29, Rev. 3, Seismic Design Classification, USNRC, September 1978.

40. Regulatory Guide 1.30, Quality Assurance Requirements for the Installation, Inspection, and Testing of Instrumentation and Electric Equipment, USNRC, August 1972.

41. RG 1.47, Bypassed and Inoperable Status Indication for Nuclear Power Plant Safety Systems, USNRC, May 1973.

42. Regulatory Guide 1.89, Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants, USNRC, November 1974.

43. Regulatory Guide 1.97, Rev 3, Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident, USNRC, May 1983.

44. NUREG-0800, Appendix 7.0-A, Rev. 5, Review Process for Digital Instrumentation and Control Systems, USNRC, March 2007.

45. BTP 7-14 Rev. 5 Guidance on Software Reviews for Digital Computer-Based Instrumentation and Control Systems, USNRC, March 2007.

46. BTP 7-18 Rev. 5, Guidance on the use of Programmable Logic Controllers in Digital Computer-Based Instrumentation and Control Systems, USNRC, March 2007.

47. MIL-STD-461E Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment, USDOD, August 1999

48. ANSI/ANS-4.5-1980, Criteria for Accident Monitoring Functions in Light-Water-Cooled Reactors, American Nuclear Society, January 1980

49. NEMA ICS 1-2000, Industrial Control and Systems: General Requirements, National Electrical Manufacturers Association, December 2008

50. NFPA 70 (NEC) 2002 National Electric Code, National Fire Protection Association, January 2002

51. IEC 61131-3 1993, Programming Industrial Automations Systems, International Electrotechnical Commission, December 1993

52. ISA-S67.04-1994, Setpoints for Nuclear Safety-Related Instrumentation, International Society of Automation, January 1994

7.4.5 REFERENCE DRAWINGS

Figures representing controlled engineering drawings are incorporated by reference and are identified in Table 1.6-1. The contents of the drawings are controlled by DCPP procedures.

7.5 SAFETY-RELATED DISPLAY INSTRUMENTATION

This section provides a description of the instrumentation display systems that provide information to enable the operator to perform required safety functions and post-accident monitoring.

7.5.1 DESIGN BASES

7.5.1.1 General Design Criterion 2, 1967 – Performance Standards

The safety-related display instrumentation is designed to withstand the effects of or is protected against natural phenomena, such as earthquakes, flooding, tornadoes, winds, and other local site effects.

7.5.1.2 General Design Criterion 11, 1967 – Control Room

The safety-related display instrumentation is designed to support actions to maintain and control the safe operational status of the plant from the control room or from an alternate location if control room access is lost due to fire or other causes.

7.5.1.3 General Design Criterion 12, 1967 – Instrumentation and Control Systems

The safety-related display instrumentation is designed to monitor and maintain variables within prescribed operating ranges.

7.5.1.4 General Design Criterion 17, 1967 – Monitoring Radioactivity Releases

The safety-related display instrumentation is designed to monitor the containment atmosphere, the facility effluent discharge paths, and the facility environs for radioactivity that could be released from normal operations, from anticipated transients and from accident conditions.

7.5.1.5 10 CFR 50.49 – Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants

The safety-related display instrumentation that requires environmental qualification are qualified to the requirements of 10 CFR 50.49.

7.5.1.6 Regulatory Guide 1.97, Revision 3, May 1983 – Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident

The safety-related display instrumentation is designed to provide instrumentation to monitor plant variables and systems during and following an accident.

7.5.1.7 NUREG-0737 (Items I.D.2, II.D.3, II.E.1.2, II.F.1, II.F.2, and III.A.1.2), November 1980 – Clarification of TMI Action Plan Requirements

Item I.D.2 – Plant Safety Parameter Display Console: The safety parameter display system (SPDS) is designed to display to operating personnel a minimum set of parameters which define the safety status of the plant in accordance with the guidance of NUREG-0737, Supplement 1.

Item II.D.3 – Direct indication of relief and safety valve position: The pressurizer safety relief valve position indication system provides positive indication in the control room to determine valve position using acoustic monitoring in the discharge pipe.

Item II.E.1.2 – Auxiliary Feedwater System Automatic Initiation and Flow Indication: The Auxiliary Feedwater (AFW) System is designed to automatically initiate and is designed to the requirements of IEEE 279-1971. The AFW System is designed to provide a reliable indication of auxiliary feedwater system performance.

Item II.F.1 – Additional Accident Monitoring Instrumentation: The safety-related display instrumentation is designed to include the following subparts:

- Noble gas effluent radiological monitor;
- Provisions for continuous sampling of plant effluents for post-accident releases of radioactive iodines and particulates and onsite laboratory capabilities;
- Containment high-range radiation monitor;
- Containment pressure monitor;
- Containment water level monitor; and
- Containment hydrogen concentration monitor

Item II.F.2 – Instrumentation for Detection of Inadequate Core Cooling: The safety-related display instrumentation is designed to provide an unambiguous, easy-to-interpret indication of inadequate core cooling.

Item III.A.1.2 – Upgrade Emergency Support Facilities: The safety-related display instrumentation is designed to support the Technical Support Center (TSC), the Operations Support Center (OSC) and the Emergency Operations Facility (EOF) in accordance with the guidance of NUREG-0737, Supplement 1.

7.5.2 DESCRIPTION

Tables 7.5-1 and 7.5-2 list the information readouts provided to enable the operator to perform required manual safety functions and to determine the effect of manual actions taken following a reactor trip due to a Condition II, III, or IV event, as defined in Sections 15.2, 15.3, and 15.4, respectively. The tables list the information readouts required to maintain the plant in a hot standby condition or to proceed to cold shutdown within the limits of the Technical Specifications (Reference 1). Adequate shutdown margin following Condition II and III events is verified by sampling of the reactor coolant for

boron to ensure that the concentration is sufficient to maintain the reactor subcritical, as directed by emergency procedures.

Table 7.5-3 lists the information available to the operator for monitoring conditions in the reactor, the reactor coolant system (RCS), and in the containment and process systems throughout all normal operating conditions of the plant, including anticipated operational occurrences.

Table 7.5-4 lists the information available to the operator on the post-accident monitoring panels located in the control room. This information is designed to complement the information available on the control boards during post-accident conditions.

The following sections describe the monitoring systems available to the operator for assessing post-accident conditions in the RCS and the containment. Variables monitored include containment water level, hydrogen concentration and ambient pressure in the containment; RCS pressure; subcooling margin; and water level in the reactor vessel.

7.5.2.1 Post-Accident Reactor Coolant Pressure and Containment Monitors

The systems described in this section meet the following requirements:

(1) All devices must be environmentally qualified in accordance with IEEE-323-1974 (Reference 2).

(2) All devices must be seismically qualified in accordance with IEEE-344-1975 (Reference 3).

(3) Cables and raceways shall be separated in accordance with Section 8.3.1.4.1.

7.5.2.1.1 Reactor Coolant Pressure Monitors

The RCS pressure monitors consist of two mutually redundant monitors. The transmitters are mounted outside of containment and are tied to the RCS by means of sealed systems. Each sealed system consists of a bellows seal inside containment to separate the transmitter from the RCS, tubing through the penetration with a special fill fluid, and the transmitters outside of containment. The indicators for both monitors and the recorder for one of the monitors are provided in the control room.

7.5.2.1.2 Containment Pressure Monitors

The DCPP containment is a steel-lined, reinforced concrete structure designed for pressure loads and load combinations described in Section 3.8.1.3.2. Containment pressure transmitters with a range of -5 to 200 psig are connected to control room

recorders. This instrumentation complements the reactor protection system containment pressure indicators that have a range of -5 to 55 psig.

7.5.2.1.3 Containment Water Level Monitors

The containment water level indication system consists of wide- and narrow-range monitors. Each monitor consists of two mutually redundant and separated channels that are postaccident- qualified in accordance with IEEE Class 1E requirements. In addition, because of their locations, each of the wide-range monitor differential pressure transmitters has been qualified for submerged post-accident operation.

Each of the wide-range monitors is provided with a recorder that is mounted on the post-accident monitor panel in the control room.

The residual heat removal (RHR) recirculation sump water level instrumentation (the narrow-range monitor) has a level indicator mounted on the main control board. These indicators are located above the respective recirculation control switches as these indicators are used by the operator when operating pumps for recirculation.

Figure 7.5-1 represents the level indication system described above.

Figure 7.5-1B shows the Unit 2 wide-range level monitors with an installed spare transmitter in service.

7.5.2.1.4 Containment Hydrogen Monitors

The hydrogen monitoring system is described in Section 6.2.5.5.

7.5.2.1.5 High-Range Containment Radiation Monitor

Two mutually redundant high-range area radiation monitors are provided for containment monitoring. Both indication and recording of the readouts for these monitors are provided in the control room.

A detailed discussion of these monitors is presented in Section 11.4.2.3.

7.5.2.2 Instrumentation for Detection of Inadequate Core Cooling

The function of core cooling monitoring in a redundant and diverse manner is provided by the subcooling margin monitors described in Section 7.5.2.2.1 and the core exit thermocouples described in Section 7.5.2.2.2. A supplemental source of information for use in the detection of inadequate core cooling is provided by the reactor vessel level instrumentation system described in Section 7.5.2.2.3.

7.5.2.2.1 Subcooling Meter

DCPP uses the reactor vessel level instrumentation system (RVLIS) processors to calculate RCS subcooling. Information required on the subcooled margin monitors (SCMMs) is provided in Table 7.5-5. Details of the display, calculator, and inputs are as follows:

7.5.2.2.1.1 Display

Each display (one in post-accident monitoring panel PAM3 (train A) and one in PAM4 (train B)) indicates either the temperature or pressure margin to saturation continuously on each RVLIS monitor. A one-hour trend of the temperature margin is also displayed. Train A of the SCMM provides a temperature margin output to an analog recorder. A remote digital display of the temperature margin from SCMM B is located on the main control board in the control room. The recorder is on the post-accident monitoring panel (PAM1) with other recorders to assess core cooling conditions. Each train of the SCMM provides a temperature margin analog signal to emergency response facility display system (ERFDS) for logging purposes. Refer to Section 3.10 for a discussion of the seismic qualification of the displays.

7.5.2.2.1.2 Calculator

The redundant RVLIS processors calculate the subcooled margin. The SCMM subset of RVLIS is a software program that uses RCS pressure and temperature inputs in addition to look-up steam tables to determine subcooling. The selection logic uses the highest temperature and the input pressure. Refer to Section 3.10 for a discussion of the seismic qualification of the RVLIS processor.

7.5.2.2.1.3 Inputs

(1) Temperature – Each SCMM has three temperature inputs. Four temperature signals come from each of the four hot leg wide-range resistance temperature detectors (RTDs). Hot legs 1 and 2 input to SCMM train B, and hot legs 3 [Note: Unit 1 hot leg 3 input has been disabled, reference T-Mod 60060222] and 4 input to SCMM train A. The other temperature signal into each SCMM is the hottest temperature taken from each train of core exit thermocouples. The hottest core exit thermocouple as monitored by train A inputs to SCMM A and the hottest core exit thermocouple as monitored by train B inputs to SCMM B. The temperature inputs meet Class 1E requirements and Regulatory Guide 1.97, Revision 3 as noted in Table 7.5-6.

(2) Pressure - Pressure is sensed by the wide-range reactor coolant loop pressure transmitters as described in Section 7.5.2.1.1. Each SCMM receives a pressure input from a different wide range pressure transmitter.

7.5.2.2.2 Incore Thermocouple System

Chromel-Alumel thermocouples are inserted into guide tubes that penetrate the reactor vessel head through seal assemblies and terminate at the exit flow end of the fuel assemblies. The thermocouples are provided with two primary seals, a conoseal, and a compression-type seal from conduit to head. The thermocouples are supported in guide tubes in the upper core assembly. The incore thermocouple system incorporates all 65 incore thermocouples so that a complete temperature distribution can be provided.

The system consists of two redundant trains, one covering 32 thermocouples and one covering 33 thermocouples. The thermocouples are chosen so that all areas of the core are covered by each display. The number of operable thermocouples required per core quadrant is governed by the requirements provided in the Technical Specifications.

The display unit for each of the redundant trains can read out all thermocouple temperatures assigned to the train or can indicate selective incore thermocouple temperatures continuously on demand. The highest thermocouple reading in each train is recorded on the post-accident panel. The range and accuracy of these thermocouple readings are provided in Table 7.5-4.

The incore thermocouple signals are also provided as inputs to the plant computer as described in Section 7.7.2.9.1.

The incore thermocouple system is seismically and environmentally qualified. Each of the display units is powered from an independent Class 1E power source.

7.5.2.2.3 Reactor Vessel Level Instrumentation System

The reactor vessel level instrumentation system (RVLIS) uses differential pressure (DP) measuring devices to measure vessel level or relative void content of the circulating primary coolant system fluid. The system is redundant and includes automatic compensation for potential temperature variations of the impulse lines. Essential information is displayed in the main control room on the post-accident monitoring panel in a form directly usable by the operator.

The RVLIS is a microprocessor-based system. The system inputs to the microprocessor include the DP cell inputs, compensating inputs from the temperature measurements of the DP cell impulse lines, compensating temperature and pressure measurements from the RCS, and status inputs from the reactor coolant pumps. The system consists of two independent channels. Each channel utilizes three DP cells.

This DP measuring system utilizes cells of differing ranges to cover different flow behaviors with and without pump operation, as discussed below.

(1) *Reactor Vessel - Upper-Range* -- This DP cell provides a measurement of reactor vessel level above the hot leg pipe when the reactor coolant pump in the loop with the hot leg connection is not operating.

(2) *Reactor Vessel - Narrow-Range* -- This DP measurement provides a measurement of reactor vessel level from the bottom of the reactor vessel to the top of the reactor core during natural circulation conditions.

(3) *Reactor Vessel - Wide-Range* -- This DP cell provides an indication of reactor core and internals pressure drop for any combination of operating reactor coolant pumps. The comparison of the measured pressure drop with the normal single-phase pressure drop will provide an approximate indication of the relative void content or density of the circulating fluid. This instrument will monitor coolant conditions on a continuing basis during forced flow conditions.

To provide the required accuracy for the level measurement, the temperature measurements of the impulse lines to the DP cells, together with the temperature measurement of the reactor coolant and the reactor coolant system pressure, are employed to compensate the DP cell outputs for differences in system density and reference leg density. This process occurs particularly during the change in the environment inside the containment structure following an accident.

The DP cells are located outside of the containment to eliminate the potential reduction of accuracy that may result from various accident conditions. The location of the cells outside of containment makes the system operation, including calibration and maintenance, easier (Refer to Figure 7.5-2).

7.5.2.3 Plant Vent Post-Accident Radiation Monitors

The plant vent post-accident monitoring is provided by dual-path iodine and particulate grab samplers and an extended range noble gas monitoring channel. The grab sample paths can be changed remotely. The extended range noble gas detector is a beta scintillation detector operated in the current mode.

Potential release paths not using the plant vent are the atmospheric steam dumps/reliefs, the steam generator blowdown tank vent and the main condenser vacuum pump. The steam generator blowdown sample header and the steam generator blowdown tank overflow line to the discharge tunnel are continuously monitored using in-line radiation detectors. The blowdown tank is automatically isolated on a high-radiation signal from either of these monitors, and the discharge is rerouted to the equipment drain tank receiver for further processing so that the vent of the blowdown tank is not a discharge path under these conditions.

The steam lines, which provide the potential source for radiological release from the condenser vacuum pump exhaust and/or atmospheric steam dumps/reliefs during an

accident, are monitored using Geiger-Mueller (GM) detectors shielded from background activity. The control room readout has direct indication, recorder output, high alarm, failure alarm, and is powered from Class 1E power supplies.

These monitors meet the requirements of Regulatory Guide 1.97, Revision 3 (Reference 6). A detailed discussion of these monitors is provided in Section 11.4.2.2.

7.5.2.4 ALARA Monitors for Post-Accident Monitor Access

The as low as is reasonably achievable (ALARA) monitors for post-accident monitors access are provided to monitor the area where the plant vent radiation monitoring post-accident systems are located. Remote indication in a low dose area is provided. Indication in the control room for RE-34 is provided by RR-34.

7.5.2.5 Radioactive Gas Decay Tank Pressure

Post-accident monitoring of the pressures in the three radioactive gas decay tanks is provided in the control room. Each pressure measurement circuit consists of a field-mounted transmitter and an indicator located on the post-accident monitoring panel. The range and accuracy of these measurements are provided in Table 7.5-4.

7.5.2.6 Auxiliary Feedwater Flow Indication

The auxiliary feedwater (AFW) flow indication is provided by a single flow indication channel for the individual AFW feed lines to each of the four steam generators. These flow channels are Class 1Eand powered from the instrument and control power supply system.

An alternative means of AFW flow indication is provided by a Class 1E steam generator water level indication for each steam generator.

7.5.2.7 Dedicated Shutdown Panel

The instrumentation on the dedicated shutdown panel provides the indication required to bring the reactor to cold shutdown from hot standby (MODE 3) in the event that all equipment in the cable spreading room, including all protection racks, are destroyed by fire. In addition to indication, control of the pressurizer auxiliary spray valve (control remote from the control room) is located in this panel. Control of vital equipment is maintained at electrical switchgear and the hot shutdown panel. Equipment is powered from the Class 1E ac instrumentation panels.

None of the instrumentation and control or electrical components in this panel are required to complete any active functions for any seismic events, or events that produce harsh environmental conditions; however, the panel and certain components within the panel are seismically and environmentally qualified for integrity of safety-related circuits.

The following parameters are provided on the panel:

Reactor coolant system pressure
Pressurizer level
Reactor coolant system temperature
Steam generator level

Steam generator pressure is available from local indicators adjacent to the dedicated shutdown panel.

Alarms and recorders are not required for this system.

Additional information concerning the use of the dedicated shutdown panel to support remote operations is provided in Section 7.4.

7.5.2.8 Pressurizer Safety Relief Valve Position Indication System

The pressurizer safety relief valve (PSRV) position indication system provides the necessary information in the control room to determine the position (open/close) of each of the three PSRVs. One acoustic monitor (piezoelectric accelerometer) per PSRV is mounted inside containment on the discharge pipe in close proximity to its associated PSRV. In the event of a PSRV opening, the discharge from the pressurizer will induce pipe vibrations that will be sensed by the acoustic monitor associated with the opened PSRV. The electric signal originating from the acoustic monitors is first amplified by charge-mode amplifiers (located inside containment) and then electronically processed (on a per channel basis) in the control room to show, in the form of a bar graph (LED lights on panel RCRM) and a digital readout (on VB2), the percent flow (0 to 100 percent) of each of the three PSRVs. Additionally, a ganged annunciator will light in the event that one or more PSRVs have opened.

7.5.2.9 Emergency Response Facility Data System

The emergency response facility data system (ERFDS) is used to monitor and display plant parameters used for post-accident monitoring. The safety parameter display system (SPDS) is part of this system and is described in Section 7.5.2.10. The total ERFDS is not Class 1E nor does it meet the single failure criterion; however, it is designed to be a highly reliable system. The ERFDS is server-based with distributed desktop PCs for data displays. The ERFDS meets the criteria set forth in NUREG-0737, Supplement 1 (Reference 8). NUREG-0696, 1981 (Reference 9) is used for guidance as identified in NUREG-0737, Supplement 1.

The data storage and data retrieval functions associated with post-accident monitoring are performed by the Main Plant Historian. The Main Plant Historian is hosted on Plant Information Network (PIN) Servers in the TSC.

Each power plant unit has its own system to acquire and process data. However, Unit 1 and Unit 2 will share Technical Support Center (TSC) data display equipment. Similarly, the Alternate Technical Support Center/Operational Support Center (Alternate TSC/OSC), and Emergency Operations Facility (EOF) equipment will be shared by Unit 1 and Unit 2.

The system is divided into three subsystems as discussed in the following subsections.

7.5.2.9.1 High-Speed Data Acquisition Subsystem

The data acquisition subsystem is a high-speed, remote multiplexing system that interfaces with the plant instrumentation, converts the data to a digital form, and then transmits the data to other parts of the ERFDS.

The data acquisition subsystem provides Class 1E isolation in the remote multiplexers between the different Class 1E instrument loops, and also between the Class 1E instrument loops and the rest of the system. Remote multiplexers are located so as to minimize additional wire runs. Each remote multiplexer has a 12-bit analog to digital (A/D) converter for high accuracy. The remote multiplexers can also interface with bilevel signals. The digital information from the remote multiplexers for Unit 1 and Unit 2 is transmitted to both the Unit 1 and Unit 2 Transient Recording System (TRS) servers which host the SPDS application.

7.5.2.9.2 SPDS TRS Server Subsystem

The TRS Server Subsystem for each unit is a dedicated server that controls data transfer between the data acquisition subsystem and the different desktop PCs making up the data display subsystem. Display data is updated at 1-second intervals.

The TRS serverhosts the SPDS application. Each unit's TRS acquires ERFDS data for both units. The TRS servers transmit the data via the Plant Data Network (PDN) to the PPC, display PCs in the control room, and the Plant Information Network (PIN) servers in the TSC. TSC, Alternate TSC/OSC and EOF displays receive data from the PIN servers via the PIN and the DCPP LAN using remote applications (Remote Desktop Services). ERDS data to the NRC is sent via a secure internet connection on the PG&E LAN.

7.5.2.9.3 Display System

The display subsystem provides the system interface for the operators and emergency personnel. The ERFDS has two categories of display devices: the ERFDS displays and the SPDS displays. The subsystem has independent functional stations in the TSC, Alternate TSC/OSC, EOF, and control room, as described below.

The TSC, Alternate TSC/OSC, and EOF display equipment includes two ERFDS Human System Interfaces (HSIs) and two SPDS-HSIs. The HSIs are connected to the

DCPP LAN. A color printer connected to the DCPP LAN may be used for printouts of ERFDS, SPDS, EARS, radiation data processor, and PPC displays. The control room display equipment includes two SPDS HSIs. Additionally, SPDS screens may be displayed on a TV monitor. The displays are human-engineered with functional groupings of variables.

With the exception of an additional display monitor, the EOF portion of the display subsystem is identical to the TSC display subsystem.

7.5.2.9.4 Equipment Location

7.5.2.9.4.1 Control Room

(1) Ten remote multiplexers for each unit are located in the control room. The multiplexer location and instrument channel are specified as follows:

Multiplexer Number	Instrument Channel	Location
1	I	Main Control Board, VB1
2	II	Main Control Board, VB1
3	III	Main Control Board, VB1
4	Nonvital	Main Control Board, VB1
5	I	Main Control Board, VB4 Unit 1, (VB5, Unit 2)
6	II	Main Control Board, VB4 Unit 1, (VB5, Unit 2)
7	III	Main Control Board, VB4 Unit 1, (VB5, Unit 2)
8	IV	Main Control Board, VB4 Unit 1, (VB5, Unit 2)
9	II	Post-accident monitoring panel, PAM3
10	III	Post-accident monitoring panel, PAM4
11	Nonvital	Rack remote multiplexer, RM (Reference 1)

(2) Two submultiplexers are located in the main control board, VB1 of each unit.

(3) The SPDS desks are located in the control room. Each unit has an SPDS desk. The desks each house two SPDS monitors and personal computer and a TV monitor that is available to display SPDS screens.

7.5.2.9.4.2 Technical Support Center

The following equipment is located in the TSC:

(1) A color printer connected to the DCPP LAN may be used to print ERFDS, SPDS, PPC, EARS, and radiation data processor displays

(2) Two SPDS HSIs

(3) Two ERFDS HSIs

(4) PDN and PIN network infrastructure, domain servers, and data/application servers.

7.5.2.9.4.3 Emergency Operations Facility

The following equipment is located in the EOF:

(1) Two SPDS HSIs

(2) Two ERFDS HSIs

(3) Network infrastructure

(4) A color printer connected to the DCPP LAN may be used to print ERFDS, SPDS, PPC, EARS, and radiation data processor displays.

7.5.2.9.4.4 Alternate TSC/OSC

The following equipment is located in the Alternate TSC/OSC:

(1) Two SPDS HSIs

(2) Two ERFDS HSIs

(3) Network infrastructure

(4) Acolor printer connected to the DCPP LAN may be used to print ERFDS, SPDS, PPC, EARS, and radiation data processor displays.

7.5.2.10 Safety Parameter Display System

The SPDS is the display subsystem of the ERFDS. The ERFDS is described in Section 7.5.2.9. The SPDS provides a display of plant parameters from which the safety status of operation may be assessed in the control room. The primary function of the

SPDS is to help operating personnel in the control room make quick assessments of plant safety status.

The SPDS equipment includes HSIs with color displays.

HSIs with color displays are located in the control room, TSC, Alternate TSC/OSC, and EOF. Each control room HSI receives data from the Unit 1 or Unit 2 TRS via the PDN. TSC, Alternate TSC/OSC, and EOF HSIs receive Unit 1 and Unit 2 data from the DCPP LAN.

The SPDS has one primary display and a number of secondary displays. The primary display addresses the following important plant functions:

(1) Reactivity control

(2) Reactor core cooling and heat removal from primary system

(3) Reactor coolant system integrity

(4) Radioactivity control

(5) Containment integrity

All displays are redundant (available to both SPDS display monitors in each location). All the displays are integrated with the plant operating procedures. Magnitudes and trends can be displayed.

The SPDS displays are available in the control room, TSC, Alternate TSC/OSC, and EOF.

7.5.3 SAFETY EVALUATION

7.5.3.1 General Design Criterion 2, 1967 – Performance Standards

The post-accident reactor coolant pressure and containment monitors described in Section 7.5.2.1 are seismically qualified in accordance with IEEE-344-1975 (Reference 3).

The seismic qualification of instrumentation used for detection of inadequate core cooling is described in Sections 3.10.2.21, 3.10.2.22, and 3.10.2.32.

None of the instrumentation and control or electrical components in the dedicated shutdown panel are required to complete any active functions for any seismic events, or events that produce harsh environmental conditions; however, the panel and certain components within the panel are seismically and environmentally qualified for integrity of safety-related circuits.

The post-accident reactor coolant pressure and containment monitors, the instrumentation used for detection of inadequate core cooling and the dedicated shutdown panel are housed in seismically qualified buildings (containment structure and auxiliary building). These buildings are PG&E Design Class I (refer to Section 3.8) and designed to withstand the effects of winds and tornadoes (refer to Section 3.3), floods and tsunamis (refer to Section 3.4), external missiles (refer to Section 3.5), earthquakes (refer to Section 3.7), and other natural phenomena to protect the PG&E Design Class I portion of the safety-related display instrumentation to ensure their safety-related functions and designs will be performed.

7.5.3.2 General Design Criterion 11, 1967 – Control Room

Tables 7.5-1 and 7.5-2 list the information readouts provided to enable the operator to perform required manual safety functions and to determine the effect of manual actions taken following a reactor trip due to a Condition II, III, or IV event, as defined in Sections 15.2, 15.3, and 15.4, respectively. The tables list the information readouts required to maintain the plant in a hot standby condition or to proceed to cold shutdown within the limits of the Technical Specifications (Reference 1). Adequate shutdown margin following Condition II and III events is verified by sampling of the reactor coolant for boron to ensure that the concentration is sufficient to maintain the reactor subcritical, as directed by emergency procedures.

Table 7.5-3 lists the information available to the operator for monitoring conditions in the reactor, the reactor coolant system (RCS), and in the containment and process systems throughout all normal operating conditions of the plant, including anticipated operational occurrences.

Table 7.5-4 lists the information available to the operator on the post-accident monitoring panels located in the control room. This information is designed to complement the information available on the control boards during post-accident conditions.

For Conditions II, III, and IV events (Refer to Tables 7.5-1 and 7.5-2), sufficient duplication of information is provided to ensure that the minimum information required will be available. The information is part of the operational monitoring of the plant that is under surveillance by the operator during normal plant operation. This is functionally arranged on the control board to provide the operator with ready understanding and interpretation of plant conditions. Comparisons between duplicate information channels or between functionally related channels enable the operator to readily identify a malfunction in a particular channel.

Refueling water storage tank level is indicated and alarmed by three independent single channel systems. Similarly, two channels of the RCS pressure (wide-range) are available for maintaining proper pressure-temperature relationships following a postulated Condition II or III event. One channel of steam generator water level

(wide-range) is provided for each steam generator; this duplicates level information from steam generator water level (narrow-range) and ensures availability of level information to the operator.

The remaining safety-related display instrumentation necessary for Conditions II, III, or IV events is obtained through isolation devices from the protection system. These protection channels are described in Section 7.2.2.8.

The readouts identified in the tables were selected on the basis of sufficiency and availability during, and subsequent to, an accident for which they are necessary. Thus, the occurrence of an accident does not render this information unavailable, and the status and reliability of the necessary information is known to the operator before, during, and after an accident. No special separation is required to ensure availability of necessary and sufficient information. In fact, such separation could reduce the operator's ease of interpretation of data.

The design criteria used in the display system are listed below:

(1) Range and accuracies listed in Tables 7.5-1 and 7.5-2 are validated through the analysis of operator actions during Condition II, III, or IV events as described in Chapter 15. The display system meets the following requirements:

    (a) The range of the readouts extends over the maximum expected range of the variable being measured, as listed in column 4 of Tables 7.5-1 and 7.5-2.

    (b) The combined indicated accuracies are shown in column 5 of Tables 7.5-1 and 7.5-2.

(2) Power for the display instruments is obtained from the Class 1E 120-Vac Instrument Power Supply System as described in Section 8.3.1.1.5.2.1 and the non-Class 1E 120-Vac Instrument Power Supply System as described in Section 8.3.1.1.5.2.2.

(3) Those channels determined to provide useful information in charting the course of events are recorded as shown in column 6 of Tables 7.5-1 and 7.5-2.

The dedicated shutdown panel described in Section 7.5.2.7 provides information concerning indications to support remote operations if control room access is lost due to fire or other causes.

7.5.3.3 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Section 7.5.2 provides a description of the instrumentation display systems that provide information to enable the operator to perform required safety functions and post-accident monitoring. They are designed to monitor and maintain variables within prescribed operating ranges.

7.5.3.4 General Design Criterion 17, 1967 – Monitoring Radioactivity Releases

The monitors for the plant vent and containment radiation are described in Section 11.4.2.2.1.

The post-accident monitors used for monitoring radioactivity releases are described in Section 7.5.2.3.

7.5.3.5 10 CFR 50.49 – Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants

Environmental qualification of safety-related display information is identified in Table 7.5-6. The post-accident reactor coolant pressure and containment monitors described in Section 7.5.2.1 are environmentally qualified in accordance with IEEE-323-1974 (Reference 2).

7.5.3.6 Regulatory Guide 1.97, Revision 3, May 1983 – Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident

Table 7.5-6 summarizes the compliance of Diablo Canyon Power Plant with Regulatory Guide 1.97, Rev. 3. The format and content of the table are consistent with both the recommendations in Table 3 of the Regulatory Guide and the guidance provided at the March 1, 1983, NRC Regional meeting.

Post-Accident Monitoring Instruments and Controls

Post-accident monitoring instruments and controls are divided into variable Types A through E and Categories 1 through 3 as outlined in Regulatory Guide 1.97, Rev. 3. The variable types indicate whether the variable is considered to be a key variable needed for: (a) plant operation, (b) system status indication, or (c) backup or diagnosis. The three categories provide a graded approach to design, qualification, and quality requirements depending on the importance to safety of the measurement of a specific variable. The variable types and categories are as follows:

Variable Types

Type A - This variable is for components that provide primary information required to permit the control room (operating personnel) to take the specific manually controlled

actions for which no automatic control is provided and that are required for safety systems to accomplish their safety functions for design basis accident events. Type A variables must meet the Category 1 qualification requirements.

Type B - This variable is for components that provide information to indicate whether plant safety functions are being accomplished. Plant safety functions are (a) reactivity control, (b) core cooling, (c) maintaining reactor core coolant system integrity, and (d) maintaining containment integrity.

Type C - This variable is for components that provide information to indicate the potential for being breached or the actual breach of the barriers to fission product release. The barriers are (a) fuel cladding, (b) primary coolant pressure boundary, and (c) containment.

Type D - This variable is for components that provide information to indicate the operation of individual safety systems and other systems important to safety.

Type E - This variable is for components that are monitored as required for use in determining the magnitude of the release of radioactive materials and for continually assessing such releases.

<u>Categories 1 through 3</u>:

Category 1 - Provides the most stringent design and qualification criteria and is intended for key variables.

Category 2 - Provides less stringent design, qualification, and quality criteria and generally applies to instruments and controls designated for indicating system operating status.

Category 3 - Provides design and qualification criteria that will ensure that high-quality, off-the-shelf instrumentation is obtained. Category 3 applies to backup and diagnostic instrumentation and is also used when the design requires state-of-the-art equipment, but equipment qualified to a higher category is not available.

Category 3 instrumentation is non-safety related

Process Control System

The PCS processes the following post-accident monitoring channels:

(1) Auxiliary Feedwater Flow (Type A, Cat. 1)

(2) Charging Injection Header Flow (Type D, Cat. 2)

(3) Letdown Outlet Flow (Type D, Cat. 2)

(4) Makeup Flow-in (Type D, Cat. 2)

(5) RHR Flow to RCS Cold Legs Temperature (Type D, Cat. 2)

(6) RHR HX Outlet Flow (Type D, cat. 2)

(7) RHR HX Outlet to Hot Legs 1 & 2 Flow (Type D, Cat. 2)

(8) Safety Injection Pump Discharge Flow (Type D, Cat. 2)

(9) Steam Generator Wide Range Level (Type A, Cat. 1)

(10) Volume Control Tank Level Control (Type D, Cat. 2)

(11) CCW Heat Exchanger Outlet Temperature (Type D, Cat. 2)

(12) CCW Supply Headers A and B Flow (Type D, Cat. 2)

(13) Condensate Storage Tank Level (Type A, Cat. 1)

(14) Refueling Water Storage Tank Level (Type A, Cat. 1)

(15) Accumulator Tank Pressure (Type D, Cat. 3)

(16) Quench Tank (PRT) Level (Type D, Cat. 3)

(17) Quench Tank (PRT) Temperature (Type D, Cat. 3)

(18) Quench Tank (PRT) Pressure (Type D, Cat. 3)

References 6 and 10 through 58 were used for design, verification, validation, and qualification of all or portions of the safety related PCS hardware and software (encompassing Triconex components, manual/auto hand stations, signal converters/isolators and loop power supplies).

7.5.3.7 NUREG-0737 (Items I.D.2, II.D.3, II.E.1.2, II.F.1, II.F.2, and III.A.1.2), November 1980 – Clarification of TMI Action Plan Requirements

7.5.3.7.1 Item I.D.2 – Plant Safety Parameter Display Console

SPDS Display

The primary SPDS display was designed to provide the control room operators with a concise format of critical plant variables to aid in determining the safety status of the plant. Parameter selection was made to address the five functions as listed in Section 7.5.2.10. The major types of possible accidents were evaluated to develop the minimum number of plant variables necessary to alert the operator of an abnormal condition. The parameters selected for each function were:

(1) *Reactivity Control*

(a) Three ranges of flux indication from 120 percent full power to 1 count/second using all three ranges of nuclear instrumentation: monitors neutron flux during all modes of operation.

(b) Startup rate indication.

(c) "Control Rods In" alert, which warns the operator of a reactor trip without insertion of all control rods.

(2) *Reactor Core Cooling and Heat Removal*

(a) Subcooled margin, which is a derived variable based on RCS pressure and temperature inputs, indicates the degree of subcooling or superheat present.

(b) Highest core exit thermocouple temperature monitors core exit temperature conditions.

(c) Reactor vessel level, wide- or narrow-range depending on reactor coolant pump status, indicates lack of adequate core cooling.

(d) Narrow-range steam generator level can be used to determine heat removal capability of the secondary system.

(3) *RCS Integrity*

(a) Reactor coolant system pressure can be used to monitor high-pressure conditions against design limits and can be used with cold leg temperature to monitor plant conditions against system nil ductility transition (NDT) limits.

(b) Pressurizer level is actually used as an indication of inventory if RCS has been, or is, subcooled. However, it is an important parameter with RCS pressure for rapid determination of normal or expected plant status.

(c) Cold leg temperature can be used with RCS pressure to monitor plant status with respect to system NDT limits.

(4) *Radioactivity Control*

(a) Containment radiation monitor indicates the release of radiation from the primary system to containment.

(b) Vent gas and vent iodine monitors monitor radioactivity releases from the plant vent to the environment.

(c) Main steam monitors indicate radioactivity released to the secondary system and/or atmosphere via steam generator tube leaks or tube failures.

(5) *Containment Integrity*

(a) Containment pressure monitors monitor actual pressure against design limit.

(b) Containment Isolation Phase A and/or B alert informs the operator that a Phase A and/or B isolation signal has occurred and whether alignment of the isolation valves is complete.

SPDS Display Groupings

The parameters for the SPDS display were grouped in each of the five areas. Alarm setpoints were selected to duplicate the trip and alarm settings of the plant instrumentation, plant Technical Specification requirements, or limits specified in the plant manuals. Distinctive color coding is used on the display to alert control room personnel to an abnormal condition. If a parameter is within its normal range, the bar for that parameter on the display is green; it is displayed red if outside the specified limits.

SPDS Operation

The basis for the location of the SPDS monitors in the control room was to ensure adequate visibility by the senior control room operator and not to impede movement in the control room. Console location is indicated in Figure 7.7-16. The color coding of the SPDS display readily enables the user to determine if a parameter on the display is within normal limits. In the case of an abnormal condition, the Emergency Evaluation Coordinator will typically be the prime user of the SPDS.

SPDS Monitors

There are two (2) SPDS displays in the control room, EOF, and TSC. Each screen has the critical safety function status shown at the top.

7.5.3.7.2 Item II.D.3 – Direct indication of relief and safety valve position

The PSRV position indication system provides the necessary information in the control room to determine the position (open/close) of each of the three PSRVs as described in Section 7.5.2.8.

7.5.3.7.3 Item II.E.1.2 – Auxiliary Feedwater System Automatic Initiation and Flow Indication

AFW flow indication is provided in the control room as described in Section 7.5.2.6. AFW automatic initiation is provided as described in Section 6.5.

7.5.3.7.4 Item II.F.1 – Additional Accident Monitoring Instrumentation

The safety-related display instrumentation includes the following subparts:

- Noble gas effluent radiological monitor – refer to Section 7.5.2.3;
- Provisions for continuous sampling of plant effluents for post-accident releases of radioactive iodines and particulates – refer to Section 7.5.2.3
- Onsite laboratory capabilities – refer to Sections 12.3.2 and 6.4.2.3;
- Containment high-range radiation monitor – refer to Section 7.5.2.1.5;
- Containment pressure monitor – refer to Section 7.5.2.1.2;
- Containment water level monitor – refer to Section 7.5.2.1.3; and
- Containment hydrogen concentration monitor – refer to Section 7.5.2.1.4

A discussion of each subpart is described in the indicated section.

7.5.3.7.5 Item II.F.2 – Instrumentation for Detection of Inadequate Core Cooling

The instrumentation used for detection of inadequate core cooling is described in Section 7.5.2.2.

7.5.3.7.6 Item III.A.1.2 – Upgrade Emergency Support Facilities

ERFDS is described in Section 7.5.2.9. All input parameters are routed from the Validyne data acquisition system to the Transient Recording System (TRS), which provides the data recall and storage for ERFDS. Each Unit's TRS acquires ERFDS data for both Units. The TRS servers provide data to PDN connected HSIs and PIN servers. PIN servers provide ERFDS data to DCPP LAN connected HSIs. PDN-connected HSIs with recall capability can display ERFDS data for either Unit. There are two dedicated ERFDS HSIs connected to the DCPP LAN in both the TSC and EOF. In addition, other selected DCPP LAN connected HSIs in the TSC and EOF may also view ERFDS and SPDS data. All data available on the ERFDS HSIs in the TSC and EOF is also available on the Plant Process Computer (PPC). The PPC HSIs in the TSC and EOF receive data from PIN servers via PIN and the DCPP LAN. Additional parameters available for display by the PPC are specified in Table 7.5-6. Other parameters are also available to allow post-accident monitoring and analysis via the PPC.

7.5.4 REFERENCES

1. Technical Specifications, Diablo Canyon Power Plant Units 1 and 2, Appendix A to License Nos. DPR-80 and DPR-82, as amended.

2. IEEE Standard 323-1974, Qualifying Class 1E Equipment for Nuclear Power Generating Stations, Institute of Electrical and Electronics Engineers, Inc.

3. IEEE Standard 344-1975, Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations, Institute of Electrical and Electronics Engineers, Inc.

4. Deleted in Revision 15.

5. Deleted in Revision 15.

6. Regulatory Guide 1.97, Rev. 3 Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant Conditions During and Following an Accident, USNRC, May 1983.

7. Deleted in Revision 21.

8. NUREG-0737, Supplement 1, Safety Parameter Display System Requirements for Nuclear Power Plants, USNRC, December 17, 1982.

9. NUREG-0696, Functional Criteria for Emergency Response Facilities, USNRC, February 1981.

10. IEEE Standard 279-1971, Criteria for Protection Systems for Nuclear Power Generating Stations, Institute of Electrical and Electronics Engineers, Inc.

11. IEEE Standard 308-1971, Criteria for Class 1E Power Systems for Nuclear Power Generating Stations, Institute of Electrical and Electronics Engineers, Inc.

12. IEEE Standard 323-2003, Qualifying Class 1E Equipment for Nuclear Power Generating Stations, Institute of Electrical and Electronics Engineers, Inc.

13. IEEE Standard 336-1971, Installation, Inspection, and Testing Requirements for Power, Instrumentation, and Control Equipment at Nuclear Facilities, Institute of Electrical and Electronics Engineers, Inc.

14. IEEE Standard 338-1971, Criteria for the Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems, Institute of Electrical and Electronics Engineers, Inc.

15. IEEE Standard 344-1987, Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations, Institute of Electrical and Electronics Engineers, Inc.

16. IEEE Standard 384-1974, Criteria for Independence of Class 1E Equipment and Circuits, Institute of Electrical and Electronics Engineers, Inc.

17. IEEE Standard 730-1998, Software Quality Assurance Plans, Institute of Electrical and Electronics Engineers, Inc.

18. IEEE Standard 828-1990, Software Configuration Management Plans, Institute of Electrical and Electronics Engineers, Inc.

19. IEEE Standard 829-1983, Software Test Documentation, Institute of Electrical and Electronics Engineers, Inc.

20. IEEE Standard 830-1993, Recommended Practice for Software Requirements Specifications, Institute of Electrical and Electronics Engineers, Inc.

21. IEEE Standard 1008-1987, Software Unit Testing, Institute of Electrical and Electronics Engineers, Inc.

22. IEEE Standard 1012-1998, Software Verification and Validation, Institute of Electrical and Electronics Engineers, Inc.

23. IEEE Standard 1016-1987, Recommended Practice for Software Design Descriptions, Institute of Electrical and Electronics Engineers, Inc.

24. IEEE Standard 1016.1-1993, Guide to Software Design Descriptions, Institute of Electrical and Electronics Engineers, Inc.

25. IEEE Standard 1059-1993, Guide for Software Verification and Validation Plans, Institute of Electrical and Electronics Engineers, Inc.

26. IEEE Standard 1074-1995, Developing Software Life Cycle Processes, Institute of Electrical and Electronics Engineers, Inc.

27. IEEE Standard 1233-1998, Guide for Developing System Requirements Specifications, Institute of Electrical and Electronics Engineers, Inc.

28. IEEE Standard C62.41-1991, Recommended Practice for Surge Voltages in Low Voltage AC Power Circuits, Institute of Electrical and Electronics Engineers, Inc.

29. IEEE Standard C62.45-1992, Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and less) AC Power Circuits, Institute of Electrical and Electronics Engineers, Inc.

30. IEEE Standard 7-4.3.2-2003, Digital Computers in Safety Systems of Nuclear Power Generating Stations, Institute of Electrical and Electronics Engineers, Inc.

31. EPRI TR-106439, Guideline on Evaluation and Acceptance of Commercial-Grade Digital Equipment for Nuclear Safety Applications, Electric Power Research Institute, October, 1996.

32. EPRI TR-102323 Rev. 3, Guidelines for Electromagnetic Interference Testing in Power Plants, Electric Power Research Institute, November 2004.

33. EPRI TR-107330, Generic Requirements Specification for Qualifying a Commercially Available PLC for Safety-Related Applications in Nuclear Power Plants, Electric Power Research Institute, December 1996.

34. EPRI TR-102348 Rev. 1, Guideline on Licensing Digital Upgrades, Electric Power Research Institute, March 2002.

35. Regulatory Guide 1.100 Rev. 2, Seismic Qualification of Electrical and Mechanical Equipment for Nuclear Power Plants, USNRC, June 1988.

36. Regulatory Guide 1.105, Rev. 3, Setpoints for Safety-Related Instrumentation, USNRC, December 1999.

37. Regulatory Guide 1.152, Rev, 1, Criteria for Digital Computers in Safety Systems of Nuclear Power Plants, USNRC, January 1996.

38. Regulatory Guide 1.168, Verification, Validation, Reviews and Audits for Digital Computer Software Used in Safety Systems of Nuclear Power Plants, USNRC, February 2004.

39. Regulatory Guide 1.169, Configuration Management Plans for Digital Computer Software Used in Safety Systems of Nuclear Power Plants, USNRC, September 1997.

40. Regulatory Guide 1.170, Software Test Documentation for Digital Computer Software Used in Safety Systems of Nuclear Power Plants, USNRC, September 1997.

41. Regulatory Guide 1.171, Software Unit Testing for Digital Computer Software Used in Safety Systems of Nuclear Power Plants, USNRC, September 1997.

42. Regulatory Guide 1.172, Software Requirements Specifications for Digital Computer Software Used in Safety Systems of Nuclear Power Plants, USNRC, September 1997.

43. Regulatory Guide 1.173, Developing Software Life Cycle Processes For Digital Computer Software Used in Safety Systems of Nuclear Power Plants, USNRC, September 1997

44. Regulatory Guide 1.180, Rev. 1, Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems, USNRC, October 2003.

45. Regulatory Guide 1.22, Periodic Testing of Protection System Actuation Functions, USNRC, February 1972.

46. Regulatory Guide 1.29, Rev. 3, Seismic Design Classification, USNRC, September 1978.

47. Regulatory Guide 1.30, Quality Assurance Requirements for the Installation, Inspection, and Testing of Instrumentation and Electric Equipment, USNRC, August 1972.

48. Regulatory Guide 1.47, Bypassed and Inoperable Status Indication for Nuclear Power Plant Safety Systems, USNRC, May 1973.

49. Regulatory Guide 1.89, Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants, USNRC, November 1974.

50. NUREG-0800, Appendix 7.0-A, Rev. 5, Review Process for Digital Instrumentation and Control Systems, USNRC, March 2007.

51. BTP 7-14 Rev. 5, Guidance on Software Reviews for Digital Computer-Based Instrumentation and Control Systems, USNRC, March 2007.

52. BTP 7-18 Rev. 5, Guidance on the use of Programmable Logic Controllers in Digital Computer-Based Instrumentation and Control Systems, USNRC, March 2007.

53. MIL-STD-461E, Requirements for the Control of Electromagnetic Interference Emissions and Susceptibility, USDOD, August 1999

54. ANSI/ANS-4.5-1980, Criteria for Accident Monitoring Functions in Light-Water-Cooled Reactors, American Nuclear Society, January 1980

55. NEMA ICS 1-2000, Industrial Control and Systems: General Requirements, National Electrical Manufacturers Association, December 2008

56. NFPA 70 (NEC) 2002 National Electric Code, National Fire Protection Association, January 2002

57. IEC 61131-3 1993, Programming Industrial Automations Systems, International Electrotechnical Commission, December 1993

58. ISA-S67.04-1994, Setpoints for Nuclear Safety-Related Instrumentation, International Society of Automation, January 1994

7.5.5 REFERENCE DRAWINGS

Figures representing controlled engineering drawings are incorporated by reference and are identified in Table 1.6-1. The contents of the drawings are controlled by DCPP procedures.

7.6 ALL OTHER INSTRUMENTATION SYSTEMS REQUIRED FOR SAFETY

This section provides a description and an analysis of: (a) residual heat removal (RHR) isolation valves, (b) the pipe break isolation system (PBIS), and (c) the anticipated transients without scram (ATWS) mitigation system actuation circuitry (AMSAC). The instrumentation and control power supply system is described and analyzed in Section 8.3.1.1.5. A discussion of the refueling interlocks is provided in Section 9.1. The fire detection and protection system is described in Section 9.5.1.

7.6.1 DESIGN BASES

7.6.1.1 General Design Criterion 2, 1967 – Performance Standards

The RHR isolation valves and the PBIS are designed to withstand the effects of or are protected against natural phenomena, such as earthquakes, flooding, tornadoes, winds, and other local site effects.

7.6.1.2 General Design Criterion 11, 1967 – Control Room

The RHR isolation valves, the PBIS, and the AMSAC system are designed to support actions to maintain and control the safe operational status of the plant from the control room.

7.6.1.3 General Design Criterion 12, 1967 – Instrumentation and Control Systems

The RHR isolation valves and the PBIS have instrumentation and controls to monitor and maintain system variables within prescribed operating ranges.

7.6.1.4 10 CFR 50.49 – Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants

The RHR isolation valves and associated components and PBIS components that require environmental qualification are qualified to the requirements of 10 CFR 50.49.

7.6.1.5 10 CFR 50.62 – Requirements for Reduction of Risk from Anticipated Transients Without Scrams (ATWS) Events for Light-Water-Cooled Nuclear Power Plants

AMSAC meets the requirement of providing a system independent of the reactor trip system to initiate auxiliary feedwater flow and turbine trip under ATWS conditions.

7.6.2 DESCRIPTION

7.6.2.1 Residual Heat Removal Isolation Valves

There are two motor-operated gate valves in series in the inlet line from the reactor coolant system (RCS) to the RHR system. They are normally closed and can only be opened for RHR after RCS pressure is reduced below approximately 390 psig. In addition, one valve cannot open until the pressurizer vapor space temperature has been reduced to approximately 475°F (refer to Sections 5.6.2 and 5.5.6 for details of the RHR system.) RHR isolation valve control and indications are as follows:

(1) One isolation valve, that nearest the RCS, is interlocked with a pressure signal to prevent its being opened whenever the RCS pressure is greater than the setpoint pressure (approximately 390 psig). This interlock is derived from one process control channel.

(2) The other valve is similarly interlocked. Control signals are derived from a second process control channel. In order to both comply with IEEE 279-1971 (Reference 1) and to provide diversity, the permissive interlock to open this valve is satisfied when the pressurizer vapor space temperature is reduced to approximately 475°F and the RCS pressure is reduced below approximately 390 psig. This temperature control signal is derived from one process instrumentation protection channel.

(3) Each isolation valve is provided with an independent alarm circuit from independent process protection channels that will actuate a common annunciator in the control room whenever the isolation valve is not 100 percent closed and RCS pressure is greater than approximately 435 psig. Procedures instruct the operators to stop RCS pressurization and close the isolation valves should this alarm condition occur during RCS pressurization with the RHR system removed from service.

(4) The RHR suction valves interlock relays are powered from the solid state protection system (SSPS) output cabinets. To maintain the ability to open the RHR suction valves when the SSPS output cabinets are de-energized in Mode 6 or defueled, jumpers are used to lock-in the RHR suction valves open permissive. This defeats the applicable RHR system overpressurization/temperature protection. Jumper installation is limited to Mode 6 and defueled only.

In the fire protection review, it was postulated that fire damage to electrical cables could cause both RHR suction line isolation valves to open. To prevent this, the power will be removed from each valve's motor operator by opening manual circuit breakers after the valves have been correctly positioned whenever RCS pressure is greater than 390 psig. Continuous indication that the RHR suction line isolation valves are in the correct position is provided for each valve. The control room valve position indicators are not

disabled by opening the circuit breakers and removing power from the valves' motor operators.

RHR isolation valve control, valve position indication, and annunciation are provided in the control room.

7.6.2.2 Pipe Break Isolation System

The PBIS provides a means to detect and isolate breaks in high-energy lines in the auxiliary building. This system limits the postulated mass/energy release in affected compartments. This reduces the environmental effect on a number of PG&E Design Class I and Class 1E components in the area.

There are two postulated pipe breaks that could affect Area K of the auxiliary building: (a) chemical and volume control system (CVCS) letdown line, and (b) auxiliary steam line. The PBIS provides an alarm and automatic isolation (redundant) of a break in the letdown line after the letdown isolation valves. An alarm and a switch for manual isolation are provided for the auxiliary steam line.

A break in a high-energy line is detected by redundant temperature sensors monitoring ambient air temperature. Alarms are provided at predetermined setpoints, based on an analysis of the postulated breaks. Annunciation is provided in the control room.

The Process Control System (PCS) processes the CVCS letdown line break temperature detector inputs and provides an output to the pipe break isolation logic. The PCS also processes the Auxiliary steam line area temperature detector inputs and provides control room indication and alarm. References 1, 2, 3 and 9 through 55 were used for design, verification, validation, and qualification of all or portions of the safety related PCS hardware and software (encompassing Triconex components, manual/auto hand stations, signal converters/isolators and loop power supplies).

7.6.2.3 ATWS Mitigation System Actuation Circuitry (AMSAC)

DCPP has installed an AMSAC system in both Units.

The system uses the standard Westinghouse design with the steam generator water level option. References 5 and 6 describe the generic AMSAC design. A functional logic diagram is shown in Figure 7.2-1, Sheets 33 and 34.

The AMSAC system trips the turbine, starts auxiliary feedwater, and isolates steam generator blowdown on coincidence of low-low steam generator water level in three out of four steam generators.

The AMSAC system performs an important safety function if the plant's primary reactor protection system fails. Accordingly, to ensure the reliability of the system, all activities

that could affect the quality of non-Class 1E AMSAC equipment shall be controlled as if the equipment were Class 1E.

ATWS Mitigation System Actuation Circuitry indication is provided in the control room with annunciation windows.

7.6.3 SAFETY EVALUATION

7.6.3.1 General Design Criterion 2, 1967 – Performance Standards

The PG&E Design Class I portion of the RHR isolation valves and pipe break isolation system are seismically designed and housed in seismically qualified buildings (containment structure and auxiliary building). These buildings are Design Class I (refer to Section 3.8) and designed to withstand the effects of winds and tornadoes (refer to Section 3.3), floods and tsunamis (refer to Section 3.4), external missiles (refer to Section 3.5), earthquakes (refer to Section 3.7), and other natural phenomena to protect the PG&E Design Class I portion of the RHR isolation valves and pipe break isolation system to ensure their safety-related functions and designs will be performed.

7.6.3.2 General Design Criterion 11, 1967 – Control Room

Controls and instrumentation related to (a) RHR Isolation Valves, (b) PBIS and (c) anticipated transients without scram (ATWS) mitigation system actuation circuitry (AMSAC) which are designed to support actions to maintain and control the safe operational status of the plant from the control room are as follows:

<u>RHR Isolation Valves</u>

Each RHR isolation valve is provided with an independent alarm circuit from independent process protection channels that will actuate a common annunciator in the control room whenever the isolation valve is not 100 percent closed and RCS pressure is greater than approximately 435 psig.

Continuous indication that the RHR suction line isolation valves are in the correct position is provided for each valve by control room valve position indicators that are not disabled by opening the circuit breakers and removing power from the valves' motor operators.

<u>Pipe Break Isolation System</u>

The PBIS provides an alarm and automatic isolation (redundant) of a break in the letdown line after the letdown isolation valves. An alarm and a switch for manual isolation are provided for the auxiliary steam line.

A break in a high-energy line is detected by redundant temperature sensors monitoring ambient air temperature. Alarms are provided at predetermined setpoints, based on an analysis of the postulated breaks.

The auxiliary steam line break isolation system provides an alarm based on any one of several high-temperature detectors. A switch is provided on the main control board to close the valves on lines that supply auxiliary steam to the auxiliary building. Since the auxiliary steam line is tied to both the Unit 1 and Unit 2 main steam lines, the crosstie through the auxiliary building to both main steam lines can be closed from either board on detection of high area temperature. Indication of area temperature is provided on the main control board to verify that isolation has occurred. Temperature indication is the only PG&E Design Class I function of the auxiliary steam line isolation system.

ATWS Mitigation System Actuation Circuitry

ATWS Mitigation System Actuation Circuitry indication is provided in the control room with annunciation windows.

7.6.3.3 General Design Criterion 12, 1967 – Instrumentation and Control Systems

The RHR isolation valves and the PBIS have instrumentation and controls to monitor and maintain system variables within prescribed operating ranges as follows:

Residual Heat Removal Isolation Valves

Based on the scope definitions presented in IEEE-279-1971 (Reference 1) and IEEE 338-1971 (Reference 3), these criteria do not apply to the RHR isolation valve interlocks; however, in order to meet NRC requirements, and because of the possible severity of the consequences of loss of function, the requirements of IEEE-279-1971 are applied with the following comments.

(1) For the purpose of applying IEEE-279-71 (Reference 1) to this circuit, the following definitions are used:

   (a) Protection System - The two valves in series in each line and all components of their interlocking and closure circuits.

   (b) Protective Action - The automatic interlock of the RHR system isolation from the RCS pressure above RHR design pressure.

(2) IEEE-279-71, Paragraph 4.10: The requirement for on-line test and calibration capability is applicable only to the actuation signal and not to the isolation valves, which are required to remain closed during power operation.

(3) IEEE-279-71, Paragraph 4.15: This requirement does not apply as the setpoints are independent of mode of operation and are not changed.

Pipe Break Isolation System

The CVCS letdown line break isolation system fully complies with IEEE-279-71 (Reference 1). Three high temperature detectors are provided. Each is powered from a separate Class 1E power source. A two-out-of-three logic is used with redundant logic trains so that a single failure will not prevent system operation, while at the same time the chance of spurious operation is limited. Redundancy is carried through to the final actuation devices.

The auxiliary steam line break isolation system provides an alarm based on any one of several high-temperature detectors. A switch is provided on the main control board to close the valves on lines that supply auxiliary steam to the auxiliary building. Since the auxiliary steam line is tied to both the Unit 1 and Unit 2 main steam lines, the crosstie through the auxiliary building to both main steam lines can be closed from either board on detection of high area temperature. Indication of area temperature is provided on the main control board to verify that isolation has occurred. Temperature indication is the only PG&E Design Class I function of the auxiliary steam line isolation system. A PG&E Design Class I backup is provided by use of the main steam line isolation system. Manual action is acceptable because of the relatively slow temperature transient that occurs due to this accident. There is sufficient time for the operator to verify that the break has been isolated before backup action is required.

7.6.3.4 10 CFR 50.49 – Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants

The RHR isolation valves and associated components and PBIS components listed in the DCPP EQ Master List are qualified to the requirements of 10 CFR 50.49.

Environmental qualification of the valves and wiring is discussed in Section 3.11.

7.6.3.5 10 CFR 50.62 – Requirements for Reduction of Risk from Anticipated Transients Without Scrams (ATWS) Events for Light-Water-Cooled Nuclear Power Plants

The AMSAC system is independent and diverse from the reactor protection system. (Refer to Section 7.2 for a description of the reactor protection system). The AMSAC system trips the turbine, starts auxiliary feedwater, and isolates steam generator blowdown on coincidence of low-low steam generator water level in three out of four steam generators. This meets the requirements of 10 CFR 50.62.

The Westinghouse AMSAC System has been analyzed by the Westinghouse owners group, and has been shown to maintain the reactor coolant system pressure boundary within the ASME Boiler and Pressure Vessel Code (Reference 7). Level C stress limits

in the event of a Condition II event as described in Section 4.2. This is documented in Westinghouse Report NS-TMA-2182 (Reference 8).

7.6.4 REFERENCES

1. IEEE Standard 279-1971, Criteria for Protection Systems for Nuclear Power Generating Stations, Institute of Electrical and Electronics Engineers, Inc.

2. IEEE Standard 308-1971, Criteria for Class IE Electric Systems for Nuclear Power Generating Stations, Institute of Electrical and Electronics Engineers, Inc.

3. IEEE Standard 338-1971, Trial-Use Criteria for the Periodic Testing of Nuclear Power Generating Station Protection Systems, Institute of Electrical and Electronics Engineers, Inc.

4. Deleted in Revision 21.

5. AMSAC Generic Design Change Package, WCAP-10858P-A, July 1987.

6. AMSAC Generic Design Package, Prescriptive Version, WCAP-11436, February 1987.

7. ASME Boiler and Pressure Vessel Code, Section III, Division I, Subsection NB-3224.

8. NS-TMA-2182, Westinghouse Letter (T. M. Anderson) to USNRC (S. H. Hanauer), ATWS Submittal, December 30, 1979.

9. IEEE Standard 323-2003, Qualifying Class 1E Equipment for Nuclear Power Generating Stations, Institute of Electrical and Electronics Engineers, Inc.

10. IEEE Standard 336-1971, Installation, Inspection, and Testing Requirements for Power, Instrumentation, and Control Equipment at Nuclear Facilities, Institute of Electrical and Electronics Engineers, Inc.

11. IEEE Standard 344-1987, Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations, Institute of Electrical and Electronics Engineers, Inc.

12. IEEE Standard 384-1974, Criteria for Independence of Class 1E Equipment and Circuits, Institute of Electrical and Electronics Engineers, Inc.

13. IEEE Standard 730-1998, Software Quality Assurance Plans, Institute of Electrical and Electronics Engineers, Inc.

14. IEEE Standard 828-1990, Software Configuration Management Plans, Institute of Electrical and Electronics Engineers, Inc.

15. IEEE Standard 829-1983, Software Test Documentation, Institute of Electrical and Electronics Engineers, Inc.

16. IEEE Standard 830-1993, Recommended Practice for Software Requirements Specifications, Institute of Electrical and Electronics Engineers, Inc.

17. IEEE Standard 1008-1987, Software Unit Testing, Institute of Electrical and Electronics Engineers, Inc.

18. IEEE Standard 1012-1998, Software Verification and Validation, Institute of Electrical and Electronics Engineers, Inc.

19. IEEE Standard 1016-1987, Recommended Practice for Software Design Descriptions, Institute of Electrical and Electronics Engineers, Inc.

20. IEEE Standard 1016.1-1993, Guide to Software Design Descriptions, Institute of Electrical and Electronics Engineers, Inc.

21. IEEE Standard 1059-1993, Guide for Software Verification and Validation Plans, Institute of Electrical and Electronics Engineers, Inc.

22. IEEE Standard 1074-1995, Developing Software Life Cycle Processes, Institute of Electrical and Electronics Engineers, Inc.

23. IEEE Standard 1233-1998, Guide for Developing System Requirements Specifications, Institute of Electrical and Electronics Engineers, Inc.

24. IEEE Standard C62.41-1991, Recommended Practice for Surge Voltages in Low Voltage AC Power Circuits, Institute of Electrical and Electronics Engineers, Inc.

25. IEEE Standard C62.45-1992, Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and less) AC Power Circuits, Institute of Electrical and Electronics Engineers, Inc.

26. IEEE Standard 7-4.3.2-2003, Digital Computers in Safety Systems of Nuclear Power Generating Stations, Institute of Electrical and Electronics Engineers, Inc.

27. EPRI TR-106439, Guideline on Evaluation and Acceptance of Commercial-Grade Digital Equipment for Nuclear Safety Applications, Electric Power Research Institute, October, 1996.

28. EPRI TR-102323 Rev. 3, Guidelines for Electromagnetic Interference Testing in Power Plants, Electric Power Research Institute, November 2004.

29. EPRI TR-107330, Generic Requirements Specification for Qualifying a Commercially Available PLC for Safety-Related Applications in Nuclear Power Plants, Electric Power Research Institute, December 1996.

30. EPRI TR-102348 Rev. 1, Guideline on Licensing Digital Upgrades, Electric Power Research Institute, March 2002.

31. Regulatory Guide 1.100 Rev. 2, Seismic Qualification of Electrical and Mechanical Equipment for Nuclear Power Plants, USNRC, June 1988.

32. Regulatory Guide 1.105, Rev. 3, Setpoints for Safety-Related Instrumentation, USNRC, December 1999.

33. Regulatory Guide 1.152, Rev, 1, Criteria for Digital Computers in Safety Systems of Nuclear Power Plants, USNRC, January 1996.

34. Regulatory Guide 1.168, Verification, Validation, Reviews and Audits for Digital Computer Software Used in Safety Systems of Nuclear Power Plants, USNRC, February 2004.

35. Regulatory Guide 1.169, Configuration Management Plans for Digital Computer Software Used in Safety Systems of Nuclear Power Plants, USNRC, September 1997.

36. Regulatory Guide 1.170, Software Test Documentation for Digital Computer Software Used in Safety Systems of Nuclear Power Plants, USNRC, September 1997.

37. Regulatory Guide 1.171, Software Unit Testing for Digital Computer Software Used in Safety Systems of Nuclear Power Plants, USNRC, September 1997.

38. Regulatory Guide 1.172, Software Requirements Specifications for Digital Computer Software Used in Safety Systems of Nuclear Power Plants, USNRC, September 1997.

39. Regulatory Guide 1.173, Developing Software Life Cycle Processes For Digital Computer Software Used in Safety Systems of Nuclear Power Plants, USNRC, September 1997

40. Regulatory Guide 1.180, Rev. 1, Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems, USNRC, October 2003.

41. Regulatory Guide 1.22, Periodic Testing of Protection System Actuation Functions, USNRC, February 1972.

42. Regulatory Guide 1.29, Rev. 3, Seismic Design Classification, USNRC, September 1978.

43. Regulatory Guide 1.30, Quality Assurance Requirements for the Installation, Inspection, and Testing of Instrumentation and Electric Equipment, USNRC, August 1972.

44. Regulatory Guide 1.47, Bypassed and Inoperable Status Indication for Nuclear Power Plant Safety Systems, USNRC, May 1973.

45. Regulatory Guide 1.89, Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants, USNRC, November 1974.

46. Regulatory Guide 1.97, Rev. 3, Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident, USNRC, May 1983.

47. NUREG-0800, Appendix 7.0-A, Rev. 5, Review Process for Digital Instrumentation and Control Systems, USNRC, March 2007.

48. BTP 7-14 Rev. 5, Guidance on Software Reviews for Digital Computer-Based Instrumentation and Control Systems, USNRC, March 2007.

49. BTP 7-18 Rev. 5, Guidance on the use of Programmable Logic Controllers in Digital Computer-Based Instrumentation and Control Systems, USNRC, March 2007.

50. MIL-STD-461E, Requirements for the Control of Electromagnetic Interference Characteristics of Sub-systems and Equipment, USDOD, August 1999

51. ANSI/ANS-4.5-1980, Criteria for Accident Monitoring Functions in Light-Water-Cooled Reactors, American Nuclear Society, January 1980

52. NEMA ICS 1-2000, Industrial Control and Systems: General Requirements, National Electrical Manufacturers Association, December 2008

53. NFPA 70 (NEC) 2002 National Electric Code, National Fire Protection Association, January 2002

54. IEC 61131-3 1993, Programming Industrial Automations Systems, International Electrotechnical Commission, December 1993

55. ISA-S67.04-1994, Setpoints for Nuclear Safety-Related Instrumentation, International Society of Automation, January 1994

7.6.5 REFERENCE DRAWINGS

Figures representing controlled engineering drawings are incorporated by reference and are identified in Table 1.6-1. The contents of the drawings are controlled by DCPP procedures.

7.7 CONTROL SYSTEMS NOT REQUIRED FOR SAFETY

The general design objectives of the plant control systems are:

(1) To establish and maintain power equilibrium between primary and secondary systems during steady state unit operation

(2) To constrain operational transients so as to preclude unit trip and reestablish steady state unit operation

(3) To provide the reactor operator with monitoring instrumentation that indicates required input and output control parameters of the systems, and provides the operator with the capability of assuming manual control of the system

7.7.1 DESIGN BASES

7.7.1.1 General Design Criterion 11, 1967 – Control Room

The plant control systems are designed to support actions to maintain and control the safe operational status of the plant from the control room or from an alternate location if control room access is lost due to fire or other causes.

7.7.1.2 General Design Criterion 12, 1967 – Instrumentation and Control Systems

The plant control systems have instrumentation and controls to monitor and maintain variables within prescribed operating ranges.

7.7.1.3 General Design Criterion 13, 1967 – Fission Process Monitors and Controls

The plant control systems are designed to monitor and maintain control over the fission process throughout core life and for all conditions that can reasonably be anticipated to cause variations in reactivity of the core, such as indication of position of control rods and concentration of soluble reactivity control poisons.

7.7.1.4 General Design Criterion 22, 1967 – Separation of Protection and Control Instrumentation Systems

The plant control systems are designed such that protection functions are separated from control instrumentation functions to the extent that failure or removal from service of any control instrumentation system component or channel, or of those common to control instrumentation and protection circuitry, leaves intact a system satisfying all requirements for the protection channels.

7.7.1.5 General Design Criterion 27, 1967 – Redundancy of Reactivity Control

The plant control systems are designed such that at least two independent reactivity control systems, preferably of different principles, are provided.

7.7.1.6 General Design Criterion 31, 1967 – Reactivity Control Systems Malfunction

The rod control system is designed such that it is capable of sustaining any single malfunction, such as, unplanned continuous withdrawal (not ejection) of a control rod, without causing a reactivity transient which could result in exceeding acceptable fuel damage limits.

7.7.2 SYSTEM DESCRIPTION

The plant control systems described in Sections 7.7.2.1 through 7.7.2.10 perform the following functions:

(1) *Reactor Control System*

(a) Enables the nuclear plant to accept a step load increase or decrease of 10 percent, and a ramp increase or decrease of 5 percent per minute, within the load range of 15 to 100 percent without reactor trip, steam dump, or pressurizer relief actuation, subject to possible xenon limitations.

(b) Maintains reactor coolant average temperature Tavg within prescribed limits by creating the bank demand signals for moving groups of rod cluster control assemblies (RCCAs) during normal operation and operational transients. The Tavg auctioneer unit supplies signals to pressurizer water level control and steam dump control.

(2) *Rod Control System*

(a) Provides for reactor power modulation by manual or automatic control of control rod banks in a preselected sequence, and for manual operation of individual banks

(b) Provides manual control of control banks to control the power balance between the top and bottom halves of the core

(c) Provides systems for monitoring and indicating:

1. Provide alarms to alert the operator if the required core reactivity shutdown margin is not available due to excessive control rod insertion

2. Display control rod position

3. Provide alarms to alert the operator in the event of control rod deviation exceeding a preset limit

(3) *Plant Control Signals for Monitoring and Indicating*

(a) Provide for measurement of reactor power level, axial power imbalance, and radial power imbalance

(b) Sense and display control rod position

(c) Provide warning to the operator of excessive rod insertion

(d) Provide an alarm whenever an individual rod position signal deviates from the other rods in the bank by a preset limit

(e) Provide rod bottom alarm for individual dropped rods

(4) *Plant Control System Interlocks* (refer to Table 7.7-1)

(a) Prevent further withdrawal of the control banks when signal limits are approached that predict the approach of a departure from nucleate boiling ratio (DNBR) limit or kW/ft limit

(b) Initiate automatic turbine load runback on overpower or overtemperature

(5) *Pressurizer Pressure Control* - Maintains or restores the pressurizer pressure to the nominal operating pressure ±60 psi (which is well within reactor trip and relief and safety valve action setpoint limits) following normal operation transients that induce pressure changes by control (manual or automatic) of heaters and spray in the pressurizer. It also provides steam relief by controlling the power-operated relief valves

(6) *Pressurizer Water Level Control* - Establishes, maintains, and restores pressurizer water level within specified limits as a function of the average coolant temperature. Changes in level are caused by coolant density changes induced by loading, operational, and unloading transients. Level changes required to maintain the level within prescribed limits are produced by charging flow control (manual or automatic), as well as by manual selection of letdown orifices

(7) *Steam Generator Water Level Control*

(a) Establishes and maintains the steam generator water level to within predetermined physical limits during normal operating transients

(b) Restores the steam generator water level to within predetermined limits at unit trip conditions. Regulates the feedwater flow under operational transients to maintain the proper heat sink for the reactor coolant system (RCS). Steam generator water inventory control is manual or automatic through use of the digital feedwater control system (Reference 7).

(8) *Steam Dump Control*

(a) Permits the nuclear plant to accept a sudden loss of load without incurring reactor trip. Steam is dumped to the condenser and/or the atmosphere as necessary to accommodate excess power generation in the reactor during turbine load reduction transients

(b) Ensures that stored energy and residual heat are removed following a reactor trip to bring the plant to equilibrium no-load conditions without actuation of the steam generator safety valves

(c) Maintains the plant at no-load conditions and permits a manually controlled cooldown of the plant

(9) *Incore Instrumentation* - Provides information on the neutron flux distribution and on the core outlet temperatures at selected core locations

(10) *Control Locations* - Provide central control and monitoring locations to perform plant operations both inside and outside the control room

7.7.2.1 Reactor Control System

The reactor control system enables the nuclear plant to follow load changes automatically, including the acceptance of step load increases or decreases of 10 percent, and ramp increases or decreases of 5 percent per minute within the load range of 15 to 100 percent without reactor trip, steam dump, or pressure relief, subject to possible xenon limitations. The system is also capable of restoring coolant average temperature to within the programmed temperature deadband following a change in load. Manual control rod operation may be performed at any time.

The reactor control system controls the reactor coolant average temperature by regulation of control rod bank position. The reactor coolant loop average temperatures are determined from hot leg and cold leg measurements in each reactor coolant loop. There is an average coolant temperature (T_{avg}) computed for each loop, where:

$$T_{avg_i} = \frac{T_{have_i} + T_{cave_i}}{2} \qquad (7.7\text{-}1)$$

$i = \text{loop numbers } 1 \rightarrow 4$

The error between the programmed reference temperature (based on turbine impulse chamber pressure), and the highest of the average loop measured temperatures (which is then processed through a lead-lag compensation unit) from each of the reactor coolant loops, constitutes the primary control signal as shown in general in Figure 7.7-1, and in more detail on the functional diagrams shown in Figure 7.2-1, Sheets 17 and 18. The system is capable of restoring coolant average temperature to the programmed value following a change in load. The programmed coolant temperature increases linearly with turbine load from zero power to the full power condition. The T_{avg} auctioneer unit also supplies a signal to pressurizer level control and steam dump control, and rod insertion limit monitoring.

An additional control input signal is derived from the reactor power versus turbine load mismatch signal. This additional control input signal improves system performance by enhancing response. The T_{avg} and T_{ref} signals are also supplied to the plant computer for a T_{avg} vs T_{ref} deviation alarm.

7.7.2.2 Rod Control System

7.7.2.2.1 Control Rod System

The control rod system receives rod speed and direction signals from the reactor control system. The rod speed demand signal varies over the corresponding range from 5 to 45 inches per minute (8 to 72 steps/minute), depending on the magnitude of the error signal. The rod direction demand signal is determined by the positive or negative value of the error signal. Manual control is provided to move a control bank in or out at a prescribed fixed speed.

When the turbine load reaches approximately 15 percent of rated load, the operator may select the AUTOMATIC mode, and rod motion is then controlled by the reactor control system. A permissive interlock C-5 (refer to Table 7.7-1), derived from measurements of turbine impulse chamber pressure, prevents automatic withdrawal when the turbine load is below 15 percent. In the AUTOMATIC mode, the rods are again withdrawn (or inserted) in a predetermined programmed sequence by the automatic programming equipment. The manual and automatic controls are further interlocked with the control interlocks (refer to Table 7.7-1).

The shutdown banks are always in the fully withdrawn position during normal operation (except as required by surveillance testing) and are moved to this position prior to criticality. A reactor trip signal causes them to fall by gravity into the core. There are four shutdown banks.

The control banks are the only rods that can be manipulated under automatic control. Each control bank is divided into two groups to obtain smaller incremental reactivity changes per step. All rod cluster control assemblies (RCCAs) in a group are electrically paralleled to move simultaneously. There is individual position indication for each RCCA.

Power to rod drive mechanisms is supplied by two motor generator sets operating from two separate 480-V, three-phase buses. Each generator is the synchronous type and is driven by a 150 hp induction motor. The ac power is distributed to the rod control power cabinets through the two series-connected reactor trip breakers.

The variable speed rod control system rod drive programmer affords the ability to insert small amounts of reactivity at low speed to accomplish fine control of reactor coolant average temperature about a small temperature deadband, as well as furnishing control at high speed.

A summary of the RCCA sequencing characteristics is provided below:

(1) Two groups within the same bank are stepped so that the relative position of the groups will not differ by more than one step.

(2) The control banks are programmed so that withdrawal of the banks is sequenced in the following order: control bank A, control bank B, control bank C, and control bank D. The programmed insertion sequence is the opposite of the withdrawal sequence; i.e., the last control bank withdrawn (bank D) is the first control bank inserted.

(3) The control bank withdrawals are programmed so that when the first bank reaches a preset position, the second bank begins to move out simultaneously with the first bank. When the first bank reaches the top of the core, it stops, while the second bank continues to move toward its fully withdrawn position. When the second bank reaches a preset position, the third bank begins to move out, and so on. This withdrawal sequence continues until the unit reaches the desired power. The control bank insertion sequence is the opposite.

(4) Overlap between successive control banks is adjustable between 0 to 50 percent (zero and 115 steps), with an accuracy of ±1 step.

(5) Rod speeds for either shutdown banks or control banks are capable of being controlled between a minimum of 8 steps per minute and a maximum of 72 steps per minute.

7.7.2.3 Plant Control Signals for Monitoring and Indicating

The following sections describe the monitoring and/or indicating functions provided by:

(1) Nuclear instrumentation system (7.7.2.3.1)

(2) Rod position (7.7.2.3.2)

(3) Control bank rod insertion monitoring (7.7.2.3.3)

(4) Rod deviation alarm (7.7.2.3.4)

(5) Rod bottom alarm (7.7.2.3.5)

7.7.2.3.1 Monitoring Functions Provided by the Nuclear Instrumentation System

The nuclear instrumentation system (NIS) is described below and in detail in Reference 1. However, the Reference 1, Section 3.7 Item e, Ion-Chamber-Current Recorders (NR-41 through NR-44) description does not apply.

The power range channels are important because of their use in monitoring power distribution in the core within specified safe limits. They are used to measure reactor power level, axial power imbalance, and radial power imbalance. These channels are capable of recording power excursions up to 200 percent of full power. Suitable alarms are derived from these signals as described below.

Basic power range signals are:

(1) Total current from a power range detector (four such signals from separate detectors). These detectors are vertical and have a neutron sensitive length of 10 feet

(2) Current from the upper half of each power range detector (four such signals)

(3) Current from the lower half of each power range detector (four such signals)

Derived from these basic signals are the following (including standard signal processing for calibration):

(1) Indicated nuclear power (four such)

(2) Indicated axial flux imbalance, derived from upper half flux minus lower half flux (four such)

Alarm functions derived are as follows:

(1) Deviation (maximum minus minimum of four) in indicated nuclear power

(2) Upper radial tilt (maximum to average of four) on upper half currents

(3) Lower radial tilt (maximum to average of four) on lower half currents

Axial Flux Difference (AFD) limits are found in the cycle specific COLR (Core Operating Limits Report) for each unit. Technical Specifications provide the limiting values for the QPTR (Quadrant Power Tilt Ratio) limit.

Nuclear power and axial flux imbalance are selectable for recording. Indicators are provided on the control board for nuclear power and for axial flux imbalance.

7.7.2.3.2 Rod Position Monitoring

Two separate systems are provided to sense and display control rod position as described below:

(1) *Digital Rod Position Indication System (DRPI)* - The digital rod position indication system measures the actual position of each rod using a detector that consists of 42 discrete coils mounted concentric with the rod drive pressure housing. The coils are located axially along the pressure housing on 3.75 inch spacing. They magnetically sense the entry and presence of the rod drive shaft through its centerline. The coils are interlaced into two data channels and are connected to the containment electronics (Data A and B) by separate multiconductor cables. Multiplexing is used to transmit the digital position signals from the containment electronics to the control board display unit. The digital position signal is displayed on the main control board by light emitting diodes (LEDs) for each control rod. The one LED illuminated in the column shows the position for that particular rod. By employing two separate channels of information, the digital rod position indication system can continue to function (at reduced accuracy) when one channel fails.

Included in the system is a rod-at-bottom signal that operates a local alarm and a control room annunciator.

(2) *Demand Position Indication System* - The demand position indication system counts pulses generated in the rod drive control system to provide a digital readout of the demanded bank position.

The demand position indication and digital rod position indication systems are separate systems; each serves as a backup for the other. Operating procedures require the reactor operator to compare the demand and digital (actual) readings upon recognition of any apparent malfunction.

Therefore, a single failure in rod position indication does not in itself lead the operator to take erroneous action in the operation of the reactor.

The demand position indication system is described in detail in Reference 2.

7.7.2.3.3 Control Bank Rod Insertion Monitoring

When the reactor is critical, the normal indication of reactivity status in the core is the position of the control bank in relation to reactor power (as indicated by RCS loop ΔT) and coolant average temperature. These parameters are used to calculate insertion limits for the control banks. Two alarms are provided for each control bank:

(1) The low alarm alerts the operator of an approach to the rod insertion limits requiring boron addition by following normal procedures with the chemical and volume control system (CVCS).

(2) The low-low alarm alerts the operator to take immediate action to add boron to the RCS by any one of several alternate methods.

The purpose of the control bank rod insertion monitor is to give warning to the operator of excessive rod insertion. The insertion limit maintains sufficient core reactivity shutdown margin following reactor trip, provides a limit on the maximum inserted rod worth in the unlikely event of a hypothetical rod ejection, and limits rod insertion so that acceptable nuclear peaking factors are maintained. Since the amount of shutdown reactivity required for the design shutdown margin following a reactor trip increases with increasing power, the allowable rod insertion limits must be decreased (the rods must be withdrawn further) with increasing power. Two parameters that are proportional to power are used as inputs to the insertion monitor. These are the ΔT between the hot leg and the cold leg, which is a direct function of reactor power, and T_{avg}, which is programmed as a function of power.

The rod insertion monitor uses parameters for each control rod bank as follows:

$$Z_{LLi} = K_{1i}\,\Delta T_{auct} + K_{2i}\,(T_{avg\ auct} - T_{no\text{-}load}) + K_{3i} \qquad (7.7\text{-}2)$$

where:

Z_{LLi} = maximum permissible insertion limit for affected control bank

i = A, B, C, and D respectively

$(\Delta T)_{auct}$ = highest ΔT of all loops

$(T_{avg})_{auct}$ = highest T_{avg} of all loops

K_{1i} = constants chosen to maintain $Z_{LLi} \geq$ actual limit based on physics
K_{2i} calculations
K_{3i}

The control rod bank demand position Z is compared to Z_{LLi} as follows:

If $Z - Z_{LLi} \leq D$, a low alarm is actuated
If $Z - Z_{LLi} \leq E$, a low-low alarm is actuated

where:

D, E = constants as described below

Since the highest values of T_{avg} and ΔT are chosen by auctioneering, a conservatively high representation of power is used in the insertion limit calculation.

Actuation of the low alarm alerts the operator of an approach to a reduced shutdown reactivity situation. Plant procedures require the operator to add boron through the CVCS. Actuation of the low-low alarm requires the operator to initiate emergency boration procedures. The value for E is chosen so that the low-low alarm would normally be actuated before the insertion limit is reached. The value for D is chosen to allow the operator to follow normal boration procedures. Figure 7.7-2 shows a block diagram of the control rod bank insertion monitor. The monitor is shown in more detail in the functional diagrams in Figure 7.2-1, Sheets 17 and 18. In addition to the rod insertion monitor for the control banks, an alarm system is provided to warn the operator if any shutdown RCCA leaves the fully withdrawn position. Rod insertion limits are found in the cycle specific COLR for each unit and are established by:

(1) Establishing the allowed rod reactivity insertion at full power, consistent with the purposes discussed above

(2) Establishing the differential reactivity worth of the control rods when moved in normal sequence

(3) Establishing the change in reactivity with power level by relating power level to rod position

(4) Linearizing the resultant limit curve. All key nuclear parameters in this procedure are measured as part of the initial and periodic physics testing program.

Any unexpected change in the position of the control bank under automatic control, or a change in coolant temperature under manual control, provides a direct and immediate indication of a change in the reactivity status of the reactor. In addition, samples are taken periodically of coolant boron concentration. Variations in concentration during

core life provide an additional check on the reactivity status of the reactor including core depletion.

7.7.2.3.4 Rod Deviation Alarm

The demanded and measured rod position signals are displayed on the control board. They are also monitored by the plant computer that provides an indication and an alarm whenever an individual rod position signal deviates from the other rods in the bank by a preset limit. The alarm can be set with appropriate allowance for instrument error and within sufficiently narrow limits to preclude exceeding core design hot channel factors. Rod alignment requirements are provided in the Technical Specifications.

Figure 7.7-3 is a block diagram of the rod deviation comparator and alarm system.

7.7.2.3.5 Rod Bottom Alarm

A rod bottom signal for each rod in the digital rod position system is used to operate a control relay, which generates the ROD BOTTOM ROD DROP alarm.

7.7.2.4 Plant Control System Interlocks

The listing of the plant control system interlocks, along with the description of their derivations and functions, is presented in Table 7.7-1. It is noted that the designation numbers for these interlocks are preceded by C. The development of these logic functions is shown in the functional diagrams (Figure 7.2-1, Sheets 17 to 32).

7.7.2.4.1 Rod Stops

Rod stops are provided to prevent abnormal power conditions that could result from excessive control rod withdrawal initiated by either a control system malfunction or operator violation of administrative procedures.

Rod stops are the C_1, C_2, C_3, C_4, and C_5 control interlocks identified in Table 7.7-1. The C_3 rod stop derived from overtemperature ΔT, and the C_4 rod stop derived from overpower ΔT, are also used for turbine runback, which is discussed below.

7.7.2.4.2 Automatic Turbine Load Runback

Automatic turbine load runback is initiated by an approach to an overpower or overtemperature condition. This prevents high power operation that might lead to an undesirable condition, which, if reached, would be protected by reactor trip.

Turbine load reference reduction is initiated by either an overtemperature or overpower ΔT signal. Two-out-of-four coincidence logic is used.

A rod stop and turbine runback are initiated when:

$\Delta T > \Delta T_{rod\ stop}$

For the overtemperature condition, an overtemperature ΔT (OTΔT) turbine runback (TR) occurs when:

$$\Delta T_i \left(\frac{1+\tau_4 s}{1+\tau_5 s} \right) - OT\Delta T_{setpoint_i} > OTTR_{setpoint_i}$$

$\Delta T_i = T_{havei} - T^f c_i$

T_{havei}, $T^f c_i$, τ_4, and τ_5 are defined in Section 7.2.2.1.2

$OT\Delta T_{setpoint_i}$ = -20 to +20% (usually zero)[(a)]

$OTTR_{setpoint_i}$ = -20 to +20% (usually negative)[(a)]

For the overpower condition, an overpower ΔT (OPΔT), turbine runback occurs when:

$$\Delta T_i \left(\frac{1+\tau_4 s}{1+\tau_5 s} \right) - OP\Delta T_{setpoint_i} > OPTR_{setpoint_i}$$

$\Delta T_i = T_{havei} - T^f c_i$

T_{havei}, $T^f c_i$, τ_4, and τ_5 are defined in Section 7.2.2.1.2

$OP\Delta T_{setpoint_i}$ = -20 to +20% (usually zero)[(a)]

$OPTR_{setpoint_i}$ = -20 to +20% (usually negative)[(a)]

ΔT setpoint refers to the overtemperature ΔT reactor trip value and the overpower ΔT reactor trip value for the two conditions. The turbine runback is continued until ΔT is equal to or less than $\Delta T_{rod\ stop}$.

This function serves to maintain an essentially constant margin to trip.

(a) The measured ΔT and ΔT setpoints should be in percent of full power ΔT. During initial plant operation, the ΔT channels were calibrated to indicate 100 percent at 100 percent power such that the channels do not reflect minor flow variations between loops or minor variations from design flow. Provisions to allow this calibration must be available in each channel before the ΔT signal is used for any alarm or protection function.

7.7.2.5 Pressurizer Pressure Control

The RCS pressure is controlled by using either the heaters (in the water region) or the spray (in the steam region) of the pressurizer plus steam relief for large transients. The electrical immersion heaters are located near the bottom of the pressurizer. A portion of the heater group is proportional plus integral controlled to correct small pressure variations. These variations are due to heat losses, including heat losses due to a small continuous spray. The remaining (backup) heaters are turned on when the pressurizer pressure-controlled signal demands approximately 100 percent proportional plus integral heater power.

The spray nozzles are located on the top of the pressurizer. Spray is initiated when the pressure controller spray demand signal is above a given setpoint. The spray rate increases proportionally with increasing spray demand signal until it reaches a maximum value.

Steam condensed by the spray reduces the pressurizer pressure. A small continuous spray is normally maintained to reduce thermal stresses and thermal shock and to help maintain uniform water chemistry and temperature in the pressurizer.

Three power operated relief valves limit system pressure for large positive pressure transients. In the event of a large load reduction, not exceeding the design plant load reduction capability, the pressurizer power-operated relief valves might be actuated for the most adverse conditions; e.g., the most negative Doppler coefficient and the minimum incremental rod worth. The relief capacity of the power-operated relief valves is sized large enough to limit the system pressure to prevent actuation of high-pressure reactor trip for the above condition.

A block diagram of the pressurizer pressure control system is shown in Figure 7.7-4.

7.7.2.6 Pressurizer Water Level Control

The pressurizer operates by maintaining a steam cushion over the reactor coolant. As the density of the reactor coolant adjusts to the various temperatures, the steam-water interface moves to absorb the variations with relatively small pressure disturbances.

The water inventory in the RCS is maintained by the CVCS. During normal plant operation, charging flow varies to produce the flow demanded by the pressurizer water level controller. The pressurizer water level is programmed as a function of coolant average temperature, with the highest average temperature (auctioneered) being used. The pressurizer water level decreases as the load is reduced from full load. This is a result of coolant contraction following programmed coolant temperature reduction from full power to low power. The programmed level is designed to match as nearly as possible the level changes resulting from the coolant temperature changes. To control pressurizer water level during startup and shutdown operations, the charging flow is

either automatically regulated with the controller setpoint adjusted to the desired level or manually regulated from the main control room. The pressurizer water level is programmed so that the water level is above the setpoint for heater cutout (refer to Section 7.7.3.2.2).

A block diagram of the pressurizer water level control system is shown in Figure 7.7-5.

7.7.2.7 Steam Generator Water Level Control

Each steam generator is equipped with a digital feedwater flow control system that maintains a constant steam generator (SG) water level over all power ranges. The feedwater controller regulates the main feedwater valve and the bypass feedwater valve by continuously comparing the feedwater flow signal, the water level signal, the programmed level, and the pressure-compensated steam flow signal. The digital feedwater control system has high and low power modes, determined by the feedwater flow measurement. The mode switch will automatically occur for a given loop when the feedwater flow in the subject loop reaches a predetermined valid value. In the low power mode, wide-range steam generator level provides a feedforward index to a single element feedwater control algorithm to anticipate nuclear steam supply system (NSSS) load changes. High power mode control is three element.

In both modes, feedwater temperature adjusts the level controller gain to account for variations in steam generator level dynamics with feedwater temperature. Narrow-range level is validated in both modes as the median value of the three isolated protection system level channels on each steam generator. As explained in WCAP-12221, this median signal selection (MSS) validation scheme meets the requirements of IEEE Std 279-1971 regarding separation of control and protection functions and control/protection interaction. The MSS was implemented to reduce the frequency of unscheduled trips resulting from equipment failure or human error during surveillance testing.

The feedwater pump speed is varied to maintain a programmed pressure differential between the average of the four steam generator steam line pressures and the feed pump discharge header. The speed demand controller continuously compares the actual differential pressure (DP) with a programmed DP_{ref} that is a linear function of steam flow. The speed demand controller then provides the feedpump speed demand to the feedpump speed control system. This system opens or closes the high pressure (HP) and low pressure (LP) governor valves for each pump to match the actual pump speed to the speed demand. The system also has a feature to back down or limit pump speed if pump discharge pressure is going high, to avoid feedpump trips on high discharge pressure due to feedwater system transients.

Continued delivery of feedwater to the steam generators is required as a sink for the heat stored and generated in the reactor following a reactor trip and turbine trip. An override signal closes the feedwater valves when the average coolant temperature is below a given temperature and the reactor has tripped. Manual override of the

feedwater control system is available at all times in the absence of a main feedwater isolation signal. Refer to Reference 7 for additional details.

A block diagram of the steam generator water level control system is shown in Figures 7.7-6 and 7.7-7.

7.7.2.8 Steam Dump Control

The steam dump system was originally designed to accept a 100 percent net load loss exclusive of the station auxiliaries without reactor or turbine trip. However, as described in Section 5.2.1.5.1, the design basis load reduction transient has been revised to a 50 percent step load reduction.

The automatic steam dump system is able to accommodate this abnormal load reduction and to reduce the effects of the transient imposed upon the RCS. By bypassing main steam directly to the condenser, an artificial load is thereby maintained on the primary system. The rod control system can then reduce the reactor temperature to a new equilibrium value without causing overtemperature and/or overpressure conditions.

If the difference between the T_{ref} based on turbine impulse chamber pressure and the lead/lag compensated auctioneered T_{avg} exceeds a predetermined amount, and the interlock mentioned below is satisfied, a demand signal will actuate the steam dump to maintain the RCS temperature within control range until a new equilibrium condition is reached.

To prevent actuation of steam dump on small load perturbations, an independent load reduction sensing circuit is provided. This circuit senses the rate of decrease in the turbine load as detected by the turbine impulse chamber pressure. The circuit is provided to unblock the dump valves when the rate of load reduction exceeds a preset value corresponding to a 10 percent step load decrease or a sustained ramp load decrease of 5 percent per minute.

A block diagram of the steam dump control system is shown in Figure 7.7-8.

7.7.2.8.1 Load Rejection Steam Dump Controller

This circuit prevents a large increase in reactor coolant temperature following a large, sudden load decrease. The error signal is a difference between the lead-lag compensated auctioneered T_{avg} and the T_{ref}, which is based on turbine impulse chamber pressure.

The T_{avg} signal is the same as that used in the reactor control system. The lead-lag compensation for the T_{avg} signal is to compensate for lags in the plant thermal response and in valve positioning. Following a sudden load decrease, T_{ref} is immediately decreased and T_{avg} tends to increase, thus generating an immediate demand signal for

steam dump. Since control rods are available in this situation, steam dump terminates as the error comes within the maneuvering capability of the control rods.

7.7.2.8.2 Reactor Trip Steam Dump Controller

Following a reactor trip above 15 percent power, the load rejection steam dump controller is defeated and the reactor trip steam dump controller becomes active. Since control rods are not available in this situation, the demand signal is the error signal between the lead-lag compensated auctioneered T_{avg} and the no-load reference T_{avg}. When the error signal exceeds a predetermined setpoint, the dump valves are tripped open in a prescribed sequence. As the error signal reduces in magnitude, indicating that the RCS T_{avg} is being reduced toward the reference no-load value, the dump valves are modulated by the reactor trip controller to regulate the rate of removal of decay heat and thus gradually establish the equilibrium hot shutdown condition.

The error signal determines whether a group of valves is to be tripped open or modulated open. In either case, they are modulated when the error is below the trip-open setpoints.

Some documentation may refer to the “reactor trip steam dump controller” as the “plant trip steam dump controller.”

7.7.2.8.3 Steam Header Pressure Controller

The removal of residual heat from the system is maintained by the steam header pressure controller (manually selected) that controls the amount of steam flow to the condensers. This controller operates a portion of the same steam dump valves to the condensers that are used during the initial transient following turbine/reactor trip or load reduction. This mode of operation is used during startup and cooldown (turbine not paralleled), and when operating the turbine below approximately 15 percent load.

7.7.2.9 Incore Instrumentation

The incore instrumentation system consists of Chromel-Alumel thermocouples at fixed core outlet positions, and movable miniature neutron detectors that can be positioned at the center of selected fuel assemblies anywhere along the length of the fuel assembly vertical axis. The basic system for inserting these detectors is shown in Figure 7.7-9. Sections 1 and 2 of Reference 3 outline the incore instrumentation system in more detail.

7.7.2.9.1 Thermocouples

The incore thermocouple system has been upgraded to safety-grade to qualify the system for postaccident monitoring. The upgraded system is discussed in Section 7.5.2.2.2.

The plant computer is also used to monitor and display the incore thermocouple temperatures through Class 1E isolation devices provided in the upgraded thermocouple system.

7.7.2.9.2 Movable Neutron Flux Detector Drive System

Miniature fission chamber detectors can be remotely positioned in retractable guide thimbles to provide flux mapping of the core. Flux mapping is described in Section 7.7.2.9.3 and the use of the data is described in Section 4.3.2.2. Refer to Reference 3 for neutron flux detector parameters. The stainless steel detector shell is welded to the leading end of helical wrap drive cable and to stainless steel sheathed coaxial cable. The retractable thimbles, into which the miniature detectors are driven, are pushed into the reactor core through conduits that extend from the bottom of the reactor vessel, down through the concrete shield area, and then up to a thimble seal table.

The thimbles are closed at the leading ends, are dry inside, and serve as the pressure barrier between the reactor water pressure and the atmosphere.

Mechanical seals between the retractable thimbles and the conduits are provided at the seal line. During reactor operation, the retractable thimbles are stationary. They are extracted downward from the core during refueling to avoid interference within the core. A space above the seal line is provided for the retraction operation.

The drive system for inserting the miniature detectors consists basically of drive assemblies, five-path rotary transfer operation selector assemblies, ten-path rotary transfer selector assemblies, and stop valves, as shown in Figure 7.7-9. These assemblies are described in Reference 3. The drive system pushes hollow helical wrap drive cables into the core with the miniature detectors attached to the leading ends of the cables and small-diameter sheathed coaxial cables threaded through the hollow centers back to the ends of the drive cables. Each drive assembly consists of a gear motor that pushes a helical, wrap-drive cable and a detector through a selective thimble path by means of a special drive box and includes a storage device that accommodates the total drive cable length.

The leakage detection and gas purge provisions are discussed in Reference 3.

Manual isolation valves (one for each thimble) are provided for closing the thimbles. When closed, the valve forms a 2500 psig barrier. The manual isolation valves are not designed to isolate a thimble while a detector/drive cable is inserted into the thimble. The detector/drive cable must be retracted to a position above the isolation valve prior to closing the valve.

A small leak would probably not prevent access to the isolation valves and, thus, a leaking thimble could be isolated during a hot shutdown. A large leak might require cold shutdown for access to the isolation valve. Access to the lower reactor cavity is provided through a small access room located below the incore instrumentation seal

area. During normal operations and hot or cold shutdown, the access room will be pressurized as cooling air from the containment heating, ventilating, and air conditioning (HVAC) system is forced through the lower reactor cavity. A normally closed PG&E Design Class I pressure relief shutter damper in the access room may be opened manually to relieve the pressure through the damper opening into the larger containment volume, thus reducing the pressure against the entry door and facilitating personnel access to the room. This damper contains counterweight devices that permit it to be automatically forced open if the pressure in the access room rises above the maximum normal operating pressure. In the event of a loss-of-coolant accident (LOCA), this damper will open and act as one of several reactor cavity subcompartment pressure-relief flowpaths.

7.7.2.9.2.1 Flux Thimble Tube Acceptance Criteria

The acceptance criteria to address nonlinear wear include capping or replacing flux thimble tubes that:

(1) showed greater than 25 percent wear per year; or

(2) had to be repositioned more than once; or

(3) had multiple wear scars with any two that measured greater than 40 percent; or

(4) had to be repositioned more than a total of 6 inches; or

(5) can not be inspected.

For wear above 40 percent, an additional predictability allowance of 5 percent is adequate to ensure that actual nonlinear wear does not exceed projected wear.

Based on Reference 11, 80 percent acceptance criterion, including 5 percent predictability uncertainty and 10 percent for eddy current testing instrument and wear scar uncertainty, PG&E will use a net acceptance criterion of 65 percent (References 9 and 10).

7.7.2.9.3 Control and Readout Description

The control and readout system provides means for inserting the miniature neutron detectors into the reactor core and withdrawing the detectors while plotting neutron flux versus detector position. The thimbles are distributed nearly uniformly over the core with about the same number of thimbles in each quadrant. The control system consists of two sections, one physically mounted with the drive units, and the other contained in the control room. Limit switches in each transfer device provide feedback of path selection operation. Each gear box drives an encoder for position feedback. One five-path operation selector is provided for each drive unit to insert the detector in one of

five functional modes of operation. A ten-path rotary transfer assembly is a transfer device that is used to route a detector into any one of up to ten selectable paths. A common path is provided to permit cross-calibration of the detectors.

The control room contains the necessary equipment for control, position indication, and flux recording for each detector. Panels are provided to indicate the position of the detectors and to plot the flux level. Additional panels are provided for such features as drive motor controls, core path selector switches, plotting, and gain controls.

A flux mapping consists, briefly, of selecting (by panel switches) flux thimbles in given fuel assemblies at various core locations. The detectors are driven to the top of the core and stopped automatically. An x-y plot (position versus flux level) is initiated with the slow withdrawal of the detectors through the core from the top to a point below the bottom. Other core locations are selected and plotted in a similar manner. Each detector provides axial flux distribution data along the center of a fuel assembly. Various radial positions of detectors may then be compared to obtain a flux map for a region of the core.

Operating plant experience has demonstrated the adequacy of the incore instrumentation system in meeting the design bases stated.

7.7.2.10 Control Locations

7.7.2.10.1 Control Room

A common control room for Unit 1 and Unit 2 contains the controls and instrumentation necessary for operating each unit's reactor and turbine-generator during normal and accident conditions. The control boards for Unit 2 are physically separated from the Unit 1 control boards. The control room is continuously occupied by licensed operating personnel during all operating conditions. It is also expected to be continuously occupied during all accident conditions. In the remote case where it is not possible to occupy the control room, alternative control locations are provided. The control room for each unit is designed to normally accommodate three to five people.

Sufficient shielding, distance, and containment integrity are provided to ensure that control room personnel are not subjected to doses under postulated accident conditions that would exceed 2.5 rem to the whole body or 30 rem to the thyroid, including doses received during both entry and exit. Control room ventilation is provided by a system capable of having a large percentage of recirculated air. The fresh air intake can be closed to limit the intake of airborne activity if monitors indicate that such action is appropriate. (A complete discussion of control room ventilation and air conditioning is presented in Chapter 9.)

Provisions are made so that plant operators can readily shut down and maintain the plant at hot standby by means of controls located outside the control room at central alternative locations, one for each unit, in the auxiliary building.

Control room arrangement is shown in Figure 7.7-16.

7.7.2.10.1.1 Main Control Boards

The control board design and layout presents all the controls, indicators, recorders, and alarms required for the safe startup, operation, and shutdown of the plant.

The control board layout is based on operator ease in relating the control board devices to the physical plant and determining, at a glance, the status of related equipment. This is referred to as providing a functional layout. Within the boundaries of a functional layout, modules are arranged in columns of control functions associated with separation trains defined for the reactor protection and Engineered Safety Features (ESF) systems. Teflon-coated wire is used within the module and between the module and the first termination point.

Modular train column wiring is formed into wire bundles and carried to metal wireways (gutters). Gutters are run into metal vertical wireways (risers). The risers are the interface between field wiring and control board wiring. Risers are arranged to maintain the separated routing of the field wire trays.

Alarms and annunciators on the control board provide warning of abnormal plant conditions that might lead to possible unsafe conditions. An annunciator terminal display and logger printer are also available in the main control room. Indicators and recorders are provided for observation of instantaneous and trend values of plant operating conditions. The charts are also used for record-keeping purposes.

The bench-vertical control boards and control console are arranged to afford the operator instant access to the continuing controllers, recorders, and indicators, while allowing easy access to all the other controls. Refer to Figure 7.7-17.

The control console houses the reactor controls, plant process computer terminals, turbine controls, and generator controls. These are arranged from left to right of an operator sitting at the console. Various trip switches and safety system indicators are also located on the console. Refer to Figures 7.7-18 and 7.7-19.

The bench-vertical board houses the indicators, recorders, and controllers for ESF, primary plant, steam generator, turbine-generator, ventilation, diesel generator, and station electrical systems. These instruments, however, do not require the immediate attention of the operator as do those located on the control console. Refer to Figures 7.7-20 through 7.7-29.

Indication provided in the control room is discussed under the description of each individual system.

A process computer is used to provide supplementary information to the operator and to effectively assist in the operation of the NSSS. However, the analog indication provides the operator with ample information for safe operation without the computer system.

The plant operator's computer panel is located on the control console for easy access to information. A plant process computer terminal display is also at this location.

7.7.2.10.1.1.1 Main Annunciator System

The function of the main annunciator system is to monitor the status of selected plant equipment, systems and components, and to alert the Plant Operations Staff when an abnormal (alarm) condition is detected. The design of the main annunciator system is described in Section 3.10.2.9.

A partial list of annunciator displays includes:

(1) Loss of power supplies

(2) SSPS trouble

(3) SSPS in test

(4) NIS detector loss

(5) NIS channel test

(6) NIS trip bypass

(7) Hot shutdown panel open

(8) Hot shutdown panel in control

(9) Heat tracing fault (boric acid systems)

(10) Radiation monitoring system failure

(11) Radiation monitoring system in test

(12) Diesel generator system

(13) NIS reactor trip bypass

(14) NIS rod stop bypass

(15) Containment high-high pressure in test

(16) Process protection system (PPS) channel in bypass

(17) PPS channel set failure

(18) PPS trouble

(19) PPS RTD failure

(20) Steam generator trip time delay timer actuated

7.7.2.10.1.2 Occupancy Requirements

The control room area that is located in the auxiliary building at elevation 140 feet is designed for safe occupancy during abnormal conditions. Adequate shielding is used to maintain acceptable radiation levels in these areas under all normal operating and accident conditions. Radiation detectors and smoke detectors are provided to monitor the air intake and to initiate appropriate alarms and modes of operation. Air conditioning is included with provisions for the air to be recirculated through charcoal filters. Emergency lighting is provided in the control room area.

Fire hazards in the control room area are limited by the following:

(1) Noncombustible materials are used in construction where possible. Structural and finish materials (including furniture) for the control room and interconnecting areas have been selected on the basis of fire-retardant characteristics. Structural floors and exterior and interior walls are of reinforced concrete. Interior partitions within the control room areas incorporate concrete blocks, metal, and gypsum drywalls on metal studs. The control room door frames and doors are metallic. Personnel doors are tight fitting and gasketed. Wood trim is not used.

(2) Control cables are provided with an individual flame-retardant insulation over each single conductor and overall flame-retardant jacket over multiconductor cables. Cables throughout the installation have an exterior jacket that meets the Insulated Power Cable Engineers Association (IPCEA) requirements. Shielded instrumentation cables are provided with fire-resistant insulation and covered with a jacket of the same material. For a more detailed discussion on insulated cable construction, refer to Appendix 8.3B and Sections 8.3.1.2 and 8.3.1.4.3.

(3) All pressure information is transmitted to the control room by electrical signals. No high-pressure fluids are piped into the control room.

(4) Combustible materials are administratively controlled in the control room area.

(5) Combustible supplies, such as logs, records, procedures, and manuals, are limited to the amounts required for current operation.

(6) Detectors, sensitive to smoke and combustibles, are located in the vicinity of equipment cabinets and in the air conditioning system ducts. Fire detection alarms are provided in the control room with indication of which detector has been actuated.

(7) All areas of the control room are readily accessible for fire extinguishing.

(8) Adequate fire extinguishers and breathing apparatus that are easily accessible are provided and are to be used in accordance with National Fire Code (NFC) and National Fire Protection Association (NFPA) requirements. This equipment is provided to control any fire that could occur.

(9) The control room is occupied at all times by an operator who has been trained in fire extinguishing techniques.

Therefore, as a result of these provisions, any fires in the control room area are expected to be of such small magnitude that they could be extinguished by the operator using a hand fire extinguisher. The resulting smoke and vapors would be removed by the air conditioning system.

The control room area is protected from infiltration of fire, smoke, or airborne radioactivity from outdoors and other areas of the auxiliary building by minimum leakage penetrations, weather-stripped doors, absence of outside windows, and the positive air pressure maintained in the area during normal and accident operation.

A smoke detection device provides warning so that the operator can take steps to minimize any hazard (refer to Section 9.4).

An area radiation detector monitors the control room for radiation content and will alert the operator to a high radioactivity level.

There are additional area radiation monitors in the auxiliary building and containment structures that provide the plant operator with a warning of unexpected high levels of radioactivity. Process monitors located in the residual heat removal exhaust ducts, component cooling water system, and liquid and gaseous radwaste systems also warn the operator of higher than expected concentrations of radioactivity. A plant vent gas process monitor is backed up by an air particulate monitor that can also sample the containment air and detect primary plant piping leaks within containment. For a complete discussion of the radiation monitoring system, refer to Section 11.4.

Should the operator be forced to leave the control room, operating procedures require that the operator first trip the reactor and turbine-generator through manual trip switches located on the console. The operator would then verify the reactor trip and the turbine

trip using approved plant procedures. After the reactor and turbine have tripped, plant controls automatically bring the plant to no-load condition after which it is necessary only to control the removal of decay heat and to maintain the water level in the pressurizer to maintain the plant in a safe condition. The operator would monitor and control these operations from the hot shutdown panel.

7.7.2.10.2 Hot Shutdown Panel

The hot shutdown panel, which is located in the auxiliary building at elevation 100 feet (refer to Figure 7.7-30), contains control stations, switches, and indicators to:

(1) Enable the operator to control water level in the steam generators with the auxiliary feedwater system (pumps and valves)

(2) Display auxiliary feedwater pump discharge pressure, auxiliary feedwater flow, auxiliary feedwater source levels, steam generator pressure and level, pressurizer pressure and level, emergency borate flow, charging flow, source range neutron flux, and vital 4.16-kV bus voltages

(3) Enable the operator to manipulate the steam dump system (10 percent)

(4) Start and stop:

  (a) Component cooling water pumps (3)

  (b) Auxiliary saltwater pumps (2)

  (c) Charging pumps CCP1 and CCP2 (2)

  (d) Boric acid transfer pumps (2)

(5) Control:

  (a) Emergency boric acid valve (1)

  (b) Charging flow control valves (2)

  (c) Power-operated relief valves (PORVs) for the pressurizer (close only) (3)

  (d) RCP seal injection back-pressure

  (e) RCP seal injection pressure

Boric acid concentration can be verified by reading the boron analyzer local indication or by sampling and analysis.

Transfer switches are located on this panel to allow the operator to activate these controls individually. Except for motor-driven equipment, any transfer switch operation will cause annunciation in the control room. For motor-driven equipment, refer to Section 7.4.1.2.1(4).

The hot shutdown panel for plant shutdown and decay heat removal would be used only under abnormal conditions when access to the control room has been lost, and not during normal plant operation. The controls and indicators are located behind doors to reduce the possibility of misoperation during normal operation. An alarm is initiated when a panel door is opened.

The indications and controls listed above are required for remote shutdown and/or Title 10, U.S. Code of Federal Regulations, Part 50, Appendix R purposes. Other indications and controls located on the hot shutdown panel are for operator convenience (additional indications and controls required for remote shutdown and Appendix R are located elsewhere throughout the plant.

7.7.2.10.3 Auxiliary Building Control Board

The auxiliary building control board, which is located in the auxiliary building at elevation 85 feet (refer to Figure 7.7-31), contains the controls, indicators, and alarm functions for:

(1) CVCS (Unit 1)

(2) Common panel for radioactive waste handling

(3) CVCS (Unit 2)

The control system provides a mimic for the radioactive waste handling system to aid the operator in setting up these systems.

7.7.2.10.4 Auxiliary Control Stations

Local control panels are provided for systems and components that do not require full-time operator attendance or are not used on a continuous basis. Examples of such systems are the waste disposal system and the turbine-generator hydrogen cooling system. In these cases, however, appropriate alarms are activated in the control room to alert the operator to an equipment malfunction or approach to unsafe conditions.

7.7.3 SAFETY EVALUATION

7.7.3.1 General Design Criterion 11, 1967 – Control Room

The plant is provided with a centralized control room common to both Unit 1 and Unit 2 that contains the controls and instrumentation necessary for operation of both units under normal and accident conditions. Should the operator be forced to leave the control room, operating procedures require that the operator first trip the reactor and turbine-generator through manual trip switches located on the console. Provisions are made so that plant operators can readily shut down and maintain the plant at hot standby by means of controls located outside of the control room. Refer to Section 7.7.2.10.

Proper positioning of the control rods is monitored in the control room by bank arrangements of the individual column meters for each RCCA. A rod deviation alarm alerts the operator of a deviation of one RCCA from the other rack in that bank position. There are also insertion limit monitors with visual and audible annunciation. A rod bottom alarm signal is provided to the control room for each RCCA. Four out-of-core long ion chambers also detect asymmetrical flux distribution indicative of rod misalignment.

7.7.3.2 General Design Criterion 12, 1967 – Instrumentation and Control Systems

The plant control systems are designed to ensure high reliability in any anticipated operational occurrences. Equipment used in these systems is designed and constructed to maintain a high level of reliability.

7.7.3.2.1 Step Load Changes without Steam Dump

The plant control systems restore equilibrium conditions, without a trip, following a $\pm$ 10 percent step change in load demand, over the 15 to 100 percent power range for automatic control. Steam dump is blocked for load decrease less than or equal to 10 percent. A load demand greater than full power is prohibited by the turbine control load limit devices.

The plant control systems minimize the reactor coolant average temperature deviation during the transient within a given value, and restore average temperature to the programmed setpoint. Excessive pressurizer pressure variations are prevented by using spray and heaters and power operated relief valves in the pressurizer.

The control systems limit nuclear power overshoot to acceptable values following a 10 percent increase in load to 100 percent.

7.7.3.2.2 Loading and Unloading

Ramp loading and unloading of 5 percent per minute can be accepted over the 15 to 100 percent power range under automatic control without tripping the plant. The function of the control systems is to maintain the coolant average temperature as a function of turbine-generator load.

The coolant average temperature increases during loading and causes a continuous insurge to the pressurizer as a result of coolant expansion. The sprays limit the resulting pressure increase. Conversely, as the coolant average temperature is decreasing during unloading, there is a continuous outsurge from the pressurizer resulting from coolant contraction. The pressurizer heaters limit the resulting system pressure decrease. The pressurizer water level is programmed so that the water level is above the setpoint for heater cutout during the loading and unloading transients. The primary concern during loading is to limit the overshoot in nuclear power and to provide sufficient margin in the overtemperature ΔT setpoint.

7.7.3.2.3 Load Reduction Furnished by Steam Dump System

When a load reduction occurs, if the difference between the required temperature setpoint of the RCS and the actual average temperature exceeds a predetermined amount, a signal will actuate the steam dump to maintain the RCS temperature within control range until a new equilibrium condition is reached.

The reactor power is reduced at a rate consistent with the capability of the rod control system. Reduction of the reactor power is automatic. The steam dump flow reduction is as fast as RCCAs are capable of inserting negative reactivity.

The rod control system can then reduce the reactor temperature to a new equilibrium value without causing overtemperature and/or overpressure conditions. The steam dump steam flow capacity is nominally 40 percent of full load steam flow at full load steam pressure.

The steam dump flow reduces proportionally as the control rods act to reduce the average coolant temperature. The artificial load is therefore removed as the coolant average temperature is restored to its programmed equilibrium value.

The dump valves are modulated by the reactor coolant average temperature signal. The required number of steam dump valves can be tripped quickly to stroke full open or modulate, depending on the magnitude of the temperature error signal resulting from loss of load.

7.7.3.2.4 Turbine-Generator Trip with Reactor Trip

Whenever the turbine-generator unit trips at an operating power level above the protection system interlock P-9 setting, the reactor also trips. The unit is operated with a programmed average temperature as a function of load, with the full load average temperature significantly greater than the equivalent saturation pressure of the safety valve setpoint. The thermal capacity of the RCS is greater than that of the secondary system, and because the full load average temperature is greater than the no-load temperature, a heat sink is required to remove heat stored in the reactor coolant to prevent actuation of steam generator safety valves for a trip from full power. This heat sink is provided by the combination of controlled release of steam to the condenser and by makeup of cold feedwater to the steam generators.

The steam dump system is controlled from the reactor coolant average temperature signal whose setpoint values are programmed as a function of turbine load. Actuation of the steam dump is rapid to prevent actuation of the steam generator safety valves. With the dump valves open, the average coolant temperature starts to reduce quickly to the no-load setpoint. A direct feedback of temperature acts to close the valves proportionally to minimize the total amount of steam that is bypassed.

Following the turbine trip, the feedwater flow is cut off when the average coolant temperature decreases below a given temperature, or when the steam generator water level reaches a given high level.

Additional feedwater makeup is then controlled manually to restore and maintain steam generator water level, while ensuring that the reactor coolant temperature is at the desired value. Residual heat removal is maintained by the steam header pressure controller (manually selected) that controls the amount of steam flow to the condensers. This controller operates a portion of the same steam dump valves to the condensers that are used during the initial transient following turbine and reactor trip.

The pressurizer pressure and water level fall rapidly during the transient because of coolant contraction. Following the turbine and reactor trip, the pressurizer level control follows RCS T_{avg} to its no load value. If heaters become uncovered following the trip, they are deenergized and the CVCS will provide full charging flow to restore water level in the pressurizer. Heaters are then turned on to restore pressure to normal.

The steam dump feedwater control systems are designed to prevent the average coolant temperature from falling below the programmed no-load temperature following the trip to ensure adequate reactivity shutdown margin.

7.7.3.2.5 General Considerations

The plant control systems prevent an undesirable condition in the operation of the plant that, if reached, would be protected by reactor trip. The description and analysis of this protection is covered in Section 7.2. Worst-case failure modes of the plant control

systems are postulated in the analysis of off-design operational transients and accidents covered in Chapter 15, such as the following:

(1) Uncontrolled RCCA withdrawal from a subcritical condition

(2) Uncontrolled RCCA withdrawal at power

(3) RCCA misalignment

(4) Loss of external electric load and/or turbine trip

(5) Loss of all ac power to the station auxiliaries

(6) Excessive heat removal due to feedwater system malfunctions

(7) Excessive load increase

(8) Accidental depressurization of the RCS

These analyses show that a reactor trip setpoint is reached in time to protect the health and safety of the public under these postulated incidents, and that the resulting coolant temperatures produce a DNBR well above the applicable limit value (refer to Sections 4.4.1.1 and 4.4.2.3). Thus, there will be no cladding damage and no release of fission products to the RCS under the assumption of these postulated worst case failure modes of the plant control systems.

7.7.3.3 General Design Criterion 13, 1967 – Fission Process Monitors and Controls

Overall reactivity control is achieved by the combination of soluble boron and RCCAs. Long-term regulation of core reactivity is accomplished by adjusting the concentration of boric acid in the reactor coolant. Short-term reactivity control for power changes is accomplished by the plant control systems that automatically move RCCAs. This system uses input signals including neutron flux, coolant temperature, and turbine load.

7.7.3.4 General Design Criterion 22, 1967 – Separation of Protection and Control Instrumentation Systems

In some cases, it is advantageous to employ control signals derived from individual protection channels through isolation devices contained in the protection channel. As such, a failure in the control circuitry does not adversely affect the protection channel. Accordingly, this postulated failure mode meets the requirements of GDC 22, 1967. Test results have proved that failure of any single control system component or channel did not perceptibly disturb the protection side (input) of the devices.

Where a single random failure can cause a control system action that results in a generating station condition requiring protective action, and can also prevent proper action of a protection system channel designed to protect against the condition, the remaining redundant protection channels are capable of providing the protective action even when degraded by a second random failure. This meets the applicable requirements of Paragraph 4.7 of IEEE-279-1971 (Reference 5).

Channels of the nuclear instrumentation that are used in the protective system are combined to provide nonprotective functions, such as signals, to indicating or recording devices; the required signals are derived through isolation devices.

These isolation devices are designed so that open or short circuit conditions, as well as the application of 120-Vac or 140-Vdc to the isolation side of the circuit, will have no effect on the input, or protection, side of the circuit. As such, failures on the nonprotective side of the system will not affect the individual protection channels.

7.7.3.5 General Design Criterion 27, 1967 – Redundancy of Reactivity Control

Two independent reactivity control systems are provided for each reactor. These are RCCAs and chemical shim (boration).

Overall reactivity control is achieved by the combination of soluble boron and RCCAs. Long-term regulation of core reactivity is accomplished by adjusting the concentration of boric acid in the reactor coolant. Short-term reactivity control for power changes is accomplished by the plant control systems that automatically move RCCAs. This system uses input signals including neutron flux, coolant temperature, and turbine load.

No single electrical or mechanical failure in the rod control system could cause the accidental withdrawal of a single RCCA from the partially inserted bank at full power operation. The operator could deliberately withdraw a single RCCA in the control bank; this feature is necessary in order to retrieve a rod, should one be accidentally dropped. In the extremely unlikely event of simultaneous electrical failures that could result in single withdrawal, rod deviation would be displayed on the plant annunciator, and the rod position indicators would indicate the relative positions of the rods in the bank. Withdrawal of a single RCCA by operator action, whether deliberate or by a combination of errors, would result in activation of the same alarm and the same visual indications.

The control and shutdown rods are arranged as follows:

Control	Shutdown
Bank A Group 1	Bank A Group 1
Bank A Group 2	Bank A Group 2
Bank B Group 1	Bank B Group 1
Bank B Group 2	Bank B Group 2
Bank C Group 1	Bank C One Group

Bank C Group 2 Bank D One Group
Bank D Group 1
Bank D Group 2

The rods in a group operate in parallel through multiplexing thyristors. The two groups in a bank move sequentially so that the first group is always within one step of the second group in the bank. A definite schedule of actuation or deactuation of the stationary gripper, movable gripper, and lift coils of a mechanism is required to withdraw the RCCA attached to the mechanism. Since the four stationary grippers, movable grippers, and lift coils associated with the RCCAs of a rod group are driven in parallel, any single failure that could cause rod withdrawal would affect a minimum of one group of RCCAs. Mechanical failures are in the direction of insertion, or immobility.

The identified multiple failure involving the least number of components consists of open circuit failure of the proper two out of sixteen wires connected to the gate of the lift coil thyristors. The probability of open wire (or terminal) failure is 0.016 x 10-6 per hour by MIL HDBK-217A (Reference 6). These wire failures would have to be accompanied by failure, or disregard, of the indications mentioned above. The probability of this occurrence is therefore too low to have any significance.

Concerning the human element, to erroneously withdraw a single RCCA, the operator would have to improperly set the bank selector switch, the lift coil disconnect switches, and the in-hold-out switch. In addition, the three indications would have to be disregarded or ineffective. Such a series of errors would require a complete lack of understanding and administrative control. A probability number cannot be assigned to a series of errors such as these. Such a number would be highly subjective.

The rod position indication provides direct visual displays of each control rod assembly position. The plant computer alarms for deviation of rods from their banks. In addition, a rod insertion limit monitor provides an audible and visual alarm to warn the operator of an approach to an abnormal condition due to dilution. The low-low insertion limit alarm alerts the operator to follow emergency boration procedures. The facility reactivity control systems are such that acceptable fuel damage limits will not be exceeded in the event of a single malfunction of either system.

An important feature of the control rod system is that insertion is provided by gravity fall of the rods.

In all analyses involving reactor trip, the single, highest worth RCCA is postulated to remain untripped in its full out position.

One means of detecting a stuck control rod assembly is available from the actual rod position information displayed on the control board. The control board position readouts for each rod give the plant operator the actual position of the rod in steps. The indications are grouped by banks (e.g., control bank A, control bank B, etc.) to indicate

to the operator the deviation of one rod with respect to other rods in a bank. This serves as a means to identify rod deviation.

The plant computer monitors the actual position of all rods. Should a rod be misaligned from the other rods in that bank by more than 12 steps, the rod deviation alarm is actuated.

Misaligned RCCAs are also detected and alarmed in the control room via the flux tilt (QPTR) monitoring system that is independent of the plant computer.

Isolated signals derived from the NIS are compared with one another to determine if a preset amount of deviation of average power has occurred. Should such a deviation occur, the comparator output will operate a bistable unit to actuate a control board annunciator. This alarm will alert the operator to a power imbalance caused by a misaligned rod. By use of individual rod position readouts, the operator can determine the deviating control rod and take corrective action. Thus, the design of the plant control systems meets the applicable requirements of GDC 12, 1967 and GDC 31, 1967.

The boron system can compensate for all xenon burnout reactivity transients without exception.

The rod system can compensate for xenon burnout reactivity transients over the allowed range of rod travel. Xenon burnout transients of larger magnitude must be accommodated by boration or by reactor trip (which eliminates the burnout).

The boron system is not used to compensate for the reactivity effects of fuel/water temperature changes accompanying power level changes.

The rod system can compensate for the reactivity effects of fuel/water temperature changes accompanying power level changes over the full range from full-load to no-load at the design maximum load uprate.

Automatic control of the rods is, however, limited to the range of approximately 15 to 100 percent of rating for reasons unrelated to reactivity or reactor safety.

The boron system (by the use of administrative measures) will maintain the reactor in the cold shutdown state, irrespective of the disposition of the control rods.

The overall reactivity control achieved by the combination of soluble boron and RCCAs meets the applicable requirements of GDC 27, 1967.

7.7.3.6 General Design Criterion 31, 1967 – Reactivity Control Systems Malfunction

Reactor shutdown with control rods is completely independent of the control functions since the trip breakers interrupt power to the rod drive mechanisms regardless of existing control signals. The design is such that the system can withstand accidental withdrawal of control groups or unplanned dilution of soluble boron without exceeding acceptable fuel design limits. Thus, the design meets the applicable requirements of GDC 31, 1967.

7.7.4 REFERENCES

1. J. B. Lipchak and R. A. Stokes, Nuclear Instrumentation System, WCAP-7669, April 1971.

2. A. E. Blanchard, Rod Position Monitoring, WCAP-7571, March 1971.

3. J. J. Loving, In-Core Instrumentation (Flux-Mapping System and Thermocouples), WCAP-7607, July 1971.

4. Deleted in Revision 21.

5. IEEE Standard 279-1971, Criteria for Protection Systems for Nuclear Power Generating Stations, Institute of Electrical and Electronics Engineers, Inc.

6. MIL-HDBK-217A, Reliability Prediction of Electronic Equipment, December 1965.

7. Advanced Digital Feedwater Control System Input Signal Validation for Pacific Gas and Electric Co., Diablo Canyon Units 1 and 2, WCAP - 12221, April 1997 (W Proprietary Class 3) (PGE-97-540) and WCAP - 12222, March 1989 (W Proprietary Class 3).

8. Westinghouse Protection System Noise Tests, WCAP - 12358, Revision 2, October 1975 (W Proprietary Class 3).

9. PG&E Letter DCL-11-037, Response to Telephone Conference Calls Held on February 2 and 4, 2011, Between the U.S. Nuclear Regulatory Commission and Pacific Gas and Electric Company Concerning Responses to Requests for Additional Information Related to the Diablo Canyon Nuclear Power Plant, Units 1 and 2, License Renewal Application, dated March 25, 2011.

10. NRC Letter to PG&E, Safety Evaluation Report Related to the License Renewal of Diablo Canyon Nuclear Power Plant, Units 1 and 2, dated June 2, 2011 (Section 3.0.3.1.2).

11. Westinghouse Commercial Atomic Power (WCAP) - 12866, Bottom Mounted Instrumentation Flux Thimble Wear, January 1991

7.7.5 REFERENCE DRAWINGS

Figures representing controlled engineering drawings are incorporated by reference and are identified in Table 1.6-1. The contents of the drawings are controlled by DCPP procedures.

TABLE 7.1-1

APPLICABLE DESIGN BASIS CRITERIA

CRITERIA	TITLE	APPLICABILITY					
Instrumentation and Controls		Reactor Trip System (RTS)	Engineered Safety Features Actuation System (ESFAS)	Systems Required for Safe Shutdown	Safety-Related Display Instrumentation	All Other Instrumentation Systems Required for Safety	Control Systems Not Required for Safety
Section		7.2	7.3	7.4	7.5	7.6	7.7
1. General Design Criteria							
Criterion 2, 1967	Performance Standards	X	X		X	X	
Criterion 3, 1971	Fire Protection			X			
Criterion 11, 1967	Control Room	X	X	X	X	X	X
Criterion 12, 1967	Instrumentation and Control System	X		X	X	X	X
Criterion 13, 1967	Fission Process Monitors and Controls						X
Criterion 14, 1967	Core Protection Systems	X					
Criterion 15, 1967	Engineered Safety Features Protection Systems		X				
Criterion 17, 1967	Monitoring Radioactivity Releases				X		
Criterion 19, 1967	Protection Systems Reliability	X	X				
Criterion 20, 1967	Protection Systems Redundancy and Independence	X	X				
Criterion 21, 1967	Single Failure Definition	X	X				
Criterion 22, 1967	Separation of Protection Control Instrumentation Systems	X	X				X
Criterion 23, 1967	Protection Against Multiple Disability for Protection Systems	X	X				
Criterion 24, 1967	Emergency Power for Protection Systems	X	X				
Criterion 25, 1967	Demonstration of Functional Operability of Protection Systems	X	X				
Criterion 26, 1967	Protection Systems Fail-Safe Design	X	X				

APPLICABLE DESIGN BASIS CRITERIA

CRITERIA	TITLE	APPLICABILITY					
Instrumentation and Controls		Reactor Trip System (RTS)	Engineered Safety Features Actuation System (ESFAS)	Systems Required for Safe Shutdown	Safety-Related Display Instrumentation	All Other Instrumentation Systems Required for Safety	Control Systems Not Required for Safety
Section		7.2	7.3	7.4	7.5	7.6	7.7
Criterion 27, 1967	Redundancy of Reactivity Control						X
Criterion 31, 1967	Reactivity Control Systems Malfunction	X					X
Criterion 37, 1967	Engineered Safety Features Basis for Design		X				
Criterion 38, 1967	Reliability and Testability of Engineered Safety Features		X				
Criterion 40, 1967	Missile Protection		X				
Criterion 48, 1967	Testing of Operational Sequence of Emergency Core Cooling Systems		X				
Criterion 49, 1967	Containment Design Basis	X	X				
2. 10 CFR Part 50							
50.49	Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants	X	X		X	X	
50.62	Requirements for Reduction of Risk from Anticipated Transients without Scrams (ATWS) Events for Light-Water-Cooled Nuclear Power Plants					X	
3. Atomic Energy Commission (AEC) Safety Guides							
Safety Guide 22, February 1972	Periodic Testing of Protection System Actuation Functions	X	X				
4. Regulatory Guides							
Regulatory Guide 1.97, Revision 3, May 1983	Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and				X		

TABLE 7.1-1

APPLICABLE DESIGN BASIS CRITERIA

CRITERIA	TITLE	APPLICABILITY					
Instrumentation and Controls		Reactor Trip System (RTS)	Engineered Safety Features Actuation System (ESFAS)	Systems Required for Safe Shutdown	Safety-Related Display Instrumentation	All Other Instrumentation Systems Required for Safety	Control Systems Not Required for Safety
Section		7.2	7.3	7.4	7.5	7.6	7.7
	Following an Accident						
5. NRC NUREG							
NUREG-0737 (Item I.D.2), November 1980	Clarification of TMI Action Plan Requirements				X		
NUREG-0737 (Item II.D.3), November 1980	Clarification of TMI Action Plan Requirements				X		
NUREG-0737 (Item II.E.1.2), November 1980	Clarification of TMI Action Plan Requirements				X		
NUREG-0737 (Item II.F.1), November 1980	Clarification of TMI Action Plan Requirements				X		
NUREG-0737 (Item II.F.2), November 1980	Clarification of TMI Action Plan Requirements				X		
NUREG-0737 (Item II.K.3.10), November 1980	Clarification of TMI Action Plan Requirements	X					
NUREG-0737 (Item II.K.3.12), November 1980	Clarification of TMI Action Plan Requirements	X					
NUREG-0737 (Item II.A.1.2), November 1980	Clarification of TMI Action Plan Requirements				X		
6. NRC Generic Letters							
Generic Letter 83-28, July 1983	Required Actions Based on Generic Implications of Salem ATWS Events	X					

TABLE 7.2-1

LIST OF REACTOR TRIPS

Reactor Trip	Coincidence Logic	Interlocks	Comments
1. Power range high nuclear power	2/4	Manual block of low setting permitted by P-10	High and low settings; manual and automatic reset of low setting by P-10
2. Intermediate range high neutron flux	1/2	Manual block permitted by P-10	Manual block and automatic reset
3. Source range high neutron flux	1/2	Manual block permitted by P-6, interlocked with P-10	Manual block and automatic reset. Automatic block above P-10
4. Power range high positive nuclear power rate	2/4	No interlocks	-
5. Deleted in Revision 20.		-	-
6. Overtemperature ΔT	2/4	No interlocks	-
7. Overpower ΔT	2/4	No interlocks	-
8. Pressurizer low pressure	2/4	Interlocked with P-7	Blocked below P-7
9. Pressurizer high pressure	2/4	No interlocks	-

Reactor Trip	Coincidence Logic	Interlocks	Comments
10. Pressurizer high water level	2/3	Interlocked with P-7	Blocked below P-7
11. Reactor coolant low flow	2/3 per loop	Interlocked with P-7 and P-8	Low flow in one loop will cause a reactor trip when above P-8 and a low flow in two loops will cause a reactor trip with permissive P-7 enabled. Blocked below P-7
12. Reactor coolant pump breakers open or redundant breaker open	2/4	Interlocked with P-7	Blocked below P-7
13. Reactor coolant pump bus under-voltage	1/2 on both buses	Interlocked with P-7	Low voltage on all buses permitted below P-7
14. Reactor coolant pump bus under-frequency	2/3 on either bus	Interlocked with P-7	Underfrequency on 2/3 sensors on either bus will trip reactor if above P-7 setpoint
15. Steam generator low- low level	2/3 per loop	No interlocks	-

Reactor Trip	Coincidence Logic	Interlocks	Comments
16. Safety injection signal	Coincidence with actuation of safety injection	No interlocks	(See Section 7.3 for engineered safety features actuation conditions)
17. Turbine trip-Reactor trip			
a. Low autostop oil pressure	2/3	Interlocked with P-9	Blocked below P-9
b. Turbine stop valve close	4/4	Interlocked with P-9	Blocked below P-9
18. Manual	1/2	No interlocks	Reactor trip or Safety Injection Signal Actuation
19. Seismic	2/3 per axis	No interlocks	-
20. Reactor trip/bypass breakers	2/2	No interlocks	Both trains
21. Automatic trip logic	1/2	No interlocks	Both trains
22. General warning	2/2	No interlocks	Both trains

TABLE 7.2-2

PROTECTION SYSTEM INTERLOCKS

Designation	Derivation	Function
	Power Escalation Permissives	
P-6	1/2 Neutron flux (intermediate range) above setpoint	Allows manual block of source range reactor trip
	2/2 Neutron flux (intermediate range) below setpoint	Defeats the block of source range reactor trip
P-10	2/4 Nuclear power (power range) above setpoint	Allows manual block of power range (low setpoint) reactor trip
		Allows manual block of intermediate range reactor trip and intermediate range rod stops (C-1)
		Blocks source range reactor trip (backup for P-6)
		Blocks subcooled margin monitor lo-margin alarm
	3/4 Nuclear power (power range) below setpoint	Defeats the block of power range (low set- point) reactor trip
		Defeats the block of intermediate range reactor trip and intermediate range rod stops (C-1)
		Input to P-7
		Enables subcooled margin monitor lo-margin alarm

TABLE 7.2-2

Designation	Derivation	Function
	Blocks of Reactor Trips	
P-7	3/4 Nuclear power (power range) below setpoint (from P-10), and 2/2 turbine impulse chamber pressure below setpoint (from P-13)	Blocks reactor trip on: low flow or reactor coolant pump breakers open in more than one loop, undervoltage, underfrequency, pressurizer low pressure, and pressurizer high level
P-8	3/4 Nuclear power (power range) below setpoint	Blocks reactor trip on low flow in a single loop
P-9	3/4 Neutron Flux (power range) below setpoint	Blocks reactor trip on turbine trip
P-13	2/2 Turbine impulse chamber pressure below setpoint	Input to P-7

TABLE 7.3-1

INSTRUMENTATION OPERATING CONDITION
FOR ENGINEERED SAFETY FEATURES

No.	Functional Unit	No. of Channels	No. of Channels To Trip
1.	Safety Injection		
	a. Manual	2	1
	b. High containment pressure	3	2
	c. Pressurizer low pressure	4	2
	d. Low steam line pressure (lead/lag compensated)	12 (3/steam line)	2/3 in any steam line
2.	Containment Spray		
	a. Manual	2	2 coincident
	b. Containment pressure high-high	4	2

TABLE 7.3-2

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM
INSTRUMENTATION OPERATING CONDITIONS FOR ISOLATION FUNCTIONS

No.	Functional Unit	No. of Channels	No. of Channels To Trip
1.	Containment Isolation		
	a. Safety injection (Phase A)	(See Item No. 1 of Table 7.3-1)	
	b. Containment pressure (Phase B)	(See Item No. 2b of Table 7.3-1)	
	c. Manual		
	Phase A	2	1
	Phase B	(See Item No. 2a of Table 7.3-1)	
2.	Steam Line Isolation		
	a. Low steam line pressure (lead/lag compensated)	(See Item No. 1d of Table 7.3-1)	
	b. High steam pressure rate (rate lag compensated)	12 (3/steam line)	2/3 in any steam line
	c. Containment pressure high- high 2/4	(See Item No. 2b of Table 7.3-1)	
	d. Manual	1/loop	1/loop
3.	Feedwater Line Isolation		
	a. Safety injection	(See Item No. 1 of Table 7.3-1)	
	b. Steam generator high-high level	12 (3/steam generator)	2/3 in any steam generator

TABLE 7.3-2

No.	Functional Unit	No. of Channels	No. of Channels To Trip
4.	Containment Ventilation Isolation		
	a. Safety injection	(See Item No. 1 of Table 7.3-1)	
	b. Containment exhaust detectors	2	1
	c. Containment isolation		
	1) Phase A (manual)	2	1
	2) Phase B (manual)	2	2
	3) Spray actuation (manual)	2	2
5.	Control Room Air Intake Duct Isolation		
	a. Safety injection	(See Item No. 1 of Table 7.3-1)	
	b. Control room air intake radiation monitor[(a,b,c)]	2	1
	c. Manual	1	1

(a) Circuitry is not part of the safeguards system.

(b) Monitors on either unit control room air intake duct will initiate the isolation of both Units' control room ventilation systems.

(c) Circuitry is not redundant.

TABLE 7.3-3

INTERLOCKS FOR ENGINEERED SAFETY FEATURES ACTUATION SYSTEM

Designation	Input	Function Performed
P-4	Reactor trip	Actuates turbine trip
		Closes main feedwater valves on T_{avg} below setpoint
		Prevents opening of main feedwater valves which were closed by safety injection or high steam generator water level
		Allows manual block of safety injection
	Reactor not tripped	Defeats the block of the automatic reactuation of safety injection
P-11	2/3 Pressurizer pressure below setpoint	Allows manual block of safety injection actuation on low pressurizer pressure signal
		Allows manual block of safety injection and steam line isolation on low steamline pressure. Steam line isolation on high negative rate steam line pressures is permitted when this manual block is accomplished
	2/3 Pressurizer pressure above setpoint	Defeats manual block of safety injection actuation
		Defeats manual block of safety injection and steam line isolation on low steam line pressure and defeats steam line isolation on high negative rate steam line pressure

Designation	Input	Function Performed
P-12[(a)]	2/4 T_{avg} below setpoint	Blocks steam dump condenser valves
		Allows manual bypass of steam dump block for the cooldown condenser valves only[(b)]
		Blocks trip open atmospheric dump
		Blocks modulation of the dump valves according to sequence described in Sheets 19 and 20 of Figure 7.2-1
	3/4 T_{avg} above setpoint	Defeats the manual bypass of steam dump block
		Enables steam dump (all condenser dump valves except the cooldown dump valves)
		Enables steam dump (atmospheric dump valves)
P-14	2/3 Steam generator water level above setpoint in any steam generator	Closes all feedwater control valves
		Closes feedwater bypass valves
		Trips all main feedwater pumps
		Actuates turbine trip

(a) Circuitry is not part of safeguards system

(b) Operations procedures allow bypassing the P-12 interlock once the reactor is in Mode 3 and borated to cold shutdown conditions.

TABLE 7.5-1

MAIN CONTROL BOARD INDICATORS AND/OR RECORDERS AVAILABLE TO THE OPERATOR
(CONDITIONS II AND III EVENTS)

Parameter	No. of Channels Avail.	No. of Channels Req.	Range	Available Indicated Accuracy[(a)]	Indicator/ Recorder	Purpose
1. T_{cold} &/or T_{hot} (measured, wide-range)	1 T_{hot} or 1 T_{cold} per loop	1 T_{hot} & 1 T_{cold} any 2 operating loops	0 to 700°F	±4% of full range	All channels are recorded	Ensure maintenance of proper cooldown rate and maintenance of proper relationship between system pressure and temperature for NDT considerations
2. Pressurizer Water Level	3	2	0 to 100%	±6% span at 2250 psia	All three channels indicated; one channel is selected for recording	Ensure maintenance of proper reactor coolant inventory
3. RCS Pressure (wide-range)	2	2	0 to 3000 psig	±4% of full range	One channel indicated and one recorded	Ensure maintenance of proper relationship between system pressure and temperature for NDT considerations
4. Containment Pressure (normal-range)	4	2	-5 to +55 psig	±3.5% of full span	All 4 are indicated	Monitor containment conditions to indicate need for potential engineered safety features

TABLE 7.5-1

Parameter	No. of Channels Avail.	No. of Channels Req.	Range	Available Indicated Accuracy[(a)]	Indicator/ Recorder	Purpose
5. Steam Line Pressure	3/Loop	2/Loop	0 to 1,200 psig	±4.0% of full span	All channels are indicated	Monitor steam generator pressure conditions during hot shutdown and cooldown, and for use in recovery from steam generator tube ruptures
6. Steam Generator Water Level (wide-range)	1/Steam generator	N/A	0 to 100%	±3% span[(b)]	All channels recorded	Ensure maintenance of reactor heat sink
7. Steam Generator Water level (narrow-range)	3/Steam generator	2/Steam generator	0 to 100%	±3% span[(b)]	All channels indicated; the channels used for control are recorded	Ensure maintenance of reactor heat sink
8. Intermediate Range Flux Level	2	N/A	8 decades logarithmic 10^{-11} to 10^{-3} amps overlapping the source range by 2 decades	Indicator: -16.8% to +20.2% of input; Recorder: -24% to +30% of input[(c)]	Both channels indicated. All channels are recorded.	

TABLE 7.5-1

Parameter	No. of Channels Avail.	No. of Channels Req.	Range	Available Indicated Accuracy[(a)]	Indicator/ Recorder	Purpose
9. Power Range						
a. Uncompensated ion chamber current (top and bottom uncompensated ion chambers)	4	N/A	0 to 120% of full power current	±1% of full span	All 8 current signals indicated	
b. Average flux of the top and bottom ion chambers	4	N/A	0 to 120% of full power	±3% of full power for indication, ±2% for recording	All 4 channels indicated. All channels are recorded.	
c. Average flux of the top and bottom ion chambers	4	N/A	0 to 200% of full power	±2% of full power to 120% ±6% of full power to 200%	All 4 channels recorded	
d. Flux difference of the top and bottom ion chambers	4	N/A	-30 to +30%	±4%	All 4 channels indicated. All channels are recorded.	

(a) Includes channel accuracy and environmental effects during normal plant operation, but does not include post-accident environmental effects.

Changes which are within the stated accuracy band or within the reading accuracy of the indicator are not reflected in this table. Actual values are found in design documents.

The instrumentation accuracies listed are typical indicator values and are not directly comparable to the channel accuracies utilized in the Chapter 15 analysis.

TABLE 7.5-1

(b) Instrument accuracy only. The accuracy statement does not include the effect of density changes in the vessel.

(c) Does not include instrument drift allowance.

TABLE 7.5-2

MAIN CONTROL BOARD INDICATORS AND/OR RECORDERS AVAILABLE TO THE OPERATOR
(CONDITION IV EVENTS)

Parameter	No. of Channels Avail.	No. of Channels Req.	Range	Available Indicated Accuracy[a]	Indicator/ Recorder	Purpose
1. Containment Pressure (normal range)	4	2	-5 to +55 psig	±3.5% of full span	All 4 are indicated	Monitor post-LOCA containment conditions
2. Containment Sump Level (NR)	2	1	88.5 to 96.6 ft El.	±6.5% of full span[e]	Indicator	Assess recirculation mode and general conditions
3. Refueling Water Storage Tank Water Level	3	2	0 to 100% of span	±4.5% of level span	All 3 are indicated and alarmed	Ensure that water is flowing to the safety injection system after a LOCA, and determine when to shift from injection to recirculation mode
4. Steam Generator Water Level (narrow-range)	3/Steam generator	2/Steam generator	0 to 100%	±3% of level span[b][c]	All channels indicated; the channels used for control are recorded	Detect steam generator tube rupture; monitor steam generator water level following a feedwater line break

TABLE 7.5-2

Parameter	No. of Channels Avail.	No. of Channels Req.	Range	Available Indicated Accuracy[a]	Indicator/ Recorder	Purpose
5. Steam Generator Water Level (wide range)	1/Steam generator	N/A	0 to 100%	±3% of level span[b][c]	All channels are recorded	Detect steam generator tube rupture; monitor steam generator water level following a feedwater line break
6. Steam Line Pressure	3/Steam line	2/Steam line	0 to 1,200 psig	±4% of full scale	All channels are indicated	Monitor steam line pressures following steam generator tube rupture or steam line break
7. Steam Line Flow	2/Steam line	N/A	0 to 4.5 million pounds/hour	Within ±10% span when flow >25%	All channels are indicated; the channels used for control are recorded	Indication purposes only
8. Pressurizer Water Level	3	2	0 to 100%	Indicate that level is somewhere between 0 and 100% of span	All three channels are indicated, and one channel is selected for recording	Indicate that water has returned to the pressurizer following cooldown after steam generator tube rupture or steam line break
9. Pressurizer Pressure	4	3	1250 to 2500 psig	±3.5% of full span	All channels indicated, one channel recorded	Detect steam generator tube breaks

TABLE 7.5-2

Parameter	No. of Channels Avail.	No. of Channels Req.	Range	Available Indicated Accuracy[a]	Indicator/ Recorder	Purpose
10. Intermediate Range Flux Level	2	N/A	Logarithmic 10^{-11} to 10^{-3} amps	Indicator: -16.8% to +20.2% of input; Recorder: -24% to +30% of input[d]	Both channels indicated. All channels are recorded.	Assess rod cluster control assembly ejection
11. Power Range						
a. Un-compensated ion chamber current (top and bottom un-compensated ion chambers)	4	N/A	0 to 120% of full power current	±1% of full span	All 8 current signals indicated	Assess rod cluster control assembly ejection
b. Average flux of the top and bottom ion chambers	4	N/A	0 to 120% of full power	±3% of full power for indication, ±2% for recording	All four channels indicated. All channels are recorded.	Assess rod cluster control assembly ejection

(a) Includes channel accuracy and environmental effects for normal operation. Does not include post-accident environmental effects. The instrumentation accuracies listed are typical indicator values and are not directly comparable to the channel accuracies utilized in the Chapter 15 analysis.

Changes which are within the stated accuracy band or within the reading accuracy of the indicator are not reflected in this table. Actual values are found in design documents.

(b) For the steam break, when the water level channel is exposed to a hostile environment, the accuracy required can be relaxed. The indication need only convey to the operator that water level in the steam generator is somewhere between the narrow-range steam generator water level taps.

TABLE 7.5-2

(c) Instrument accuracy only. The accuracy statement does not include the effect of density changes in the vessel, mid-deck plate delta-P, and other process measurement or environmental uncertainties.

(d) Does not include instrument drift allowance.

(e) Stated uncertainty applied to channel safety function as it is used in accordance with the EOPs. Channel uncertainty at 100% span is within ±10% span.

TABLE 7.5-3

CONTROL ROOM INDICATORS AND/OR RECORDERS AVAILABLE TO THE OPERATOR TO MONITOR SIGNIFICANT PLANT PARAMETERS DURING NORMAL OPERATION

Parameter	No. of Channels Available	Indicated Range	Indicator/ Accuracy[(a)]	Indicator/Recorder	Location	Notes
Nuclear Instrumentation						
1. Source Range						
a. Count rate	2	1 to 10^6 counts/sec	±7% of the linear full scale analog voltage	Both channels indicated. All channels are recorded.	Control console	Deenergize above P-6
b. Startup rate	2	-0.5 to 5.0 decades/min	±7% of the linear full scale analog voltage	Both channels indicated	Control console	Deenergize above P-6
2. Intermediate Range						
a. Flux level	2	8 decades logarithmic 10^{-11} to 10-3 amps overlapping the source by 2 decades	Indicator: -16.8% to +20.2% of input; Recorder: -24% to +30% of input	Both channels indicated. All channels are recorded.	Control console	
b. Startup rate	2	-0.5 to 5.0 decades/min	±7% of the linear full scale analog voltage	Both channels indicated	Control console	

TABLE 7.5-3

Parameter	No. of Channels Available	Indicated Range	Indicator/ Accuracy[(a)]	Indicator/Recorder	Location	Notes
3. Power Range						
a. Uncompensated ion chamber current (top and bottom uncompensated ion chambers)	4	0 to 5 mA	±1% of full span	All 8 current signals indicated	NIS racks in control room	
c. Average flux of the top and bottom ion chambers	4	0 to 120% of full power	±3% of full power for indication, ±2% for recording	All 4 channels indicated. All channels are recorded.	Control console	
d. Average flux of the top and bottom ion chambers	4	0 to 200% of full power	±2% of full power to 120% ±6% of full power to 200%	All 4 channels recorded	Control board	
e. Flux difference of the top and bottom ion chambers	4	-30 to +30%	±4%	All 4 channels indicated. All channels are recorded.	Control console	
<u>Reactor Coolant System</u>						
1. $T_{average}$ (measured)	1/Loop	530 to 630°F	±4°F	All channels indicated; auctioneered high is recorded	Control console	

TABLE 7.5-3

Parameter	No. of Channels Available	Indicated Range	Indicator/ Accuracy[a]	Indicator/Recorder	Location	Notes
2. ΔT (measured)	1/Loop	0 to 150% of full power ΔT	±4% of full power ΔT	All channels indicated. One channel is selected for recording	Control console	
T_{cold} or T_{hot} (measured, wide-range)	1-T_{hot} and 1-T_{cold} per loop	0 to 700°F	±4%	Both channels recorded	Control board	
3. Overpower ΔT Setpoint	1/Loop	0 to 150% of full power ΔT	±4% of full power ΔT	All channels indicated. One channel is selected for recording	Control board & control console	
4. Overtemperature ΔT Setpoint	1/Loop	0 to 150% of full power ΔT	±4% of full power ΔT	All channels indicated. One channel is selected for recording	Control board & control console	
5. Pressurizer Pressure	4	1250 to 2500 psig	±3.5% of span	All channels indicated, controlling channel recorded	Control board & control console	
6. Pressurizer Level	3	0 to 100%	±6.1% span at 2250 psia[b]	All channels indicated. One channel is selected for recording	Control board & control console	Two-pen recorder used, second pen records reference level signal

TABLE 7.5-3

Parameter	No. of Channels Available	Indicated Range	Indicator/ Accuracy[(a)]	Indicator/Recorder	Location	Notes
7. Primary Coolant Flow	3/Loop	0 to 120% of rated flow	Repeatability of ±4% of full flow	All channels indicated	Control board	
8. Reactor Coolant Pump Motor Amperes	1/Loop	0 to 400 amp	±2%	All channels indicated	Control board	One channel for each motor
9. RCS Pressure Wide-range	2	0 to 3000 psig	±4%	One channel indicated and one recorded	Control board	
10. Pressurizer Safety Relief Valve Position	3	Open/closed	NA	All channels indicated	Vertical board	
Reactor Control System						
1. Demanded Rod Speed	1	8 to 72 steps/min	±2 steps/min	The one channel is indicated	Control console	
2. Auctioneered $T_{average}$	1	530 to 630°F	±4°F	The one channel is recorded	Control console	The highest of the four T_{avg} channels into the auctioneer will be passed to the recorder
3. $T_{reference}$	1	530 to 630°F	±4°F	The one channel is recorded	Control console	
4. Control Rod Position						If system not available, borate and sample accordingly

Parameter	No. of Channels Available	Indicated Range	Indicator/ Accuracy[(a)]	Indicator/Recorder	Location	Notes
a. Number of steps of demanded rod withdrawal	1/group	0 to 231 steps	±1 step	Each group is indicated.	Control console	These signals are used in conjunction with the measured position signals (4b) to detect deviation of any individual rod from the demanded position. A deviation will actuate an annunciator. An alarm annunciator is actuated when the last rod control bank to be withdrawn reaches the withdrawal limit, when any rod control bank reaches the low insertion limit, and when any rod control bank reaches the low-low insertion limit
b. Full-length rod measured position	1 for each rod	0 to 228 steps	±3 steps at full accuracy, ±6 steps at 1/2 accuracy	Each rod position is indicated	Control board	
Containment System						
1. Containment Pressure (normal range)	4	-5 to +55 psig	±3.5% of full span	All 4 channels indicated	Control board	

TABLE 7.5-3

Parameter	No. of Channels Available	Indicated Range	Indicator/ Accuracy[a]	Indicator/Recorder	Location	Notes
2. Containment Pressure (narrow range)	1	-1 to +1.5 psig	±0.1 psi	Recorded	Control board	
Feedwater and Steam Systems						
1. Auxiliary Feedwater Flow	1/Steam generator	0 to 300 gpm	±10% of full span	All channels indicated	Control board	One channel to measure the flow to each steam generator
2. Steam Generator Level (narrow-range)	3/Steam generator	0 to 100%	±3% of ΔP span (hot) [b]	All channels indicated. The channels used for control are trended indications.	Control board & control console	
3. Steam Generator Level (wide-range)	1/Steam generator full load level	0 to 100%	±3% of ΔP span (hot) [b]	All channels recorded	Control board	
4. Programmed Steam Generator Signal	1 for 4 Steam generators	0 to 100%	±4%	One channel indicated	Control board	
5. Main Feedwater Flow	2/Steam generator	0 to 4.5 million pounds per hour	Within ±10% span when flow >25%	All channels indicated. The channels used for control are trended indications.	Control board	

TABLE 7.5-3

Parameter	No. of Channels Available	Indicated Range	Indicator/ Accuracy[(a)]	Indicator/Recorder	Location	Notes
6. Magnitude of Signal Controlling Main and Bypass Feedwater Control Valve	1/main 1/bypass	0 to 100% of valve opening	±2%	All channels indicated	Control board & control console	One channel for each main and bypass valve. OPEN/SHUT indication is provided in the control room for each main and bypass feedwater control valve
7. Steam Flow	2/Steam generator	Unit 1: 0 to 4.5 million pounds per hour Unit 2: 0 to 4.5 million pounds per hour	±10% span when flow >20%	All channels indicated. The channels used for control are trended indications.	Control board	Accuracy is equipment capability; however, absolute accuracy depends on calibration against feedwater flow
8. Steam Line Pressure	3/Loop	0 to 1,200 psig	±4.0% of full span	All channels indicated	Control board	
9. Steam Dump Demand Signal	1	0 to 100% equivalent to 0 to 85% max calculated steam flow	±2% span[(c)]	The one channel is indicated	Control board	OPEN/SHUT indication is provided in the control room for each steam dump valve

TABLE 7.5-3

Parameter	No. of Channels Available	Indicated Range	Indicator/ Accuracy[(a)]	Indicator/Recorder	Location	Notes
10. Turbine Impulse Chamber Pressure	2	0 to 110% of max calculated turbine load	±3.5% of full span	Both channels indicated	Control board	OPEN/SHUT indication is provided in the control room for each turbine stop valve
11. Condensate Storage Tank Level	1	0 to 100%	±3.5% of full span	Indicator and Recorded	Control board	
<u>Charging and Volume Control</u>						
1. Boric Acid Tank Level	1/Tank	0 to 100%	±3.5% of full span	Indicator	Control board	
2. Emergency Borate Flow	1	0 to 50 gpm	±4% of full span	Indicator	Control board	
3. Charging Pump Flow	1	0 to 200 gpm	±10% span when flow >60 gpm	Indicator	Control console	

(a) Includes channel accuracy and environmental effects.
Changes which are within the stated accuracy band or within the reading accuracy of the indicator are not reflected in this table. Actual values are found in design documents.

(b) Instrument accuracy only. The accuracy statement does not include the effect of density changes in the vessel.

(c) Indicator calibration tolerance.

TABLE 7.5-4

POSTACCIDENT MONITORING PANEL INDICATORS AND/OR RECORDERS AVAILABLE TO THE OPERATOR

Parameter	No. of Channels	Indicated Range	Available Indicated Accuracy[j]	Indicator/ Recorder	Comments
1. Reactor vessel level (bottom of vessel to top)	2	0 to 120% (vessel span)	±10% of calibrated span [h]	Recorder/indicator	
2. Reactor plenum level (hot leg pipe to top of vessel)	2	60 to 120% (vessel span)	25.4% of calibrated span total error band [i]	Recorder	
3. Containment pressure (wide-range)	2	-5 to 200 psig	±4% of full span	Recorder	
4. Containment water level (wide-range)	2	64 ft to 98 ft	-8 to +5.5 ft[e]	Recorder	
5. Containment radiation (high-range)	2	1 to 10^7 R/hr	-50% to +60% reading[d]	Recorder/indicator	
6. Plant vent noble gas – normal and extended range	1	10^{-6} to 10^5 μCi/cc	±15% reading based on min. expected sample pressure[f]	Recorder[c]/indicator	
7. Containment hydrogen	2	0 to 10%	±10% of full span	Recorder	
8. Degree of subcooling	2	-40 to +200°F	< 20°F when RCS pressure >900 psig[e] and temperature ≤ 700°F	Recorder (Train A)/ Indicator (Train B)	
9. Plant vent monitor (ALARA)	1	0.1 to 10^7 mR/hr	-40% to +55% reading	Recorder	
10. Gas decay tank pressure	1 per tank	0 to 200 psig	±3.5% of full span[b]	Indicator	

TABLE 7.5-4

Parameter	No. of Channels	Indicated Range	Available Indicated Accuracy[j]	Indicator/ Recorder	Comments
11. Incore temperature	65	0 to 2300°F	±5% of full span[g]	Recorder/indicator	
12. Liquid hold-up tank level	1 per tank	0 to 100%	±5% of full span	Indicator	
13. Containment spray pump discharge flow	1 per pump	0 to 3000 gpm	±5% of full span from 550 to 3000 gpm	Indicator	

(a) Deleted.

(b) Does not include sensor accuracy.

(c) Indicator on RMS panels - Recorder available on EARS until the Central Radiation Processor is available.

(d) Includes detector efficiency.

(e) Accident scenario: HELB inside containment.

(f) Indication accuracy is computed based on the expected detector efficiency. In calculating the offsite dose, however, the actual detector efficiency is taken into account for expected distribution of radioisotopes based on the accident condition.

(g) The stated accuracy is met in the instrument range needed for operator action.

(h) Levels ≤69.3% vessel span (top of hot leg) and coolant temperature ≤650°F.

(i) Top of vessel and coolant temperature 600°F.

(j) Changes which are within the stated accuracy band or within the reading accuracy of the indicator are not reflected in this table. Actual values are found in design documents.

TABLE 7.5-5

INFORMATION REQUIRED ON THE SUBCOOLEDMARGIN MONITORS (SCMMs)

Display	
Information displayed	TSAT - T, P - PSAT
Display type	Digital and analog
Continuous or on demand	Continuous
Single or redundant display	Redundant
Location of displays	Control board, (indicator from SCMM B) PAM 1 (recorder from SCMM A) PAM 3 and 4 (indicator and trend)
Alarms	30°F, 20°F Subcooling from SCMM A or B
Overall uncertainty	<+20°F when RCS pressure >900 psig, temperature ≤ 700°F
Range of display	-40 to +200°F
Qualifications	Seismic
Calculator (Processors)	
Type	Digital (shared with RVLIS)
If process computer is used, specify availability	N/A
Single or redundant calculators	Redundant
Selection logic	High T
Qualifications	Seismic
Calculational technique	Steam tables 0.1 to 3000 psi 150 to 750°F

Input

Temperature[b]	4 RTDs, hottest T/C
Temperature[b]	Hottest core exit T/C (per train) and 2 Reactor Hot Leg (per train)
Range of temperature sensors	0 to 700°F (RTDs) (useful 150°F to 700°F) 100 to 2300°F (T/Cs) (useful 150°F to 750°F)
Uncertainty[a] of temperature signal	< +12°F (up to 700°F), < +23°F (up to 1200°F)
Qualifications	Seismic, environmental
Pressure	Barton Model 763 or Rosemount Model 1153
Pressure	1 on loop 3 hot leg (train A input) 1 on loop 4 hot leg (train B input)
Range of pressure sensors	0 to 3000 psi
Uncertainty[a] of pressure signal	≤±35 psi
Qualifications	Seismic, environmental

(a) Uncertainties must address conditions of forced flow and natural circulation

(b) Unit 1 RTD input from loop 3 Reactor Hot Leg is disabled, reference T-Mod 60060222.

TABLE 7.5-6

SUMMARY OF COMPLIANCE WITH REGULATORY GUIDE 1.97 REV. 3

TYPE A VARIABLES

RCS cold leg water temperature (see Item 4)

RCS hot leg water temperature (see Item 5)

RCS pressure (see Item 7)

Core exit temperature (see Item 8)

Containment sump water level - wide range (see Item 12)

Containment sump water level - narrow range (see Item 13)

Containment pressure - normal range (see Item 14)

Refueling water storage tank level (see Item 38)

Pressurizer level (see Item 41)

Steam generator level - narrow range (see Item 46)

Steam generator level - wide range (see Item 46)

Steam generator pressure (see Item 47)

Auxiliary feedwater flow (see Item 50)

Condensate storage tank level (see Item 51)

TABLE 7.5-6

Reg Guide 1.97 Variable	RG 1.97 Category		Instrument Range[(a)]	Envr. Qual[(b)]	Seismic Qual[(c)]	QA[(d)]	Redundant	Power Supply	Control Room	Display at TSC[(e)]	Display at EOF	Comments
TYPE B VARIABLES												
Reactivity Control												
1. Neutron flux	NRC	1	10^{-6}-100% Full power	Yes	Yes	Yes	Yes	1E	Continuous recording			
	DCPP	1	10^{-8}-100% Full power	Yes	Yes	Yes	Yes	1E	Continuous indication& recording	No	No	Note 27 Note 57
2. Control rod position	NRC	3	Full in or not full in	No	No	Yes	No	--	Continuous indication			
	DCPP	3	Full range indication	No	No	Yes	No	Non-1E	Continuous indication	Yes	Yes	
3. RCS soluble boron concentration												Note 1
4. RCS cold leg water temp.	NRC	1	50-700°F	Yes	Yes	Yes	Yes	1E	Continuous recording			
	DCPP	1	50-700°F	Yes	Yes	Yes	Yes	1E	Continuous recording	Yes	Yes	Note 47 Note 48 Note 58
Core Cooling												
5. RCS hot leg water temp	NRC	1	50-700°F	Yes	Yes	Yes	Yes	1E	Continuous recording			
	DCPP	1	0-700°F	Yes	Yes	Yes	Yes	1E	Continuous recording	Yes	Yes	Note 47 Note 48 Note 58
6. RCS cold leg water temp (see Item 4)												
7. RCS pressure	NRC	1	0-3000 psig	Yes	Yes	Yes	Yes	1E	Continuous recording			
	DCPP	1	0-3000 psig	Yes	Yes	Yes	Yes	1E	Continuous indication & recording	Yes	Yes	Note 27 Note 48
8. Core exit temperature	NRC	1	200-2300°F	Yes	Yes	Yes	Yes	1E	Continuous recording			
	DCPP	1	0-2300°F	Yes	Yes	Yes	Yes	1E	Continuous indication & recording	Yes	Yes	Note 48

Reg Guide 1.97 Variable	RG 1.97 Category		Instrument Range[a]	Envr. Qual[b]	Seismic Qual[c]	QA[d]	Redundant	Power Supply	Control Room	Display at TSC[e]	Display at EOF	Comments
9. Coolant level in reactor	NRC	1	Bottom of hot leg to top of vessel	Yes	Yes	Yes	Yes	1E	Continuous recording			
	DCPP	1	Bottom to top of vessel	Yes	Yes	Yes	Yes	1E	Continuous indication & recording	Yes	Yes	
10. Degrees of subcooling	NRC	2	200°F subcooling to 35°F superheat	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	2	200°F subcooling to 40°F superheat	Yes	Yes	Yes	Yes	1E	Continuous indication & recording	Yes	Yes	Note 46
Maintaining Reactor Coolant System Integrity												
11. RCS pressure (see Item 7)												
12. Containment sump water level (WR)	NRC	1	Plant specific	Yes	Yes	Yes	Yes	1E	Continuous recording			
	DCPP	1	64 ft (CNT bottom) to 98 ft	Yes	Yes	Yes	Yes	1E	Continuous recording	Yes	Yes	Note 48
13. Containment sump water level (NR)			Sump depth	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	1	88.5-96.6 ft	Yes	Yes	Yes	Yes	1E	Continuous indication	No	No	Note 48
14. Containment pressure	NRC	1	-5 psig to 3 times design pressure	Yes	Yes	Yes	Yes	1E	Continuous recording			
Normal range	DCPP	1	-5 to +55 psig	Yes	Yes	Yes	Yes	1E	Continuous indication	Yes	Yes	Note 48
Wide range	DCPP	1	-5 to 200 psig	Yes	Yes	Yes	Yes	1E	Continuous recording	Yes	Yes	N0te 39
Maintaining Containment Integrity												
15. Containment isolation valve position	NRC	1	Closed-not closed	Yes	Yes	Yes	Yes	1E	Continuous recording			
	DCPP	1	Closed-not closed	Yes	Yes	Yes	Yes	1E	Indication	Yes	Yes	Note 28 Note 36 Note 49 Note 59
16. Containment pressure (see Item 14)												

TABLE 7.5-6

Reg Guide 1.97 Variable	RG 1.97 Category		Instrument Range[(a)]	Envr. Qual[(b)]	Seismic Qual[(c)]	QA[(d)]	Redundant	Power Supply	Control Room	Display at TSC[(e)]	EOF	Comments
TYPE C VARIABLES												
Fuel Cladding												
17. Core exit temperature (see Item 8)												
18. Radioactivity concentration in circulating primary coolant (see Note 18)												
19. Analysis of primary coolant - gamma spectrum (seeNote 55)												
Reactor Coolant Pressure Boundary												
20. RCS pressure (see Item 7)												
21. Containment pressure (see Item 14)												
22. Containment sump water level (see Items 12 and 13)												
23. Containment area radiation (see Item 65)												
24. Effl. radio-activity-noble gas effl. from condenser air removal sys. exhaust	NRC	3	10^{-6} to 10^{-2} µCi/cc	No	No	Yes	No	-	Recording			
	DCPP	3	10^{-4} to 3 µCi/cc	No	No	Yes	No	non-1E	Continuous indication, recording	Yes	Yes	Note 3 Note 34
Containment												
25. RCS pressure (see Item 7)												
26. Containment hydrogen concentration	NRC	3	0-10%	No	No	Yes	No	Highly Reliable	Continuous recording			
	DCPP	3	0-10%	No	No	Yes	Yes	Highly Reliable	Continuous recording	Yes	Yes	
27. Containment pressure (see Item 14)												
28. Containment effluent radioactivity - noble gases from identified release points (see Item 67)												
29. Effluent radioactivity - noble gases from buildings or areas where penetrations and hatches are located (see Item 67)												

Reg Guide 1.97 Variable	RG 1.97 Category		Instrument Range(a)	Envr. Qual(b)	Seismic Qual(c)	QA(d)	Redundant	Power Supply	Control Room	Display at TSC(e)	EOF	Comments
TYPE D VARIABLES												
Residual Heat Removal System												
30. RHR system flow	NRC	2	0-110% design flow	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	2	0-1500 gpm (Lo) 0-5000 gpm (Hi) 0-7000gpm (HL)	Yes	No	Yes	No	1E	Continuous indication	Yes	Yes	Note 50
31. RHR heat exchanger outlet temp.	NRC	2	40-350°F	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	2	50-400°F	Yes	No	Yes	No	1E	Continuous recording	Yes	Yes	Note 6
32. Accumulator tank level	NRC	2	10%-90% volume	No	No	Yes	No	Highly reliable	Continuous indication			Note 51
	DCPP	3	10%-90% volume	No	No	Yes	No	Highly reliable, non-1E	Continuous indication	No	No	
33. Accumulator tank pressure	NRC	2	0-750 psig	No	No	Yes	No	Highly reliable	Continuous indication			Note 51
	DCPP	3	0-700 psig	No	No	Yes	Yes	Highly reliable, non-1E	Continuous indication	Yes	Yes	Note 7
34. Accumulator isolation valve position	NRC	2	Closed or open	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	3	Closed or open	No	No	Yes	No	1E	Continuous indication	No	No	Note 32
35. Boric acid charging flow (charging inj header flow)	NRC	2	0-110% design	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	2	0-1000 gpm	Yes	No	Yes	No	1E	Continuous indication	Yes	Yes	
36. Flow in HPI system (SI pump disch.)	NRC	2	0-110% design	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	2	0-750 gpm	Yes	No	Yes	No	1E	Continuous indication	Yes	Yes	
37. Flow in LPI system - RHR system (see Item 30)												

TABLE 7.5-6

Reg Guide 1.97 Variable	RG 1.97 Category		Instrument Range[a]	Envr. Qual[b]	Seismic Qual[c]	QA[d]	Redundant	Power Supply	Control Room	Display at TSC[e]	Display at EOF	Comments
38. Refueling water storage tank level	NRC	2	Top to bottom	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	1	0-100%	Yes	Yes	Yes	Yes	1E	Continuous indication	Yes	Yes	Note 8 Note 28 Note 41 Note 48
Primary Coolant System												
39. Reactor coolant pump status	NRC	3	Motor current	No	No	Yes	No	--	Continuous indication			
	DCPP	3	Motor current 0-400 amp	No	No	Yes	No	non-1E	Continuous indication	Yes	Yes	Note 21
40. Primary system safety relief valve position	NRC	2	Closed-not closed	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	2	Closed-not closed	Yes	Yes	Yes	No	1E	Continuous indication	Yes	Yes	Note 9 Note 46
41. Pressurizer level	NRC	1	Bottom to top	Yes	Yes	Yes	Yes	1E	Continuous recording			
	DCPP	1	0-100%	Yes	Yes	Yes	Yes	1E	Continuous indication	Yes	Yes	Note 8 Note 28 Note 33 Note 48
42. Pressurizer heater status	NRC	2	Electric current	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	2	Electric power 0-600 kW	Yes	No	Yes	No	1E	Continuous indication	Yes	Yes	Note 45
43. Quench tank (PRT) level	NRC	3	Top to bottom	No	No	Yes	No	--	Continuous indication			
	DCPP	3	0-100%	No	No	Yes	No	Highly reliable, non-1E	Continuous indication	Yes	Yes	Note 8
44. Quench tank (PRT) temperature	NRC	3	50-750°F	No	No	Yes	No	--	Continuous indication			
	DCPP	3	50-350°F	No	No	Yes	No	Highly reliable, non-1E	Continuous indication	Yes	Yes	Note 10

TABLE 7.5-6

Reg Guide 1.97 Variable	RG 1.97 Category		Instrument Range[(a)]	Envr. Qual[(b)]	Seismic Qual[(c)]	QA[(d)]	Redundant	Power Supply	Control Room	Display at TSC[(e)]	EOF	Comments
45. Quench tank (PRT) pressure	NRC	3	0 design	No	No	Yes	No	--	Continuous indication			
	DCPP	3	0-100 psig	No	No	Yes	No	Highly reliable, non-1E	Continuous indication	Yes	Yes	
Secondary System (Steam Generator)												
46. Steam generator level	NRC	1	From tube sheet to separators	Yes	Yes	Yes	Yes	1E	Continuous recording			
Narrow range	DCPP	1	From within the transition cone to separators.	Yes	Yes	Yes	Yes	1E	Continuous indication	Yes	Yes	Note 26 Note 28 Note 48
Wide range	DCPP	1	From 12 inches above tube sheet to separators	Yes	Yes	Yes	Yes	1E	Continuous recording	Yes	Yes	Note 26 Note 36 Note 47 Note 48
47. Steam generator pressure	NRC	2	From atm. press. to 20% above the lowest safety valve setting	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	1	0-1200 psig	Yes	Yes	Yes	Yes	1E	Continuous indication	Yes	Yes	Note 11 Note 28 Note 41 Note 48
48. Main steam flow	NRC	2	--	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	2	0-4.5 x 10^6 lb/hr	Yes	No	Yes	No	1E	Continuous indication	Yes	Yes	
49. Main feedwater flow	NRC	3	0-110% design	No	No	Yes	No	--	Continuous indication			
	DCPP	3	0-4.5 x 10^6 lb/hr	No	No	Yes	No	1E	Continuous indication	Yes	Yes	
Auxiliary Feedwater or Emergency Feedwater System												
50. Auxiliary or emergency feedwater flow	NRC	2	0-110% design	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	1	0-300 gpm	Yes	Yes	Yes	Yes	1E	Continuous indication	Yes	Yes	Note 26 Note 28 Note 47 Note 48 Note 52

TABLE 7.5-6

Reg Guide 1.97 Variable	RG 1.97 Category		Instrument Range[a]	Envr. Qual[b]	Seismic Qual[c]	QA[d]	Redundant	Power Supply	Control Room	Display at TSC[e]	EOF	Comments
51. Condensate storage tank	NRC	1	Plant specific	Yes	Yes	Yes	Yes	1E	Continuous recording			
	DCPP	1	0-100%	Yes	Yes	Yes	Yes	1E	Continuous recording	Yes	Yes	Note 37 Note 48
Containment Cooling Systems												
52. Containment spray flow	NRC	2	0-110% design	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	2	0-3000 gpm	Yes	No	Yes	No	1E	Continuous indication	No	No	
53. Heat removal by containment fan heat removal system	NRC	2	Plant specific	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	2	See Note 12	Yes	No	Yes	No	1E	Continuous indication	Yes	Yes	Note 12
54. Containment atmosphere temperature	NRC	2	40-400°F	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	2	0-400°F	Yes	No	Yes	Yes	1E	Continuous indication	No	No	
55. Containment sump water temperature	NRC	2	50-250°F	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	2	0-300°F	Yes	No	Yes	Yes	1E	Continuous indication	No	No	
Chemical and Volume Control System												
56. Makeup flow-in	NRC	2	0-110% design	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	2	0-50 gpm 0-200 gpm	Yes	No	Yes	No	1E	Continuous indication	Yes	Yes	Note 53
57. Letdown flow-out	NRC	2	0-110% design	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	2	0-200 gpm	Yes	No	Yes	No	1E	Continuous indication	Yes	Yes	
58. Volume control tank level	NRC	2	Top to bottom	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	2	0-100%	Yes	No	Yes	No	1E	Continuous indication	Yes	Yes	Note 8

TABLE 7.5-6

Reg Guide 1.97 Variable	RG 1.97 Category		Instrument Range(a)	Envr. Qual(b)	Seismic Qual(c)	QA(d)	Redundant	Power Supply	Control Room	Display at TSC(e)	EOF	Comments
Cooling Water System												
59. CCW temp. to ESF system	NRC	2	40-200°F	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	2	0-200°F	Yes	No	Yes	No	1E	Continuous indication	Yes	Yes	
60. CCW flow to EFS system	NRC	2	0-110% design	Yes	No	Yes	No	Highly reliable	Continuous indication			
	DCPP	2	0-12,000 gpm	Yes	No	Yes	No	1E	Continuous indication	Yes	Yes	
Radwaste Systems												
61. High level radioactive	NRC	3	Top to bottom	No	No	Yes	No	--	Continuous indication			
liquid tank level	DCPP	3	0-100%	No	No	Yes	No	1E	Continuous indication	No	No	Yes Yes
62. Radioactive gas holdup tank	NRC	3	0-150% design	No	No	Yes	No	--	Continuous indication			
pressure	DCPP	3	0-200 psig	No	No	Yes	No	1E	Continuous indication	Yes	Yes	Note 54
Ventilation Systems												
63. Emergency ventilation	NRC	2	Open-closed	Yes	No	Yes	No	Highly reliable	Continuous indication			
damper position	DCPP	2	Open-closed	Yes	No	Yes	No	1E	Continuous indication	No	No	Note 24
Power Supplies												
64. Status of standby power	NRC	2	Voltages, currents	Yes	No	Yes	No	Highly reliable	Continuous indication			
and other emergency sources	DCPP	2	Voltages, currents	Yes	No	Yes	No	1E	Continuous indication	Yes	Yes	Note 13 Note 43
TYPE E VARIABLES												
Containment Radiation												
65. Containment area radiation -	NRC	1	1 to 10^7 R/hr	Yes	Yes	Yes	Yes	1E	Continuous recording			
high range	DCPP	1	1 to 10^7 R/hr	Yes	Yes	Yes	Yes	1E	Continuous recording	Yes	Yes	

TABLE 7.5-6

Reg Guide 1.97 Variable	RG 1.97 Category		Instrument Range(a)	Envr. Qual(b)	Seismic Qual(c)	QA(d)	Redundant	Power Supply	Control Room	Display at TSC(e)	EOF	Comments
Area Radiation												
66. Radiation exposure rate (inside bldgs or areas)	NRC	3	10^{-1} to 10^{4} mR/hr	No	No	Yes	No	--	Recording			
	DCPP	3	10^{-1} to 10^{4} mR/hr	No	No	Yes	No	Non-1E	Local indication and alarm	No	No	Note 5 Note 34
Airborne Radioactive Materials Released From Plant												
67. Noble gases and vent flow rate: Containment or purge effluent (see Note 14) Reactor shield building annulus (see Note 14) Auxiliary building (see Note 14) Condenser air removal system exhaust (see Item 24)												
Noble gases from common-plant vent + discharging any of above releases (including cont. purge)	NRC	2	10^{-6} to 10^{4} µCi/cc	Yes	No	Yes	No	Highly reliable	Continuous recording			
	DCPP	2	10^{-6} to 10^{4} µCi/cc	Yes	No	Yes	No	Highly reliable	Continuous indication, recording	Yes	Yes	Note 34
Plant vent flow	NRC	2	0-110% design	Yes	No	Yes	No	Highly reliable	Continuous recording			
	DCPP	2	0-30x10^{4} cfm	Yes	No	Yes	No	Highly reliable	Continuous recording			
Vent from steam generator safety relief valves or atmospheric dump valves	NRC	2	10^{-1} to 10^{3} µCi/cc	Yes	No	Yes	No	Highly reliable	Continuous recording			
	DCPP	2	10^{-1} to 10^{3} µCi/cc	Yes	No	Yes	No	1E	Continuous recording			
All other identified release points (see Note 56)												
68. Particulates and halogens	NRC	3	10^{-3} to 10^{2} µCi/cc	No	No	Yes	No	--	Recording			
	DCPP	2	Note 15	Yes	No	Yes	No	Highly reliable	Continuous indication, recording	Yes	Yes	Note 15 Note 34

TABLE 7.5-6

Reg Guide 1.97 Variable	RG 1.97 Category		Instrument Range(a)	Envr. Qual(b)	Seismic Qual(c)	QA(d)	Redundant	Power Supply	Control Room	Display at TSC(e)	Display at EOF	Comments
Environs Radiation and Radioactivity												
69. Airborne radiohalogens & particulates (portable with on-site analysis)	NRC	3	10^{-9} to 10^{-3} μCi/cc	No	No	Yes	No	--	--			
	DCPP	3	10^{-9} to 10^{-3} μCi/cc	No	No	Yes	No	--	--	--	--	
70. Plant and environs radiation (portable instrumentation)	NRC	-	As specified in RG 1.97, Rev. 3	No	No	Yes	No	--	--			
	DCPP	-	As specified in RG 1.97, Rev. 3	No	No	Yes	No	--	--	--	--	
71. Plant and environs radioactivity (portable instrumentation)	NRC	3	Isotopic analysis	No	No	Yes	No	--	--			
	DCPP	3	Multichannel gamma-ray spectrometer	No	No	Yes	No	--	--	--	--	Note 16
Meteorology												
72.	NRC		As specified in RG 1.97, Rev. 3	No	No		No	--	Recording			
	DCPP		As specified in RG 1.97, Rev. 3	No	No		No	non-1E	Indication, recording	Yes	Yes	Note 38 Note 40
Accident Sampling Capability												
73.												Note 55

(a) Instrument Range - Where the NRC and Diablo Canyon instrument ranges are not directly comparable, the Diablo Canyon ranges meet or exceed the NRC ranges, unless otherwise noted

(b) EQ (Environmental Qualification) - A "Yes" entry means that the instrumentation complies with 10 CFR 50.49. A "No" entry means there is no specific provision for environmental qualification of this instrumentation

(c) Seismic Qualification - A "Yes" entry means that the instrumentation complies with Regulatory Guide (RG) 1.100. A "No" entry means there are no specific provisions for seismic qualification of this instrument.

(d) QA (Quality Assurance) - A "Yes" entry means that the instrumentation complies with the applicable quality assurance provisions contained in RG 1.97 for the category of the instrument.

(e) This column represents the TSC and the Alternate TSC/OSC.

TABLE 7.5-6

1. Elimination of the boron concentration monitoring system (BCMS) and utilization of the post-accident monitoring system (PASS) was approved by NRC letter dated December 4, 2000. Elimination of the PASS was approved by License Amendments 149 (Unit 1) and 149 (Unit 2), dated July 13, 2001

2. Deleted in Revision 4.

3. Installed range is adequate since air ejector exhaust is routed to the plant vent.

4. Deleted in Revision 11.

5. The Reg Guide 1.97 instrument range is erroneously stated as 10-1 to 104 R/hr for this variable.

6. Installed range is adequate for the Diablo Canyon site as the RHR outlet temperature is not expected to be less than 50°F.

7. Installed range is adequate. Tank pressure limited to 700 psig by relief valve.

8. Zero to 100% indicates usable volume of tank.

9. Position indication for safety valves is provided by acoustic monitors and by position switches for the power operated relief valves.

10. Quench tank pressure is limited to 100 psig by a rupture disk, so water temperature cannot exceed the saturation temperature at 100 psig, or 338°F. Therefore, the range of 50-350°F is adequate.

11. Installed ranged is adequate. Redundant instrumentation is installed and all safety valves lift before 1200 psig. The relieving capability of the safety valves is greater than rated steam flow. Hence, pressure cannot physically reach 1200 psig.

12. Containment fan cooler unit (CFCU) operation is verified by white monitor lights (that confirm proper CFCU response to ESF actuation), CFCU ammeters, and CFCU motor speed indicating lights. Category 1 containment pressure (Variable 14) and Category 2 containment temperature (Variable 54) provide an overall indication of CFCU system performance. CFCU operation is an indirect measurement of these containment parameters that are of primary importance to plant operators.

13. Category 2 indications for vital 4 KV voltage, EDG wattage and amperage, 4 KV/480 V transformer primary side amperage, 480 V voltage, and battery voltage and amperage are provided. All indications are Class 1E except for battery voltage and amperage.

14. Not needed if effluent discharges through common plant vent.

15. The particulate monitor has a range of 10^{-12} to 10^{-7} µCi.cc. Additional range is achieved through use of particulate filters installed on postaccident grab sampling equipment. The iodine monitor has a range of 10^{-7} to 10^{-2} µCi/cc. Additional range is provided by postaccident grab sampling equipment up to 102 µCi/cc.

16. An offsite laboratory with gamma spectroscopy equipment is available for environmental analysis.

17. Deleted in Revision 4.

18. Category 1 instrumentation to monitor radiation level in circulating primary coolant is not provided. Routine reactor coolant sampling verifies fuel cladding integrity during normal operation. During an accident, rapid assessment of cladding failures can be obtained from the Category 1 containment high range area radiation monitors in conjunction with a DCPP emergency procedure titled, “Core Damage Assessment Procedure”.

19. Deleted in Revision 4.

20. Deleted in Revision 7.

21. Display at TSC, Alternate TSC/OSC, and EOF is circuit breaker status.

22. Deleted in Revision 4.

23. Deleted in Revision 4.

24. Most of the critical damper positions are indicated at the TSC, Alternate TSC/OSC, and EOF, enough to assure that the system is working as expected.

25. Deleted in Revision 11.

26. The narrow range steam generator level is the key variable for monitoring secondary heat sink if the water level is within the narrow range span. If the water level is below the narrow range span, auxiliary feedwater flow in conjunction with steam generator wide range level meet the Category 1 requirements for monitoring steam generator status.

27. Category 1 recording is provided for one channel.

28. This post-accident monitoring data is recorded/stored in the Transient Recording System (TRS). The TRS provides the data storage and recall functions associated with ERFDS. The TRS is a Class II, highly reliable computer system with uninterruptible battery backed power.

29. Deleted in Revision 11.

30. Deleted in Revision 7.

31. Deleted in Revision 7.

32. Accumulator isolation valve position indication is Category 3. Power is removed from the valve actuator during normal operation; hence, following an accident the valve is known to be in its correct (open) position. Power to these valves may be manually restored following a LOCA, but operation of the valves, and thus the position indication, is not critical for post-LOCA accident mitigation or plant shutdown. Power is also restored to these valves during certain (non-LOCA) emergency conditions when operation of the valves is required. However, the position switches will not be exposed to a harsh environment under these conditions, so the position switches will remain operable.

33. Pressurizer water level indication meets Category 1 requirements; the recorder for this variable is Instrument Class II and is common for all the channels. This combination of Category 1 indication and Class II recording is sufficient to meet the Regulatory Guide requirements.

34. Recording as necessary on EARS, ERFDS and/or TRS.

35. Deleted.

36. Redundant channels are powered from different Class 1E power supplies; however, electrical cabling does not meet separation criteria.

37. Zero to 100% indicates contained volume of tank.

38. The plant process computer is used as the indicating device to display meteorological instrument signals. In addition, Type E, Category 3 recorders are located in the meteorological towers.

39. Normal range containment pressure channels provide indication from -5 to +55 psig. Wide range channels provide recording from -5 to 200 psig, but only the positive pressure range is credited as Category 1. Recording negative pressures is not required as negative pressures would not be the range of interest during an accident when containment pressures can be expected to increase.

40. Control room indication is processed for display upon demand.

41. Recording of this Category 2 variable which PG&E classifies as Category 1 is not provided because variable trending does not provide essential information.

TABLE 7.5-6

42. DCPP instrument ranges are in terms of CPM or mR/hr., with conversion factors and graphs that allow easy conversion.

43. 480V and 4160V bus voltages are indicated on an indicator scale of 0 to 150; actual voltage is determined by applying a scaling factor (4 for the 480V bus, and 35 for the 4160V bus).

44. The recording capability associated with this variable is provided by a Category 3 multi-channel recorder.

45. Pressurizer heater power consumption is indicated, for groups 2 and 3 only, at CC-1 and (via ERFDS) the TSC and EOF. Although not credited for RG 1.97, circuit breaker status is also available at the TSC and EOF for groups 1 and 4.

46. Seismic qualification in accordance with NUREG-0737 requirements.

47. Redundancy is provided on a system basis as opposed to a per loop basis. Loop 1 and 2 channels are redundant to loop 3 and 4 channels.

48. Instrument channels are designated as Type A variables as they provide information required for operator action.

49. CIV position indication redundancy is provided on a per penetration basis as opposed to a per valve basis.

50. Each RHR train is monitored by 0-1500 gpm and 0-5000 gpm flow indicators in all modes of RHR operation except hot leg recirculation. The 0-7000 gpm flow indication monitors RHR system flow in the hot leg recirculation mode of operation.

51. In accordance with NRC guidance subsequent to issuance of Reg Guide 1.97, environmental qualification is not required for the accumulator tank pressure and level channels.

52. If flow exceeds instrument range, steam generator level instruments provide the necessary information to monitor steam generator status.

53. Emergency borate flowpath to charging pump suction monitored by 0-50 gpm flow indication. Charging pump discharge flow monitored by 0-200 gpm flow indication.

54. Gas decay tank pressure indication spans 0-200 psig. Control system maintains normal tank pressure in the range of 0-100 psig and relief valves limit tank pressure to 150 psig.

55. Post-accident sampling system requirements were deleted by License Amendments (LAs) 149 (Unit 1) and 149 (Unit 2), dated July 13, 2001. Three commitments were established to meet the conditions of LAs 149/149 to (1) maintain contingency plans for obtaining and analyzing highly radioactive samples of reactor coolant, containment sump, and containment atmosphere (T36279), (2) maintain a capability for classifying fuel damage events at the Alert level threshold (T36280), and (3) maintain the capability to monitor radioactive iodines that have been released to offsite environs (T36281).

56. The steam generator blowdown tank vent is a potential noble gas release point that is not discharged through the plant vent. However, the blowdown tank is only used intermittently and is automatically isolated on high radiation in the liquid blowdown effluent. This is not a credible noble gas release path. Grab sample capability is provided for the blowdown tank vent effluent.

57. Source, intermediate and power range nuclear instrumentation provide displays at TSC and EOF.

58. RCS loop 1 hot leg and cold leg temperature channels are not environmentally qualified for outside-containment line break accidents.

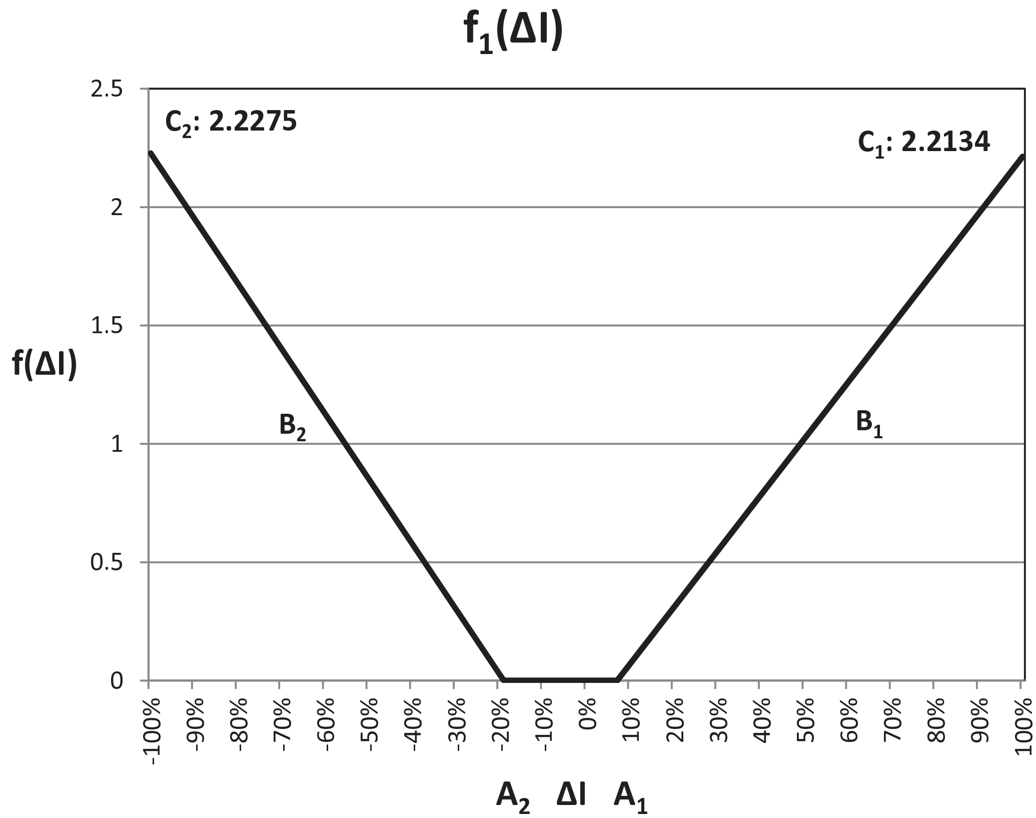
59. Containment isolation valves credited for RG 1.97 Category 1 position indication are defined as only those containment isolation valves that receive a Phase A, Phase B or containment ventilation isolation signal.

TABLE 7.7-1

PLANT CONTROL SYSTEM INTERLOCKS

Designation	Derivation	Function
C-1	1/2 Neutron flux (intermediate range) above setpoint	Blocks automatic and manual control rod withdrawal
C-2	1/4 Nuclear power (power range) above setpoint	Blocks automatic and manual control rod withdrawal
C-3	2/4 Overtemperature ΔT above setpoint	Blocks automatic and manual control rod withdrawal
		Actuates turbine runback via load reference
		Defeats remote load dispatching
C-4	2/4 Overpower ΔT above setpoint	Blocks automatic and manual control rod withdrawal
		Actuates turbine runback via load reference
		Defeats remote load dispatching
C-5	1/1 Turbine impulse chamber pressure below setpoint	Defeats remote load dispatching
		Blocks automatic control rod withdrawal
C-7A	1/1 Time derivative (absolute value) of turbine impulse chamber pressure (decreases only) above setpoint	Makes condenser steam Dump valves available for either tripping or modulation

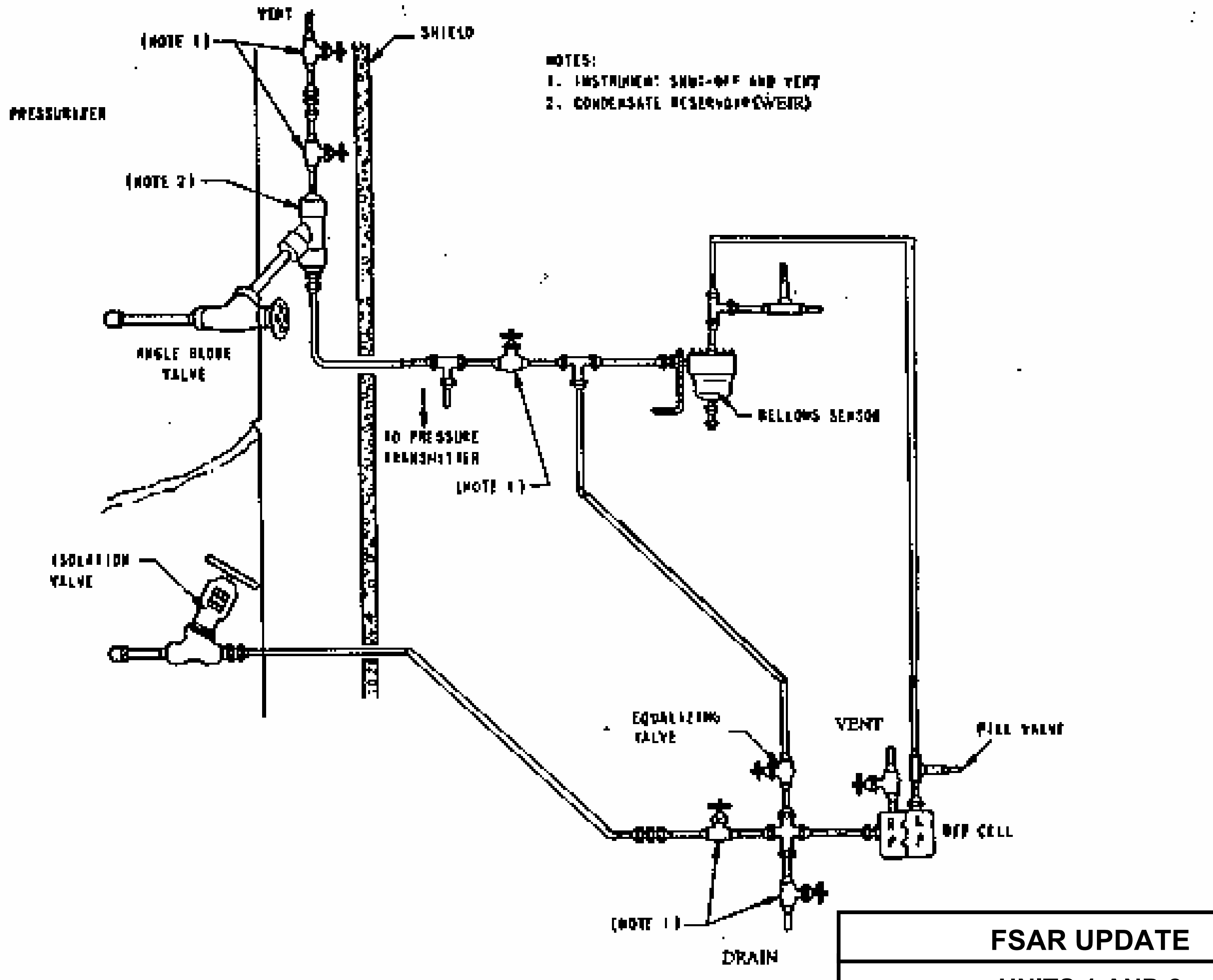
Designation	Derivation	Function
C-7B	1/1 Time derivative (absolute value) of turbine impulse chamber pressure (decreases only) above setpoint	Makes atmospheric steam dump valves available for either tripping or modulation
P-4	Reactor trip	Blocks steam dump control via load rejection T_{avg} controller Makes condenser steam dump valves available for either tripping or modulation Blocks atmospheric steam dump valves Unblocks steam dump control via reactor trip T_{avg} controller
C-9	Any condenser pressure above setpoint or All circulating water pump breakers open	Blocks steam dump to condenser
C-11	1/1 Bank D control rod position above setpoint	Blocks automatic rod withdrawal



ΔI	–	NEUTRON FLUX DIFFERENCE BETWEEN UPPER AND LOWER LONG ION CHAMBERS
A_1 to A_2	–	LIMIT OF F(ΔI) DEADBAND (+7 TO -19)
B_1 and B_2	–	SLOPE OF RAMP; DETERMINES RATE AT WHICH FUNCTION REACHES ITS MAXIMUM VALUE ONCE DEADBAND IS EXCEEDED
C_1 and C_2	–	MAGNITUDE OF MAXIMUM VALUE THE FUNCTION MAY ATTAIN

NOTE:
- NOTE 1 IN TABLE 3.3.1-1 OF THE TECHNICAL SPECIFICATIONS GIVES THE REDUCTION FUNCTIONS FOR THE OTΔT AND OPΔT SETPOINTS.
- $F_2(\Delta I) = 0$ FOR ALL VALUES OF ΔI

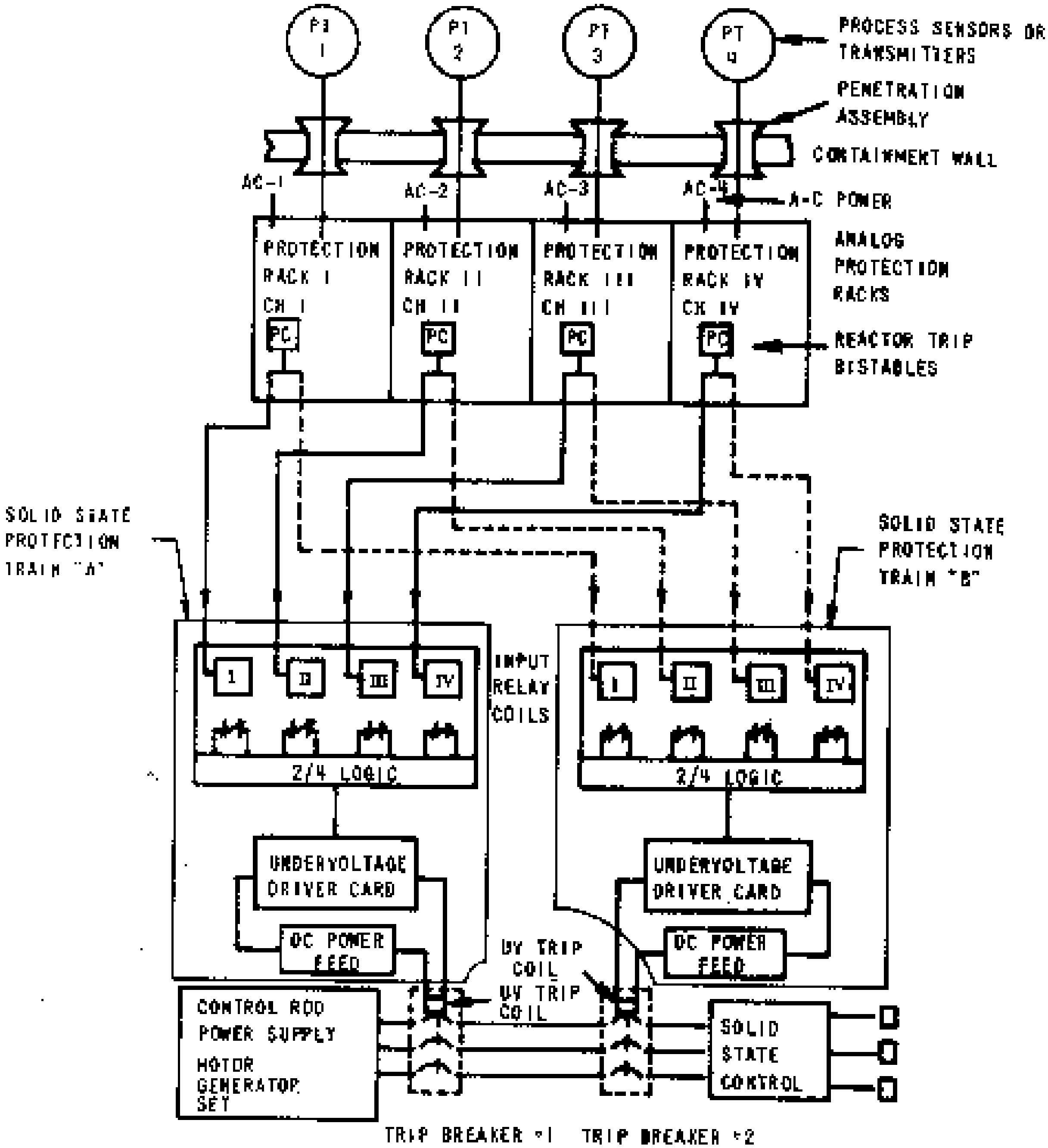
FSAR UPDATE
UNITS 1 AND 2 DIABLO CANYON SITE
FIGURE 7.2-2 SETPOINT REDUCTION FUNCTION FOR OVERPOWER AND OVERPRESSURE ΔT TRIPS



FSAR UPDATE

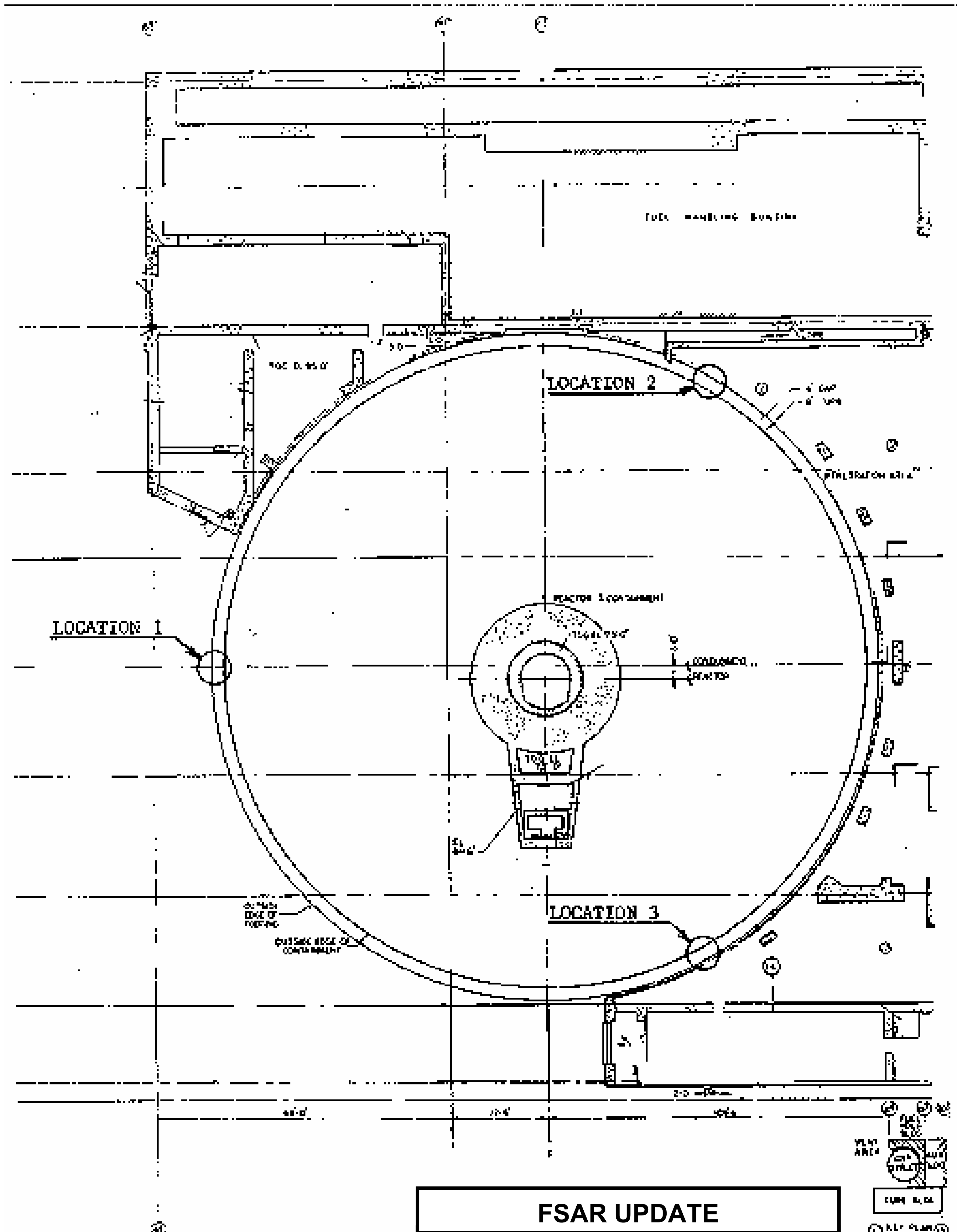
UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 7.2-4
PRESSURIZER SEALED REFERENCE LEG LEVEL SYSTEM



FSAR UPDATE
UNITS 1 AND 2 DIABLO CANYON SITE
FIGURE 7.2-5 DESIGN TO ACHIEVE ISOLATION BETWEEN CHANNELS

Revision 11 November 1996

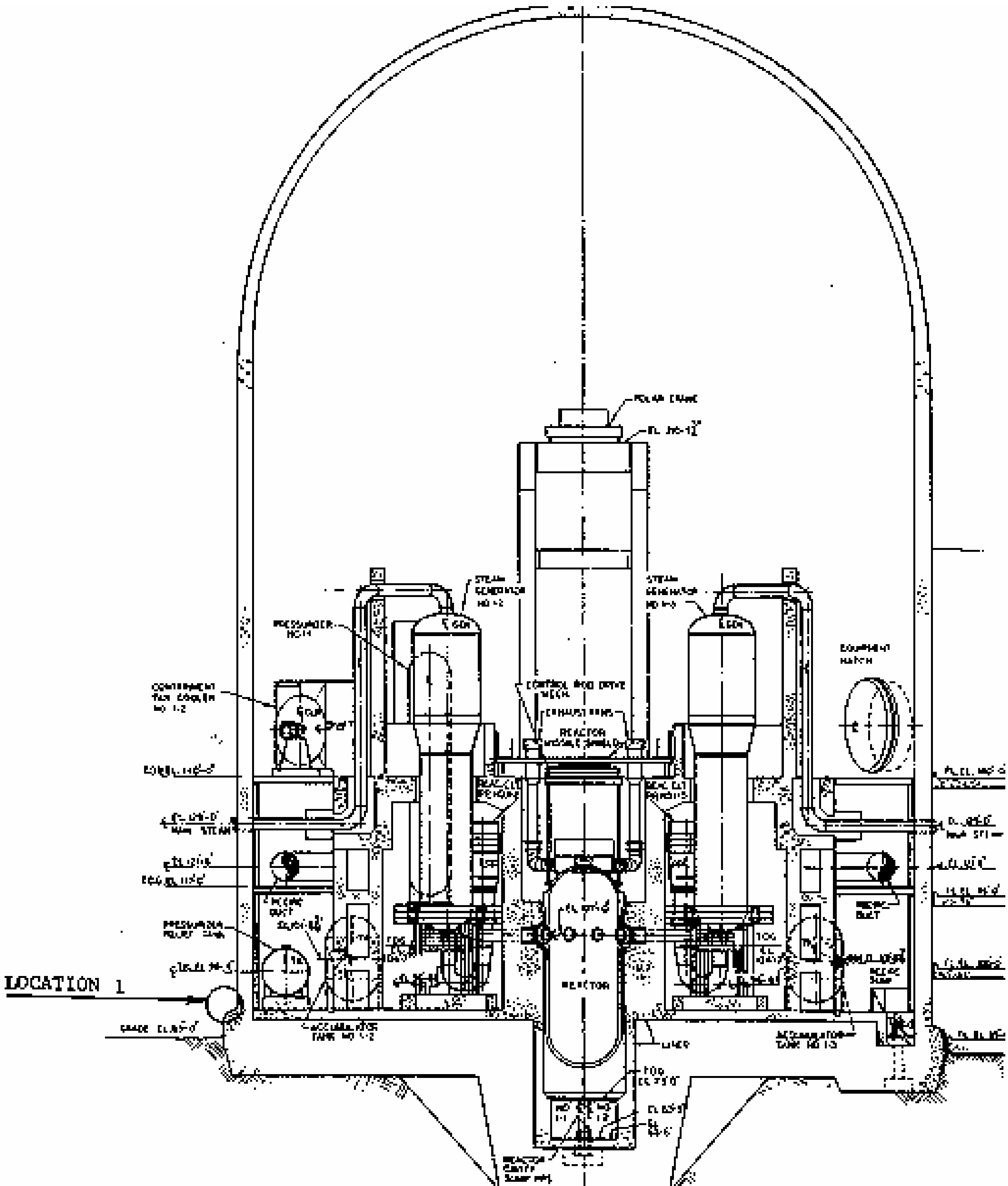


NOTE: THIS FIGURE IS FOR UNIT 1, UNIT 2 IS OPPOSITE HAND

FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 7.2-6 (Sheet 1 of 2)
SEISMIC SENSOR LOCATIONS

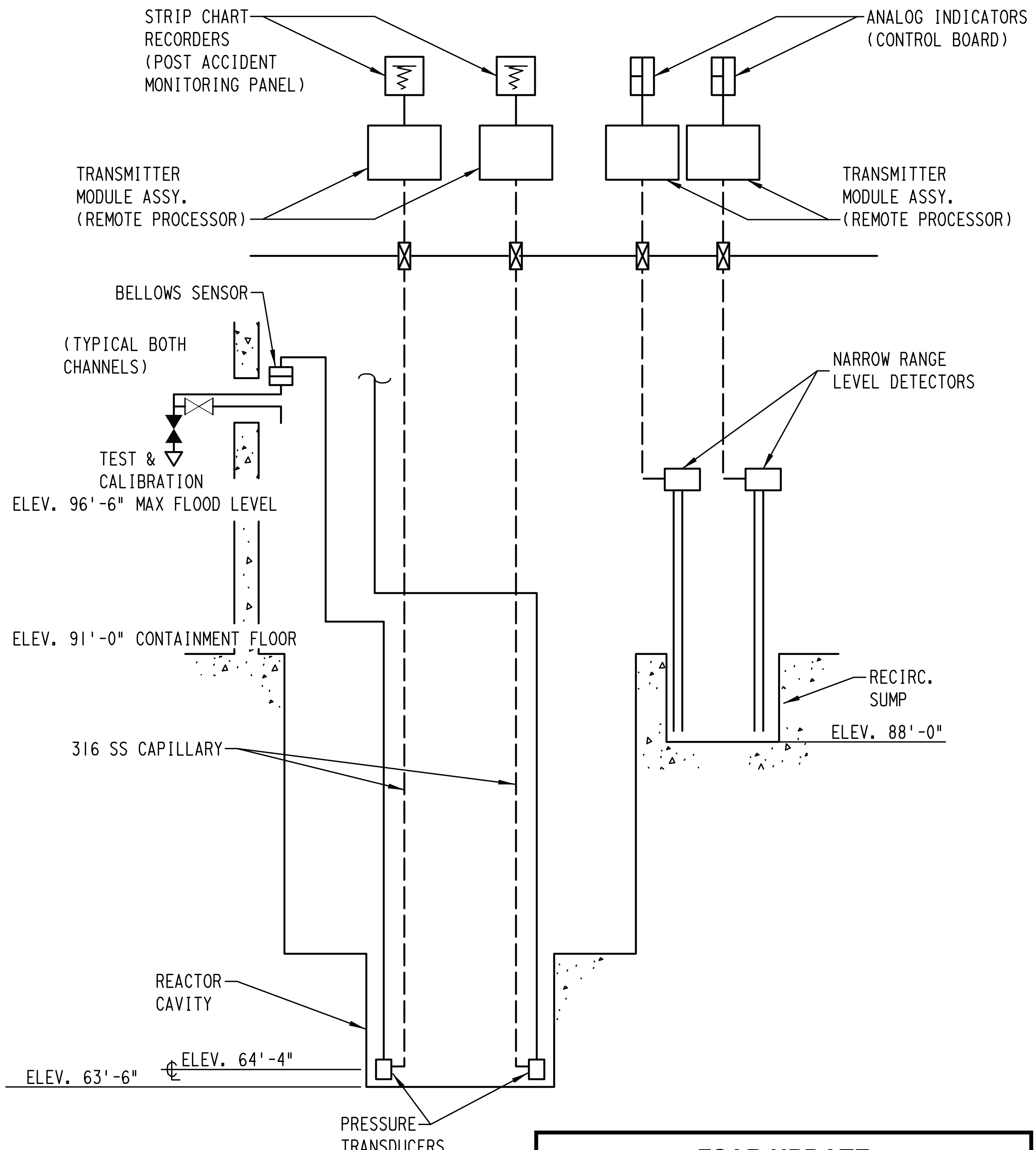


NOTE: THIS FIGURE IS FOR
UNIT 1, UNIT 2 IS
OPPOSITE HAND

FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 7.2-6 (Sheet 2 of 2)
SEISMIC SENSOR LOCATIONS

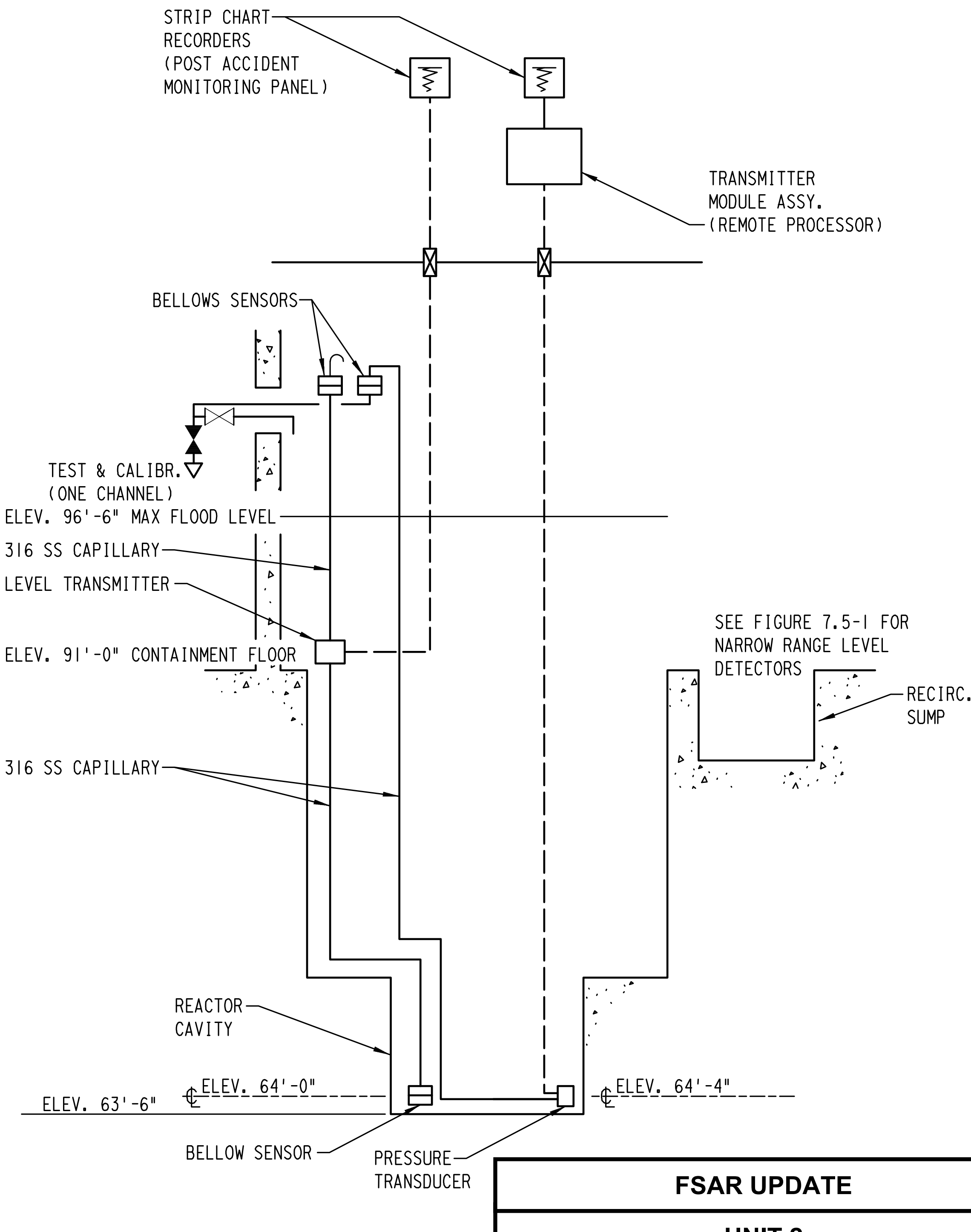


NOTE:
Refer to Figure 7.5-1B for
Unit 2 Wide-Range Diagram

FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 7.5-1
CONTAINMENT WATER LEVEL INDICATION
(NOT AN ACTUAL LAYOUT)

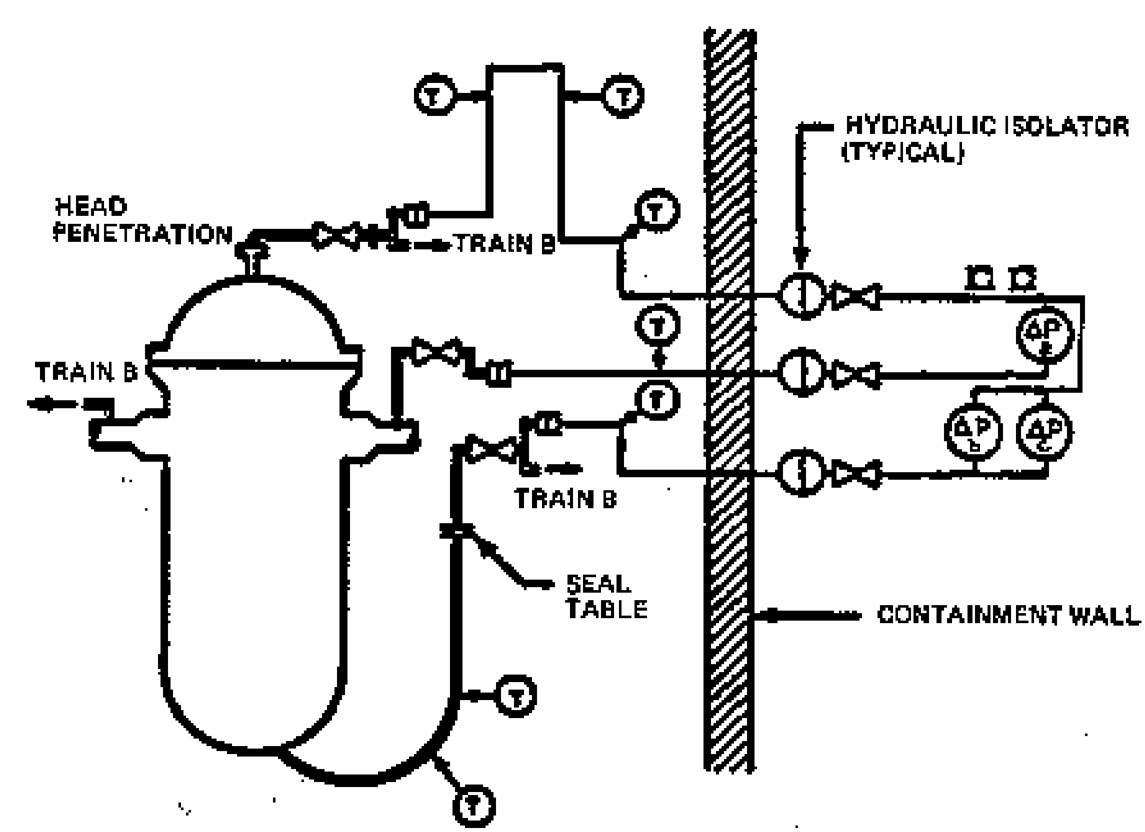


FSAR UPDATE

UNIT 2
DIABLO CANYON SITE

FIGURE 7.5-1B

CONTAINMENT WATER LEVEL WIDE-RANGE INDICATION WITH INSTALLED SPARE WIDE-RANGE LEVEL TRANSMITTER IN SERVICE (NOT AN ACTUAL LAYOUT)

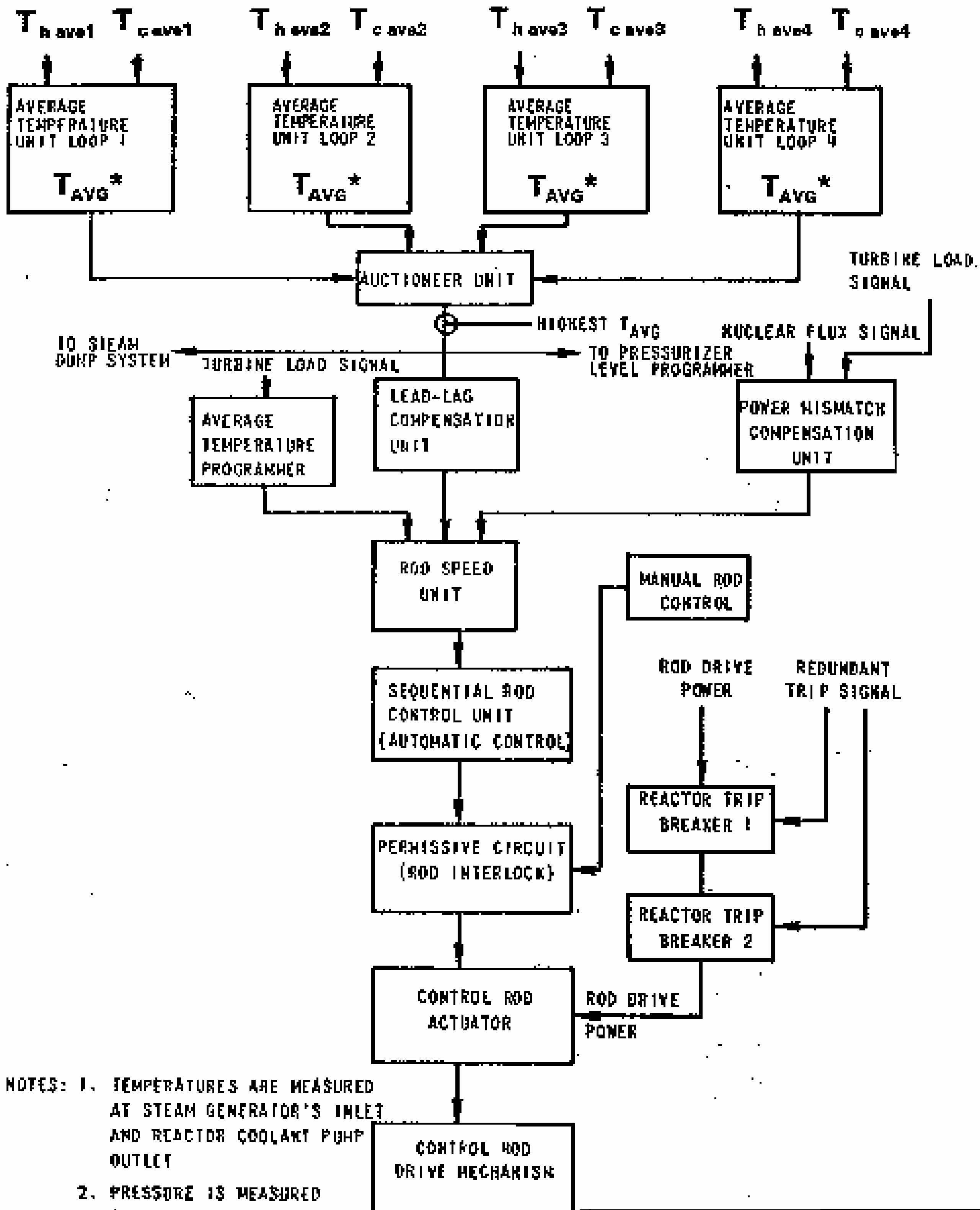


FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 7.5-2
REACTOR VESSEL LEVEL
INSTRUMENTATION PROCESS CONNECTION
SCHEMATIC (TRAIN A)

Revision 12 September 1998



NOTES: 1. TEMPERATURES ARE MEASURED AT STEAM GENERATOR'S INLET AND REACTOR COOLANT PUMP OUTLET

2. PRESSURE IS MEASURED AT THE PRESSURIZER

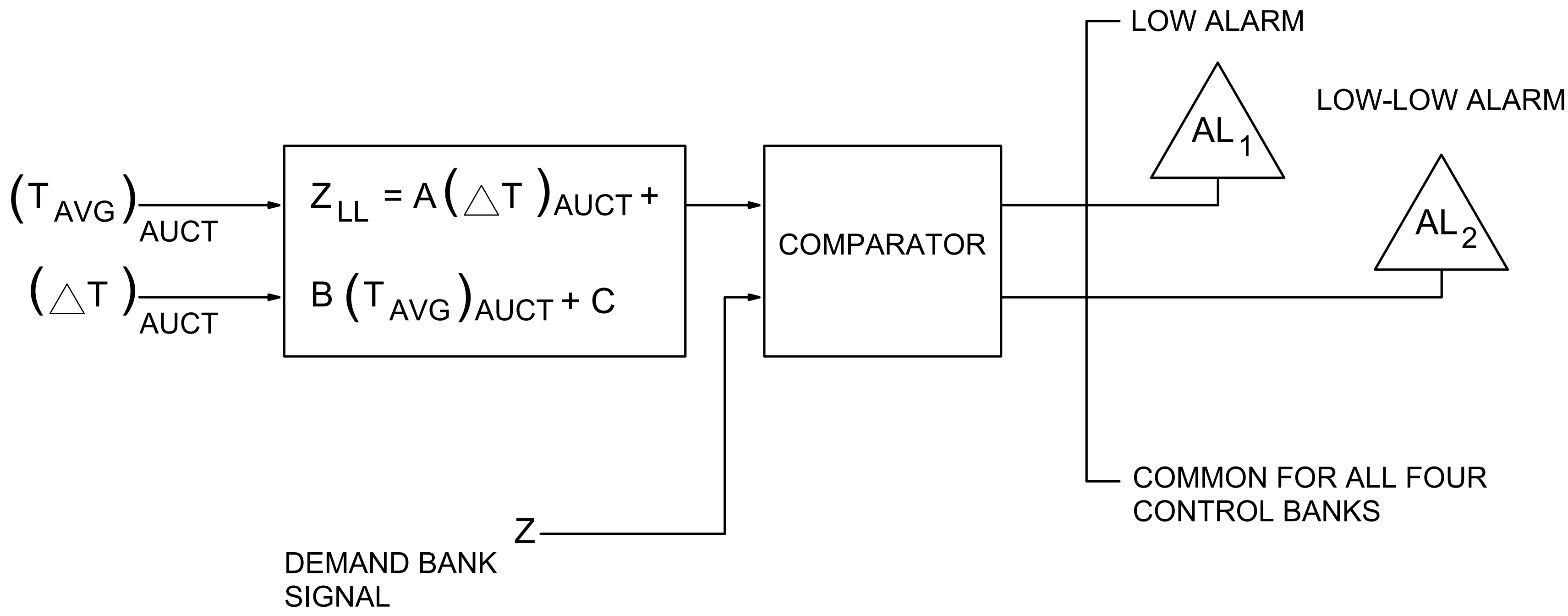
$$* \quad T_{AVGi} = \frac{T_{h\,avei} + T_{c\,avei}}{2}$$

i = Loop numbers 1 → 4

FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 7.7-1
SIMPLIFIED BLOCK DIAGRAM OF REACTOR CONTROL SYSTEM

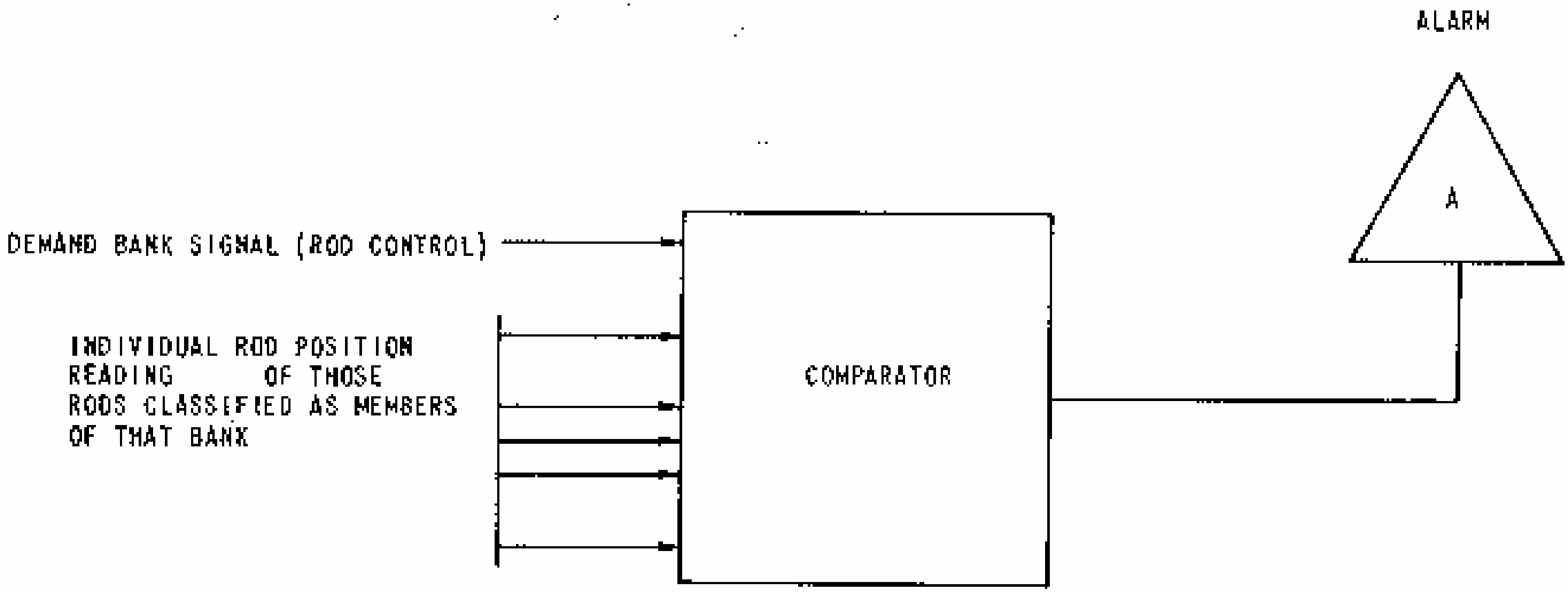


TYPICAL OF ONE CONTROL BANK

NOTES:
1. The PPC is used for the comparator network.
2. Comparison is done for all control banks.

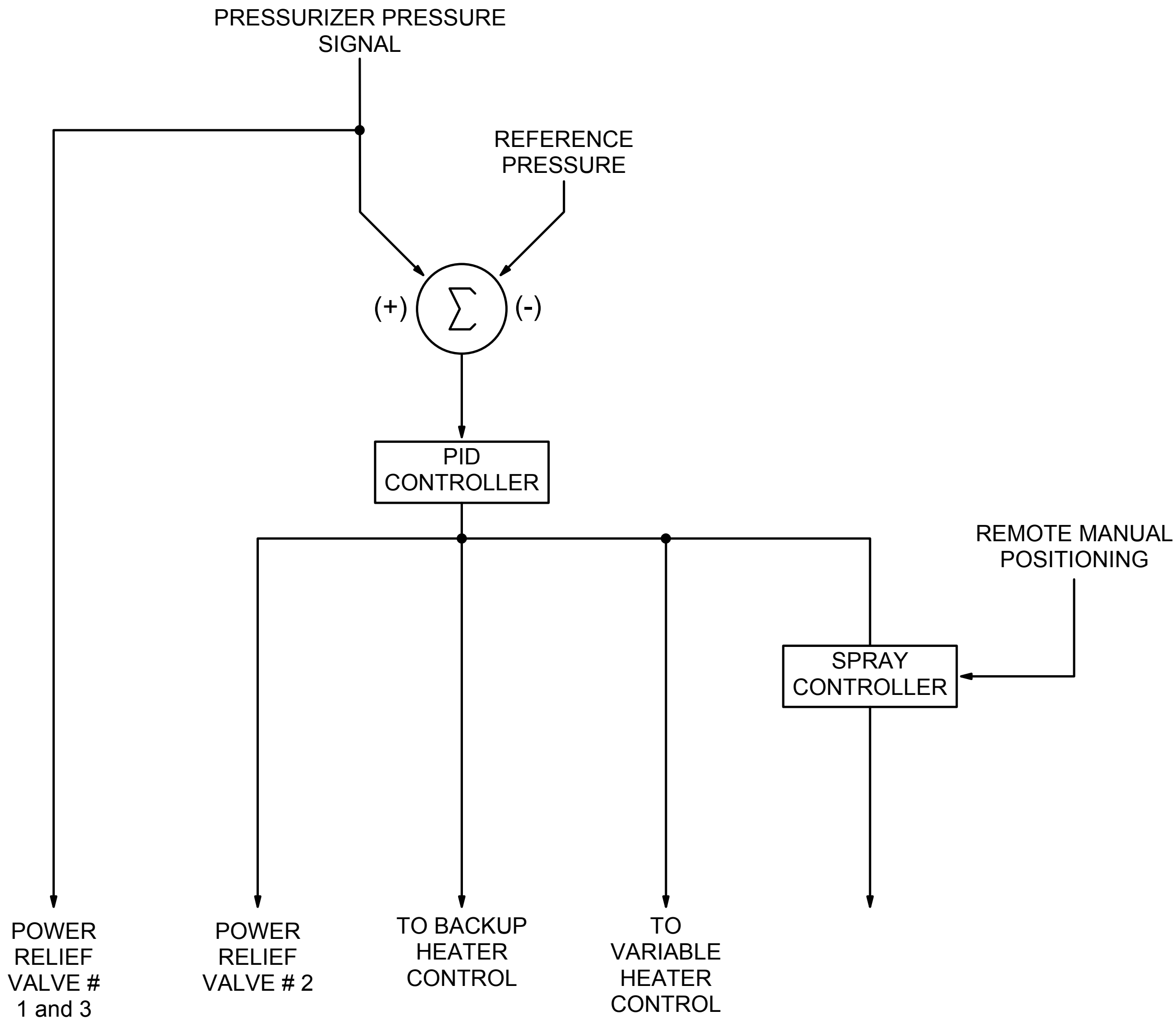
FSAR UPDATE
UNITS 1 AND 2 **DIABLO CANYON SITE**
FIGURE 7.7-2 **CONTROL BANK ROD** **INSERTION MONIOTOR**

Revision 16 June 2005



NOTE:
1. DIGITAL OR ANALOG SIGNALS MAY BE USED FOR THE COMPARATOR COMPUTER INPUTS.
2. THE COMPARATOR WILL ENERGIZE THE ALARM IF THERE EXISTS A POSITION DIFFERENCE GREATER THAN A PRESENT LIMIT BETWEEN ANY INDIVIDUAL ROD AND THE DEMAND BANK SIGNAL.
3. COMPARISON IS INDIVIDUALLY DONE FOR ALL CONTROL BANKS.

FSAR UPDATE
UNITS 1 AND 2 **DIABLO CANYON SITE**
FIGURE 7.7-3 **ROD DEVIATION COMPARATOR**

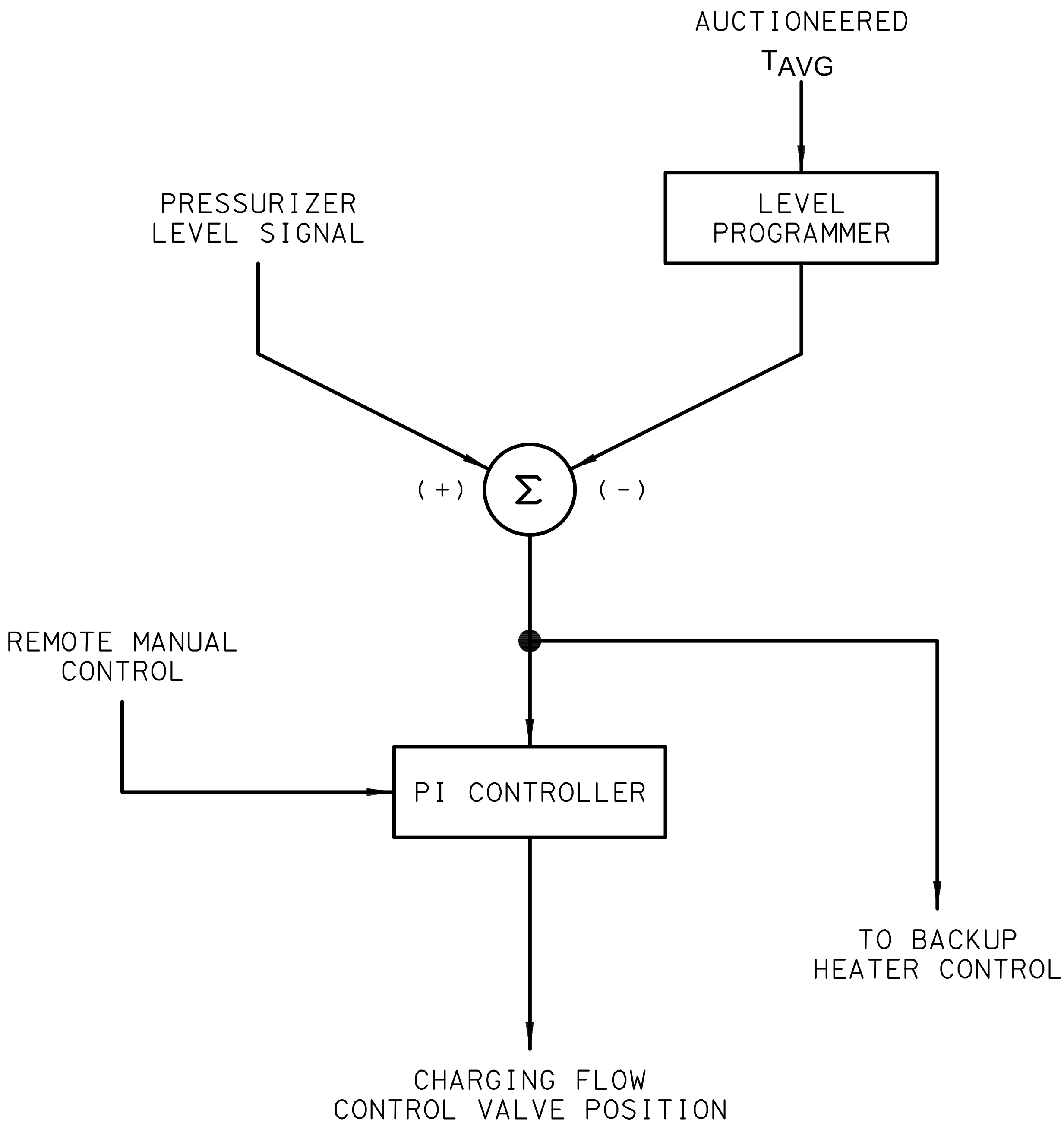


Note:
Valve 1 = PCV 456
Valve 2 = PCV 474
Valve 3 = PCV 455C

FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 7.7-4
BLOCK DIAGRAM OF PRESSURIZER PRESSURE CONTROL SYSTEM

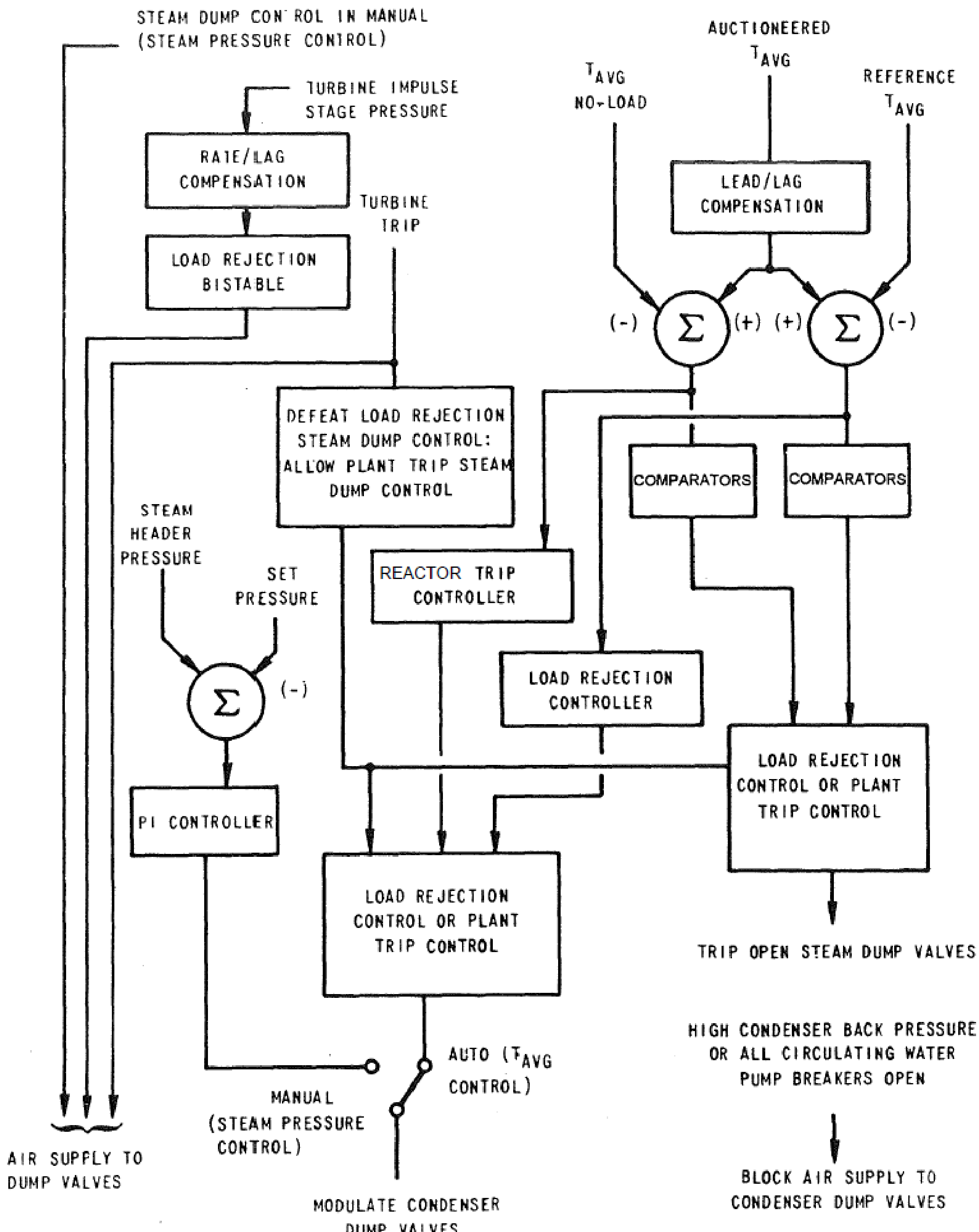


FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 7.7-5
BLOCK DIAGRAM OF PRESSURIZER LEVEL CONTROL SYSTEM

Revision 21 September 2013

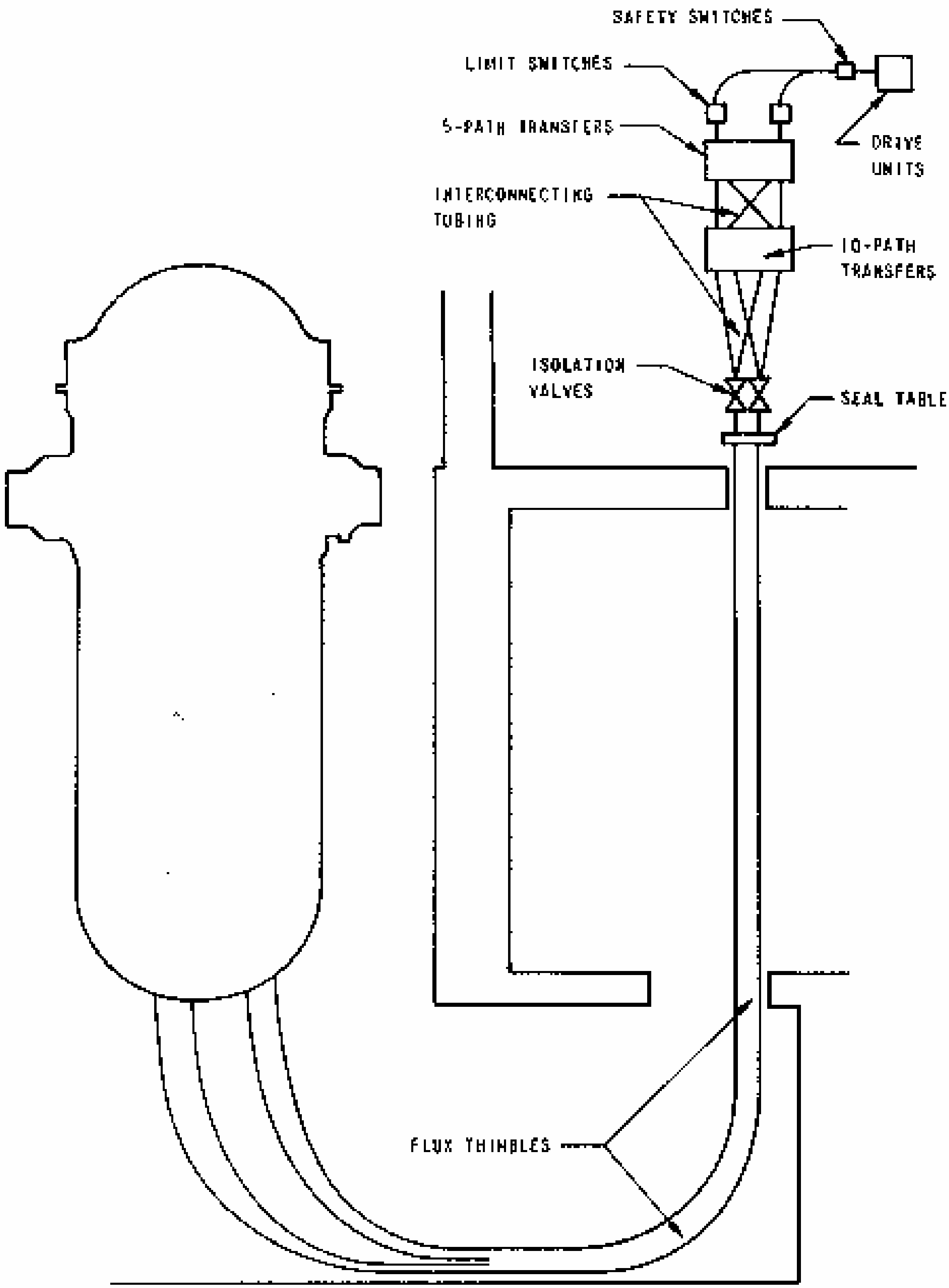


FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 7.7-8

BLOCK DIAGRAM OF STEAM DUMP CONTROL SYSTEM



FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 7.7-9

BASIC FLUX MAPPING SYSTEM

Chapter 8

ELECTRIC POWER

CONTENTS

Section	Title	Page
8.1	INTRODUCTION	8.1-1
8.1.1	Definitions	8.1-1
8.1.2	General Description	8.1-3
8.1.3	Power Transmission System	8.1-3
8.1.4	Safety Loads	8.1-3
8.1.5	Design Bases, Criteria, Safety Guides, and Standards	8.1-4
8.1.5.1	Design Bases	8.1-5
8.1.5.2	Applicable Design Basis Criteria	8.1-5
8.1.5.3	Codes and Standards	8.1-5
8.1.6	Reference Drawings	8.1-6
8.2	OFFSITE POWER SYSTEM	8.2-1
8.2.1	Design Bases	8.2-1
8.2.1.1	General Design Criterion 4, 1967 - Sharing of Systems	8.2-1
8.2.1.2	General Design Criterion 17, 1971 - Electric Power Systems	8.2-2
8.2.1.3	General Design Criterion 18, 1971 - Inspection and Testing of Electric Power Systems	8.2-2
8.2.1.4	Transmission Capacity Requirements	8.2-3
8.2.1.5	Single Failure Requirements	8.2-3
8.2.1.6	10 CFR 50.63 - Loss of All Alternating Current Power	8.2-3
8.2.1.7	Safety Guide 32, August 1972 - Use of IEEE Standard 308-1971 Criteria for Class 1E Electric Systems for Nuclear Power Generating Stations	8.2-3
8.2.2	Description	8.2-3
8.2.2.1	230-kV System	8.2-3
8.2.2.2	500-kV	8.2-4
8.2.3	Safety Evaluation	8.2-6
8.2.3.1	General Design Criterion 4, 1967 - Sharing of Systems	8.2-6
8.2.3.2	General Design Criterion 17, 1971 – Electric Power Systems	8.2-6

CONTENTS (Continued)

Section	Title	Page
8.2.3.3	General Design Criterion 18, 1971 Inspection and Testing of Electric Power Systems	8.2-12
8.2.3.4	Transmission Capacity Requirements	8.2-12
8.2.3.5	Single Failure Requirements	8.2-13
8.2.3.6	10 CFR 50.63 Loss of All Alternating Current Power	8.2-14
8.2.3.7	Safety Guide 32, August 1972 Use of IEEE Standard 308-1971 Criteria for Class 1E Electric Systems for Nuclear Power Generating Stations	8.2-14
8.2.4	Tests and Inspections	8.2-15
8.2.5	Instrumentation Applications	8.2-15
8.2.6	References	8.2-15
8.2.7	Reference Drawings	8.2-16
8.3	ONSITE POWER SYSTEMS	8.3-1
8.3.1	AC Power Systems	8.3-1
8.3.1.1	Description	8.3-1
8.3.1.2	Analysis	8.3-57
8.3.1.3	Conformance with Appropriate Quality Assurance Standards	8.3-57
8.3.1.4	Independence of Redundant Systems	8.3-58
8.3.1.5	Physical Identification of Safety-Related Equipment	8.3-67
8.3.1.6	Station Blackout	8.3-70
8.3.2	DC Power Systems	8.3-72
8.3.2.1	Design Basis	8.3-73
8.3.2.2	System Description	8.3-76
8.3.2.3	Safety Evaluation	8.3-80
8.3.2.4	Tests and Inspections	8.3-86
8.3.2.5	Instrumentation Applications	8.3-87
8.3.3	References	8.3-87
8.3.4	Reference Drawings	8.3-89

Chapter 8

TABLES

Table	Title
8.1-1	Applicable Design Basis Criteria
8.3-1	Notes for Tables
8.3-2	Timing Sequence and Intervals - No Safety Injection Signal
8.3-3	Maximum Steady State Load Demand - No Safety Injection Signal
8.3-4	Diesel Generator Loading - Timing Sequence and Intervals - With Safety Injection Signal
8.3-5	Diesel Generator Loading - Maximum Steady State Load Demand Following Loss-of-Coolant Accident
8.3-6	Vital 4160/480-Volt Load Centers Loading
8.3-7	Vital 480-Volt Load Centers Maximum Demand
8.3-8	Summary of Shop Testing of Diablo Canyon Diesel Engine Generator Units by Alco Engine Division
8.3-9	Summary of Preoperational Testing of Diablo Canyon Diesel Engine Generator Units by PG&E During Startup
8.3-10	Identification of Electrical Systems
8.3-11	Unit 1 125-Vdc Distribution Panel Safety-Related Loads
8.3-12	Deleted in Revision 11
8.3-13	Deleted in Revision 11
8.3-14	Deleted in Revision 11
8.3-15	Deleted in Revision 11
8.3-16	Deleted in Revision 11
8.3-17	Deleted in Revision 11

FIGURES (Continued)

Figure	Title
8.1-1[a]	Plant Single Line Diagram
8.1-2	DCPP Power Supply Boundary Diagram
8.2-1	Deleted in Revision 17
8.2-2	Deleted in Revision 17
8.2-3[a]	General Arrangement 230-kV and 500-kV Switchyard
8.2-4[a]	Deleted in Revision 17
8.2-5[a]	Deleted in Revision 17
8.2-6[a]	Arrangement of 12-kV Startup Transformers
8.3-1[a]	Single Line Meter and Relay Diagram - Generator, Main, and Auxiliary Transformers, and Excitation
8.3-2[a]	Single Line Meter and Relay Diagram - 12-kV System
8.3-3[a]	Single Line Meter and Relay Diagram - 4-kV System
8.3-4[a]	Single Line Meter and Relay Diagram - 4-kV System (Vital Bus)
8.3-5[a]	Single Line Meter and Relay Diagram - 12-kV Startup System
8.3-6[a]	Single Line Meter and Relay Diagram - 480-V System Bus Section F (Vital Bus)
8.3-7[a]	Single Line Meter and Relay Diagram - 480-V System Bus Section G (Vital Bus)
8.3-8[a]	Single Line Meter and Relay Diagram - 480-V System Bus Section H (Vital Bus)
8.3-9[a]	Schematic Diagram - 4-kV Bus Section F Automatic Transfer
8.3-10[a]	Schematic Diagram - 4-kV Bus Section G Automatic Transfer
8.3-11[a]	Schematic Diagram - 4-kV Bus Section H Automatic Transfer

FIGURES (Continued)

Figure	Title
8.3-12[(a)]	Schematic Diagram - 4-kV Diesel Generators Controls
8.3-13[(a)]	Schematic Diagram - 4-kV Diesel Generators and Associated Circuit Breakers
8.3-14[(a)]	Schematic Diagram - 4-kV Diesel Generators Auxiliary Motors
8.3-15	Deleted in Revision 11
8.3-16[(a)]	Logic Diagram - Automatic Transfer 4-kV buses F, G, and H
8.3-17[(a)]	Class 1E 125-Vdc System
8.3-18[(a)]	Normal (Non-Class 1E) 125-V and 250-Vdc System
8.3-19[(a)]	Pressurizer Heaters, Single Line Diagram
8.3-20[(a)]	Schematic Diagram Potential and Synchronizing 4160-Volt System (Vital Bus)
8.3-21	Typical Arrangement of Jumboduct Sleeve Through Concrete
8.3-22	Typical Detail of Four or More Jumboducts in Concrete Slab
8.3-23	Typical Arrangement of Transite Conduit Sleeve for Electrical Cables Through Concrete
8.3-24	Typical Fire Stop for Horizontal Cable Trays
8.3-25	Typical Fire Stop for Vertical Trays
8.3-26	Typical Fire Stop for Parallel Trays
8.3-27	Typical Vertical Tray Fire Stop
8.3-28	Typical Fire Barrier for Horizontal Trays

NOTE:

[(a)] This figure corresponds to a controlled engineering drawing that is incorporated by reference into the FSAR Update. See Table 1.6-1 for the correlation between the

FIGURES (Continued)

Figure	Title
	FSAR Update figure number and the corresponding controlled engineering drawing number.

Chapter 8

APPENDICES

Appendix	Title
8.3A	Deleted in Revision 11
8.3B	INSULATED CABLE - CONSTRUCTION AND VOLTAGE RATINGS
8.3C	MATERIALS FOR FIRE STOPS AND SEALS

Chapter 8

ELECTRIC POWER

8.1 INTRODUCTION

The electrical auxiliary power system at the Diablo Canyon Power Plant (DCPP) is designed to provide electric power to the necessary plant electrical equipment under all foreseeable combinations of plant operation and electric power source availability. The various subsystems provide adequate protection for electrical equipment during fault conditions, while maintaining maximum system flexibility and reliability.

8.1.1 DEFINITIONS

The following definitions apply to the electrical auxiliary power system.

Offsite Power System: The system that delivers electric power from the transmission network to the onsite distribution system

Preferred Power Supply: The preferred power supply is the Offsite Power System. The preferred power supply is comprised of two physically independent offsite power circuits. The startup offsite power circuit (230-kV) and the auxiliary offsite power circuit (500-kV).

Normal Onsite Power Source: The normal onsite power source is the electric source which is generated by DCPP via the main generator and distributed by the 25-kV system to the 4.16-kV system.

Startup Offsite Power Circuit: The startup offsite power circuit (230-kV system) provides an immediate source of offsite power from either of the two 230-Kv transmission lines connecting to the 230-kV switchyard. Refer to Section 8.2 and Figure 8.1-2 for description of the boundary of the startup offsite power circuit.

Auxiliary Offsite Power Circuit: The auxiliary offsite power circuit (500-kV system) provides the delayed source of offsite power from any one of the three 500-kV transmission lines connecting to the 500-kV switchyard. Refer to Section 8.2 and Figure 8.1-2 for description of the boundary of the auxiliary offsite power circuit.

The main generator also feeds the auxiliary offsite

power circuit during normal plant operation.

Onsite Distribution System:	The Class 1E distribution system (both ac and dc voltages) permits the functioning of structures, systems, and components important to safety. Refer to Sections 8.3.1.1.1 through 8.3.1.1.5 and 8.3.2 for detailed descriptions of the onsite distribution systems. There is also a non-Class 1E electrical distribution system (i.e., balance of plant). Those balance of plant (BOP) portions comprising part of an offsite power circuit are subject to offsite power requirements. Those portions supplied from a Class 1E bus are subject to Class 1E isolation requirements. The remainder of the non-Class 1E BOP electrical distribution system is outside the scope of GDC 17, 1971 and IEEE 308-1971.
Standby Power Supply:	The onsite emergency power supply. The emergency diesel generators (EDGs) are the ac standby power supply when the preferred power supply is not available. The dc standby power supply is comprised of the station batteries and the 125-Vdc system. Refer to Section 8.3.1.1.6 and 8.3.2 for detailed descriptions of the standby power supplies.
Class 1E:	Refer to 3.2.2.6
Non-Class 1E:	Refer to 3.2.2.6
Source:	In the context of GDC 17, 1971 and IEEE 308-1971, the Class 1E ac electrical distribution system has three sources: 1) the preferred power supply 2) the standby power supply 3) the normal onsite power supply
Grid:	The grid is the source of electrical power to the offsite power system. The grid is comprised of the electrical generation resources, transmission lines, interconnections with neighboring systems, and

associated equipment, generally operated at voltages of 100-kV or higher.

Transmission Network: The grid elements operating at a given voltage level. DCPP connects with the grid at both the 230-kV and 500-kV transmission network level.

8.1.2 GENERAL DESCRIPTION

The electrical systems generate and transmit power to the high-voltage system, distribute power to the auxiliary loads, and provide control, protection, instrumentation, and annunciation power supplies for the units. Power is generated at 25-kV. Auxiliary loads are served at 12-kV, 4.16-kV, 480-V, 120-Vac, 250-Vdc, and 125-Vdc. The engineered safety feature (ESF) auxiliary loads are served directly by the 4.16-kV, 480-V, 120-Vac, and 125-Vdc Class 1E systems.

Offsite ac power for plant auxiliaries is available from two 230-kV transmission circuits and three 500-kV transmission circuits (refer to Figures 8.1-1 and 8.1-2).

Onsite ac auxiliary power is supplied by each unit's main generator and is also available for Class 1E loads from six diesel engine-driven generators. Three diesel generators are dedicated to each unit.

Onsite dc power is supplied from six 125-Vdc station batteries in each unit. Three batteries serve 125-Vdc Class 1E loads plus some non-Class 1E loads, and three batteries serve 125-Vdc non-Class 1E loads. Two of the three batteries supplying the non-Class 1E loads are also used together (i.e., in series) to supply 250-Vdc non-Class 1E loads (see Figure 8.3-18).

8.1.3 POWER TRANSMISSION SYSTEM

The PG&E 500-kV ac transmission system overlays an extensive 230-kV ac transmission network. The 500-kV system is further connected through the 500-kV Pacific Intertie to the Western Systems Coordinating Council network covering the eleven western states plus British Columbia. Since March 31, 1998, the California Independent System Operator (CAISO) has been responsible for operating the transmission system within California. PG&E, as well as the other transmission system operators (owners) in the state, continues to own and operate their transmission facilities.

8.1.4 SAFETY LOADS

A representative listing of each unit's systems and loads requiring electric power to perform their safety functions are listed below.

(1) Emergency core cooling system (ECCS), including two each of centrifugal charging pumps (CCP1 and CCP2), residual heat removal (RHR) pumps, safety injection (SI) pumps, motor-driven auxiliary feedwater pumps, and their associated valves and lube oil pumps

(2) Containment spray system, including two pumps and associated valves

(3) Containment ventilation system, including five fan cooler units

(4) Auxiliary saltwater system (ASW), including two pumps and associated valves

(5) Component cooling water system (CCW), including three pumps and associated motor-operated valves

(6) Diesel fuel oil system, including two pumps and valves

(7) Auxiliary building ventilation system, including fans, dampers, and control cabinets

(8) Fuel handling building ventilation system, including fans, dampers, and control cabinets

(9) Chemical volume and control system (CVCS), including boric acid transfer pumps, valves, and tank heaters

Each of these and the other safety systems are discussed in detail in the appropriate section of this FSAR Update. The safety loads, plus additional important loads that are listed in Tables 8.3-5 and 8.3-6 are served from Class 1E buses at 4.16-kV or 480-V. These buses are designated buses F, G, and H; Unit 1 is shown, with its bus loads, in Figures 8.3-4, 8.3-6, 8.3-7, and 8.3-8. The Unit 1 Class 1E 125-Vdc and 120-Vac instrumentation systems, with their loads, are shown in Table 8.3-11 and Figures 8.3-17 and 7.6-1. The Class 1E 480-V buses are supplied through transformers fed from the Class 1E 4.16-kV buses. These, in turn, are supplied power from both the normal and the emergency power sources described in Sections 8.2 and 8.3. Unit 2 loads and configuration are similar to Unit 1.

8.1.5 DESIGN BASES, CRITERIA, SAFETY GUIDES, AND STANDARDS

The electric power system is designed to provide reliable power for all necessary equipment during startup, normal operation, shutdown, and all emergency situations. Design criteria, as well as guides, codes, and applicable standards, are discussed in this section.

8.1.5.1 Design Bases

The electrical systems are designed to ensure an adequate supply of electrical power to all essential auxiliary equipment during normal operation and under accident conditions. PG&E Design Class I loads receive power from Class 1E buses that meet the requirements for IEEE Class 1E systems as defined in IEEE 308-1971. Those electrical systems and components which are not classified Class 1E are designated non-Class 1E.

Non-Class 1E 4.16-kV auxiliary buses are provided with two power sources: offsite power and power from the main generator. Class 1E buses have an additional source: onsite diesel generators. The Class 1E electrical systems are designed so that failure of any one electrical device will not prevent operation of the minimum required ESF equipment.

The overall plant single line diagram is shown in Figure 8.1-1. The loads on the Class 1E buses and the capabilities of the diesel generators are listed in Section 8.3.

8.1.5.2 Applicable Design Basis Criteria

The documents listed in Table 8.1-1 were utilized in the design, construction, testing, and inspection of the electrical systems. Table 8.1-1 designates the electrical systems which have relevance to the indicated design basis criteria. The design basis criteria for each system are addressed in the relevant system sections of Chapter 8.

Compliance of electrical systems with the general design criteria, including seismic and environmental qualifications, is also discussed in Chapter 3.

8.1.5.3 Codes and Standards

The following codes and standards have been implemented where applicable:

IEEE Standard No. 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations"

IEEE Standard No. 308-1971, "Criteria for Class 1E Electric Systems for Nuclear Power Stations"

IEEE Standard No. 317-1971, "Electrical Penetration Assemblies in Containment Structures for Nuclear Power Generating Stations"

IEEE Standard No. 323-1971, "IEEE Trial Use Standard: General Guide for Qualifying Class 1 Electric Equipment for Nuclear Power Generating Stations," except for formal organization of the documentation

IEEE Standard No. 334-1971, "IEEE Trial Use Guide for Type Tests of Continuous Duty Class 1 Motors Installed Inside the Containment of Nuclear Power Generating Stations"

IEEE Standard No. 336-1971, "Requirements for Instrumentation and Electric Equipment During the Construction of Nuclear Power Generating Stations-Installation, Inspection, and Testing"

IEEE Standard No. 344-1971, "Trial Use Guide for Seismic Qualification of Class I Electric Equipment for Nuclear Power Generating Stations"

(NOTE: Original Westinghouse-supplied equipment was qualified to IEEE 344-1971. Specific cases have been supplemented by seismic qualification criteria per IEEE 344-1975, "IEEE Recommended Practices for Seismic Qualification of Class I Electric Equipment for Nuclear Power Generating Stations")

IEEE Standard No. 485-1983, “Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations.”

ANSI Standard C37, 1972 Edition

ANSI Standard C57, 1971 Edition

AIEE Publication S-135-1, (1962), "Power Cable Ampacities"

IPCEA Standard S-66-524, (1971)

NEMA Standards MG-1, SG-5, SG-6, IC-1, VE-1, TR-1, (1971 Editions)

National Electric Code, 1968 Edition

8.1.6 REFERENCE DRAWINGS

Figures representing controlled engineering drawings are incorporated by reference and are identified in Table 1.6-1. The contents of the drawings are controlled by DCPP procedures.

8.2 OFFSITE POWER SYSTEM

The PG&E grid, which operates at several voltage levels, provides power to the DCPP preferred power supply as defined in Section 8.1. DCPP is interconnected to PG&E's electric grid system via two 230-kV and three 500-kV transmission lines emanating from their respective switchyards. These switchyards are physically and electrically separated and independent of each other. The 500-kV transmission lines out from the 500-kV switchyard provide for transmission of the plant's electric power output to the PG&E grid. The numbers of 230-kV and 500-kV transmission lines provide capability beyond that required to meet minimum NRC regulatory requirements to ensure reliability of the offsite power systems.

The preferred power supply consists of the two independent circuits (230-kV and 500-kV) from the PG&E transmission networks. The preferred power supply consists of the offsite circuits from the switchyards' DCPP circuit breakers (including associated disconnect switches) 212 (230-kV) and 532, 542, 632 and 642 (500-kV) to the onsite distribution systems. The startup offsite power circuit consists of the 230-kV switchyard breaker (212) and lines to the standby startup transformers and the 12-kV onsite distribution which provides power to the onsite Class 1E 4.16-kV distribution system. The auxiliary offsite power circuit consists of the 500-kV switchyard breakers 532, 542, 632 and 642 and lines to the main transformers and the 25-kV onsite distribution system which also provide power to the onsite Class 1E 4.16-kV distribution system. The 12-kV system, the 25-kV system and the onsite Class 1E 4.16-kV system are addressed in Section 8.3.

The startup offsite power circuit provides startup and standby power, and is immediately available following a loss-of-coolant accident to assure that core cooling, containment integrity, and other vital safety functions are maintained. The auxiliary offsite power circuit provides a delayed access source of preferred power supply after the main generator is disconnected following anticipated operational occurrences. A combination of the startup offsite power circuit and the auxiliary offsite power circuit provides the preferred power supply, as required by GDC 17, 1971.

8.2.1 DESIGN BASES

8.2.1.1 General Design Criterion 4, 1967 – Sharing of Systems

The startup offsite power circuit is designed with a single line and breaker (212) which is shared with both Units startup offsite circuits. The startup offsite power circuit is designed such that the shared components do not impair plant safety. The startup offsite power circuit is designed with sufficient capacity and capability to operate the engineered safety features (ESF) for a design basis accident (or unit trip) on one unit, and those systems required for a concurrent safe shutdown of the second unit consistent with the requirements of Section 8 of IEEE 308-1971. Additionally, the startup offsite power circuit has sufficient capacity and capability to operate the ESF for a dual unit trip as a result of a seismic event or abnormal operational occurrences.

8.2.1.2 General Design Criterion 17, 1971 – Electric Power Systems

The DCPP preferred power supply is designed with two physically independent circuits. The preferred power supply has sufficient capacity and capability to assure that: (1) specified fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded as a result of anticipated operational occurrences, and (2) the core is cooled and containment integrity and other vital functions are maintained in the event of postulated accidents.

Each of the offsite power circuits are designed to be available in sufficient time following a loss of all onsite alternating current power supplies and the other offsite power circuit, to assure that specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded.

The startup offsite power circuit provides startup and standby power, and is immediately available following a design basis accident to assure that core cooling, containment integrity, and other vital safety functions are maintained.

The auxiliary offsite power circuit provides a delayed access source of preferred power supply after the main generator is disconnected to assure specified fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded as a result of anticipated operation occurrences. The auxiliary offsite power circuit is available in sufficient time to safely shutdown the plant following a loss of the normal onsite power source and the startup offsite power circuit.

The combination of the startup offsite power circuit and the auxiliary offsite power circuit provide physical independent sources of preferred power supply, as required by GDC 17, 1971. The preferred power supply is designed to minimize the probability of losing electric power from the transmission network coincident with the loss of onsite power generated by the main generator or the loss of onsite electric power sources (standby power supply as defined in IEEE-308-1971).

DCPP maintains protocols with the grid operator to help ensure grid reliability, to ensure that impacts on plant risk are understood, and to ensure the operability of the preferred power supply is maintained.

8.2.1.3 General Design Criterion 18, 1971 – Inspection and Testing of Electric Power Systems

The preferred power supply and its components have provisions for periodic inspection and testing. The preferred power supply components have been provided with convenient and safe features for inspecting, and testing.

8.2.1.4 Transmission Capacity Requirements

Each of the 230-kV transmission lines feeding the DCPP 230-kV switchyard is independently able to support the loads for a design basis accident on one unit and loads required for concurrent safe shutdown on the other unit.

8.2.1.5 Single Failure Requirements

The preferred power supply has sufficient independence, capacity and testability to permit the operation of the ESF systems assuming a failure of a single active component.

8.2.1.6 10 CFR 50.63 – Loss of All Alternating Current Power

The preferred power supply is used for restoration of offsite power following a station blackout (SBO) event.

8.2.1.7 Safety Guide 32, August 1972 – Use of IEEE Standard 308-1971 Criteria for Class 1E Electric Systems for Nuclear Power Generating Stations

Safety Guide 32, August 1972 identifies a conflict between IEEE 308-1971 and GDC 17, 1971 specifically with respect to the time at which the delayed access offsite power circuit is required. Safety Guide 32, August 1972 supports a delayed access offsite power circuit provided that the availability of the delayed access offsite power circuit conforms to the requirements of GDC 17, 1971.

The startup offsite power circuit is the immediate source of the preferred power supply following a design basis accident or unit trip. The auxiliary offsite power circuit provides a delayed access source of preferred power supply within sufficient time as required by GDC 17, 1971.

8.2.2 DESCRIPTION

8.2.2.1 230-kV System

Offsite electrical power for startup and standby service is provided from the 230-kV system. The two incoming 230-kV transmission lines, one from the Morro Bay switchyard (about 10 miles away) and the other from the Mesa Substation, feed the 230-kV switchyard (refer to Figures 8.1-1 and 8.1-2). Shunt capacitors at DCPP and Mesa Substations are utilized to provide voltage support when required by the 230-kV grid conditions.

Each of the two 230-kV transmission lines feeding the 230-kV switchyard is provided with relay protection consisting of a carrier distance relaying terminal, including carrier distance and directional ground relays, with backup directional ground and fault detector relays, and automatic reclosing.

A single tie-line from the 230-kV switchyard supplies the 230-kV/12-kV standby startup transformer for each unit through breaker 212. The 230-kV standby startup service power line from the 230-kV switchyard to the plant is provided with relay protection consisting of a differential pilot wire relay system with overcurrent and fault detector relays for backup.

The single line diagram of the grid and the preferred offsite power supply to Units 1 and 2 is shown on Figures 8.1-1 and 8.1-2. Figure 8.2-3 shows the general location of the 230-kV (and 500-kV) switchyards. Reference 4 shows the arrangement of the 230-kV switch, bus, and circuit breaker structures. Figure 8.2-6 shows the arrangement of the 230-kV/12-kV standby startup transformers.

The tap position on each 230-kV/12-kV standby startup transformer load tap changer (LTC) is monitored in the DCPP Main Control Room. Malfunction of the LTC is monitored in the Control Room through indication and annunciator action which could include taking manual control of the LTC or removing the transformer from service. Both units are designed to be supplied from a dedicated startup transformer, with the startup bus Unit 1-Unit 2 cross-tie breaker open. However, a single 230-kV/12-kV standby startup transformer can be aligned to both units via the cross-tie breaker. Operation in this configuration is restricted by Technical Specification. The DCPP surveillance program confirms the availability of the preferred power supply by verifying the correct breaker alignments, voltage levels, capacitor bank status, and any configuration control measures.

The automatic load tap changers (LTCs) on the 230-kV/12-kV standby startup transformers, in addition to the grid shunt capacitors, enable the 230-kV system to be independent of Morro Bay generation (References 1 and 2).

The 230-kV switchyard dc control power is provided by a lead-acid battery and two battery chargers. Each charger is capable of supplying the normal dc load of the 230-kV switchyard and maintaining the battery in a fully charged condition. Normally, one charger is operating with the second charger available on standby. Both chargers may be operated in parallel if desired. Each charger is equipped with an ac failure alarm that operates on loss of ac to the charger. The battery and chargers feed a 125-Vdc distribution panel that is equipped with a dc undervoltage relay that initiates an alarm if the dc voltage drops below a preset value. Separate dc control circuits are provided from the dc distribution panel for each 230-kV power circuit breaker.

8.2.2.2 500-kV System

The 500-kV system provides for transmission of the plant's power output to the grid. The three 500-kV transmission lines, one from the Gates Substation (about 79 miles away) and two other from the Midway Substation (about 84 miles away), feed the DCPP 500-kV switchyard.

Each 500-kV transmission line is provided with relay protection terminal equipment consisting of two line relay sets (directional comparison), each operating over physically separate channels, microwave and power line carrier, and each provided with a separate dc power circuit. Single-pole tripping is not enabled for any of the lines. High-speed automatic reclosing is not enabled for the circuit breakers at the DCPP end of the lines. Backup protection (provided by a distance relaying terminal, including distance and directional ground relays) is normally cut-out, and cut-in when either primary relay set is not operable.

The 500-kV system provides power for station auxiliaries via the main transformer and the unit auxiliary transformers. Offsite electrical power is also provided from the 500-kV system. A single circuit to each unit from the 500-kV switchyard provides auxiliary offsite power through the 500-kV/25-kV main transformers and through breakers 532 and 632 (Unit 1) and breakers 542 and 642 (Unit 2). The dc motor operated main generator disconnecting switch is opened to provide auxiliary offsite power (backfeed). This telescoping disconnect switch is an integral part of the generator isolated phase bus. This switch is operated under manual control from the control room and is interlocked to prevent opening under load. Upon actuation, the motor-operated disconnect switch takes approximately 30 seconds to isolate the main generator from the main and the unit auxiliary transformers. In the event of a loss of main generator output, the auxiliary offsite power circuit could be placed in service after approximately 30 minutes. The position of the motor-operated disconnect switch is verified prior to backfeeding from the 500-kV switchyard. The position of the motor-operated disconnect switch is verified prior to backfeeding from the 500-kV switchyard.

Figures 8.1-1 and 8.1-2 (plant single line diagram) shows the three 500-kV transmission lines from the transmission network to the interconnections to the plant auxiliaries. Figure 8.2-3 shows the general location of the 230-kV and 500-kV switchyards. Reference 5 shows the arrangement of the 500-kV switches, buses, and circuit breaker structures.

Each 500-kV line between the 500-kV switchyard and a generator step-up transformer bank is provided with redundant current differential protection channels. Directional over-current relays are available as backup. A Special Protection Scheme (SPS) supplements the existing DCPP 500-kV switchyard/line protection. Refer to Section 8.2.3.2.2.

The 500-kV switchyard dc control power is provided by a lead-acid battery and two battery chargers. Each charger is capable of supplying the normal dc load of the 500-kV switchyard and maintaining the battery in a fully charged condition. Normally, one charger is operating with the second charger available on standby. Both chargers may be operated in parallel, if desired. Each charger is equipped with an ac failure alarm that operates on loss of ac to the charger. The battery and chargers feed two 125-Vdc distribution panels, one of which is equipped with a dc undervoltage relay that initiates an alarm if the dc voltage should drop below a preset value. Separate dc control circuits are provided for each 500-kV power circuit breaker.

8.2.3 SAFETY EVALUATION

8.2.3.1 General Design Criterion 4, 1967 – Sharing of Systems

The startup offsite power circuit is designed such that the single 230-kV line from the 230-kV switchyard, including breaker 212, is shared by both Unit 1 and Unit 2 startup offsite power circuits. The shared components have sufficient capacity to operate the ESF for a design basis accident (or unit trip) on one unit, and those systems required for a concurrent safe shutdown of the second unit consistent with the requirements of Section 8 of IEEE 308-1971. Additionally, the startup offsite power circuit has sufficient capability to operate the ESF for a dual unit trip as a result of a seismic event or abnormal operational occurrences (Reference 8). The capacity of the shared startup offsite power circuit components is evaluated to ensure that a spurious ESF actuation on the non-accident unit, concurrent with a design basis accident on the other unit, would not result in the loss of the preferred power supply.

Both units are designed to be supplied from a dedicated startup transformer, with the startup bus Unit 1-Unit 2 cross-tie breaker open. However, a single 230-kV/12-kV standby startup transformer can be aligned to both units via the cross-tie breaker. Operation in this configuration is restricted by Technical Specification.

8.2.3.2 General Design Criterion 17, 1971 – Electric Power Systems

8.2.3.2.1 Preferred Power Supply

The preferred power supply is designed to provide two physically independent offsite power circuits (from the 230-kV and the 500-kV systems) for the Class IE buses. The startup offsite power circuit is the 230-kV power supply which includes the first inter-tie breaker (212) at the 230-kV switchyard, 230-kV/12-kV standby startup transformers and includes all equipment downstream such as transformers, switches, interrupting devices, cabling, and controls up to the Class 1E buses. The startup offsite power circuit is designed to provide the immediate access preferred power supply from the 230-kV switchyard to the Class 1E buses within a few seconds after a loss-of-coolant accident.

The auxiliary offsite power circuit is the 500-kV power supply which includes inter-tie breakers (generator output breakers 532 and 632 for Unit 1, breakers 542 and 642 for Unit 2) at the 500-kV switchyard, 500-kV/25-kV main transformers and all equipment downstream such as isophase bus, breakers, transformers, switches, interrupting devices, cabling, and controls up to the Class 1E buses. The auxiliary offsite power circuit is designed to provide the delayed access source of preferred power supply from the 500-kV switchyard to the Class 1E buses after the main generator motor operated disconnect switch is opened. The auxiliary offsite power circuit is available in sufficient time to safely shutdown the plant following a loss of the auxiliary onsite power source and the startup offsite power circuit (refer to Section 8.2.3.7).

The combination of the startup offsite power circuit and the auxiliary offsite power circuit provide physical independent sources of preferred power supply, as required by GDC 17, 1971. The preferred power supply is designed to minimize the probability of losing electric power from the transmission network coincident with the loss of onsite power generated by the main generator or the loss of onsite electric power sources (standby power supply as defined in IEEE-308-1971).

8.2.3.2.2 Analysis

8.2.3.2.2.1 Grid Load Flow Analysis

Load flow analyses are performed for anticipated configurations of the grid (e.g., generating units out of service, transmission line(s) out of service, or voltage control devices out of service).

For postulated design-basis events, the transmission system is assumed to be in steady state. Any external condition affecting the transmission network is assumed to occur in sufficient time prior to the transfer to the 230-kV system such that the voltage on the 230 kV/12 kV LTC has adjusted to the transient.

PG&E’s Grid Control Center controls the DCPP 230-kV switchyard voltage to meet or exceed the minimum allowed pre-trip voltage. The minimum voltage from the transmission network at the DCPP 230-kV switchyard is maintained at or above 218-kV for normal operation with all transmission lines in service. The minimum voltage from the transmission network at the DCPP 500-kV switchyard is maintained at or above 512-kV. With both DCPP units off-line, the preferred power supply is capable of providing 104 MW and 78 MVAR to DCPP for normal operation, safe shutdown and design basis accident mitigation.

Depending upon system load and available voltage support, a degraded grid voltage condition could occur and result in DCPP configuration control measures (refer to Section 8.2.3.2.2.2). PG&E operating procedures are used by the California Independent System Operator (CAISO), Grid Control Center, the Diablo Canyon Control Center, and DCPP.

Configuration control measures and the voltages required to maintain operability are reviewed annually. The purpose of the review is to examine major changes in system load projections, generating capacity, and transmission grid connections. PG&E's Energy Delivery engineering staff performs the load flow studies using the current analytical model of the entire Western Electricity Coordinating Council (WECC). The initial conditions for the studies include the peak system loading, and only one DCPP unit generating. The 230-kV configurations modeled include all local transmission elements in service; one line out of service; two parallel lines out of service; split buses at nearby 230-kV substations; and capacitor banks unavailable. The results of the studies are calculated system equivalents and voltages with and without DCPP loading

for each configuration. The results of the system load flow studies ensure transmission voltages are adequate to support a postulated DCPP post trip load transfer.

8.2.3.2.2.2 DCPP Load Flow and Dynamic Loading Analysis

The startup offsite power circuit is the immediate source of preferred power supply following a design basis accident or unit trip. The DCPP design and licensing basis requires that the startup offsite power circuit have sufficient capacity and capability to: (1) operate the ESFs for a design-basis accident on one unit and concurrent safe shutdown (safe shutdown includes a unit trip) on the other unit, and (2) operate the ESFs for dual unit trips as a result of a seismic event or abnormal operational occurrences.

Existing DCPP calculations demonstrate the capacity of the preferred power supply for anticipated operational occurrences and postulated post accident conditions. The calculations demonstrate that the preferred power supply has sufficient capacity and capability to start and operate the required loads.

Depending upon system load and available voltage support, a degraded grid voltage condition can result. DCPP configuration control measures, including blocking the transfer of non-essential loads, may be necessary for certain transmission network configurations to ensure adequate voltage to the Class 1E buses and return to the startup offsite power circuit to operable status.

PG&E operating procedures identify when configuration control measures are necessary based on surrounding area load, voltage, and the availability of critical transmission elements. When notified of adverse grid conditions, DCPP operating procedures identify what configuration control measures to invoke. Continued operation of the DCPP units under these conditions is procedurally controlled to ensure the preferred power supply meets DCPP operability requirements.

Configuration control measures and the voltages required to maintain operability are reviewed annually. DCPP dynamic loading analyses are then performed, using the results of the transmission load flow studies as input. The DCPP analyses determine if the calculated voltages are adequate for starting of required plant loads and for the bus transfer to the startup offsite power circuit following a design basis accident on one unit and concurrent safe shutdown of the second unit, or a dual unit trip following a seismic event or other abnormal operational occurrences. If the voltages and existing configuration control measures are not adequate, the analysis is rerun with additional configuration control measures. Analyses are also performed to examine the effect of one 230 kV/12-kV standby startup transformer being unavailable, and for manual 230-kV/12-kV standby startup transformer LTC operation. DCPP procedures (which provide configuration control measures for the preferred power supply operability) are then modified to reflect the results of the analyses.

8.2.3.2.2.3 Grid Stability Analysis

The licensing basis requires the grid to remain stable (no complete loss of power from the preferred power source) following the loss of a generator, the loss of a large load block, or a fault on the most critical transmission line. Grid stability analyses are performed periodically whenever there is a significant change in generation, load, or transmission capability to ensure that this criterion is met. These analyses, and the load flow and dynamic loading analyses discussed above, are done to demonstrate compliance with GDC 17, 1971.

The fundamental purpose of the grid is to move electric power from the areas of generation to the areas of customer demand. The transmission network should be capable of performing this function under a wide variety of expected conditions. In addition to the more probable forced and planned outage contingencies, the planned ability to withstand less probable contingencies measure the robustness of a system.

The California transmission network (control area under CAISO) is designed and operated to comply with WECC reliability criteria (Reference 6). These criteria establish performance requirements for numerous grid contingencies, including the DCPP license basis contingencies which consist of the loss of any generator, the loss of a large load block, or a fault on the most critical transmission line.

The WECC criteria define four levels of transmission events, as follows:

Category A: No contingency, all facilities in service
Category B: Events resulting in the loss of a single grid element
Category C: Events resulting in the loss of two or more elements
Category D: Extreme events resulting in two or more (multiple elements removed or cascading out of service)

The DCPP licensing basis contingencies identified earlier in this section are consistent with the above WECC Category B events. CAISO compliance with WECC Category B ensures the availability of offsite power to DCPP because the loss of multiple elements and cascading are not involved.

The Category C and D events are beyond the licensing basis to satisfy GDC 17, 1971 criteria. CAISO compliance with WECC Category C and select Category D contingencies provides additional margin to ensure an adequate offsite power to Diablo Canyon Units by protecting against dual unit trips.

Grid stability analyses are performed periodically by PG&E Electrical Operations whenever there is a significant change in generation, load, or transmission capability (based on an annual review of configuration control measures and voltages required to maintain operability) to ensure that the Category B criterion is met.

The model used in these studies represents PG&E grid and the interconnected western states in sufficient detail so that they properly address the electromechanical reaction of the combined systems to the cases studied. Scenarios modeled by PG&E include both a single-unit trip and a dual-unit trip of DCPP. Both worst case summer and winter loadings are simulated because the total area load and available generation varies with the season.

Assuming one DCPP unit already shutdown, the grid stability study concluded that the loss of the remaining generating unit at the Diablo Canyon site has little effect on the preferred power supply feeding the DCPP switchyard 230-kV buses and will not result in the complete loss of the preferred power supply. Both voltage and frequency will stabilize within several seconds. For a single-unit trip, the availability of the preferred power supply to the ESFs at Diablo Canyon will not be affected.

For a dual-unit trip (WECC Category C event), the 230-kV switchyard will remain energized (i.e., non-cascading event).

8.2.3.2.2.4 Operation During Severe Grid Disturbances Analysis

The CAISO exercises centralized control over generation and transmission facilities within California. CAISO schedules electric generation and operates the transmission network to minimize cascading during severe transmission network disturbances.

The CAISO also coordinates the scheduled outage of the electric generation and transmission facilities for preventive maintenance and repair, thereby ensuring a nearly constant level of system reliability.

It is the CAISO's responsibility to carry, at all times, operating reserve to satisfy the WECC Reliability Criteria and meet the requirements of the North American Electric Reliability Council.

To preserve the integrity of generating units during extreme grid disturbances, nuclear power plants (including DCPP) will be given the highest priority for restoration of power to their switchyards. PG&E and the CAISO have emergency restoration plans in place to utilize combustion turbine units, hydroelectric units, and the transmission grid to provide startup power to its major thermal electric generating plants. PG&E has several megawatts (MW) of its own hydro-generation within its control area that assists the grid through disturbances.

System disturbances can be initiated by trouble either within the CAISO control area or external to it. The 500-kV ac Pacific Intertie, running the length of PG&E's grid, provides an internal transmission network with ties to neighboring utilities. If the grid is subjected to a severe disturbance caused by upset conditions external to the PG&E grid, underfrequency protective relaying has been provided that will activate at the interface. This relaying automatically separates the PG&E grid from its neighbors

should frequency drop below relay settings in accordance with Exhibit A of PG&E Utility Standard S1426 for Tie Lines.

The WECC has prepared a coordinated response to underfrequency events. A coordinated response by all utilities and generation owners under WECC jurisdiction maximizes the integrity of the grid. PG&E has implemented a multi-step load shed scheme within WECC guidelines to maintain a balance between load and generation.

These guidelines include the separation of generation based on underfrequency setpoints that have been coordinated within the WECC areas of control. All setpoints for load shedding and generation tripping have been selected to minimize equipment damage and provide long term grid reliability. To minimize the possibility of a cascading failure and the possibility of severe overloading of generating units, underfrequency load shedding is used to automatically relieve load during an extreme emergency. This load is removed automatically in increments based on declining frequency. Should these measures fail to arrest system frequency decay, provisions have been made to automatically separate thermal power plants from the transmission network should abnormal low frequency conditions develop. DCPP has implemented setpoints and durations for conditions corresponding to those specified in Exhibit A of PG&E Utility Operations Standard S1426 for Thermal Power Plants. Additional manual load shedding may be required to stabilize the grid. Hydroelectric units connected to the transmission network have a broad capability to operate during underfrequency conditions. The hydroelectric units' underfrequency setpoints are lower than the thermal power plants, although most hydroelectric units do not have underfrequency control and would remain connected and continue to provide power to the transmission system.

A Special Protection Scheme (SPS) has been added to supplement the existing DCPP 500-kV switchyard/line protection. This SPS was designed and installed by PG&E's transmission organization. An SPS is designed to detect abnormal grid conditions and take pre-planned, corrective action (other than the isolation of faulted elements) to provide acceptable grid performance. SPS actions may include, among others, changes in demand (e.g., load shedding), generation, or system configuration to maintain grid stability, acceptable voltages, or acceptable facility loadings. The use of an SPS is an acceptable transmission practice to meet the grid performance requirements as defined under WECC Categories A, B, or C.

The Diablo Canyon switchyard SPS was installed to mitigate the potential loss of two Diablo Canyon Units after the occurrence of certain 500-kV Category C events. These events, if left unmitigated, would result in the loss of both Diablo Canyon Units. The SPS will prevent voltage dips that are in violation of the WECC standards. The SPS system will selectively open the generator output breakers of one generating unit (i.e., load rejection) when the pre-defined conditions exist regarding the DCPP outlet lines. The purpose of this corrective action is to prevent intensive swings that would otherwise result in the trip of both units by either RCP undervoltage or generator out-of-step protection.

The measures outlined above, together with others, provide the basis for PG&E's confidence that the offsite power sources to the Diablo Canyon site are extremely reliable. The interconnection of Diablo Canyon to the 500-kV transmission network by way of Midway and Gates switchyards, and to the 230-kV transmission network by way of Morro Bay switchyard and Mesa substation, ensures access to PG&E's electrical grid systems.

8.2.3.3 General Design Criterion 18, 1971 Inspection and Testing of Electric Power Systems

Periodic testing and surveillance of the standby startup transformers, unit auxiliary transformers, and the main transformer are part of the normal DCPP program for oil-filled transformers.

The DCPP surveillance program confirms the availability of the preferred power supply by verifying the correct breaker alignments, voltage levels, capacitor bank status, and any configuration control measures.

8.2.3.4 Transmission Capacity Requirements

Each of the two 230-kV transmission lines feeding the DCPP 230-kV switchyard is independently able to support the loads for a design basis accident on one unit and loads required for concurrent safe shutdown on the other unit.

The startup preferred power supply from the transmission network including the 230-kV/12-kV standby startup offsite power circuit is designed in a manner intended to obtain a high degree of service reliability and to minimize the time and extent of outage if failures do occur. Other than the failure mechanisms identified in Section 8.2.3.5, the startup offsite power circuit is designed for the following normal grid conditions:

(1) Each transmission line (as described in Section 8.2.2) in service with full capacity.

(2) Voltage support devices such as the automatic load tap changers and capacitor banks at DCPP and Mesa in service

(3) Operating at full load under maximum expected transmission system load

The startup offsite power circuit is capable of mitigating a design basis event without reliance on manual operator actions to restore capability. This startup offsite power circuit capability includes automatic operation of voltage support devices and transmission switching systems to re-stabilize the system following a loss of a single generator in the transmission network, transmission line, or voltage support device. For off normal conditions (e.g., following a loss of a single generator in the transmission network, transmission line, or voltage support device) such that transmission from one of the two 230-kV transmission lines is degraded, configuration control measures, that

include the blocking of selective large loads (e.g., 12-kV buses D and E auto transfer, condensate/condensate booster pumps auto start), are required to maintain operability (capability to mitigate an accident in one unit and a concurrent trip of the other unit) from the other 230-kV transmission line. These configuration control measures are procedurally controlled based on grid conditions.

8.2.3.5 Single Failure Requirements

The preferred power supply is designed such that both the offsite and the onsite power systems have sufficient independence, capacity and testability to permit the operation of the ESF systems assuming a failure of a single active component in each system. The combination of either two 230-kV line plus the 500-kV system provides a high degree of assurance that offsite power will be available when required.

Occurrences that could result in the loss of the startup offsite power circuit are described below. Note that these occurrences do not result in a loss of the auxiliary offsite power circuit and therefore ensure the preferred power supply is available in the event of a loss of the startup offsite power circuit.

(1) Loss of Morro Bay Switchyard or loss of both circuits of the 230-kV transmission line in the sections between the Morro Bay switchyard and Diablo Canyon site. It is noted that an outage of any one of the three 230-kV circuits (Morro Bay-Diablo Canyon, Diablo Canyon-Mesa, or Morro Bay-Mesa) would not result in interruption of the transmission supply to Diablo Canyon.

(2) Loss of the 230-kV bus structure at the Diablo Canyon site. This 230-kV structure has a double bus arranged so that either bus can supply the feed to the 230-kV/12-kV standby startup transformers. A permanently faulted bus section can be isolated from the remaining unfaulted bus section by means of manual switching operations. These structures are suitably spaced from one another. Only an event of great physical extent would cause the loss of both buses.

(3) Loss of the 230-kV line from the Diablo Canyon switchyard to the 230-kV/12-kV standby startup transformers, or loss of its associated 230-kV oil circuit breaker. If the power loss is due to mechanical or electrical failure of the oil circuit breaker, the circuit breaker can be isolated and bypassed by means of manual switching operations. A physical disruption of the short section of 230-kV line from the switchyard to the plant is considered highly unlikely.

(4) Loss of either 230-kV/12-kV standby startup transformer 11 or 21 or the associated 12-kV breakers or buses. Standby startup transformers 11 and 21 are normally separated on the 12-kV side, with transformer 11 feeding Unit 1 and transformer 21 feeding Unit 2. In case of a failure of

either transformer, the faulted transformer can be manually switched out of service, its bus can then be transferred to the other transformer by closing the 12-kV bus tie vacuum circuit breaker. This circuit breaker is common to the 12-kV standby startup buses of Units 1 and 2, and is normally kept open (i.e., procedurally controlled).

(5) Failure of 12-kv/4.16-kV standby startup transformer 12 (22). By means of manual switching after a failure, the buses served from this transformer can be supplied from the 230-kV system by unit auxiliary transformer 12 (22) through unit auxiliary transformer 11 (21), fed from the 12-kV standby startup bus. This requires removal of links in the generator bus at the main transformer as well as opening of the disconnecting switch to the generator. This is an unusual configuration and is used only when better methods are not available.

8.2.3.6 10 CFR 50.63 Loss of All Alternating Current Power

The 230-kV system or the 500-kV system is used for restoration of offsite power following a station blackout (SBO). The plant procedures for SBO use several different flow paths to restore ac power and place the plant in a safe, controlled condition. Refer to Section 8.3.1.6 for additional discussion.

8.2.3.7 Safety Guide 32, August 1972 Use of IEEE Standard 308-1971 Criteria for Class 1E Electric Systems for Nuclear Power Generating Stations

Safety Guide 32, August 1972 identifies a conflict between IEEE 308-1971 and GDC 17, 1971 specifically with respect to the time at which the delayed access circuit is required. Safety Guide 32, August 1972 allows a delayed access circuit provided that the availability of the delayed access circuit conforms to requirements of GDC 17, 1971.

The startup offsite power circuit provides standby startup power, and is immediately available following a loss-of-coolant accident to assure that core cooling, containment integrity, and other vital safety functions are maintained. The auxiliary offsite power circuit provides a delayed access source of preferred power supply to the plant auxiliary systems and Class 1E buses when the main generator is not in operation. The auxiliary offsite power circuit is available in sufficient time to safely shutdown the plant following anticipated operational occurrences. In the event of a loss of main generator output, the auxiliary offsite power circuit could be placed in service after about 30 minutes to ensure that specified acceptable fuel design limits and design conditions of the reactor coolant boundary are not exceeded.

The position of the motor-operated disconnect switch is verified prior to backfeeding from the 500-kV switchyard.

After the two 500-kV breakers are opened, operations personnel coordinate with PG&E's Grid Control Center to realign plant protective relaying; open the generator disconnect; and re-close the generator output breakers.

8.2.4 TESTS AND INSPECTIONS

Refer to Section 8.2.3.3 for inspection and testing of electric power systems.

8.2.5 INSTRUMENTATION APPLICATIONS

The tap position on each 230-kV/12-kV startup/standby transformer LTC is monitored in the DCPP Main Control Room. Malfunctioning of the LTC is alarmed in the Main Control Room.

8.2.6 REFERENCES

1. License Amendment Request 98-01 submitted to the NRC by PG&E letters DCL-98-008, dated January 14, 1998; DCL-98-076, dated May 19, 1998; DCL-99-013, dated February 5, 1999, and DCL-99-018, dated February 5, 1999. Also PG&E letter DCL-99-014, dated February 5.

2. NRC letter to PG&E, dated April 29, 1999, granting License Amendments No. 132 to Unit 1 and No. 130 to Unit 2.

3. Deleted in Revision 21.

4. PG&E Substation and Transmission Drawing 435895, "Arrangement of 230-kV Switch, Bus, and Circuit Breaker Structures (DCPP)"

5. PG&E Substation and Transmission Drawing 57486, "Arrangement of 500-kV Switch, Bus, and Circuit Breaker Structures (DCPP)"

6. WECC "Reliability Criteria", Part 1, "NERC/WECC Planning Standards"

7. IEEE Standard 308-1971, Criteria for Class IE Electric Systems for Nuclear Power Generation

8. NRC Letter to PG&E, dated December 14, 2009, Safety Evaluation, Diablo Canyon Power Plant, Unit Nos. 1 and 2 - Request for Technical Specification Interpretation of 230 Kilovolt System Operability (TAC Nos. ME0711 and ME0712).

8.2.7 REFERENCE DRAWINGS

Figures representing controlled engineering drawings are incorporated by reference and are identified in Table 1.6-1. The contents of the drawings are controlled by DCPP procedures.

8.3 ONSITE POWER SYSTEMS

The onsite power systems consist of all sources of electric power and their associated distribution systems within the DCPP. Included are the main generators, emergency diesel generators (EDGs), and the vital and nonvital station batteries.

8.3.1 AC POWER SYSTEMS

As described in the introduction (Section 8.1), the onsite ac systems consist of the 25-kV, 12-kV, 4.16-kV, and 480-V power systems, the 208Y/120-V lighting system, and the 120-Vac instrument supply systems.

8.3.1.1 Description

Auxiliary power for normal plant operation is supplied by each unit's main generators through the unit auxiliary transformers (see Figure 8.1-1), except during startups and shutdowns. Auxiliary power for startups and shutdowns is supplied by offsite power sources. If offsite power is unavailable, auxiliary shutdown power is furnished by the emergency diesel generators.

8.3.1.1.1 25-kV System

As described in Section 8.2.2.2, the auxiliary offsite power circuit consists of the 500-kV switchyard breakers 532, 542, 632 and 642 and lines to the main transformers and the portion of the 25-kV onsite distribution system which provide power to the onsite Class 1E 4.16-kV distribution system.

8.3.1.1.1.1 Design Bases

8.3.1.1.1.1.1 General Design Criterion 17, 1971 – Electric Power Systems

The auxiliary offsite power circuit provides a delayed access source of preferred power supply after the main generator is disconnected to assure specified fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded as a result of anticipated operation occurrences. The auxiliary offsite power circuit is available in sufficient time to safely shut down the plant following a loss of the normal onsite power source and the startup offsite power circuit.

8.3.1.1.1.1.2 General Design Criterion 18, 1971 – Inspection and Testing of Electric Power Systems

The 25-kV system design permits appropriate periodic inspection and testing of functional and operational performance of the system as a whole and under conditions as close to design as practical.

8.3.1.1.1.1.3 10 CFR 50.63 - Loss of All Alternating Current Power

The 25-kV system is used for restoration of the preferred power supply following a station blackout (SBO).

8.3.1.1.1.1.4 Safety Guide 32, August 1972 – Use of IEEE Standard 308-1971, Criteria for Class 1E Electrical Systems for Nuclear Power Generating Stations

Safety Guide 32, August 1972 identifies a conflict between IEEE 308-1971 and GDC-17, 1971 with respect to the time at which the delayed access offsite power circuit is required. Safety Guide 32, August 1972 supports a delayed access offsite power circuit provided that the availability of the delayed access offsite power circuit conforms to the requirements of GDC 17, 1971.

The auxiliary offsite power circuit provides a delayed access source of preferred power supply within sufficient time as required by GDC 17, 1971, after the main generator is disconnected.

8.3.1.1.1.1.5 Single Failure Requirements

The preferred power supply has sufficient independence, capacity and testability to permit the operation of the ESF systems assuming a failure of a single active component.

8.3.1.1.1.2 System Description

The main electrical generator output voltage is 25-kV. Approximately 96 percent of the generated power is transformed to 500-kV at the main transformers, and the remainder is transformed to 12-kV and 4.16-kV at the unit auxiliary transformers. The portion of the 25-kV system which is part of the auxiliary offsite power circuit provides access to the 500-kV preferred power supply after the main generator is disconnected by operating the isophase bus motor operated generator disconnect switch.

8.3.1.1.1.3 Safety Evaluation

8.3.1.1.1.3.1 General Design Criterion 17, 1971 – Electric Power Systems

The portion of the 25-kV system which is part of the auxiliary offsite power circuit is designed to assure specified fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded in the event of the loss of the standby power source or the startup offsite power circuit. The capability and capacity of the auxiliary offsite power circuit is adequate to power both ESF and non-ESF functions. Refer to Section 8.2.3.2.

8.3.1.1.1.3.2 General Design Criterion 18, 1971 – Inspection and Testing of Electric Power Systems

Periodic testing and surveillance of the 500-kV/25-kV main transformers and the 25-kV/4.16-kV transformers are part of the normal DCPP program for oil-filled transformers.

The DCPP surveillance program confirms the availability of the auxiliary offsite power circuit by verifying the correct 25-kV isolated phase bus motor operated disconnect (MOD) switch alignment and voltage levels.

8.3.1.1.1.3.3 10 CFR 50.63 – Loss of All Alternating Current Power

The 25-kV system is a part of the auxiliary offsite power circuit used for restoration of the preferred power supply following a SBO. Refer to Section 8.3.1.6 for further discussion of SBO.

8.3.1.1.1.3.4 Safety Guide 32, August 1972 – Use of IEEE Standard 308-1971, Criteria for Class 1E Electrical Systems for Nuclear Power Generating Stations

The portion of the 25-kV system which is part of the auxiliary offsite power circuit provides access to the auxiliary offsite power circuit after the main generator is disconnected. Refer to Section 8.2.3.7.

8.3.1.1.1.3.5 Single Failure Requirements

A failure of a single active component in the 25-kV portion of the auxiliary offsite power circuit does not result in a complete loss of the preferred power supply. Refer to Section 8.2.3.5.

8.3.1.1.1.4 Tests and Inspections

Refer to 8.3.1.1.1.3.2 for test and inspection details.

8.3.1.1.1.5 Instrumentation Applications

Equipment monitoring instrumentation is provided for the 25-kV isophase bus and main transformer banks.

8.3.1.1.2 12-kV System

As described in Section 8.2.2.1, the startup offsite power circuit consists of the 230-kV switchyard breaker (212) and lines to the standby startup transformers and a portion of the 12-kV onsite distribution which provides power to the onsite Class 1E 4.16-kV distribution system.

8.3.1.1.2.1 Design Bases

8.3.1.1.2.1.1 General Design Criterion 2, 1967 – Performance Standards

The portion of the 12-kV system which provides input to the reactor trip system (RTS), undervoltage (UV) relays and underfrequency (UF) relays, is designed to withstand the effects of, or is protected against, natural phenomena such as earthquakes, flooding, tornadoes, winds, and other local site effects.

8.3.1.1.2.1.2 General Design Criterion 4, 1967 – Sharing of Systems

The 12-kV system and components are not shared by the DCPP Units unless safety is shown to not be impaired by the sharing.

8.3.1.1.2.1.3 General Design Criterion 11, 1967 – Control Room

The 12-kV system is designed to support actions to maintain and control the safe operational status of the plant from the control room.

8.3.1.1.2.1.4 General Design Criterion 12, 1967 – Instrumentation and Control System

Instrumentation and controls are provided as required to monitor and maintain 12-kV system variables within prescribed operating ranges.

8.3.1.1.2.1.5 General Design Criterion 15, 1967 – Engineered Safety Features Protection Systems

The 12-kV system design provides input to the solid state protection system (SSPS) through bus monitoring UV and UF relays for the reactor coolant pumps (RCPs). The UV and UF relays monitor the 12-kV bus for accident situations through potential transformer sensing circuits.

8.3.1.1.2.1.6 General Design Criterion 17, 1971 – Electric Power Systems

The startup offsite power circuit is designed to provide an immediate access source of preferred power supply from the 230-kV switchyard to the ESF buses within a few seconds after a loss-of-coolant accident. A portion of the 12-kV system (from the standby startup transformer 11(21) through the standby startup transformer 12(22) to the 4.16-kV Class 1E buses) is designed with sufficient capacity and capability, and is immediately available to operate the engineered safety features following a design basis accident to assure that core cooling, containment integrity, and other vital safety functions are maintained.

8.3.1.1.2.1.7 General Design Criterion 18, 1971 – Inspection and Testing of Electric Power Systems

The 12-kV system design permits appropriate periodic inspection and testing of functional and operational performance of the system as a whole and under conditions as close to design as practical.

8.3.1.1.2.1.8 General Design Criterion 49, 1967 – Containment Design Basis

The 12-kV system circuits routed through containment electrical penetrations are designed to support the containment design basis such that the containment structure can accommodate, without exceeding the design leakage rate, pressure and temperatures following a loss-of-coolant accident.

8.3.1.1.2.1.9 Single Failure Requirements

The preferred power supply has sufficient independence, capacity and testability to permit the operation of the ESF systems assuming a failure of a single active component in the 12-kV system.

8.3.1.1.2.1.10 10 CFR 50.63 – Loss of All Alternating Current Power

The 12-kV system is a part of the auxiliary offsite power circuit used for restoration of the preferred power supply following a SBO.

8.3.1.1.2.1.11 Safety Guide 32, August 1972 – Use of IEEE Standard 308-1971 Criterion for Class 1E Electric Systems for Nuclear Power Generating Stations

Safety Guide 32, August 1972 identifies a conflict between IEEE 308-1971 and GDC 17, 1971 specifically with respect to the time at which the delayed access offsite power circuit is required. Safety Guide 32, August 1972 supports a delayed access offsite power circuit provided that the availability of the delayed access offsite power circuit conforms to the requirements of GDC 17, 1971.

The startup offsite power circuit is the immediate source of the preferred power supply following a design basis accident or unit trip.

8.3.1.1.2.1.12 Regulatory Guide 1.63, Revision 1, May 1977 – Electrical Penetration Assemblies in Containment Structures for Light-Water-Cooled Nuclear Plants

The 12-kV circuits routed through containment electrical penetrations are designed to the requirements of Regulatory Guide 1.63, Revision 1 regarding installation of redundant or backup fault current protection devices to limit fault current to less than

that which the penetration can withstand, assuming a single random failure of the circuit overload protective device.

8.3.1.1.2.2 System Description

The 12-kV system for each unit is a three-phase, three-wire, high-resistance-grounded non-Class 1E system that serves two circulating water pumps and the four reactor coolant pumps. The loads are divided into two groups, each served by a separate bus having two sources: one from the main generator through the unit auxiliary transformer 11(21) and one from the 230-kV transmission system through standby startup transformer 11(21), as shown in Figures 8.1-1, 8.3-1, 8.3-2, and 8.3-5.

Auxiliary buildings and other loads not associated with power generation are normally fed from two 12-kV circuit breakers on the startup bus of each unit.

The 12-kV system is provided with metalclad switchgear located indoors. Refer to Figures 8.1-1, 8.3-2 and 8.3-5 for detailed component ratings and vendor information. Each bus section is separated from the other by an aisle space, and each circuit breaker cubicle is separated from adjacent units by metal barriers. The 230-kV/12-kV standby startup transformer 11(21) load tap changers (LTCs) are described in Section 8.2.2. A grounding transformer is provided on each 12-kV source. No ESF loads are served at 12-kV; however, the startup bus is part of the startup offsite power circuit between the 230-kV switchyard and the 4.16-kV Class 1E buses for each respective unit (refer to Figure 8.1-1).

8.3.1.1.2.3 Safety Evaluation

8.3.1.1.2.3.1 General Design Criterion 2, 1967 – Performance Standards

The 12-kV undervoltage and underfrequency circuits are contained within the PG&E Design Class II turbine building. This building or applicable portions have been designed not to impact PG&E Design Class I components and associated safety functions. Refer to Sections 3.2.1, 3.3.2.3.2.8, 3.4.1, 3.5.1.2, and 3.7.2.1.7.2 for additional information. Analyses have been performed to assure that the lack of seismic qualification and seismic installation of these inputs will not degrade the function of the RTS from these monitoring channels. Refer to Section 7.2.3.1 for additional discussion.

8.3.1.1.2.3.2 General Design Criterion 4, 1967 – Sharing of Systems

The 12-kV system is designed with cross-tie capability to align a single 230-kv/12-kv standby startup transformer (11 or 21) to provide power to both units via the cross-tie breaker. Operation in this configuration is restricted by Technical Specification. The shared portion of the 12-kV system is designed with sufficient capacity and capability to operate the engineered safety features for a design basis accident (or unit trip) on one unit, and those systems required for a concurrent safe shutdown of the second unit consistent with the requirements of IEEE 308-1971, Section 8 (Reference 3).

8.3.1.1.2.3.3 General Design Criterion 11, 1967 – Control Room

Each 12-kV bus is provided with a voltmeter and ammeter mounted on the control room main control board for remote indication to facilitate actions that maintain the safe operational status of the plant.

8.3.1.1.2.3.4 General Design Criterion 12, 1967 – Instrumentation and Control Systems

The startup switchgear has internally mounted potential transformers (PT) and current transformers (CT) for maintaining and operating the 12-kV system within prescribed operating ranges through use of the 230-kV/12-kV standby startup transformer 11(21) load tap changer (LTC). Refer to Section 8.2.2.1 for additional discussion.

8.3.1.1.2.3.5 General Design Criterion 15, 1967 – Engineered Safety Features Protection Systems

The 12-kV system provides input to the SSPS for reactor protection through UV and UF sensors. Refer to Section 7.2.3.1 for additional discussion.

8.3.1.1.2.3.6 General Design Criterion 17, 1971 – Electric Power System

The DCPP offsite power system is designed to supply offsite electrical power by two physically independent circuits. The portion of the 12-kV system from the 230-kv/12-kV standby startup transformer 11(21) through the 12-kv/4.16-kv standby startup transformer 12(22) to the 4.16-kV Class 1E buses provide startup and standby power, and is immediately available following a design basis accident to assure that core cooling, containment integrity, and other vital safety functions are maintained. The portion of the 12-kV system which is part of the immediately available offsite power circuit is designed with sufficient capacity and capability to operate the engineered safety features (ESF) following a design basis accident. The startup bus portion of the 12-kV system is included in the startup offsite power circuit and provides input to the startup transformer 11(21) LTC controller for voltage control. The capability of the 12-kV startup bus is adequate to power both ESF and non-ESF functions. Refer to Section 8.2.3.2.1 for additional discussion of capacity and capability of the startup offsite power circuit.

8.3.1.1.2.3.7 General Design Criterion 18, 1971 – Inspection and Testing of Electric Power Systems

Periodic testing and surveillance of the standby startup transformers and the 12-kV/4.16-kV transformers are part of the normal DCPP program for oil-filled transformers.

The DCPP surveillance program confirms the availability of the startup offsite power circuit by verifying the correct breaker alignments, voltage levels, and compensatory measures.

8.3.1.1.2.3.8 General Design Criterion 49, 1967 – Containment Design Basis

The 12-kV circuits routed through containment electrical penetrations are each provided with electrical protection devices. This arrangement is such that with the failure of one device, the penetration remains protected from high current temperature by the other in-series device to ensure the containment penetration remains functional (refer to Section 3.8.1.1.3 and 8.3.1.4.8 for additional details).

8.3.1.1.2.3.9 Single Failure Requirements

A failure of a single active component in the 12-kV portion of the startup offsite power circuit does not result in a complete loss of the preferred power supply. Refer to Section 8.2.3.5.

8.3.1.1.2.3.10 10 CFR 50.63 – Loss of All Alternating Current Power

A portion of the 12-kV system is used as an attendant distribution system of the 230-kV offsite power circuits used for restoration of offsite power following a SBO event. The plant procedures for SBO and loss-of-offsite power (LOOP) use several different flow paths to restore ac power and place the plant in a safe, controlled cooldown. Refer to Section 8.3.1.6 for further discussion of SBO.

8.3.1.1.2.3.11 Safety Guide 32, August 1972 – Use of IEEE Standard 308-1971 Criterion for Class 1E Electric Systems for Nuclear Power Generating Stations

The portion of the 12-kV system from the standby startup transformer 11(21) through the standby startup transformer 12(22) to the 4.16-kV Class 1E buses provides startup and standby power, and is immediately available following a design basis accident or unit trip to assure that core cooling, containment integrity, and other vital safety functions are maintained. The immediately available 12-kV startup bus is continuously energized to support the immediate availability of the startup offsite power circuit. Refer to Section 8.2.3.7.

8.3.1.1.2.3.12 Regulatory Guide 1.63, Revision 1, May 1977 – Electrical Penetration Assemblies in Containment Structures for Light-Water-Cooled Nuclear Plants

12-kV circuits routed through containment electrical penetrations are designed with redundant overcurrent protection. Refer to Section 8.3.1.4.8 for additional details.

8.3.1.1.2.4 Tests and Inspections

Refer to Section 8.3.1.1.2.3.7 for test and inspection details.

8.3.1.1.2.5 Instrumentation Applications

Refer to Section 8.3.1.1.2.3.4 for instrumentation applications.

8.3.1.1.3 4.16-kV System

8.3.1.1.3.1 Design Bases

8.3.1.1.3.1.1 General Design Criterion 2, 1967 – Performance Standards

The Class 1E portion of the 4.16-kV system is designed to withstand the effects of, or is protected against, natural phenomena such as earthquakes, flooding, tornados, winds, and other local site effects.

8.3.1.1.3.1.2 General Design Criterion 3, 1971 – Fire Protection

The Class 1E portion of the 4.16-kV system is designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

8.3.1.1.3.1.3 General Design Criterion 11, 1967 – Control Room

The Class 1E portion of the 4.16-kV system is designed to support actions to maintain and control the safe operational status of the plant from the control room or from an alternate location if control room access is lost due to fire or other causes.

8.3.1.1.3.1.4 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Instrumentation and controls are provided as required to monitor and maintain 4.16-kV system variables within prescribed operating ranges.

8.3.1.1.3.1.5 General Design Criterion 17, 1971 – Electric Power Systems

The Class 1E portion of the 4.16-kV system is designed with sufficient capacity, capability, independence, redundancy, and testability to perform its safety function assuming a single failure.

8.3.1.1.3.1.6 General Design Criterion 18, 1971 – Inspection and Testing of Electric Power Systems

The Class 1E portion of the 4.16-kV system design permits appropriate periodic inspection and testing of functional and operational performance of the system as a whole and under conditions as close to design as practical.

8.3.1.1.3.1.7 General Design Criterion 21, 1967 – Single Failure Definition

The Class 1E portion of the 4.16-kV system is designed to remain operable after sustaining a single failure. Multiple failures resulting from a single event shall be treated as a single failure.

8.3.1.1.3.1.8 General Design Criterion 40, 1967 – Missile Protection

The portions of the Class 1E 4.16-kV system, that support ESF loads, are designed to be protected against dynamic effects and missiles that might result from plant equipment failures.

8.3.1.1.3.1.9 10 CFR 50.49 – Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants

The Class 1E 4.16-kV system electrical components that require environmental qualification (EQ) are qualified to the requirements of 10 CFR 50.49.

8.3.1.1.3.1.10 10 CFR 50.63 – Loss of All Alternating Current Power

The Class 1E 4.16-kV system provides power to the loads required to support systems that assure core cooling and containment integrity is maintained following a SBO event.

8.3.1.1.3.1.11 10 CFR Part 50 Appendix R (Sections III.G, III.J, and III.L) – Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979

Section III.G – Fire Protection of Safe Shutdown Capability: Fire protection of the Class 1E portion of the 4.16-kV system is provided by a combination of physical separation, fire-rated barriers, and/or automatic suppression and detection.

Section III.J – Emergency Lighting: Emergency lighting or battery operated lights (BOLs) are provided in areas where operation of the 4.16-kV system may be required to safely shut down the Unit following a fire.

Section III.L – Alternative and Dedicated Shutdown Capability: Safe shutdown capabilities are provided in the control room and at an alternate location via the hot shutdown panel (HSP) or locally at the 4.16-kV switchgear, for equipment power by the 4.16-kV system required for the safe shutdown of the plant following a fire event.

8.3.1.1.3.1.12 Safety Guide 6, March 1971 – Independence Between Redundant Standby (Onsite) Power Sources and Between their Distribution Systems

The Class 1E portion of the 4.16-kV system is designed so that electrically powered loads are separated into redundant load groups such that loss of any one group will not prevent the minimum safety functions from being performed.

8.3.1.1.3.1.13 Regulatory Guide 1.97, Revision 3, May 1983 – Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident

The 4.16-kV system provides instrumentation in the control room to monitor 4.16-kV system electrical status for post-accident instrumentation.

8.3.1.1.3.2 System Description

The 4.16-kV system is a three-phase, three-wire, high-resistance-grounded neutral system that serves motors from 200 to 3000 hp, and transformers for the smaller loads at the lower voltages. The Class 1E 4.16-kV distribution system provides power to ESF loads to safely shut down the unit. The 4.16-kV loads are divided into five groups; two of these groups are not vital to the ESFs and are connected to non-Class 1E 4.16-kV buses D and E. Each of the non-Class 1E buses has two sources of preferred power supply: one from the main generator (or the 500-kV system through the main transformer) through the 25-kV/4.16-kV unit auxiliary transformer 12(22), and one from the 230-kV transmission system through the 230-kV/12-kV standby startup transformers 11(21) and 12-kV/4.16-kV standby startup transformers 12(22). Refer to Figures 8.1-1, 8.3-3, and 8.3-5). Utility power for the 230-kV and 500-kV switchyards is provided from the Unit 1, non-Class 1E, 4.16-kV switchgear buses D and E, respectively. Refer to Sections 8.2.2.1 (230-kV system) and 8.2.2.2 (500-kV system) for further discussion.

The other three load groups are important to safety and are connected to 4.16-kV Class 1E buses F, G, and H. Each of these buses has three sources: two being the immediate and delayed preferred power supply, and the standby power supply from the diesel-driven generators (refer to Figures 8.3-3 and 8.3-4).

As noted in Section 8.2.3.2, compensatory action will be taken as necessary to ensure that the ESF motor terminal voltages are within their acceptable voltage tolerance (typically ±10 percent) when fed from the preferred power supply. Once started, the motors will operate with applied voltages as low as 70 percent of rated voltage without breakdown, but the time is limited because of motor heating.

The 4.16-kV system is provided with metal clad switchgear and breakers rated at 350-MVA interrupting capacity, and 78,000 amperes of closing and latching capability. The circuit breakers are in individual cubicles, each separated from the adjacent circuit breakers by metal barriers. All 4.16-kV switchgear is located in the turbine building.

The non-Class 1E 4.16-kV switchgear is located in the same room as the 12-kV switchgear and have the two bus sections separated by a common aisle. The Class 1E 4.16-kV switchgear is located in rooms separated from each other and from non-Class 1E equipment (refer to Figures 1.2-14, 1.2-15, 1.2-16, 1.2-18, 1.2-19, and 1.2-20).

The unit auxiliary and standby startup transformers are equipped with an automatic water spray deluge system that can be manually actuated locally at the system valves or remotely from the control room (refer to Section 9.5.1.2.4).

8.3.1.1.3.3 Safety Evaluation

8.3.1.1.3.3.1 General Design Criterion 2, 1967 – Performance Standards

The Class 1E 4.16-kV switchgear and associated 4.16-kV/120-Vac potential transformers and safeguard relay boards are located in the PG&E Design Class II turbine building. This building, or applicable portions thereof, has been designed not to impact PG&E Design Class I components and associated safety functions (refer to Section 3.7.2.1.7.2). The turbine building is designed to withstand the effects of winds and tornados (refer to Section 3.3.1.2 and 3.3.2.3.2.8), floods and tsunamis (refer to Section 3.4), external missiles (refer to Section 3.5), and earthquakes (refer to Section 3.7.2.1.7.2) to protect the Class 1E 4.16-kV switchgear and associated 4.16-kV/120-Vac potential transformers and safeguard relay boards, ensuring their design function will be performed.

The 4.16-kV switchgear and associated 4.16-kV/120-Vac potential transformers and safeguard relay boards are seismically designed to perform their safety functions under the effects of earthquakes (refer to Section 3.10.2.7).

8.3.1.1.3.3.2 General Design Criterion 3, 1971 – Fire Protection

The Class 1E 4.16-kV switchgear and cable spreading room are designed to the fire protection guidelines of Branch Technical Position (BTP) Auxiliary and Power Systems Branch (APCSB) 9.5-1 (refer to Appendix 9.5B Table B-1).

Refer to Section 8.3.1.4.9 for further discussion on fire barriers and separation.

8.3.1.1.3.3.3 General Design Criterion 11, 1967 – Control Room

The Class 1E 4.16-kV supply and load breakers are controlled remotely from the main control room and locally at their respective switchgear cubicles. The supply breaker for each Class 1E load center transformer is equipped with an isolation switch, located at the switchgear that disconnects breaker control from the control room in the event that the main control room is rendered uninhabitable. The hot shutdown panel (HSP), which is the alternate control location in the event that the main control room is rendered uninhabitable, is provided with a mode switch, control switch and status indication for each of the pumps required to bring the plant to a safe shutdown condition. It is also

provided with a voltage indication of each Class 1E 4.16-kV bus. Transfer switches are located in the Class 1E 4.16-kV switchgear cubicles to isolate 4.16-kV circuit breaker control cables between the main control room and the switchgear and transfer control of the breaker locally to the HSP or the switchgear. Alarms are provided in the control room to monitor the status of the 4.16-kV system and alert the plant when an abnormal condition is detected. Refer to Section 8.3.1.1.3.3.4 for additional instrumentation and control information.

8.3.1.1.3.3.4 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Control switches, status indication and ammeters are provided in the main control room and at the respective switchgear cubicle for all the motor load and load center transformer feeder breakers. Additionally, watt and var meters are provided for each load center transformer feeder in the main control room as well as voltage indication for each 4.16-kV bus.

The unit auxiliary and standby startup transformers feeding the 4.16-kV buses are provided with an ammeter, voltmeter, wattmeter, varmeter, watt-hour meter and an indicating light in the main control room.

8.3.1.1.3.3.5 General Design Criterion 17, 1971 – Electric Power Systems

Each Unit’s Class 1E 4.16-kV distribution system is comprised of three electrically independent and redundant load groups. Each Class 1E switchgear, including its associated relay board, is located in separate rooms and meets the single failure criteria. If a single failure occurs in any of the three load groups, the remaining load groups have sufficient capability and capacity to provide power to ESF loads required to safely shut the unit down.

Each load group is normally supplied power from the main generator via the unit auxiliary transformer. In the event of a unit trip or accident condition, the power source to each Class 1E, 4.16-kV switchgear is automatically transferred to the immediate preferred power source via the standby startup transformers 11 and 12 (21 and 22) in series. If the transfer to the standby startup transformer is unsuccessful or if there is a loss of voltage or degraded voltage from the standby startup transformer, undervoltage protection for each Class 1E 4.16-kV bus is provided by the first level undervoltage relays (FLUR) and second level undervoltage relays (SLUR). These sets of relays and associated timers start the EDG, perform a load shed on its respective bus and transfer loading to the EDG in the event the preferred power supply is unavailable or in a degraded condition. Refer to Figure 8.3-16.

8.3.1.1.3.3.5.1 Class 1E Bus Undervoltage Protection Design Criteria

The emergency electric power system including each Class 1E bus and its control, protection, and instrumentation is designed in accordance with IEEE 308-1971 (Reference 3), IEEE 279-1971 (Reference 4), and the following supplemental NRC positions regarding the susceptibility to sustained degraded voltage conditions and the interaction of the preferred power supply and standby power supply (Reference 26).

(1) Second Level Undervoltage Protection with Time Delay:

A second level of voltage protection for the onsite power system is provided (i.e. in addition to loss of voltage protection). The preferred power supply is the common source that normally supplies power to the redundant Class 1E buses. Any transient or sustained degradation of this common source will be reflected onto the onsite Class 1E electrical distribution system. A sustained degradation of the preferred power supply voltage could result in the loss of capability of the redundant safety loads, their control circuitry, and the associated electrical components required for performing safety functions. The following requirements ensure adequate protection from this common mode failure mechanism:

(a) The selection of voltage and time set points are based on an analysis of the voltage requirements of the safety related loads at all onsite system distribution levels;

(b) The voltage protection includes coincidence logic to preclude spurious trips of the preferred power supply;

(c) The time delay selection is based on the following conditions:

i) The allowable time delay, including margin, does not exceed the maximum time delay that is assumed in the accident analyses;

ii) The time delay minimizes the effect of short duration disturbances from reducing the availability of the preferred power supply;

iii) The allowable time duration of a degraded voltage condition at all distribution system levels does not result in failure of safety systems or components;

(d) The voltage sensors automatically initiate the disconnection of the preferred power supply whenever the voltage set point and time delay limits have been exceeded; and

(e) The voltage sensors are designed to satisfy the applicable requirements of IEEE 279-1971 (Reference 4).

(2) Interaction of Onsite Power Supplies with Load Shed Feature:

The second level undervoltage logic (i.e. degraded grid) input to the load shed feature for each Class 1E 4.16-kV bus is inhibited when the EDG output breaker is closed and the Auxiliary preferred power supply feeder breaker is open (i.e. bus is solely energized by the standby power supply). The second level undervoltage logic input to the load shed feature is also inhibited when EDG is paralleled to the startup preferred power supply. The second level undervoltage logic input to the load shed feature is automatically reinstated when the EDG output breaker opens.

8.3.1.1.3.3.5.2 Operation of 4.16-kV Distribution System

The ESF loads and their onsite sources are grouped so the functions required during a major accident are provided regardless of any single failure in the electrical system. Any two of the three diesel generators and their buses are adequate to serve at least the minimum required ESF loads of a unit after a major accident.

During normal operation, the main generator supplies the auxiliary load for each unit. The circuit breakers on 4.16-kV Class 1E buses F, G, and H, which feed the ESFs, are aligned as follows:

(1) 4.16-kV circuit breakers that are open:

(a) Diesel-driven generators

(b) Standby startup Transformer 12 (22)

(c) Safety injection pumps

(d) Containment spray pumps

(e) Auxiliary feedwater pumps

(f) Residual heat removal (RHR) pumps

(2) 4.16-kV circuit breakers that are closed:

(a) Unit auxiliary transformer 12 (22)

(b) 4.16-kV/480-V Class 1E load centers that provide power for pumps, fans, valves, and other low-voltage devices

(3) 4.16-kV circuit breakers that may be either open or closed, depending on the operating conditions of the following pumps:

(a) Charging pumps

(b) Auxiliary saltwater (ASW) pumps

(c) Component cooling water (CCW) pumps

To achieve the objective of an adequate source of electrical power for the Class 1E 4.16 kV buses F, G, and H, the electrical systems are designed to operate as follows:

In the event of a loss of satisfactory electrical power from the main generating unit, due to a unit trip, a safeguard signal, or a loss of voltage on the bus, the Class 1E 4.16-kV buses are automatically disconnected immediately from the main unit as a source.

If power is available from the startup offsite power circuit, the Class 1E 4.16-kV buses are transferred to this source automatically after a short delay to allow for voltage decay on the motors that were running.

The delayed method of transfer is used to protect the ESF motors from overvoltage transients. The advantage of motor protection is greater than any disadvantage of reduced operating capacity during the short delay period, especially in view of the fact that when there is also a loss of startup offsite power circuit, the delay in transferring to emergency power is on the order of 10 seconds (the time for the diesel generators to reach minimum bus voltage) plus load sequencing. Schematic diagrams of the automatic transfer circuits for the ESF buses are presented in Figures 8.3-9, 8.3-10, and 8.3-11; logic diagrams are shown in Figure 8.3-16.

Because the individual loads are not tripped under these circumstances, they remain in the same operating state as before the transfer, except for the low-voltage loads operated by magnetic controllers having no maintained contact control circuits, such as the containment fan coolers. Without an SIS signal, individual timers start the containment fan coolers and the ASW pump. The containment fan coolers would operate at the low speed after the transfer of the Class 1E power supply. With an SIS signal, the Class 1E loads are started in sequence in the same manner as with the diesel generators. As noted in Table 8.3-4, an SIS signal only allows the containment fan coolers to start on low speed.

Also, if bus voltage is not restored, the associated diesel generator is started automatically and brought to a condition suitable for loading.

Each of the following initiates the starting of the diesel generators:

(1) A safety injection (SI) actuation signal from either Train A or B of the ESF actuation system.

(2) Undervoltage on the startup offsite power circuit to each of the Class 1E 4.16-kV buses start its respective diesel.

(3) Sustained undervoltage or loss of voltage on any of the Class 1E 4.16-kV buses starts its respective diesel.

In each case, an independent set of signals or relays is applied to start the diesel for its bus. The first level undervoltage relay (initiating load shedding signal) for the startup offsite power circuit of each Class 1E 4.16-kV bus has inverse time characteristics and a slight delay upon complete voltage failure. The first level undervoltage relay has three select voltages and time delay settings, with the lowest being set at approximately 818-V.

The second level of undervoltage protection for each Class 1E 4.16-kV bus is set at approximately 3800-V. The protection consists of two relays for each bus having a two-out-of-two logic arrangement. Start of the respective diesel is delayed by 10 seconds. Bus loads are shed in 20 seconds, and bus transfer to the diesel generator takes place in 22 seconds. These timing features will prevent needless diesel starts during transient voltage dips, and provide adequate time delay for the startup offsite power circuit voltage to recover before transferring the bus to the diesel generator.

Should there be a loss of the startup offsite power circuit concurrent with the loss of onsite power (i.e., the main generating unit), the following events occur automatically, initiated by the first level of undervoltage protection:

(1) The 4.16-kV circuit breaker feeding the Class 1E 4.16-kV buses F, G, and H from the main generating unit is opened immediately.

(2) All three diesel generators for the unit are started and accelerated to normal frequency and minimum bus voltage in a period of less than 10 seconds.

(3) Should the startup offsite power circuit be restored before the diesel auto-transfer interlock relay actuates, the circuit breakers feeding the Class 1E 4.16-kV buses F, G, and H from the startup offsite power circuit are closed to restore power to the loads. First-level undervoltage relays have already shed loads. Loads, including certain ESF loads that may not have been operating, are started in the same manner and sequence as when fed from the diesel generator. The preferred power supply may be restored by reclosing the circuit breakers for the 230-kV transmission lines automatically and/or manually at Morro Bay switchyard under the control of the CAISO (refer to Section 8.2.3.2).

Should the startup offsite power circuit still be unavailable when the diesel generators have reached breaker close-in voltage, all circuit breakers from the standby power supply and startup offsite power circuit to these Class 1E 4.16-kV buses are given a trip signal independently to make sure they are open (the expected condition at this point). The startup offsite power circuit is automatically blocked from reclosing. The circuit

breakers for all loads, except the 4.16-kV/480-V load center transformers, have already been opened by the first level undervoltage relays. Each of the Class 1E 4.16-kV buses has a separate pair of these relays. The relays have a two-out-of-two logic arrangement for each bus to prevent inadvertent tripping of operating loads during a loss of voltage either from a single failure in the potential circuits or from human error. Also, one of the relays has an inverse time characteristic and a slight delay of about 4 seconds at no voltage to prevent loss of operating loads during transient voltage dips, and to permit the startup offsite power circuit to pick up the load.

The Class 1E buses are then isolated from the rest of the plant, and from each other, and therefore operate independently. Any required or desired bus interconnecting is done manually by the operator.

The 4.16-kV circuit breaker for each diesel generator then closes automatically to restore power to the Class 1E 4.16-kV bus, and, consequently, the 480-V and 120-Vac buses also. All 4.16-kV circuit breakers have stored-energy closing mechanisms and close in less than 0.1 seconds.

The loads that remain connected to the 480-V buses become energized at the same time as the buses (refer to Section 8.3.1.1.4). These loads are within the initial load pickup capability of the diesel generators and are composed of the Class 1E lighting, the battery chargers, etc.

Other 480-V and 120-Vac equipment that can also operate immediately are those that are under automatic process control, and those under control of the protection system for the ESFs.

When the bus voltage is restored by the diesel generators, the undervoltage relays that previously had tripped the loads will reset automatically. The individual loads are put into operation in a staggered sequence to reduce the effects of momentary loads and motor starting on the diesel generators (refer to Technical Specifications (Reference 5)). The timing sequences have been given a nominal 4-second interval between steps during an SI signal, and a nominal 2 to 6 seconds between steps without an SI signal. The overall time to complete starting of all Class 1E loads is limited to less than 1 minute. The remaining loads can then be put into operation as desired.

The timing sequence for each Class 1E bus is initiated only when voltage is restored to the bus. When the startup offsite power circuit is available, power to the buses is restored in a few seconds when the residual voltage on the motors drops to 25 percent of normal. Otherwise, the delay is the time required for the diesel generators to transfer to the bus (shed loads and reach the minimum bus voltage, approximately 10 seconds or less).

To improve independence of control and to provide flexibility in setting the delays, individual adjustable timing relays are used for each motor. In addition, separate sets of these timing relays are used, depending on the presence or absence of the safety

injection signal, so that response can be optimized for each condition. Should there be a second-level degraded grid condition, where the voltage of the Class 1E 4.16-kV buses remains at approximately 3,800 V or below, but above the setpoints of the first-level undervoltage relays, the following events occur automatically within the time periods stated in the Technical Specifications:

(1) After the specified time delay, the respective diesel generators will be started.

(2) After the next specified time delay, if the undervoltage condition persists, the circuit breakers for all loads to the respective Class 1E 4.16-kV buses, except the 4.16-kV/480-V load center transformer, are opened.

(3) Then the 4.16-kV circuit breakers from the normal onsite power source is given a trip signal to open the breaker feeding the bus and the standby power source breaker is already open, and then the circuit breaker for each respective diesel generator is closed.

(4) Restoration of normal voltage to the Class 1E 4.16-kV buses, supplied by the individual diesel generators, actuates timers that put loads back into operation in a staggered sequence.

Each Class 1E 4.16-kV bus has its own set of second level undervoltage relays and associated timers causing the above sequences. Again, the Class 1E buses are now isolated from each other and from the rest of the plant and operate independently. Any required or desired bus interconnection has to be done manually by the operator. The transfer and subsequent operation of the Class 1E buses, because of degraded grid undervoltage protection, is the same as described above for loss of the startup offsite power circuit concurrent with a loss of onsite power. However, no attempt will be made to transfer to the startup offsite power circuit. Switching directly to the diesel generators ensures fast restoration of reliable power to the Class 1E 4.16-kV buses.

The logic used in starting and loading the emergency diesel generators is shown in Figure 8.3 16. Schematic diagrams of these functions are shown in Figures 8.3-12, 8.3-13, and 8.3-14. A schematic diagram of the potential and synchronizing circuitry for the Class 1E buses is shown in Figure 8.3-20.

The starting inrush and momentary loads that occur during the initial phases of each interval will be handled by the short-time overload capability of the diesel generators. The diesel generators can maintain the electric power frequency and voltage at satisfactory levels during the cumulative loading of the successive steps.

The engine has an adequate short-time overload capability along with a fast response governor to hold the frequency. The generator has a low subtransient reactance and a voltage regulator with a fast response and a high excitation ceiling that will hold the voltage to a minimum of 75 percent of nominal during motor starting.

The Class 1E 4.16kv/480-V load centers are left connected to their buses and are, therefore, energized first. Their initial load will consist of the momentary loads of the equipment that was left on, in addition to those initiated during the interruption. The net initial load on the load center consists of those loads that operate for a short time, such as motor operated valves, auxiliary lube oil pumps, etc., and the normal steady-state values for the remainder.

The starting loads of the larger motors that are started subsequently have also been included in the capabilities of the diesel generators.

8.3.1.1.3.3.5.3 4.16-kV Emergency Loads

In the event of an emergency shutdown of the main generating unit in the absence of the preferred power supply, the loads supplied by the diesel generator are applied in the following manner:

(1) In the absence of a SI signal, the first set of timing relays will operate and start the loads listed:

    (a) The timing sequence and intervals are listed in Table 8.3-2. Notes for Table 8.3-2 and others in Section 8.3 are listed in Table 8.3-1.

    (b) The maximum steady-state load demand on the Class 1E 4.16-kV buses, immediately following a unit shutdown without a loss-of-coolant accident (LOCA), is as listed in Table 8.3-3.

(2) In the presence of a safety injection signal, the second set of timing relays operate and start the loads for the injection phase as listed in Table 8.3-4.

(3) The maximum steady-state load demand on the Class 1E 4.16-kV buses immediately following a unit shutdown, concurrent with a LOCA, is as listed in Table 8.3-5.

(4) The loadings of the Class 1E 4.16-kV/480-V load centers, following a unit shutdown, with or without a LOCA, are listed in Table 8.3-6. These loads may not necessarily all be on simultaneously; however, to be conservative they are all considered in maximum demand.

8.3.1.1.3.3.6 General Design Criterion 18, 1971 – Inspection and Testing of Electric Power Systems

Surveillance tests and inspections are performed periodically to demonstrate the 4.16-kV system's design basis requirements are met. The controls for the 4.16-kV system are designed to be capable of periodic testing to assure operational and

functional performance of the Class 1E components and operability of the system as a whole.

8.3.1.1.3.3.7 General Design Criterion 21, 1967 – Single Failure Definition

Each unit's Class 1E 4.16-kV distribution system is comprised of three electrically independent and redundant (refer to Section 8.3.1.4) Class 1E buses enclosed in separate rooms. If a single failure occurs in any of the three buses, the remaining buses have sufficient capability to provide power to ESF loads required to safely shut down the unit.

8.3.1.1.3.3.8 General Design Criterion 40, 1967 – Missile Protection

The portions of the Class 1E 4.16-kV system that are located in zones where provision against dynamic effects must be made, are protected from missiles, pipe whip, or jet impingement from the rupture of any nearby high-energy line (refer to Sections 3.5, 3.6, 8.3.1.4.10.2 and 8.3.1.4.10.3).

8.3.1.1.3.3.9 10 CFR 50.49 – Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants

The Class 1E 4.16-kV system SSCs required to function in harsh environments under accident conditions are qualified to the applicable environmental conditions to ensure that they will continue to perform their safety functions. Section 3.11 describes the DCPP EQ program and the requirements for the environmental design of the electrical and related mechanical equipment. The affected components are listed in the EQ Master List.

8.3.1.1.3.3.10 10 CFR 50.63 – Loss of All Alternating Current Power

The Class 1E portion of the 4.16-kV system serves to distribute power to loads required to bring the plant to a safe shutdown condition during a SBO. Refer to Section 8.3.1.6 for further discussion on station blackout.

8.3.1.1.3.3.11 10 CFR Part 50 Appendix R (Sections III.G, III.J, and III.L) – Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979

Section III.G – Fire Protection of Safe Shutdown Capability: 10 CFR Part 50 Appendix R requires the evaluation of the safe shutdown capability for DCPP in the event of a fire and loss of offsite power. The Class 1E 4.16-kV system satisfies the applicable requirements of 10 CFR Part 50 Appendix R, fire protection of safe shutdown capability (Appendix 9.5G).

Section III.J – Emergency Lighting: Emergency lighting or battery operated lights (BOL) are provided in areas where operation of the 4.16-kV system may be required for safe

shutdown following a fire as defined by 10 CFR Part 50, Appendix R, Section IIIJ (refer to Appendix 9.5D).

Section III.L – Alternative and Dedicated Shutdown Capability: Safe shutdown capabilities are provided in the control room and at an alternate location via the HSP or locally at the 4.16-kV switchgear as defined by 10 CFR Part 50, Appendix R, Section III.L. Refer to Section 7.4 for a discussion of the HSP and local switchgear controls for the 4.16-kV system. The ability to safely shut down the plant following a fire in any fire area is summarized in Section 4.0 of Appendix 9.5A.

Refer to Section 8.3.1.4.10.1 for additional discussion.

8.3.1.1.3.3.12 Safety Guide 6, March 1971 – Independence Between Redundant Standby (Onsite) Power Sources and Between their Distribution Systems

The three Class 1E 4.16-kV buses are physically enclosed in separate rooms and are electrically independent from each other when powered from their respective emergency diesel generators. Refer to Section 8.3.1.4 for further discussion on independence of redundant systems.

8.3.1.1.3.3.13 Regulatory Guide 1.97, Revision 3, May 1983 – Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident

Class 1E, Category 2 indication for each of the Class 1E 4.16-kV bus voltage and load center transformer primary amperage is provided in the control room for Regulatory Guide 1.97, Revision 3, monitoring. Refer to Table 7.5-6.

8.3.1.1.3.4 Tests and Inspections

Refer to Section 8.3.1.1.3.3.6 for test and inspections details.

8.3.1.1.3.5 Instrumentation Applications

Refer to Section 8.3.1.1.3.3.4 for instrumentation details.

8.3.1.1.4 480 Volt System

8.3.1.1.4.1 Design Bases

8.3.1.1.4.1.1 General Design Criterion 2, 1967 – Performance Standards

The Class 1E portion of the 480-V system is designed to withstand the effects of, or is protected against, natural phenomena such as earthquakes, flooding, tornados, winds, and other local site effects.

8.3.1.1.4.1.2 General Design Criterion 3, 1971 – Fire Protection

The Class 1E portion of the 480-V system is designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

8.3.1.1.4.1.3 General Design Criterion 4, 1967 – Sharing of Systems

The 480-V system or components are not shared by the DCPP Units unless safety is shown not to be impaired by the sharing.

8.3.1.1.4.1.4 General Design Criterion 11, 1967 – Control Room

The Class 1E portion of the 480-V system is designed to support actions to maintain and control the safe operational status of the plant from the control room or from an alternate location if control room access is lost due to fire or other causes.

8.3.1.1.4.1.5 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Instrumentation and controls are provided as required to monitor and maintain 480-V system variables within prescribed operating ranges.

8.3.1.1.4.1.6 General Design Criterion 17, 1971 – Electric Power Systems

The Class 1E portion of the 480-V system is designed to have sufficient capacity, capability, independence, redundancy, and testability to perform its safety function assuming a single failure.

8.3.1.1.4.1.7 General Design Criterion 18, 1971 – Inspection and Testing of Electric Power Systems

The Class 1E portion of the 480-V system design permits appropriate periodic inspection and testing of functional and operational performance of the system as a whole and under conditions as close to design as practical.

8.3.1.1.4.1.8 General Design Criterion 21, 1967 – Single Failure Definition

The Class 1E portion of the 480-V system is designed to remain operable after sustaining a single failure. Multiple failures resulting from a single event shall be treated as a single failure.

8.3.1.1.4.1.9 General Design Criterion 40, 1967 – Missile Protection

The portions of the Class 1E 480-V system that support ESF loads are designed to be protected against dynamic effects and missiles that might result from plant equipment failures.

8.3.1.1.4.1.10 General Design Criterion 49, 1967 – Containment Design Basis

The Class 1E and non-Class1E 480-V circuits routed through containment electrical penetrations are designed to support the containment design basis such that the containment structure can accommodate, without exceeding the design leakage rate, pressures and temperatures following a loss of coolant accident.

8.3.1.1.4.1.11 10 CFR 50.49 – Environmental Qualification of Electrical Equipment

The 480-V system electrical components that require environmental qualification are qualified to the requirements of 10 CFR 50.49.

8.3.1.1.4.1.12 10 CFR 50.63 – Loss of All Alternating Current Power

The Class 1E 480-V system provides power to the loads required to support systems that ensure core cooling and containment integrity is maintained following a station blackout event.

8.3.1.1.4.1.13 10 CFR Part 50 Appendix R (Sections III.G, III.J, and III.L) – Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979

Section III.G – Fire protection of Safe Shutdown Capability: Fire protection of the Class 1E portion of the 480-V system is provided by a combination of physical separation, fire-rated barriers, and/or automatic suppression and detection.

Section III.J – Emergency Lighting: Emergency lighting or BOLs are provided in areas where operation of the 480-V system may be required to safely shut down the unit following a fire.

Section III.L – Alternative and Dedicated Shutdown Capability: Safe shutdown capabilities are provided in the control room and at an alternate location via the hot shutdown panel (HSP) or locally at the 480-V switchgear, for equipment powered by the 480-V system required for the safe shutdown of the plant following a fire event.

8.3.1.1.4.1.14 Safety Guide 6, March 1971 – Independence Between Redundant Standby (Onsite) Power Sources and Between their Distribution Systems

The Class 1E portion of the 480-V system is designed such that electrically powered loads are separated into redundant load groups such that loss of any one group will not prevent the minimum safety functions from being performed.

8.3.1.1.4.1.15 Regulatory Guide 1.63, Revision 1, May 1977 – Electric Penetration Assemblies in Containment Structures for Light-Water-Cooled Nuclear Plants

The Class 1E and non-Class1E 480-V circuits routed through containment electrical penetrations are designed to meet the requirements of Regulatory Guide 1.63, Revision 1, for the installation of redundant or backup fault current protection devices. The protection devices are designed to limit fault current to less than which the penetration can withstand assuming a single random failure of the circuit overload protective device.

8.3.1.1.4.1.16 Regulatory Guide 1.97, Revision 3, May 1983 – Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident

The 480-V system provides instrumentation in the control room to monitor 480-V system electrical status for post-accident instrumentation.

8.3.1.1.4.1.17 NUREG-0737 (Items II.E.3.1 (1) and II.G.I (2)), November 1980 – Clarification of TMI Action Plan Requirements

Item II.E.3.1 (1) – Emergency Power for Pressurizer Heaters: The non-Class 1E pressurizer heater power supply design provides the capability to supply, from either the preferred offsite power source or the standby power source (when offsite power is not available), to a predetermined number of pressurizer heaters and associated controls necessary to establish and maintain natural circulation at hot standby conditions. The required heaters and their controls are connected to the Class 1E emergency buses in a manner that will provide redundant power supply capability.

Item II.G.1 (2) – Emergency Power for Pressurizer Equipment: Motive and control components associated with the PORV block valves are capable of being supplied from either the preferred offsite power source or the standby power source when the offsite power is not available.

8.3.1.1.4.2 System Description

The 480-V system is a three-phase, three-wire, ungrounded system that provides power to motors not greater than 350 hp, lighting and electric heating systems, battery chargers, and instrument and control systems.

The 480-V loads are served from the 4.16-kV buses through 4.16-kV/480-V transformers closely coupled to either metal-enclosed low voltage switchgear or to motor control centers. Five transformers in a duplex arrangement are provided for the non-Class 1E 480-V loads; two in the turbine building, two in the auxiliary building, and one at the intake structure. Three additional transformers, connected radially, are provided for the Class 1E 480-V loads, and the units are isolated from each other to maintain separation for the redundant Class 1E loads (refer to Figures 1.2-6, 1.2-8, 1.2-14, 1.2-16, 1.2-18, 1.2-20, 8.3-6, 8.3-7, and 8.3-8).

8.3.1.1.4.2.1 Maximum Demand

The maximum demands on the Class 1E 480-V load centers immediately following a unit shutdown are listed in Table 8.3-7. About 40 minutes after a major accident, the manual change-over of certain vital bus loads to support the recirculation phase would be completed.

8.3.1.1.4.2.2 Pressurizer Equipment Power Supplies

Pressurizer equipment power supplies are designed to meet the requirements of GDC 17, 1971 and NUREG-0737 (Reference 2) in the event of loss of offsite power. For further discussion of pressurizer equipment, refer to Section 5.5.9.

8.3.1.1.4.2.2.1 Pressurizer Heaters

The four pressurizer heater groups are normally connected to non-Class 1E 480-V power sources. All of the four pressurizer heater groups can be supplied with power from the offsite power sources when they are available.

When offsite power is not available, power can be provided to two out of four heater groups from the emergency power system (refer to Section 8.3.1.1.6) through Class 1E buses G and H (refer to Figure 8.3-19). Sufficient power (150 kW) is available from the Class 1E buses to energize enough heaters to maintain natural circulation at hot standby conditions. Redundancy is provided by supplying the two groups of heaters from the different Class 1E buses. The ability to supply emergency power to the heaters minimizes a potential loss of subcooling in the reactor coolant system after a loss of offsite power.

Transfer of pressurizer heater power supplies can be performed manually (in accordance with operating procedures) in less than 60 minutes using manual transfer switches located at the 100-foot elevation in the auxiliary building. Since the pressurizer

heaters are non-Class 1E loads, they are automatically tripped off of the Class 1E buses upon occurrence of a safety injection actuation signal. Breaker and switchgear equipment interfacing the pressurizer heaters with the Class 1E buses is Class 1E and seismically qualified.

8.3.1.1.4.2.3 Lighting

Normal lighting is operated at 208Y/120-V, three-phase, on a four-wire solidly grounded system supplied from the 480-V system through dry-type, delta-wye connected, 3-phase transformers.

The ac emergency lighting is supplied from two of the three Class 1E 480-V buses. Emergency lighting is located throughout the plant to provide minimum general lighting during a failure of normal lighting. Direct current emergency lighting is operated at 125-Vdc from the non-Class 1E station batteries.

ESF equipment areas and various access routes thereto are provided with individual battery-operated lights (BOLs) capable of providing 8 hours of illumination when ac power to the BOL is lost. The batteries are continuously charged with a built-in charger. Rack area uninterruptible power supply (UPS) lighting is provided for the same purpose.

Refer to Section 9.5.3 and Appendices in 9.5 for Appendix R emergency lighting descriptions.

8.3.1.1.4.3 Safety Evaluation

8.3.1.1.4.3.1 General Design Criterion 2, 1967 – Performance Standards

The Class 1E 480-V load center transformers and switchgear are located at 100 foot elevation of the auxiliary building, a PG&E Design Class I structure (refer to Figure 1.2-6). The auxiliary building is designed to withstand the effects of winds and tornados (refer to Section 3.3), floods and tsunamis (refer to Section 3.4), external missiles (refer to Section 3.5), and earthquakes (refer to Section 3.7). This design protects the Class 1E 480-V load center transformers and switchgear, ensuring their design function will be performed.

The Class 1E 480-V load center transformers and switchgear are seismically designed to perform their safety functions under the effects of earthquakes (refer to Section 3.10.2.7.4).

8.3.1.1.4.3.2 General Design Criterion 3, 1971 – Fire Protection

The Class 1E 480-V switchgear and cable spreading room are designed to the fire protection guidelines of Branch Technical Position (BTP) Auxiliary and Power Conversion Systems Branch (APCSB) 9.5-1 (refer to Appendix 9.5B, Table B-1).

Refer to Section 8.3.1.4.9 for further discussion on fire barriers and separation.

8.3.1.1.4.3.3 General Design Criterion 4, 1967 – Sharing of Systems

Portions of the control room ventilation system and control room pressurization system equipment required to maintain control room habitability are shared between Unit 1 and Unit 2, 480-V, Class 1E switchgear buses via mechanically interlocked transfer switches.

Power to the technical support center, which is normally fed by a Unit 2, non-Class 1E, 480-V motor control center (MCC), may be manually transferred via a transfer switch to a Unit 2, Class 1E 480-V switchgear. If this power supply is not available, power can be transferred to the Unit 1 Class 1E 480-V switchgear via another transfer switch.

The diesel fuel oil transfer pumps are powered from either Unit 1 or Unit 2 Class 1E 480-V bus via a manual transfer switch.

The Unit 1 and Unit 2 communication room power distribution panels are normally fed from their corresponding Class 1E 480-V bus. Each is provided with a manual transfer switch, which allows transfer of power source to the other unit’s Class 1E 480-V bus.

Operation of these transfer switches is administratively controlled to ensure that a fault in one Unit is isolated from the other Units power source.

8.3.1.1.4.3.4 General Design Criterion 11, 1967 – Control Room

The Class 1E 480-V switchgear and MCCs fed by a load transformer have a single phase voltmeter and an indicating potential light to monitor bus availability within the control room.

The HSP, which is the alternate control location in the event that the control room is rendered uninhabitable, is provided with transfer switches, control switches and status indication for the 480-V components that are controllable at the HSP. Additionally, a cut-in/cut-out switch and relay located at the 480-V MCC is provided to isolate the HSP from the switchgear control circuits in the event of fire at the HSP.

8.3.1.1.4.3.5 General Design Criterion 12, 1967 – Instrumentation and Control Systems

The Class 1E and non-Class 1E 480-V switchgear and MCCs that are directly fed from a load transformer are equipped with a ground detection circuit and ground indicating lights that provide annunciation in the main control room. The 480-V switchgears and MCCs are also provided with local bus monitoring devices. The load center transformers are equipped with winding temperature sensors with alarm contacts and provide automatic and manual control of the cooling fans.

8.3.1.1.4.3.6 General Design Criterion 17, 1971 – Electric Power Systems

The Class 1E 480-V distribution system is comprised of three (3) electrically independent and redundant load groups (refer to Section 8.3.1.4). Each of the Class 1E MCCs are located in separate rooms for independence to meet the single failure criterion. If a single failure occurs in any of the three MCC groups, the remaining two MCC groups have sufficient capacity and capability (refer to Section 8.3.1.1.4.2.1) to provide power to ESF loads required to safely shut down the unit.

8.3.1.1.4.3.7 General Design Criterion 18, 1971 – Inspection and Testing of Electric Power Systems

The Class 1E 480-V system is designed to be capable of periodic testing to assure operational and functional performance of the Class 1E components and operability of the system. Refer to Section 8.3.1.4.3.2 for further discussion on test and inspection for electrical cables.

Each MCC is independently supplied power (refer to Section 8.3.1.4) from a load center transformer that derives power from a 4.16-kV switchgear and allows for testability of the 480-V distribution system.

8.3.1.1.4.3.8 General Design Criterion 21, 1967 – Single Failure Definition

The Class 1E 480-V distribution system is comprised of three (3) electrically independent and physically separated redundant (refer to Section 8.3.1.4) Class 1E buses enclosed in separate rooms. If a single failure occurs in any of the Class 1E buses, the remaining two buses have sufficient capacity and capability to provide power to ESF loads required to safely shut down the unit.

8.3.1.1.4.3.9 General Design Criterion 40, 1967 – Missile Protection

The portions of the Class 1E 480-V system that are located in zones where provision against dynamic effects must be made, are protected from missiles, pipe whip, or jet impingement from the rupture of any nearby high-energy line (refer to Sections 3.5, 3.6, and 8.3.1.4.10.2).

8.3.1.1.4.3.10 General Design Criterion 49, 1967 – Containment Design Basis

The Class 1E and non-Class1E 480-V circuits routed through containment electrical penetrations are each provided with electrical protection devices. This arrangement is such that with the failure of one device, the penetration remains protected from high current temperature by the other in-series device to ensure the containment penetration remains functional. Refer to Sections 3.8.1.1.3.1 and 8.3.1.4.8 for additional details.

8.3.1.1.4.3.11 10 CFR 50.49 – Environmental Qualification of Electrical Equipment

The Class 1E 480-V system SSCs required to function in harsh environments under accident conditions are qualified to the applicable environmental conditions to ensure that they will continue to perform their safety functions. Section 3.11 describes the DCPP EQ program and the requirements for the environmental design of the electrical and related mechanical equipment. The affected components are listed on the EQ Master List (refer to Section 3.11.1).

8.3.1.1.4.3.12 10 CFR 50.63 – Loss of All Alternating Current Power

The Class 1E portion of the 480-V system serves to distribute power to loads required to bring the plant to a safe shutdown condition during a SBO. Refer to Section 8.3.1.6 for further discussion on SBO.

8.3.1.1.4.3.13 10 CFR Part 50 Appendix R (Sections III.G, III.J, and III.L) – Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979

Section III.G – Fire protection of Safe Shutdown Capability: The Class 1E 480-V system satisfies the applicable fire protection requirements of 10 CFR Part 50 Appendix R, Section III.G, fire protection of safe shutdown capability, by either meeting the technical requirements or by providing an equivalent level of fire safety. Refer to Section 8.3.1.4.10.1 and Appendix 9.5G for further discussion.

Section III.J – Emergency Lighting: Emergency lighting or BOLs capable of providing 8 hours of illumination when ac power to the BOL is lost, are provided in areas where operation of the 480-V system may be required to safely shut down the unit following a fire as defined by 10 CFR Part 50, Appendix R, Section III.J. Refer to Sections 8.3.1.1.4.2.3, 9.5.3 and Appendix 9.5D for further discussion.

Section III.L – Alternative and Dedicated Shutdown Capability: Safe shutdown capabilities are provided in the control room and at an alternate location via the HSP (refer to Section 7.4) as defined by 10 CFR Part 50, Appendix R, Section III.L. The ability to safely shut down the plant following a fire in any fire area is summarized in Section 4.0 of Appendix 9.5A and Appendix 9.5E.

8.3.1.1.4.3.14 Safety Guide 6, March 1971 – Independence Between Redundant Standby (Onsite) Power Sources and Between their Distribution Systems

The three Class 1E 480-V buses are physically enclosed in separate rooms and are electrically independent from each other when powered from their respective emergency diesel generators. Refer to Section 8.3.1.4 for further discussion on independence of redundant systems.

8.3.1.1.4.3.15 Regulatory Guide 1.63, Revision 1, May 1977 – Electric Penetration Assemblies in Containment Structures for Light-Water-Cooled Nuclear Plants

Class 1E and non-Class 1E 480-V circuits routed through containment electrical penetrations are designed with redundant overcurrent protection. Refer to Section 8.3.1.4.8 for further discussion.

8.3.1.1.4.3.16 Regulatory Guide 1.97, Revision 3, May 1983 – Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident

Class 1E, Category 2 indications for each Class 1E 480-V bus voltage is provided in the control room for Regulatory Guide 1.97, Revision 3, monitoring. Refer to Table 7.5-6.

8.3.1.1.4.3.17 NUREG-0737 (Items II.E.3 (1) and II.G.1 (2)), November 1980 – Clarification of TMI Action Plan Requirements

II.E.3.1 (1) – Emergency Power Supply for Pressurizer Heaters: Section 8.3.1.1.4.2.2.1 provides a discussion of the power supply design configuration for the pressurizer heaters in conformance with NUREG-0737, II.E.3.1 (1).

II.G.1 (2) – Emergency Power for Pressurizer Equipment: The three Class 1E 480-V motor operated PORV block valves are each powered independently from the Class 1E 480-V ESF buses which are capable of being supplied from either the offsite source or the emergency power source when the offsite power source is not available. This conforms to the requirement of NUREG-0737, II.G.1 (2).

8.3.1.1.4.4 Tests and Inspections

Refer to Section 8.3.1.1.4.3.7 for tests and inspections.

8.3.1.1.4.5 Instrumentation Applications

Refer to Section 8.3.1.1.4.3.5 for instrumentation applications.

8.3.1.1.5 120-Vac Instrument Supply Systems

8.3.1.1.5.1 Design Bases

8.3.1.1.5.1.1 General Design Criterion 2, 1967 – Performance Standards

The Class 1E 120-Vac system is designed to withstand the effects of, or is protected against, natural phenomena such as earthquakes, flooding, tornados, winds, and other local site effects.

8.3.1.1.5.1.2 General Design Criterion 3, 1971 – Fire Protection

The Class 1E 120-Vac system is designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

8.3.1.1.5.1.3 General Design Criterion 4, 1967 – Sharing of Systems

The 120-Vac system or components are not shared by the DCPP Units unless safety is shown not to be impaired by the sharing.

8.3.1.1.5.1.4 General Design Criterion 11, 1967 – Control Room

The Class 1E portion of the 120-Vac system is designed to support actions to maintain and control the safe operational status of the plant from the control room or from an alternate location if control room access is lost due to fire or other causes.

8.3.1.1.5.1.5 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Instrumentation and controls are provided as required to monitor and maintain the 120-Vac system variables within prescribed operating ranges.

8.3.1.1.5.1.6 General Design Criterion 17, 1971 – Electric Power Systems

The Class 1E 120-Vac system is required to have sufficient capacity, capability, independence, redundancy, and testability to perform its safety function assuming a single failure.

8.3.1.1.5.1.7 General Design Criterion 18, 1971 – Inspection and Testing of Electric Power Systems

The Class 1E portion of the 120-Vac system design permits appropriate periodic inspection and testing of functional and operational performance of the system as a whole and under conditions as close to design as practical.

8.3.1.1.5.1.8 General Design Criterion 21, 1967 – Single Failure Definition

The Class 1E portion of the 120-Vac system is designed to remain operable after sustaining a single failure. Multiple failures resulting from a single event shall be treated as a single failure.

8.3.1.1.5.1.9 General Design Criterion 24, 1967 – Emergency Power for Protection Systems

The Class 1E portion of the 120-Vac system is designed to remain operable after a loss of all offsite power.

8.3.1.1.5.1.10 General Design Criterion 40, 1967 – Missile Protection

The portions of the Class 1E 120-Vac system that support ESF loads are designed to be protected against dynamic effects and missiles that might result from plant equipment failures.

8.3.1.1.5.1.11 General Design Criterion 49, 1967 – Containment Design Basis

The Class 1E and non-Class 1E 120-Vac circuits routed through containment electrical penetrations are designed to support the containment design basis such that the containment structure can accommodate, without exceeding the design leakage rate, the pressures and temperatures following a loss of coolant accident.

8.3.1.1.5.1.12 10 CFR 50.49 – Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants

The Class 1E 120-Vac system electrical components that require environmental qualification are qualified to the requirements of 10 CFR 50.49.

8.3.1.1.5.1.13 10 CFR 50.62 – Requirements for Reduction of Risk from Anticipated Transients without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants

The non-Class 1E 120-Vac power source meets the electrical power requirements to provide a source to the ATWS mitigation actuation circuitry (AMSAC) that is independent from the protection system power supplies.

8.3.1.1.5.1.14 10 CFR 50.63 – Loss of All Alternating Current Power

The Class 1E 120-Vac system provides power to the loads required to support systems that assure core cooling and containment integrity is maintained following a SBO event.

8.3.1.1.5.1.15 10 CFR Part 50 Appendix R (Sections III.G, III.J, and III.L) – Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979

Section III.G – Fire protection of Safe Shutdown Capability: Fire protection of the Class 1E portion of the 120-Vac system is provided by a combination of physical separation, fire-rated barriers, and/or automatic suppression and detection.

Section III.J – Emergency Lighting: Emergency lighting or BOLs are provided in areas where operation of the 120-Vac system may be required to safely shut down the Unit following a fire.

Section III.L – Alternative and Dedicated Shutdown Capability: Safe shutdown capabilities are provided in the control room and at an alternate location via the hot

shutdown panel or locally at the 120-Vac switchgear, for equipment powered by the 120-Vac system required for the safe shutdown of the plant following a fire event.

8.3.1.1.5.1.16 Safety Guide 6, March 1971 – Independence Between Redundant Standby (Onsite) Power Sources and Between their Distribution Systems

The Class 1E portion of the 120-Vac system is designed such that electrically powered loads are separated into redundant load groups such that loss of any one group will not prevent the minimum safety functions from being performed.

8.3.1.1.5.1.17 Regulatory Guide 1.63, Revision 1, May 1977 – Electric Penetration Assemblies in Containment Structures for Light-Water-Cooled Nuclear Power Plants

The Class 1E and non-Class 1E 120-Vac circuits routed through containment electrical penetrations are designed to meet the requirements of Regulatory Guide 1.63, Revision 1, regarding installation of redundant or backup fault current protection devices to limit fault current to less than the penetration can withstand assuming a single random failure of the circuit overload protective device.

8.3.1.1.5.1.18 NUREG-0737 (Item II.G.1 (4)), November 1980 – Clarification of TMI Action Plan Requirements

Item II.G.1 (4) – Emergency Power for Pressurizer Equipment (Pressurizer Level Indication): The pressurizer level indication instrument channels shall be powered from the Class 1E instrument buses. The buses shall have the capability of being supplied from either the preferred power supply or the standby power supply when the preferred power supply is not available.

8.3.1.1.5.2 System Description

8.3.1.1.5.2.1 Class 1E 120-Vac Instrument Power Supply System

The 120-Vac Class 1E instrument bus system shown in Figure 7.6-1 supplies electric power for instrumentation, control, protection, and annunciation for the nuclear steam supply system (NSSS) and other Class 1E loads. The NSSS loads are divided into four redundant groups each with its own distribution panel(s) for each unit. The six panels are served by four dedicated uninterruptible power supplies (UPSs) supplied either from their associated Class 1E 480-V bus or from their associated Class 1E batteries. The UPSs are sized to continuously carry the maximum connected load without exceeding their nameplate rating. In addition, each UPS has a backup regulating transformer with manual transfer switch that can be fed from either of two 480-V Class 1E buses. This backup power is provided through the UPS static transfer switch or the UPS manual bypass switch, and supplies backup 120-Vac power to the instrument bus when its UPS

is out of service. This four UPS design provides redundant, uninterrupted 120-V, 60-Hz, single-phase power to the Class 1E instrument buses.

The dc power flow control of the inverter unit ensures that while the ac power input to the rectifier is available, the power to the distribution panels will be supplied through the rectifier and the inverter. When the ac power input to the rectifier is not available, the power to the distribution panel(s) will be supplied from the dc bus through the inverter

8.3.1.1.5.2.2 Non-Class 1E 120-Vac Instrument Power Supply System

Other UPSs and inverters are supplied from the 480-V or 208Y/120-Vac systems and backed up by either station batteries or a dedicated UPS battery. UPSs and inverters are used to supply the plant's digital computers and other non-Class 1E plant instrumentation and control systems needing uninterrupted ac power.

8.3.1.1.5.3 Safety Evaluation

8.3.1.1.5.3.1 General Design Criterion 2, 1967 – Performance Standards

The Class 1E 120-Vac UPSs, inverter, voltage regulating transformer and distribution panel equipment are located in the auxiliary building, which is a PG&E Design Class I structure, contained within the Class 1E 125-Vdc switchgear rooms (refer to Figure 1.2-5). The Class 1E 125-Vdc switchgear rooms are adjacent to the Class 1E 125-Vdc battery rooms. The auxiliary building is designed to withstand the effects of winds and tornados (refer to Section 3.3), floods and tsunamis (refer to Section 3.4), external missiles (refer to Section 3.5), and earthquakes (refer to Section 3.7) to protect the Class 1E 120-Vac UPSs, inverters, voltage regulating transformers and distribution panel equipment, ensuring their design function will be performed. Loss of dc switchgear/inverter room ventilation and Class 1E raceways located outdoors, associated with 120-Vac system that are exposed to effects of tornados, have been evaluated and they do not compromise the capability of shutting down the plant safely (refer to Section 3.3.2.3).

The Class 1E 120-Vac UPSs, inverters, and voltage regulating transformers are seismically designed to perform their safety functions under the effects of earthquakes (refer to Section 3.10.2.1.4).

8.3.1.1.5.3.2 General Design Criterion 3, 1971 – Fire Protection

The Class 1E inverters are located in the Class 1E 125-Vdc switchgear rooms. The 125-Vdc switchgear rooms are designed to the fire protection guidelines of Branch Technical Position APCSB 9.5-1 (refer to Appendix 9.5B Table B-1). Refer to Section 8.3.1.4.9 for further discussion on fire barriers and separation.

8.3.1.1.5.3.3 General Design Criterion 4, 1967 – Sharing of Systems

The Class 1E 120-Vac system is shared between the control room ventilation system (CRVS) for both units through the use of manually operated mechanical transfer switches.

Power to Unit 1 CRVS panels, which is normally fed from a Unit 1, Class 1E 120-Vac instrument supply system, may be manually transferred to a Unit 2 Class 1E 120-Vac instrument supply system, in the event the Unit 1 supply is not available, through the mechanical transfer switch. Similar operation can be accomplished for the Unit 2 CRVS panels.

Safety is not impaired by the sharing since the transfer of power supply between the units is not done automatically but through the use of manually operated mechanical transfer switches. These transfer switches ensure that a fault in one Unit is isolated from the other Unit's power source. In addition, operation of these transfer switches is administratively controlled

8.3.1.1.5.3.4 General Design Criterion 11, 1967 – Control Room

The dc power flow is monitored internally in the UPS, and dc input power to the inverter is supplied from the rectifier or from the dc bus as appropriate.

The loss of ac power to the distribution panels is alarmed in the control room. There are no UPS breaker controls on the control board, as transfers between Class 1E ac and dc sources will occur automatically without interruption due to loss of the 480-V power source.

8.3.1.1.5.3.5 General Design Criterion 12, 1967 – Instrumentation and Control Systems

The loss of ac power to the distribution panels is alarmed in the control room.

The Class 1E UPSs have locally mounted meters for dc input, bypass input, and ac output indications. They also have power available indication lights for ac input, dc input and bypass input power sources. An alarm mimic panel mounted on the face of the UPS panel is provided with alarm indication lights to indicate normal and abnormal conditions.

8.3.1.1.5.3.6 General Design Criterion 17, 1971 – Electric Power Systems

The Class 1E UPSs are sized to continuously carry the maximum connected loads without exceeding their nameplate rating.

The inverters are designed to maintain their outputs within the limits of 60 Hz ± 0.5 percent and 120-Vac ± 2 percent from zero to full load.

There are three independent Class 1E 480-V power sources, buses F, G, and H, in each unit. Bus F serves UPS 11, bus G serves UPS 12, and bus H serves UPSs 13 and 14. Three Class 1E 125-Vdc sources serve the four UPSs: UPS 11 is supplied power from battery 11, UPSs 12 and 14 are supplied power from battery 12, and UPS 13 is supplied power from battery 13. The UPSs operate normally on both the ac and dc systems. If either system is interrupted, the UPS will be supplied from the remaining source without interruption (refer to Figure 7.6-1).

Each of the four UPSs is independently connected to its respective channel instrument distribution panels so that the loss of a UPS cannot affect more than one channel of the system.

8.3.1.1.5.3.7 General Design Criterion 18, 1971 – Inspection and Testing of Electric Power Systems

The Class 1E UPS inverters are routinely checked on a weekly basis and are inspected and tested on a refueling outage frequency. Periodic component replacements per manufacturer's specifications are performed to maintain the Class 1E qualification.

Additional discussion on inspection and testing is found in Section 8.3.1.4.3.2

8.3.1.1.5.3.8 General Design Criterion 21, 1967 – Single Failure Definition

The onsite Class 1E electrical power distribution system is designed with three independent 4.16-kV and 480-V Class 1E buses (F, G, and H) and three 125-Vdc Class 1E buses in each unit (refer to Section 8.3.1.1.5.3.6 and Figure 7.6-1).

Each of the four UPSs is independently connected to its respective channel instrument distribution panels so that the loss of a UPS cannot affect more than one channel of the system.

In addition, each of the four UPSs may be automatically transferred to a regulated 120-Vac backup power source by its static transfer switch. Each distribution panel can also receive power from the regulated 120 Vac backup source by its manual bypass switch. Each regulating transformer has its normal and alternate power source through a manual transfer switch. Each UPS has its rectifier connected to the inverter and the dc power source through a blocking diode that prevents the rectifier from backfeeding the dc system.

The UPSs operate normally on both the ac and dc systems. If the ac system is interrupted, the inverter will be supplied from the Class 1E dc source without interruption (refer to Figure 7.6-1).

The plant protection system (PPS) is designed with four input channels (I, II, III, and IV) powered from four 120-Vac Class 1E buses (1, 2, 3, and 4). The four channels provide input to the solid state protection system (SSPS) Trains A and B. Class 1E 120-Vac

bus 1 and 4 provide power to the SSPS train A and train B output relays, respectively. The SSPS input relays are fail safe (with the exception of the input circuits that initiate containment spray, the radiation monitoring channels that initiate containment ventilation isolation, and the RCP underfrequency low flow trip channels (refer to Sections 7.2.3.12 and 7.3.4.1.1), whereas the SSPS output relays require power to actuate.

Each SSPS train actuates ESF equipment in the three Class 1E ac and dc buses and certain Non-Class 1E equipment in the Non-Class 1E ac and dc buses. As allowed per IEEE 308-1971, Class 1E dc bus 12 feeds Class 1E 120-Vac buses 12 and 14 in Unit 1 and Class 1E dc bus 22 feeds Class 1E 120-Vac buses 22 and 24 in Unit 2. For design basis accident scenarios concurrent with a loss of offsite power (LOOP), a single failure of the Unit 1 Class 1E dc bus 12 will cause the loss of Class 1E 120-Vac buses 12 and 14 in Unit 1. Similarly a single failure of the Unit 2 Class 1E dc bus 22 will cause the loss of Class 1E 120-Vac buses 22 and 24 in Unit 2. This is acceptable because the loss of Class 1E dc bus 12 in Unit 1 or Class 1E dc bus 22 in Unit 2 does not prevent the minimum safety functions from being performed. Loss of both IY/PY 12(22) and IY/PY 14(24) is acceptable because the remaining two 120-Vac inverters and buses can supply at least one full ESF train.

Therefore, a single failure in the instrumentation and control power supply system or its associated power supplies does not prevent the minimum safety functions from being performed.

8.3.1.1.5.3.9 General Design Criterion 24, 1967 – Emergency Power for Protection Systems

In the event of a loss of all offsite power, the Class 1E 120-Vac system is automatically powered from the Class 1E 125-Vdc system and will automatically be re-powered from the Class 1E 4.16-kV/480-V bus when the emergency diesel generator loads onto its Class 1E 4.16-kV bus.

8.3.1.1.5.3.10 General Design Criterion 40, 1967 – Missile Protection

Class 1E 120-Vac instrument supply system equipment and cables are protected from internally generated missiles, pipe-whip and jet impingement. Detailed discussions of these protections are delineated in Sections 8.3.1.4.10.2 and 8.3.1.4.10.3 respectively.

8.3.1.1.5.3.11 General Design Criterion 49, 1967 – Containment Design Basis

Class 1E and non-Class 1E 120-Vac circuits routed through containment are analyzed for redundant overcurrent protection and available fault energy. Circuits without direct in-line redundant protection have been analyzed to determine the available fault current is not of sufficient magnitude to damage the penetration conductor, penetration, or containment integrity.

Refer to Sections 3.8.1.1.3, 8.3.1.1.5.3.14, and 8.3.1.4.8 for additional details.

8.3.1.1.5.3.12 10 CFR 50.49 – Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants

The Class 1E 120-Vac system SSCs required to function in harsh environments under accidents conditions are qualified to the applicable environmental conditions to ensure that they will continue to perform their safety functions. Section 3.11 describes the DCPP EQ program and the requirements for the environmental design of the electrical and related mechanical equipment. The affected components are listed on the EQ Master List.

8.3.1.1.5.3.13 10 CFR 50.62 – Requirements for Reduction of Risk from Anticipated Transients without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants

The ATWS Mitigation System Actuation Circuitry (AMSAC) System in both units is powered from the Non-Class 1E chemistry lab and counting room inverter. This inverter is powered from non-reactor protection system power supplies in either Unit 1 or 2.

8.3.1.1.5.3.14 10 CFR 50.63 – Loss of All Alternating Current Power

The Class 1E UPSs are sized to continuously carry the maximum connected loads without exceeding their nameplate rating during a SBO event.

To prevent receiving an spurious safety injection signal during a SBO condition, operator action is taken within 2 hours to provide at least two input channels of instrumentation to monitor system functions and actuate one train of safeguards equipment.

The Class 1E portion of the 120-Vac system serves to distribute power to loads required to bring the plant to a safe shutdown condition during a SBO event. Refer to Section 8.3.1.6 for further discussion on station blackout.

8.3.1.1.5.3.15 10 CFR Part 50 Appendix R (Sections III.G, III.J, and III.L) – Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979

Section III.G – Fire protection of Safe Shutdown Capability: The Class 1E 120-Vac system satisfies the applicable fire protection requirements of 10 CFR Part 50, Appendix R, Section III.G fire protection of safe shutdown capability; by either meeting the technical requirements or by providing an equivalent level of fire safety. Refer to Section 8.3.1.4.10.1 and Appendix 9.5G.

Section III.J – Emergency Lighting: Emergency lighting or BOLs capable of providing 8 hours of illumination when ac power to the BOL is lost are provided in areas where

operation of the 120-vac system may be required to safely shut down the Unit following a fire as defined by 10 CFR Part 50, Appendix R, Section III.J. Refer to Section 9.5.3 and Appendix 9.5D.

Section III.L – Alternative and Dedicated Shutdown Capability: Safe shutdown capabilities are provided in the control room and at an alternate location via the hot shutdown panel (refer to Section 7.4) as defined by 10 CFR Part 50, Appendix R, Section III.L. The ability to safely shut down the plant following a fire in any fire area is summarized in Section 4.0 of Appendix 9.5A and Appendix 9.5E.

8.3.1.1.5.3.16 Safety Guide 6, March 1971 – Independence Between Redundant Standby (Onsite) Power Sources and Between their Distribution Systems

Each of the redundant onsite Class 1E 120-Vac power sources and its distribution system is independent from each other. The electrically powered loads are separated into redundant load groups such that loss of any one group will not prevent the minimum safety functions from being performed.

For discussion related to independence of redundant systems, separation criteria for Class 1E systems and Class 1E separation and protection criteria, refer to Sections 8.3.1.4, 8.3.1.4.1 and 8.3.1.4.10, respectively.

Further discussions on separation and isolations are found in Sections 8.3.1.4.2, 8.3.1.4.4 and 8.3.1.4.6.

8.3.1.1.5.3.17 Regulatory Guide 1.63, Revision 1, May 1977 – Electric Penetration Assemblies in Containment Structures for Light-Water-Cooled Nuclear Power Plants

Class 1E and Non-Class 1E 120-Vac circuits routed through containment electrical penetrations are designed with redundant overcurrent protection. Circuits without direct in-line redundant protection have been analyzed to determine the available fault current is not of sufficient magnitude to damage the penetration conductor or penetration.

Refer to Sections 8.3.1.1.5.3.11 and 8.3.1.4.8 for additional details.

8.3.1.1.5.3.18 NUREG-0737 (Item II.G.1 (4)), November 1980 – Clarification of TMI Action Plan Requirements

Item II.G.1 (4) – Emergency Power for Pressurizer Equipment (Pressurizer Level Indication): The pressurizer level indication circuits are Class 1E and qualified for post-accident. The Class 1E instrument channels are supplied from inverters which are supplied from the ESF buses with automatic backup from the Class 1E emergency batteries.

8.3.1.1.5.4 Tests and Inspections

Refer to Section 8.3.1.1.5.3.7 for tests and inspections details.

8.3.1.1.5.5 Instrumentation Applications

Refer to Section 8.3.1.1.5.3.5 for instrumentation applications.

8.3.1.1.6 Diesel Generator Units

The physical arrangement of the engine generator units is shown in Figures 9.5-10 and 9.5-11 for Unit 1; the arrangement is similar for Unit 2. Figure 9.5-12 shows the outline of the Unit 1 engine generators. The arrangement is similar for the Unit 2 generators with the exception of EDG 2-3, which is slightly different.

The six diesel generators for Units 1 and 2 are essentially identical, self-contained units housed in individual compartments at elevation 85 feet in the turbine building. Three are located in the northwest or Unit 1 portion, and three are located in the southwest or Unit 2 portion of the structure. The compartments separate each diesel generator and its accessories from the adjacent units and conform to PG&E Design Class I requirements.

8.3.1.1.6.1 Design Bases

8.3.1.1.6.1.1 General Design Criterion 2, 1967 – Performance Standards

The EDG system is designed to withstand the effects of, or is protected against natural phenomena such as earthquakes, flooding, tornados, winds, and other local site effects.

8.3.1.1.6.1.2 General Design Criterion 3, 1971 – Fire Protection

The EDG system is designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

8.3.1.1.6.1.3 General Design Criterion 4, 1967 – Sharing of Systems

The EDG system or components are not shared by the DCPP Units unless safety is shown not to be impaired by the sharing.

8.3.1.1.6.1.4 General Design Criterion 11, 1967 – Control Room

The EDG system is designed to support actions to maintain and control the safe operational status of the plant from the control room or from an alternate location if control room access is lost due to fire or other causes.

8.3.1.1.6.1.5 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Instrumentation and controls are provided as required to monitor and maintain EDG system variables within prescribed operating ranges.

8.3.1.1.6.1.6 General Design Criterion 17, 1971 – Electric Power Systems

The EDG system is designed to have sufficient capacity, independence, redundancy, and testability to perform its safety function assuming a single failure.

8.3.1.1.6.1.7 General Design Criterion 18, 1971 – Inspection and Testing of Electric Power Systems

The EDG system design permits appropriate periodic inspection and testing of functional and operational performance of the system as a whole and under conditions as close to design as practical.

8.3.1.1.6.1.8 General Design Criterion 21, 1967 – Single Failure Definition

The EDG system is designed to remain operable after sustaining a single failure. Multiple failures resulting from a single event shall be treated as a single failure.

8.3.1.1.6.1.9 Protection from High and Moderate Energy Systems and Internal Missiles

The EDG systems are designed to be protected against dynamic effects and missiles that might result from plant equipment failure.

8.3.1.1.6.1.10 10 CFR 50.55a(g) – Inservice Inspection Requirements

Applicable EDG system components are inspected to the requirements of 10 CFR 50.55a(g)(4) and 50.55a(g)(5) to the extent practical.

8.3.1.1.6.1.11 10 CFR 50.63 – Loss of All Alternating Current Power

The EDG system meets the criterion of providing an alternate ac source within ten minutes of station blackout (SBO).

8.3.1.1.6.1.12 10 CFR Part 50 Appendix R (Sections III.G, III.J, and III.L) – Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979

Section III.G – Fire protection of Safe Shutdown Capability: Fire protection of the EDG system is provided by a combination of physical separation, fire-rated barriers, and/or automatic suppression and detection.

Section III.J – Emergency Lighting: Emergency lighting or battery operated lights (BOLs) are provided in areas where operation of the EDG system may be required to safely shut down the Unit following a fire.

Section III.L – Alternative and Dedicated Shutdown Capability: Safe shutdown capabilities are provided in the control room and at an alternate location via the hot shutdown panel or locally at the EDG, for equipment powered by the EDGs required for the safe shutdown of the plant following a fire event.

8.3.1.1.6.1.13 Safety Guide 9, March 1971 – Selection of Diesel Generator Set Capacity for Standby Power Supplies

The EDG system meets the applicable requirements of Safety Guide 9, March 1971 for steady state loading capability with one regulatory approved exception for DCPP:

(1) Exception to loading sequence frequency requirements of Safety Guide 9, March 1971, Position C.4 for MDAFW pump loading on EDGS 1-1, 1-3, 2-2, and 2-3 (Reference 30).

8.3.1.1.6.1.14 Regulatory Guide 1.97, Revision 3, May 1983 – Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident

The EDG instrumentation systems provide instrumentation in the control room to monitor EDG electrical status for post-accident instrumentation.

8.3.1.1.6.1.15 Regulatory Guide 1.108, Revision 1, August 1977 – Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants

As required by Regulatory Guide 1.108, Revision 1, EDG testing simulates, where practical, the parameters of operation that would be expected if actual demand were to be placed on the system, as delineated in Technical Specification Bases 3.8.1.

There are three regulatory approved exceptions to Regulatory Guide 1.108, Revision 1 for DCPP:

(1) Exception to testing frequency guidelines of Regulatory Position C.2.a based on compliance with the TS 5.5.18 Surveillance Frequency Control Program (Reference 27).

(2) Exception to EDG hot restart testing guidelines of Regulatory Position C.2.a (5) based on use of a modified hot restart test (Reference 28).

(3) Exceptions to Regulatory Positions C.2.a (9), C.2.d, C.2.e and C.3 based on compliance with NUMARC 93-01, Rev. 2, "Industry Guidelines for

Monitoring the Effectiveness of Maintenance at Nuclear Power Plants" (Reference 29).

8.3.1.1.6.2 System Description

8.3.1.1.6.2.1 Diesel Generator Unit Description

Each diesel generator unit consists of a self-contained diesel engine directly connected to an alternating current generator, and the separate accessories needed for proper operation, all mounted on a common structural steel skid-type base. Mechanical power is provided by an 18 cylinder, vee configuration, four-cycle, 9-inch bore x 10-1/2 inch stroke, 12,024 cubic inch displacement, 3630 horsepower at 900 rpm, turbocharged and aftercooled, heavy-duty, stationary-type diesel engine.

The generator is rated at 3250 kVA, 0.8 PF, 4160 V, 60 Hz, three-phase, Y-connected, ungrounded, 80°C temperature rise, Class B insulation, with a drip-proof enclosure. The transient reactance is 14.1 percent, and the subtransient reactance is 8.1 percent. The exciter is a static series, boost-type exciter controlled by a static solid-state voltage regulator.

Five diesel engine generator units have been supplied by the ALCO Engine Division of White Industrial Power, Inc. The sixth diesel engine generator, EDG 2-3, was manufactured by G. E. Locomotives, the current owner and manufacturer of ALCO engines and locomotives at the time. In most respects, this EDG is similar to the other five EDGs; the differences and commercial grade dedication are documented in RPE M-6602. ALCO has supplied engine generator units to serve as emergency onsite standby power at several nuclear power plants. Among these are two ALCO units for the Palisades Nuclear Plant, which have the same engine as the first five DCPP engine generator units and a slightly smaller generator (2500kW continuous rating), and the two ALCO units for the Pilgrim I Nuclear Station, which has engines and generators that are identical to the first 5 at DCPP. Both of these nuclear power plants are in operation. In addition, the Salem 1 and 2 nuclear power plant has engine generator units with the same engines and generators as the first five DCPP engine generator units.

The EDG auxiliary systems; starting air system, ventilation system, cooling water system, lubrication system, fuel oil storage and transfer system, and compartment ventilation system are described in Sections 9.4.7, 9.5.4, 9.5.5, 9.5.6 and 9.5.7.

8.3.1.1.6.2.2 Combustion Air Intake System

The combustion air is taken into the engine through woven, dry-type, particulate filter media, encased in a cylindrical steel retaining structure. This air intake filter structure is supported from the ceiling in the radiator fan portion of the engine generator compartment. After passing through the filter, the combustion air is drawn into the engine through a 22-inch carbon steel pipe. The physical arrangement of the air intake filter and piping for Unit 1 is shown in Figures 9.5-10 and 9.5.11, and is similar for

Unit 2. The diagram of the combustion air intake system is shown in Figure 3.2-21 (Sheets 7 and 8, 8A, 8B).

As shown in Figures 9.5-10 and 9.5-11 for Unit 1, the combustion air for the diesel engines is taken from the west side of the building, and the exhaust from the engines is directed upward through the roof on the north side of the turbine building for Unit 1. Unit 2 diesels are similar, except the exhaust is through the south wall of the turbine building. The exhaust is at a higher elevation than the combustion air intake. This arrangement ensures that the engine exhaust will be dispersed without the possibility of diluting the combustion air. There is no equipment or structure on the west side of the turbine building within the proximity of the combustion air intake that would create the potential for noncombustible or explosive gases being drawn into the engine.

Approximately 30 percent of the outside air drawn by the radiator fan is routed through ductwork providing ventilation for the diesel generator compartment. Refer to Section 9.4.7 for a complete description of the ventilation system.

8.3.1.1.6.3 Safety Evaluation

8.3.1.1.6.3.1 General Design Criterion 2, 1967 – Performance Standards

The EDGs are located at elevation 85 foot of the turbine building, which is a PG&E Design Class II structure (refer to Figure 1.2-16 and 1.2-20). This building or applicable portions have been designed not to impact PG&E Design Class I components and associated safety functions (refer to Section 3.7.2.1.7.2). The turbine building is designed to withstand the effects of winds and tornados (refer to Section 3.3.1.2 and 3.3.2.3.2.8), floods and tsunamis (refer to Section 3.4), external missiles (refer to Section 3.5), and earthquakes (refer to Section 3.7.2.1.7.2) to protect the EDGs.

The diesel generator excitation cubicle and control cabinet are seismically designed to perform their safety functions under the effects of earthquakes (refer to Section 3.10.2.6).

The engine generator units and their associated auxiliary systems, as shown for Unit 1 in Figures 9.5-8, 9.5-9, and 9.5-10, and similarly for Unit 2, are installed in separate compartments that are protected from fires, flooding, and external missiles.

Any postulated external missile would not penetrate into more than one compartment. Section 3.3.2 provides more discussion on hypothetical external missiles generated by a postulated tornado. No common failure mode exists where one single event would disable more than one diesel generator.

It is not credible for a seismic event, the Hosgri event, to restrict the flow of exhaust gases from the diesel engine and thereby create excessive back pressure on the engine. The design of the exhaust system, shown schematically in Figure 3.2-21 (Sheet 7), precludes any major failures, such as a major failure of the silencer and/or

the connecting piping, which would have to develop to produce any significant flow restriction. The internal baffles and chambers of the silencer are designed so that even if an internal baffle breaks completely loose, it will not block exhaust flow. The silencer supports, as well as the connecting piping supports, are designed in accordance with the same criteria as for PG&E Design Class I equipment supports, i.e., to withstand the Hosgri event with no loss of function.

The exhaust silencers and piping are located in separate compartments with no other piping or equipment that could adversely affect the silencers or piping during a Hosgri event. The exhaust lines of the Unit 1 diesels pass through the turbine building roof, and the exhaust lines of the Unit 2 diesels pass through the south wall of the turbine building, but are not considered a risk in the systems interaction program (SIP). The compartments are located immediately above the engine generators in the turbine building. An engineering review of the turbine building has shown that during a seismic event the building will not collapse. This analysis is discussed in Section 3.7.2.

Other equipment associated with the diesel generators that is seismically qualified includes:

(1) Fuel oil day tanks

(2) Closed cooling water system, including fan and radiator

(3) Fuel oil storage tanks and fuel oil piping

(4) Lube oil system

(5) Ventilation system

8.3.1.1.6.3.2 General Design Criterion 3, 1971 – Fire Protection

The EDG areas are designed to the fire protection guidelines of Branch Technical Position APCSB 9.5-1 (refer to Appendix 9.5B, Table B-1).

Refer to Section 8.3.1.4.9 for further discussion on fire barriers and separation. The portion of each compartment that houses the diesel generator is provided with a thermally actuated total flooding CO_2 gas system, in accordance with NFPA Standard No. 12, 1973 (Reference 6). Temperature-actuated, automatic closing, roll-down fire-rated doors close ventilation air openings to prevent CO_2 leakage. The CO_2 flooding is restricted to the engine generator compartment by closing fire doors that isolate and seal the compartment. Refer to Section 9.5.1 for a complete description of the CO_2 system. Additionally, two hose stations are provided adjacent to the compartment locations in each unit. The diesel generator installation is in accordance with NFPA 37 - 1970 (Reference 7).

Each engine generator compartment is provided with a CO_2 flooding system for fire suppression. CO_2 flooding will extinguish a fire in one compartment while the other engine generator units continue normal operation. In addition, 3-hour fire walls are provided between the individual compartments. A normally closed, 3-hour fire door separates the corridor connecting the diesel generator rooms from the main condenser area. This door is also designed to prevent a postulated condenser leak from flooding the diesel generator rooms (refer to Section 10.4.5). Section 9.5.1 provides more information on the fire protection system.

There is no combustible gas line or storage facility within or near the engine generator compartments. The only flammable liquids contained within the engine generator compartments are those necessary for the operation of the engines, i.e., engine lube oil and diesel fuel oil.

The startup transformers, located immediately north of the Unit 1 and south of the Unit 2 engine generator compartments, contain insulating oil, which is a potential fire hazard. However, the transformers are equipped with fire detection and fire suppression systems to quench potential fires. The engine generator compartment nearest the startup transformer is separated from the transformer by a 3-hour fire wall. The engine generator combustion air intakes are not affected by a transformer fire since combustion air is drawn from the west side of the building.

The main turbine seal oil systems are the closest source of flammable liquids within the turbine building. The seal oil units are located about 65 feet from the common corridor for each unit's diesel generators. Each seal oil unit is supplied with a fire detection and fire suppression system.

A failure of the number 10 turbine bearing (between the exciter and generator) is the next closest potential fire hazard, since an open bay connects the turbine deck elevation (140 feet) with the diesel generator elevation (85 feet). The bay opening is located about 35 feet horizontally from the diesel generator common corridor. The Number 10 bearing is equipped with a fire detection and fire suppression system. The turbine building fire suppression systems would contain any turbine lube oil fire and prevent any hazard to the diesel engine generators. Refer to Section 9.5.1 for additional fire protection system information.

8.3.1.1.6.3.3 General Design Criterion 4, 1967 – Sharing of Systems

The fuel oil storage and transfer subsystem of the EDG system are shared between Units 1 and 2. Refer to Section 9.5.4.3.3.

8.3.1.1.6.3.4 General Design Criterion 11, 1967 – Control Room

Controls for engine generator functions are both local at the engine generator compartment and remote in the main control room. Each of the units may be manually started or stopped from either location to facilitate periodic testing. The generators may

be synchronized from the control room so that they can be paralleled with the other power systems for testing. In addition, there is an emergency manual stop for each unit located outside each engine generator compartment. Automatic starting of the units occurs in the event of the conditions listed in Section 8.3.1.1.3.3.5.1. Each of the six units is provided with two independent starting control circuits for redundancy.

Engine generator units are normally controlled from the control room. A two-position local-remote switch located at each engine generator unit allows control of each unit to be switched from the control room (remote) to the engine generator compartment (local). Whenever control of any of the units is switched to the compartment (local), the operator is informed by a control room annunciator alarm. The alarm identifies the engine generator unit on local control.

8.3.1.1.6.3.5 General Design Criterion 12, 1967 – Instrumentation and Control Systems

The units are fully instrumented to monitor important parameters and alarm abnormal conditions, both locally at the engine generator compartment and remotely in the main control room.

Each diesel generator is designed with two starting control circuits, one field flashing circuit, and one sensing circuit. These circuits receive Class 1E dc control power through a manual transfer switch. Class 1E dc power is from the same train as the diesel generator. In the event of failure of dc power to these control circuits, an alarm appears on the main annunciator. The manual transfer switch, located near the control panel at the diesel generator can be used to transfer to backup vital dc power.

Loading of the diesel generators during the recirculation phase is under the control of the operator. To aid in loading these units, instruments are provided to indicate their load at all times.

For additional information on instrumentation application, refer to Section 8.3.1.1.6.5

8.3.1.1.6.3.6 General Design Criterion 17, 1971 – Electric Power System

The EDG system is required to have sufficient capacity, capability, independence, redundancy, and testability to perform its safety function assuming a single failure.

The emergency power system includes onsite, independent, automatic starting diesel generators that supply power to essential auxiliaries if normal power sources are not available.

Three dedicated 4.16-kV, three-phase, 60-Hz, 2600-kW, 0.8-PF continuous rating diesel generators are provided for each unit as shown in Figure 8.1-1. The individual diesel generator units are physically isolated from each other and from other equipment. Each

diesel generator supplies power to its associated 4.16-kV Class 1E bus (refer to Figures 8.3-4, 1.2-16, and 1.2-20).

The ESF loads and their onsite sources are grouped so the functions required during a major accident are provided regardless of any single failure in the electrical system. Any two of the three diesel generators and their buses are adequate to serve at least the minimum required ESF loads of a unit after a major accident.

Refer to Section 8.3.1.1.3.3.5.2 for additional discussion of ESF load grouping.

Section 8.3.1.1.6.3.13 discusses EDG capacity and Section 8.3.1.1.6.4 demonstrates EDG system testability.

8.3.1.1.6.3.7 General Design Criterion 18, 1971 – Inspection and Testing of Electric Power Systems

Descriptions of the inspections and tests are provided in Section 8.3.1.1.6.4.

8.3.1.1.6.3.8 General Design Criterion 21, 1967 – Single Failure Definition

The ESF loads and their onsite standby sources (EDGs) are grouped so the functions required during a major accident or transient coincident with a complete loss of the preferred power source are provided regardless of a single failure of an EDG. Any two of the three diesel generators and their buses are adequate to serve the required ESF loads of a unit after a major accident or transient.

The single failure criterion applies to the diesel fuel oil (DFO) system. Refer to Section 9.5.4.3.7 for discussion related to the DFO system.

8.3.1.1.6.3.9 Protection from High and Moderate Energy Systems and Missiles

The engine generator units and their associated auxiliary systems, as shown for Unit 1 in Figures 9.5-8, 9.5-9, and 9.5-10, and similarly for Unit 2, are installed in separate compartments that provide protection from internal missiles.

The possibility of flooding in the turbine building and in the diesel generator compartments is discussed in Sections 9.2.1, 10.4.5, and 10.4.6 under the ASW, circulating water and condensate and feedwater systems, respectively. High-energy line breaks outside the containment that could affect the turbine building are discussed in Section 3.6. There is no significant source of water within any of the engine generator compartments, and the design of the engine generator compartments (refer to Figures 1.2-16 and 1.2-20) prevents flooding within the generator compartments because the cross-sectional area for water to enter the compartments is less than the cross-sectional area for water to exit the compartments.

Because the engine generator units are separated from each other by the concrete walls of the compartments, the units are protected from postulated internal missiles. Any missile created by an explosion within a compartment would remain in that compartment.

8.3.1.1.6.3.10 10 CFR 50.55a (g) – Inservice Inspection Requirements

Only the EDG jacket water cooling system components are included in the DCPP Inservice Inspection (ISI) Program per 10 CFR 50.55a(g)(4) and 10 CFR 50.55a(g)(5).

8.3.1.1.6.3.11 10 CFR 50.63 – Loss of All Alternating Current Power

The SBO analysis demonstrated that the plant could be safely shutdown following a loss of offsite power utilizing either Buses G or H and their normally connected EDGs (Emergency AC sources) independent of the third EDG and its Bus F considered the alternate AC (AAC) source. The AAC source is a Class 1E EDG and meets the criterion for the AAC source to be available within 10 minutes with a target reliability of 0.95, and has sufficient capacity and capability to operate systems necessary for coping with a SBO for the required duration of 4 hours to maintain the unit in a safe shutdown condition. Refer to Section 8.3.1.6 for a complete discussion of SBO.

8.3.1.1.6.3.12 10 CFR Part 50 Appendix R (Sections III.G, III.J, and III.L) – Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979

Section III.G – Fire protection of Safe Shutdown Capability: The EDG system satisfies the applicable fire protection requirements of 10 CFR Part 50 Appendix R, Section III.G, fire protection of safe shutdown capability, by either meeting the technical requirements or by providing an equivalent level of fire safety. Refer to Section 8.3.1.4.10.1 and Appendix 9.5G.

Section III.J – Emergency Lighting: Emergency lighting or ESF equipment areas and various access routes thereto are provided with individual (BOLs) capable of providing 8 hours of illumination when ac power to the BOL is lost. BOLs are provided in areas where operation of the EDG system may be required to safely shut down the Unit following a fire as defined by 10 CFR Part 50, Appendix R, Section III.J (refer to Section 9.5.3 and Appendix 9.5D).

Section III.L – Alternative and Dedicated Shutdown Capability: Safe shutdown capabilities are provided in the control room and at an alternate location via the hot shutdown panel or locally at the EDGs (refer to Section 7.4 for a discussion of the HSP and local EDG controls for the EDG system) as defined by 10 CFR Part 50, Appendix R, Section III.L. The ability to safely shut down the plant following a fire in any fire area is summarized in Section 4.0 of Appendix 9.5A and Appendix 9.5E.

8.3.1.1.6.3.13 Safety Guide 9, March 1971 – Selection of Diesel Generator Set Capacity for Standby Power Supplies

The diesel generators have a net continuous electrical output rating of 2600 kW at 0.8 power factor (PF), and 2752 kW at 0.8 PF, for 2000 hours per year. Short-term ratings of the diesel generators are 3000 kW at 0.8 PF for 2 hours per year, 2860 kW at 0.8 PF for 2 hours per 24-hour period, and 3250 kW at 0.8 PF for 30 minutes per 24-hour period. During the starting sequence for the safeguard loads, these machines can also carry short-time overloads. EDG loading meets the applicable criteria of Safety Guide 9, March 1971 (Reference 8).

Momentary loads not included in Table 8.3-6 consist principally of transient inrush currents, relay and solenoid short-time currents, starting currents to motors, and starting and operating currents for motor-operated valves. These loads are within the short-time capability of the electric power systems and the engine generators.

During a design basis-loading scenario with nominal timer interval, these machines maintain the electric power frequency within 5 percent, hold voltages to a minimum of 75 percent, and recover successfully by complying with Safety Guide 9, March 1971 (Reference 8) with the exception of Regulatory Position C.4. Safety Guide 9, March 1971, Regulatory Position C.4 specifies that during the EDG loading sequence the frequency should be restored to within 2 percent of nominal in less than 40 percent of each load sequence time interval. For AFW pump loading for EDGs 1-1, 1-3, 2-2, and 2-3, the frequency is restored to within 2 percent of nominal in less than 60 percent of the load sequence time interval. Based on test data, EDGs 1-1, 1-3, 2-2, and 2-3 have adequate margin to prevent overlapping of loads and meet the objectives of Safety Guide 9, March 1971, Regulatory Position C.4. This exception to Safety Guide 9, March 1971, was approved in License Amendments 211/213 dated March 29, 2012.

Refer to Section 8.3.1.1.3.3.5.2 for additional discussion of EDG ESF loading and functions.

8.3.1.1.6.3.14 Regulatory Guide 1.97, Revision 3, May 1983 – Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident

Class 1E, Category 2 indications for each EDG wattage and amperage is provided in the control room for Regulatory Guide 1.97, Revision 3, monitoring. Refer to Table 7.5-6.

8.3.1.1.6.3.15 Regulatory Guide 1.108, Revision 1, August 1977 – Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants

The EDGs are designed to permit inspection and testing of all important areas and features, especially those that have a standby function, in accordance with GDC 18, 1971. This periodic testing ensures that the EDGs will meet their availability requirements. Periodic component tests are supplemented by extensive functional tests during refueling outages.

Additionally, Generic Letter 1984-15 was issued to improve EDG reliability by reducing the number of cold fast starts and by eliminating excessive testing. Cold fast starting of EDGs is not applicable to DCPP as the EDGs are equipped with lube oil and water jacket heating devices to maintain the oil and water temperatures at levels which permit immediate assumption of load. Also, engine bearings are lubricated by motor-driven lube oil circulating pumps which run continuously prior to engine start.

8.3.1.1.6.4 Tests and Inspections

The electrical systems have been designed to permit inservice inspection and periodic functional testing. The tests and scheduling are specified in the Technical Specifications. These tests are made to demonstrate that all Class 1E electrical systems are capable of performing their safety functions.

All six Diablo Canyon diesel engine generator units have undergone extensive shop testing to qualify the units as emergency standby power sources. A large part of the shop testing at ALCO Engine Division of White Industrial Power, Inc. was in addition to the normal manufacturer performance tests for units of this type. Special shop tests were conducted to verify the unit design capabilities, their reliability, and their conformance to specification requirements.

A summary of the ALCO shop testing is shown in Table 8.3-8. In addition, extensive preoperational qualification testing was performed for the engine generator units during DCPP startup. A summary of preoperational testing for the engine generators at Diablo Canyon is shown in Table 8.3-9.

Automatic starting of the diesel generators is tested by removal of available power from its offsite source or its bus, simulating a bus undervoltage condition, or by initiating a test from the reactor protection system. The bus should transfer to the offsite source automatically, and the diesel generators should start and reach normal operating conditions if bus voltage is not restored within one second.

The absence of offsite power is simulated by opening the bus feeder breaker, simulating a bus undervoltage condition, or removal of its potential to the transfer control circuits. The test is repeated, with the diesel generator as the source and the loading sequence

for the absence of safety injection. In the presence of a test safety injection signal (SIS), the test is repeated with the loading sequence for this condition.

Should there be an actual SIS while the diesel generator is paralleled with the unit auxiliary transformer during a test, the SIS signal would trip the unit auxiliary transformer (preventing a potential overload of the diesel generators), and diesel generator breaker closed prevents transfer of this bus to the startup source. Loads already running on this bus will continue to run, other loads will be started by their SIS timers, and any containment fan coolers running on high will automatically be restarted on low speed. EDG test scope and test interval frequency meets the applicable criteria of Regulatory Guide 1.9, Revision 3 (Reference 25).

8.3.1.1.6.5 Instrumentation Applications

All operating conditions that could normally be expected to render the diesel generators incapable of responding to an automatic emergency start signal are alarmed in the control room. A "diesel generator trouble" annunciator is alarmed in the main control room whenever any of the following conditions occur:

(1) Diesel is in manual or test condition

(2) Loss of dc control power

(3) Low fuel level in day tank

(4) Low starting air pressure

(5) Shutdown relay tripped

(6) Lube oil system trouble

(7) Primary filter high differential pressure (Unit 2 only)

In addition to the diesel generator trouble annunciator window, there are alarm annunciator windows and data logger printouts for each of the above seven conditions.

The following abnormal conditions are annunciated in the main control room for each unit:

(1) Engine generator on local control, manual control, or test

(2) Generator circuit breaker on local control

(3) DC control undervoltage

    (a) Engine generator control

(b) Circuit breaker control

(4) Engine starting air pressure - low

(5) Engine fails to start (overcrank)

(6) Engine lube oil system trouble

(a) Low lube oil pressure

(b) Low lube oil level

(c) High lube oil filter differential pressure

(d) High lube oil temperature

(e) Low lube oil temperature

(f) Precirculating lube oil pump failure

(7) Engine cooling system trouble

(a) High jacket water temperature

(b) Low jacket water level

(c) High compartment air temperature

(d) High radiator discharge air temperature

(8) Engine fuel oil system trouble

(a) High/low engine fuel oil day tank level

(b) High/low storage fuel oil storage tank level

(c) Fuel oil transfer pump overcurrent

(d) Low engine fuel oil priming tank level

(e) Fuel oil transfer pump running

(9) Engine crankcase vacuum trouble

(10) Generator stator temperature - high

(11) Ground overcurrent

(12) Generator negative sequence

(13) Engine trip (shutdown relay tripped)

(14) Engine generator circuit breaker trip

  (a) Reverse power

  (b) Loss of field

  (c) Generator differential overcurrent

(15) Auxiliaries undervoltage or overcurrent

(16) Engine generator on backup dc supply

(17) High fuel oil transfer filter differential pressure (Plant common alarm annunciated in Unit 1 control room only)

(18) High diesel room temperature (temperature monitoring system)

If the engine generator unit is started automatically on loss of standby power, or safety injection, or both, the engine trip or shutdown functions are limited to the following:

(1) Engine overspeed

(2) Engine low lube oil pressure

(3) Generator current differential

(4) Emergency stop switch

The engine overspeed trip is a mechanical device relying on centrifugal force to release a spring that, by mechanical action alone, stops the flow of fuel and shuts down the engine. Although a mechanical failure of the device could occur and cause a spurious shutdown of the engine, the manufacturer has many years of satisfactory operational experience with this device in all types of service. Also, the engine overspeed trip is a single-purpose device, designed specifically as a secondary or backup device in the event the normal speed control system malfunctions. Normal engine speed control is provided by the governor. The governor and the overspeed trip are considered independent, redundant devices.

The low lubricating oil pressure shutdown is actuated by two pressure switches in the engine lubricating oil system. Both devices must be actuated by low pressure to shut down the engine. A malfunction by one can be postulated but, by itself, could not generate an engine trip. Also, the low lubricating oil pressure trip is actually a low-low lubricating oil pressure condition. The setpoint for shutdown is 20 psig below the low lubricating oil pressure alarm point at which the operator is informed of the low-pressure condition.

The generator current differential relay has successfully undergone seismic testing as part of the relay boards, as reported in Section 3.10, so false operation due to an earthquake should not occur. False operation under conditions other than an earthquake would occur only due to failure of a particular internal component of the relay.

If the engine generator unit is started manually in the test mode, greater engine protection is provided and the following abnormal conditions, in addition to the four for automatic mode, will also trip the engine:

(1) Engine overcrank (after 10 seconds of engine cranking and failure to start)

(2) Engine high jacket water temperature

Protection of the electrical equipment associated with the engine generator units is provided by opening the generator circuit breaker in the event of any of the trips listed above, and any of the following abnormal electrical conditions:

(1) Generator loss of field excitation

(2) Generator reverse power (antimotoring)

(3) Generator overcurrent

(4) 4.16-kV bus current differential

(5) Generator current differential

(6) Generator field shorting contactor de-energized (loss of jacket water pressure and nominal speed less than 100 rpm)

A trip cutout switch disables the loss of field, reverse power, and overcurrent protection for each diesel generator during normal operation; that is, when the diesel is not in test mode. The switch is located in each bus's respective safeguard relay board and activates an alarm whenever protection is cut in.

Generator loss of field relay, reverse power relay, overcurrent relays, and bus differential relays have been successfully tested for seismic loads, as detailed in Section 3.10, so false operation due to an earthquake will not occur.

8.3.1.2 Analysis

As previously described in this chapter, standby and preferred power supplies are provided, each adequately sized to permit functioning of systems, equipment, and components important to safety. An analysis of the preferred power supply is contained in Section 8.2.2. Section 8.3.1.1 contains an analysis and description of the design and operation of the preferred power supply, including a tabulation of diesel generator capabilities and loading.

The design bases established for the design of the Class 1E electrical circuits, their conductors, and raceways ensure that the nuclear reactor and safeguards system and equipment can operate properly at all times. These bases comply with GDCs 17, 1971, GDC 18, 1971, Safety Guide 6, March 1971 (Reference 9), and IEEE 308-1971. In developing these design bases, careful consideration was given to the following factors:

(1) Separation and isolation of redundant electrical circuits

(2) Construction, capacity, and loading of electrical conductors and cables

(3) Construction, arrangement, and conductor fill of electrical raceways

(4) Environmental conditions and protection from physical hazards

(5) Electrical fault protection

The power and control cable insulation used has been specified and tested to meet requirements that exceed IEEE, National Electric Code (NEC), or Insulated Power Cable Engineers Association (IPCEA) standards for flame retardance and self-extinguishing capabilities.

8.3.1.3 Conformance with Appropriate Quality Assurance Standards

The Class 1E electrical systems, equipment, and components were designed, fabricated, installed, inspected, and tested under the formal quality assurance program developed during design and construction of the plant. The quality assurance program is described in Chapter 17. Reactor protection system testing is described in Chapter 7.

8.3.1.4 Independence of Redundant Systems

This section presents the criteria and bases for the installation of Class 1E electrical systems. These criteria establish the minimum requirements for preserving the independence of redundant Class 1E electrical systems to ensure that they remain operational during any design basis event.

Each of the redundant, onsite, ac power sources and its distribution system is independent from the others. The Class 1E buses F, G, and H are each independently supplied by one diesel generator. No swing bus is utilized. There is no provision for automatically paralleling the standby power source of one load with the standby source of another load. There is no provision for automatically connecting one Class 1E load group with another load group or for the automatic transfer of load groups between redundant standby power sources.

8.3.1.4.1 Separation Criteria for Class 1E Systems

Mutually redundant Class 1E electrical power equipment, devices, and circuits are physically separated from each other to meet single failure criteria of the standards. Diablo Canyon is not committed to Regulatory Guide 1.75 separation and isolation requirements.

Major Class 1E electric power distribution equipment is located in individual rooms isolated from non-Class 1E equipment, and also from other mutually redundant Class 1E equipment. In this case, separation of internal wiring is inherently achieved by the amount of spacing of the equipment, isolation by fire-rated concrete walls and floors, and use of fire-rated doors. Where Class 1E circuits of more than one mutually redundant system are in proximity in the same enclosure, panel, board, or unit of equipment, these circuits are run in separate metallic wireways or conduits and are typically connected to different terminal blocks. Separate wireways are not provided for certain low-energy steam generator wide-range water level instrument loops resulting from original plant construction. Exposed wiring at end connections to control devices (such as control switches) is separated by at least 5 inches for mutually redundant circuits. Less than 5 inches of separation is allowed for (a) low-energy signal (instrument loop) connections to indicating devices (such as recorders) that must be functionally grouped to enhance operator comprehension, and (b) certain existing Class 1E ammeters with $\geq$ 3 inches separation resulting from original plant construction. Mutually redundant circuits in boards and panels are separated by one of the following methods:

(1) Five-inch minimum separation in air

(2) Metallic barrier

(3) Metallic conduit

(4) Glastic barrier

(5) Sealtite Flex

(6) "Scotch Brand" 7700 or equivalent electric arc and fireproofing tape with "Pluton" fabric exposed, and a minimum of a 1/4-inch overlap between wraps. This tape is held in place after application with AMP-TY stainless steel cable ties, or two complete wraps of Varglass silicone tying cord, Type 46. Maximum length between steel or cord ties does not exceed 18 inches

(7) Varflex Type HA (heat-treated glassbraid)

(8) Varflex silifex sleeving

(9) Silicone RTV fire sealant material

Methods (1) through (5) are used wherever possible. Methods (6) through (9) are used only where methods (1) through (5) are not feasible. In the main control board and console, mutually redundant Class 1E devices are placed in individual modules, 5 inches apart, which provide two thicknesses of metallic or electrical insulating material between them, or the devices are separated by one of the above methods. For low-energy devices (indicators and recorders) unit cases are relied upon for adequate separation. External connections for mutually redundant circuits are brought through separate floor openings and risers. In addition, design for routing of interconnecting wiring is based on a requirement that there be no direct line of sight exposure between mutually redundant circuit conductors.

Electrical conductors that interconnect separate units of equipment or devices throughout the plant are separated for redundant systems in these ways:

(1) Where a separate room is provided exclusively for a group of redundant equipment requiring circuits, the cables may be placed in trays or troughs within the room. With the exception of underfloor wiring beneath the protection racks, these are the only areas where cable trays are used.

(2) In all other areas of the plant, Class 1E circuits are placed in metallic conduit for exposed conduit, and ABS plastic or rigid iron for embedded conduit.

(3) Nuclear protection instrumentation channels are placed in separate raceways. Cable trays under the protection racks are enclosed beneath a subfloor and barriered from each other by solid structural floor support beams. Each protection channel output from the same channel to the same logic train shares the same raceway. Separate raceways are used for the direct inputs to logic Trains A or B.

(4) In the cable spreading areas of each unit, electrical cables for redundant functions are placed in separate conduits. Circuit segregation can be on either a protection channel, train, Class 1E bus, or dc bus basis. All conductors in the cable spreading area associated with safety-related functions are enclosed in metallic conduits. Only non-Class 1E wiring is run in trays, with the exception of underfloor wiring beneath the protection racks.

For more details on separation of protective circuits, refer to Figure 7.3-50 (Sheets 1 and 2).

8.3.1.4.2 Separations and Isolations

Electrical circuits are separated from each other according to class of service and to redundancy group. Separation criteria for mutually redundant circuits are given in the preceding section. Separate raceway systems are used for each of the following service categories:

(1) High-Voltage Power - This category contains all of the power circuits above 600-V; in this case, the 4160-V and 12,000-V conductors.

(2) Low Voltage Power and Control - This category includes power circuits below 600-V; in this case, 480-V and 120/208-Vac, and also the 120-Vac and 125-Vdc control circuits.

(3) Instrumentation - This category contains the circuits transmitting low-level sensitive signals for instrumentation and process control. It includes the conductors for thermocouples, resistance temperature detectors, and the transducers and transmitters used in the fluid process and electric power instrumentation systems.

(4) Nuclear Instrumentation - This category contains the circuits for the nuclear instrumentation and control system.

8.3.1.4.3 Insulated Electrical Conductors

Electrical conductors are copper, except for some thermocouple wire, and are stranded except for thermocouple, communications, and lighting branch circuits. Conductor sizes are based on the current and temperature ratings given in the National Electric Code (Reference 10) (NEC), the "Power Cable Ampacities," Publication S-135-1 (Reference 11) of the American Institute of Electrical Engineers (AIEE), or by the cable manufacturer, as appropriate. Cables have been derated for ambient temperature and cable grouping in a common raceway. Low-voltage small power cables have been derated as specified in the NEC, 1968 Edition, Table 3.10-12, and Notes 8 and 15. High-voltage and large power cables have been derated as specified in AIEE

Publication S-135-1, Tables VII, VIII, and IX for grouping, and by using a conductor temperature that is less than the rating of the insulation by the same amount that the ambient is above the standard used in the table. Cables located in cable trays may be derated in accordance with Insulated Cable Engineers Association (ICEA) P-54-440 (Reference 19).

8.3.1.4.3.1 Construction and Voltage Ratings

The insulation and jacket materials are selected for their superior electrical and physical characteristics and will perform their function under the most severe conditions expected for the application. The compounds are thermally stable and do not melt. All power and control cable jacket materials are flame retardant. Power and control cable insulations are also flame retardant. For exceptions to the fire retardant requirements, refer to Appendix 9.5B.

Wire and cables run between equipment located in the conventional environment are insulated with ethylene-propylene rubber or cross-linked polyethylene (XLPE). Jacket materials are either neoprene, hypalon (chlorosulfonated polyethylene (CSPE)), XLPE or linear low density polyethylene. Silicon rubber, polyarlene, polyimide film, Tefzel, XLPE, or equivalent insulation material, with a silicone rubber, polyarlene, Tefzel, hypalon (CSPE), XLPE, or equivalent jacket material are used for circuits located where high ambient temperatures may be encountered.

Within equipment, boards, panels, and devices, insulation is either fluorinated ethylene-propylene, cross-linked polyethylene, polyvinyl chloride (PVC) with an asbestos jacket (NEC Type TA), or PVC alone. The use of PVC has been kept to a minimum and is used only where a manufacturer has standardized production with this material. No PG&E Design Class 1 or Class 1E panel, board, or equipment has PVC insulated wires, except that devices such as relays, transmitters, and instruments may have some PVC. The small amount of PVC present does not present any problems with respect to toxic effects or corrosive products in the event of fire.

The insulated electrical conductors that externally interconnect separate units of equipment throughout the plant are described in Appendix 8.3B

8.3.1.4.3.2 Test and Inspection

The construction and material composition of each type of cable has been selected based on careful investigation and analysis, including the results of tests performed in accordance with Underwriters' Laboratories (UL), IPCEA-NEMA, AEIC, and PG&E requirements.

All cables for circuits that externally interconnect separate units of equipment were given the production electrical and physical tests described in the standards. Flame tests for low-voltage power, control, and instrumentation cable were made according to UL and IPCEA standard procedures and to special PG&E methods using large groups

of wires bundled in a cable tray and a large burner. The cable supplier was also required to make this test. Only cables that were self-extinguishing upon removal of the burner flame were selected. Refer to the previous section for those types of cables requiring flame retardant insulation. Conductors for equipment, boards, panels, and devices were selected and specified on the basis of UL approval for this service and special PG&E or manufacturer's tests.

Conductors required to operate in containment atmosphere during a LOCA were tested in a steam chamber, either by the manufacturer or PG&E, before approval for quotations. Refer to Section 3.11 for additional information on equipment required to operate during a LOCA.

A particular effort was made to ensure that manufacturing standards of the highest quality were maintained in the production of all cables for use in Class 1E circuits. To ensure that the cable, as manufactured, is of the highest quality, PG&E inspectors performed visual inspections and witnessed factory tests on sample reels from each production run of cable.

8.3.1.4.4 Electrical Raceways

The total cross-sectional area of conductors in trays is limited generally to 30 percent of the tray cross-sectional area, with a maximum limit of 32 percent unless otherwise approved by an engineering evaluation. Electrical conduits are designed to the limits given in the NEC. The limit of 40 percent conduit fill is generally required, with a maximum of 42 percent fill unless otherwise approved by an engineering evaluation.

Electrical raceways that interconnect individual sets or units of equipment throughout the plant are arranged to provide separate raceways for each class of service and redundancy group. Also, separate raceways are provided for Class 1E electrical systems. Exposed raceways are either cable tray or metallic electrical conduit. Embedded raceways are ABS plastic of standard iron pipe size, except that some very short lengths are rigid iron.

8.3.1.4.5 Cable Trays

Cable trays are generally of the ventilated uncovered type. Solid bottom or covered trays are placed in locations where protection is needed and ventilation may be reduced. Trays are made of formed steel, hot-dip galvanized, with sides 3 inches high and widths up to 24 inches. The trays comply with NEMA Standard VE-1-1965 for Class 2 construction. Aluminum trays are used in a few cases where severe corrosion of steel is a problem, such as at the intake structure. Aluminum is not used in the containment. Cable trays for Class 1E systems are only installed where a separate room is provided exclusively for each mutually redundant group of Class 1E circuits.

8.3.1.4.6 Conduit

Metallic conduits are generally hot-dipped galvanized steel, either rigid iron or electrical metallic tubing (EMT). Aluminum conduit is used where magnetic induction may be a problem. Aluminum, Stainless Steel or PVC-coated rigid iron conduit may be used where corrosion is present, such as at the intake structure. Aluminum conduit is not used in the containment. Stainless steel conduit is used in a few cases where electrical circuits enter stainless steel liners. Flexible liquid-tight conduit is used in short sections where vibration or differential expansion may occur. An exception to this is the reactor head assembly where long flexible liquid-tight conduits exist for the convenience of the reactor head removal process upon refueling. Long flexible conduits in cable trays are also utilized in the cable spreading room for the white light circuits due to space limitations. Plastic (ABS) conduit is installed completely encased in concrete or in earth beneath a protective concrete slab. Metallic conduit is installed for mutually redundant Class 1E electrical circuits where they are close to, and exposed to, each other.

8.3.1.4.7 Supports

Cable trays are supported on spans of 8 feet or less, and also at each end of the fittings. Unless otherwise approved by an engineering evaluation, exposed conduits are supported at intervals of 8-1/2 feet or less, and also within 4 feet of any termination. Supports for Class 1E electrical raceways are designed to withstand the seismic forces established for the location. Refer to Section 3.10 for more information on seismic design. PG&E Design Class I supports are not normally shared by mutually redundant Class 1E circuits. Exceptions to this are areas such as in the cable spreading room under the control room and in the fuel handling building at elevation 100 feet. However, as stated earlier, all PG&E Design Class I supports are seismically qualified.

8.3.1.4.8 Penetrations

Cable penetrations through walls are (a) in jumboduct embedded in concrete (Figures 8.3-21 and 8.3-22), (b) in conduit embedded in concrete (Figure 8.3-23), or (c) in conduit passing through a wall opening with the space between the conduit and the concrete sealed as described below. Containment penetrations by high- and low-voltage and signal cables are either a canister-type design or feed through penetration modules that provide a single seal as part of the pressure barrier. Containment penetrations are also provided as part of the personnel and emergency airlocks. Additional information on the containment penetration design is provided in Section 3.8.1.1.3.1. These containment penetrations are LOCA qualified as described in Section 3.11.

Overcurrent protection of the containment electrical penetrations meets the requirements of Regulatory Guide 1.63, Revision 1 (Reference 12). In addition, non-Class IE penetration overcurrent protection has procurement documentation or an engineering evaluation verifying the capability to protect the penetration during and after a Design Earthquake.

The electrical penetrations are designed and built in accordance with IEEE 317-1971 (Reference 32) with the following exceptions:

(1) Prototype tests were not made with all of the physical conditions of the accident environment applied simultaneously with the electrical tests, although they were successfully made separately. For example, the momentary current tests on power penetrations are not run under simulated accident conditions. It is felt that such tests need not be made simultaneously because the construction of the penetration assemblies is such that the outer seal is located about 4-1/2 feet away from the inner seal and the containment liner and, therefore, will not be exposed to accident environmental conditions. The integrity of the containment is, therefore, maintained at the penetration assemblies during a loss-of-coolant accident (LOCA).

(2) Dielectric strength tests were conducted in accordance with the National Electrical Manufacturers Association (NEMA) standard that permits testing of this type of equipment at 20 percent higher than twice-rated voltage plus 1000 V for 1 second.

Wire and cable splice samples used at the containment penetrations were tested under conditions simulating a LOCA environment. Refer to Section 3.11 for a discussion on Class I electrical equipment environmental qualification.

8.3.1.4.9 Fire Barriers and Separation

Adequacy of design with regard to fire hazards in areas of concentration of electrical cables is analyzed in Section 8.3.1.4.10.1. Section 9.5.1 covers the fire protection system. Figures 9.5-1 and 9.5-3 show the fire protection water and CO_2 systems, respectively.

Penetration fire stops and seals between rooms, fire seals inside conduits, fire stops on vertical and horizontal trays, and fire seals under equipment all serve to control and prevent propagation of fire from one redundant system to another, and from one room to another. All jumbo ducts for cable trays are provided with fire stops where they penetrate walls, floors, ceilings, and electrical equipment. In addition, fire stops are installed at intervals of 5 feet on vertical trays and 12 feet on horizontal trays, and within 5 feet of tray crossings, either above or below. Reference drawing 050029, DCP A-47854, DCP M-049476, and FHARES 101 and 103. Typical fire stops are shown in Figures 8.3-24 through 8.3-28. Conduits are provided with fire stops at the penetration of a fire barrier or at the nearest accessible point to that penetration. All cable entrances to the cable spreading room, control room areas, and interconnecting cable entrances between these two rooms are sealed to ensure the integrity of each area. Materials used for fire stops and seals are described in Appendix 8.3C.

8.3.1.4.10 Class 1E Separation and Protection Criteria

Separation and protection of mutually redundant Class 1E systems prevent the loss of safeguard functions. Thus, a function is available even if the use of one redundant system is lost.

The criteria discussed in this section ensure protection for safeguard functions in case of fire, missiles, pipe whip, and jet impingement. (Protection from natural hazards such as earthquake, flood, and tornado is discussed in Sections 3.10, 3.4, and 3.3, respectively.)

8.3.1.4.10.1 Fire

Specifications require that Class 1E cables be insulated with materials that do not support fire and are self-extinguishing. This prevents the spread or support of combustion from the original location of any fire along Class 1E cable. Outside of Class 1E equipment rooms, all mutually redundant Class 1E cables are required to be run in separate metallic conduit. This conduit prevents direct flame contact with Class 1E cable. Thus, it provides a second barrier to fire propagation along Class 1E cable.

Specifications require that electrical conductors have adequate ratings and overcurrent protection to prevent breakdown of insulation or excessive heating. Thus, fires will not be started in cable inside conduits due to overcurrent.

IEEE 308-1971 requires that Class 1E equipment be located in individual rooms. This isolates Class 1E equipment from non-Class 1E equipment and from mutually redundant Class 1E equipment. Isolation from fire is accomplished through the use of concrete walls with fire dampers and penetration seals, as necessary. It is not credible for fire to spread between rooms. Therefore, mutually redundant Class 1E equipment will not be disabled by a single fire.

10 CFR Part 50, Appendix R (Reference 13), Section III.G, provides criteria for protection of equipment and circuits required for safe shutdown. These criteria ensure that redundant safe shutdown trains will not be damaged as a result of a single fire. Protection of redundant trains is provided by a combination of physical separation, fire-rated barriers, and/or automatic suppression and detection. Exceptions to these criteria are documented based on the fire hazard in the area and/or other compensatory fire protection features provided.

Figure 9.5-2 shows that the diesel generator and Class 1E cable spreading rooms are protected by an automatic CO_2 fire extinguishing system. Any fire starting in the cable spreading room will be extinguished in time to prevent the loss of safe shutdown capability. Class 1E cables are also run in rooms containing equipment that is not Class 1E. The possibility of fires starting in these rooms has been analyzed. It is not credible that any fire that may start in these rooms could destroy a protection function and impair plant safety.

As discussed above, fire will not cause a loss of any protection function for the following reasons:

(1) Class 1E equipment will not support fire or is protected by fire extinguishing equipment.

(2) Class 1E systems are physically separated.

(3) Redundant safe shutdown trains are separated and protected in accordance with Appendix R to 10 CFR Part 50, Section III.G, with exceptions.

For further information on fire protection, refer to Reference 14.

8.3.1.4.10.2 Missiles

The basic approach for protection of Class 1E equipment and cables from missiles is to ensure design adequacy against generation of missiles. Where missiles cannot be contained within parent equipment, missile protection is attained by routing or placing Class 1E cables and equipment in nonmissile-prone areas or by shielding the equipment.

Section 3.5 discusses postulated high-energy missiles. Class 1E cables and equipment are routed and placed so that they are protected from these missiles.

Outside of areas affected by high-energy missiles there is a very low probability of missile generation. Class 1E cables are protected from any possible low-energy missiles by the conduit in which they run.

Class 1E equipment, located in individual rooms, is protected from missiles generated outside the rooms by concrete walls and floors. After redundant Class 1E cables have passed into rooms where they make connections, they may be run in cable trays. However, mutually redundant wiring is not run in the same room. Therefore, missiles generated in the room will not cause a loss of any protection function.

8.3.1.4.10.3 Pipe Whip and Jet Impingement

The protection of Class 1E equipment and cables from pipe whip and jet impingement has been studied (refer to Section 3.6). All Class 1E cables and equipment required for this accident are protected from damage caused by these hazards.

8.3.1.5 Physical Identification of Safety-Related Equipment

Class 1E electrical power equipment is located in individual rooms isolated from non-Class 1E equipment and also from each other for mutually redundant sets of equipment. Nameplates on the sets of equipment and on the entrances to the rooms identify the equipment.

8.3.1.5.1 Color Coding

Some electrical systems are color-coded:

(1) The Class 1E electrical power systems and equipment for each mutually redundant system

(2) The reactor protection systems

(3) The 120-Vac power circuits from the instrument inverters to the reactor protection channels

(4) Control, indication, and annunciation circuits that are not required for safe shutdown that are in Class 1E raceways

These colors are listed in Table 8.3-10 and have been applied to the Class 1E electrical circuits and their raceways that externally interconnect individual sets or units of equipment.

Internal wiring within units of equipment are not necessarily color-coded. Where a set of equipment is only one redundancy class that is clearly identified by other means, the circuits may have some or all of the conductors without any color coding. Standard Type TA switchboard wire, for example, is available in either black or gray colors only.

Where circuits of more than one mutually redundant system appear in the proximity or the same enclosure, the circuits have either the conductors, their bundling bands, or wireways identified by the assigned color code.

Conductors of control, indication, and annunciation circuits that are not required for safe shutdown may, to improve reliability, be purchased and installed as Class 1E and color-coded. These circuits are designed with sufficient isolation to ensure that a single failure does not propagate to the mutually redundant device. Circuits that do not serve safety-related functions, but are affiliated with safety-related devices, are colored consistent with the safety-related device, train, or circuit. Consequently, the coloring of these nonsafety-related circuits may not necessarily reflect the color code of their electric power sources.

Generally, non-Class 1E electric systems are assigned the color black. Because of certain industry standard practices, some non-Class 1E conductors are color-coded.

These conductors are in circuits that are in no way related to those for operating the plant and are kept entirely separate. The functions of these systems are so obvious that there should be no confusion with the colors. These circuits are:

(1) Communication - these circuits are generally multiconductor with color-coded individual conductors.

(2) Thermocouple - these circuits are always multiconductor and have individual conductors colored according to the ISA standard to denote the type of metal. However, the jacket is generally color-coded to match the assigned redundancy group. Special applications and systems may have other color-coding.

(3) Lighting - these circuits have conductors color-coded according to the NEC.

Electrical conductors that interconnect separate units of equipment are identified by the color assigned to the system. On multiconductor cables, the color code is generally applied to the outer jacket and also to the individual conductors, except that thermocouple extension conductors have the ISA standard color designated for the type of metal. Each electrical raceway has its identification number stenciled in paint at readily visible places on its surface in the following colors:

(1) Black - all circuits 600 V and below

(2) Red - all circuits above 600 V

Cable tray designations are 1-inch high and spaced not more than 15 feet apart. Conduit designations are 1-inch high, except that designations for conduits smaller than 1 inch are 1/2-inch high, and placed at each end of the conduit, at pull boxes, and at intermediate points to effectively identify the run.

In addition, each Class 1E raceway, either conduit or tray, is distinctly marked at termination points and at intermediate points with a vertical stripe, 2-inches wide, and colored to match the circuits within. The color code is given under the description of electrical conductors.

8.3.1.5.2 Design and Installation

The design of electrical circuits is developed from the system requirements in conjunction with the manufacturer's circuits selected to perform the required functions. Past practices that have been successfully used by PG&E and the industry are also included in the design where possible. Functional analyses are made on the circuits by the designers and engineers during the completion of the schemes. Further review and coordination is made with persons whose interests are affected by the operation of the

circuit. Final approval is made in the manner described in Chapter 17, Quality Assurance.

Electrical circuits are shown on the type of diagram appropriate to the information desired. Diagrams generally consist of these types: single line meter and relay, schematic, logic, block or functional, and connection. Conductor and main circuit numbers, as well as the equipment identification, are given in the schematic diagrams. Power conductor sizes are given in the single line meter and relay diagrams and checked by the responsible engineer.

Electrical circuits that interconnect separate units of equipment and devices throughout the plant are compiled, tabulated, and checked by electronic data processing equipment. Each termination point is given a unique designation, referred to as the location code, for convenience and to prevent ambiguity.

Each type of electrical conductor is given a unique code (known as the wire code) that identifies its class of service and redundancy group. Also, each individual electrical conductor has a unique identity given by its wire ID and circuit number.

Each circuit is listed, giving the size and number of conductors, the raceway routing and termination points, and the identification symbol, coded to denote the circuit class of service and redundancy group and the conductor type, rating, and color. These listings are then checked manually against approved electrical diagrams. Also, the connection diagrams and a computer listing of circuits and conductors arranged by termination location are cross-checked manually. In addition, the computer checks that the circuits and raceways selected are of the same class of service and redundancy group.

Each raceway, tray, or conduit is assigned a unique code, referred to as the tray or conduit number. The raceway is then listed, giving its type, size, terminating or junction points, and the arrangement drawings showing its physical layout.

Separate circuit schedules are made for each class of service except for lighting branch circuits and telephone cables that are shown only on diagrams. Circuit schedules are typically not utilized for loads fed from the 12-kV underground distribution system.

The circuit information is stored by computer using a software program in the form of electronic drawings distributed by downloading from the network to individual computers. The electronic drawings can then be printed for use in the field.
The circuit information software checks that the raceway contains only the allowable grouping of circuits according to the class of service and redundancy. The software also calculates the percentage fill. Any overfills are corrected manually.

Individual circuit installation records for the installation and termination of the electrical circuits are derived from circuit data stored by computer using a software program. Each circuit installation record consists of installation and termination data. All predetermined data is entered in these forms.

The installation data may include the circuit schedule, termination locations, raceway routing, cable data, and purchase order or stock code.

Termination data may provide the diagram of connection for each termination point and the type and size of connectors and tools used.

Circuit and raceway installation data is retained for quality assurance purposes.

The methods and procedures for the design and installation of Class 1E electrical equipment and material are described in Chapter 17, Quality Assurance.

8.3.1.6 Station Blackout

Station Blackout (SBO) at DCPP is defined as loss of power from the preferred power source with the failure of two emergency AC sources (EDGs) in the unit experiencing the SBO (References 20, 21, 22, and 23). The other unit is assumed to experience only a loss of offsite power.

To comply with the requirements of 10 CFR 50.63, a sixth EDG was added to Unit 2 and the existing (swing) fifth EDG was made Unit 1 specific. There are now three dedicated EDGs per unit.

The DCPP Units are assigned an allowed EDG target reliability of 0.950 and a SBO duration of 4 hours. The bus F EDGs 1-3 and 2-3, the designated AAC power sources, are available within ten minutes from the onset of the SBO event. These EDGs have sufficient capacity and connectability to operate systems necessary for mitigating a SBO event for the required duration of 4 hours to maintain the reactor in a safe shutdown condition.

The DCPP SBO analysis was performed using the guidance provided in NUMARC 87-00, Rev. 0 (Reference 23) and Regulatory Guide 1.155, August 1988 (Reference 31) which contains guidance that is not provided in NUMARC 87-00. Using this guidance, (the postulated maximum SBO duration for DCPP was determined to be 4 hours. This SBO duration time was determined based on the following factors:

(1) The site susceptibility to grid-related loss of offsite power events of greater than 5 minutes duration is expected to be less frequent than once per 20 years. Grid-related loss of offsite power events are defined as losses of offsite power associated with the loss of the transmission and distribution system due to insufficient generating capacity, excessive loads, or dynamic instability. Although grid failure may also be caused by other factors, such as severe weather conditions or brush fires, these events are not considered grid-related since they are caused by external events.

(2) The probability of loss of offsite power due to the occurrence of severe weather at the plant site is low based on historical weather data (Reference 23).

(3) The plant is served by two offsite power circuits connected to the plant's Class 1E buses through two electrically independent switchyards.

(4) The reliability of the EDGs is greater than or equal to 0.95.

8.3.1.6.1 Emergency AC (EAC) Analysis

The emergency ac (EAC) classification for DCPP is Group C. For DCPP, the EAC criteria require that the unit under consideration be capable of attaining Mode 5 in the event of a LOOP and single failure (within each unit), without use of the designated alternate AC (AAC) source. The DCPP EAC analysis demonstrated that the plant could be safely shutdown to Mode 5 utilizing either buses G or H and their normally connected EDGs (EAC sources) independent of the third EDG and its bus F, considered the AAC source.

The turbine-driven AFW pump is credited for operation with bus G (a motor-driven AFW pump is available on the bus H). The EAC analysis determined that the only required shutdown system not provided on bus H is the auxiliary salt water (ASW) system. However, ASW can be made available (even given an active failure or bus failure on the other unit) through the ASW hydraulic interconnection between units. To accomplish the unit-to-unit ASW interconnection, the analysis assumes the common unit valve FCV-601 would be manually opened. One ASW pump is capable of supplying sufficient flow to both a Unit 1 and a Unit 2 CCW heat exchanger, thus handling the shutdown heat loads from both units.

Although the DCPP SBO EAC analysis takes credit for the hydraulic ASW interconnection between units, the electrical interconnection of the 4.16-kV buses within a unit to obtain the necessary ASW flow is not precluded.

During a SBO event, operator action is necessary to energize the battery charger(s), within the 2-hour battery duty cycle, to provide at least two input channels of instrumentation to monitor system functions and actuate one train of safeguards equipment. This action involves closing an input and output breaker to battery charger 121(122) if bus G is not available.
Sufficient input channels may be deenergized such that a safety injection (SI) signal may be initiated. However, it was determined that generation of an inadvertent SI signal is acceptable and does not interfere with maintaining the safe shutdown of the unit.

8.3.1.6.2 Alternate AC (AAC) Analysis

The SBO AAC analysis demonstrates that the bus F EDGs satisfy the criteria specified in Appendix B to NUMARC 87-00, and will be available within ten minutes of the onset of the SBO event, and has sufficient capacity and capability to operate systems necessary for the required duration of 4 hours to maintain the unit in a safe shutdown condition (Mode 3). However, during an SBO event, any of the three EDGs have the capability and capacity to be used as the AAC source. Because the AAC source is a Class 1E EDG, it meets the criterion for the AAC source to be available within 10 minutes and, therefore, no coping analysis was required to be performed.

The SBO AAC analysis is not required to assume a concurrent single failure or design basis accident. In addition, 10 CFR 50.63 (Reference 20) permits the use of non-safety-related systems and equipment to respond to a SBO event. Based on the SBO AAC analysis, operation of several systems and components were evaluated for the required duration of 4 hours to maintain the unit in a safe shutdown condition. The only equipment not available from the AAC bus F is the diesel fuel oil transfer pumps which can be supplied from either bus G or bus H of the other unit.

During an SBO event, operator action is necessary to energize the battery charger(s) within the 2 hour battery duty cycle, to provide at least two input channels of instrumentation to monitor system functions and actuate one train of safeguards equipment. This action involves closing an input and an output breaker to Battery Charger 131 (231).

Sufficient input channels may be deenergized such that a safety injection (SI) signal may be initiated. The additional loading on bus F of the SI pump can be accommodated; such an inadvertent SI is acceptable.

Plant-specific procedures were reviewed and updated to incorporate the requirements associated with the recovery from an SBO event. Recovery plans that include coordination with other power stations to re-route power to DCPP were also developed and implemented (Reference 21).

8.3.2 DC POWER SYSTEMS

There are two dc power systems in each unit at Diablo Canyon. One is a non-Class 1E system serving 125-Vdc and 250-Vdc non-Class 1E loads. The other is a Class 1E system serving Class 1E 125-Vdc loads that include ESF loads and some non-Class 1E loads. Refer to Figures 8.3-17 and 8.3-18.

8.3.2.1 Design Bases

8.3.2.1.1 General Design Criterion 2, 1967 – Performance Standards

The Class 1E 125-Vdc system is designed to withstand the effects of or be protected against natural phenomena, such as earthquakes, tornados, flooding, winds, and other local site effects.

8.3.2.1.2 General Design Criterion 3, 1971 – Fire Protection

The Class 1E 125-Vdc system is designed and located to minimize, consistent with other safety requirements, the probability of events such as fires and explosions.

8.3.2.1.3 General Design Criterion 4, 1967 – Sharing of Systems

The 125-Vdc system or components are not shared by the DCPP Units unless it is shown safety is not impaired by such sharing.

8.3.2.1.4 General Design Criterion 11, 1967 – Control Room

The Class 1E 125-Vdc system is designed to support safe shutdown actions to maintain and control the safe operational status of the plant from the control room or from an alternate location if control room access is lost due to fire or other cause.

8.3.2.1.5 General Design Criterion 12, 1967 – Instrumentation and Control

The Class 1E 125-Vdc system design has instrumentation and controls to monitor and maintain system variables within prescribed operating ranges.

8.3.2.1.6 General Design Criterion 17, 1971 – Electric Power Systems

The Class 1E 125-Vdc system design has sufficient capacity, capability, independence, redundancy, and testability to perform its safety function assuming a single failure.

8.3.2.1.7 General Design Criterion 18, 1971 – Inspection and Testing of Electric Power Systems

The Class 1E 125-Vdc system design permits appropriate periodic inspection and testing of functional and operational performance of the system as a whole and under conditions as close to design as practical.

8.3.2.1.8 General Design Criterion 21, 1967 – Single Failure Definition

The Class 1E 125-Vdc system is designed to remain functional after sustaining a single failure. Multiple failures resulting from a single event shall be treated as a single failure.

8.3.2.1.9 General Design Criterion 24, 1967 – Emergency Power for Protection Systems

The Class 1E 125-Vdc system provides an alternate source of power to permit the required functioning of the protection systems in the event of loss of all offsite power.

8.3.2.1.10 General Design Criterion 40, 1967 – Missile Protection

The Class 1E 125-Vdc system is designed to be protected against dynamic effects and missiles that result from plant equipment failures.

8.3.2.1.11 General Design Criterion 49, 1967 – Containment Design Basis

The Class 1E 125-Vdc and non-Class 1E 125-Vdc circuits routed through containment electrical penetrations are designed to support the containment design basis so that the containment structure can accommodate, without exceeding the design leakage rate, the pressure and temperatures following a loss-of-coolant accident.

8.3.2.1.12 10 CFR 50.49 – Environmental Qualification of Electric Equipment

The Class 1E 125-Vdc system electric components that require environmental qualification (EQ) are qualified to the requirements of 10 CFR 50.49.

8.3.2.1.13 10 CFR 50.62 – Requirements for Reduction of Risk from Anticipated Transients Without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants

The non-Class 1E 125-Vdc power source, as required for ATWS, provides a source that is independent form the protection system power supplies.

8.3.2.1.14 10 CFR 50.63 – Loss of All Alternating Current Power

The Class 1E 125-Vdc system provides power to the loads required to support systems that ensure core cooling and containment integrity is maintained from the alternate ac source following a loss of all ac power (station blackout).

8.3.2.1.15 10 CFR Part 50 Appendix R (Sections III.G, III.J, and III.L) – Fire Protection Program for Nuclear Power Facilities Operating Before January 1, 1979

Section III.G – Fire protection of Safe Shutdown Capability: Fire protection of the Class 1E 125-Vdc system is provided by a combination of physical separation, fire-rated barriers, and/or automatic suppression and detection.

Section III.J – Emergency Lighting: Emergency lighting or battery operated lights (BOLs) are provided in areas where operation of the 125-Vdc system may be required to safely shut down the Unit following a fire.

Section III.L – Alternative and Dedicated Shutdown Capability: Safe shutdown capabilities are provided in the control room and at an alternate location, via the hot shutdown panel or locally at the 125-Vdc switchgear, for equipment powered by the 125-Vdc system required for the safe shutdown of the plant following a fire event.

8.3.2.1.16 Safety Guide 6, March 1971 – Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems

The Class 1E 125-Vdc system is designed so dc electrically powered safety loads are separated into redundant load groups so that loss of any one group will not prevent the minimum safety functions from being performed. Each dc load group should be energized by a battery and battery charger. The battery-charger combination should have no automatic connection to any other redundant dc load group. If means exist for manually connecting redundant load groups together, at least one interlock should be provided to prevent an operator error that would parallel the standby power sources.

8.3.2.1.17 Safety Guide 32, August 1972 – Use of IEEE Standard 308-1971 Criteria for Class 1E Electric Systems for Nuclear Power Generating Stations

Safety Guide 32, August 1972 identifies a conflict between IEEE 308-1971 and GDC 17, 1971, specifically with respect to battery charger supply. IEEE 308-1971 requires that each battery charger supply shall furnish electric energy for the steady-state operation of connected loads required during normal operation while maintaining its battery in a fully charged state, and have sufficient capacity to restore the battery from the design minimum charge to its fully charged state while supplying normal steady-state loads. In contrast, the equivalent provision of GDC 17, 1971 requires that the onsite electric power supplies shall have sufficient independence, redundancy, and testability to perform their safety functions assuming a single failure. This Safety Guide imposes GDC 17, 1971, which does not restrict the battery charger supply load to that of the steady-state condition during normal operation.

8.3.2.1.18 Regulatory Guide 1.63, Revision 1, May 1977 – Electrical Penetration Assemblies in Containment Structures for Light-Water-cooled Nuclear Plants

The Class 1E 125-Vdc and non-Class 1E 125-Vdc circuits routed through containment electrical penetrations are designed to the requirements of Regulatory Guide 1.63, Revision 1 for installation of redundant or backup fault current protection devices to limit fault current to less than that which the penetration can withstand, assuming a single random failure of the circuit overload protective device.

8.3.2.1.19 Regulatory Guide 1.97, Revision 3, May 1983 – Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident

The Class 1E 125-Vdc battery voltmeters and ammeters located in the control room are credited Regulatory Guide 1.97, Revision 3, indications for power supply status.

8.3.2.2 System Description

8.3.2.2.1 Non-Class 1E 125-Vdc / 250-Vdc Power System

The non-Class 1E system consists of three 60-cell, 125-Vdc nominally rated batteries. Two of these batteries are connected in series to provide 250-Vdc power to a 250-Vdc motor control center (MCC). The MCC serves the non-Class 1E 250-Vdc loads, as shown in Figure 8.3-18, sheet 1 of 2. The 125-Vdc distribution panels associated with these batteries supply power non-Class 1E 125-Vdc loads, as shown in Figure 8.3-18. The third battery provides non-Class 1E 125-Vdc power to the plant process computer uninterruptible power supply. Each of the three batteries is continuously charged by a battery charger. The battery chargers are powered from separate 480-V non-Class 1E buses.

8.3.2.2.2 Class 1E 125-Vdc Power System

The Class 1E dc system consists of, or has, the following features (see Figure 8.3-17):

(1) Three 60-cell (refer to Section 8.3.2.3.6.3 for 59-cell configuration), 125-Vdc batteries.

(2) Three separate 125-Vdc power distribution switchgear assemblies, each including a 125-Vdc bus, circuit breakers, fuses, metering, and two distribution panels.

(3) Five battery chargers. Each of the three 125-Vdc switchgear buses has a battery charger. Batteries 11(21)[a] and 12(22) have an additional swing

[a] Each unit's dc power system is identical; therefore, unit identification is as follows: e.g., 11, 12, and 13 = Unit 1, and (21), (22), and (23) = Unit 2.

backup battery charger that can be connected to either bus by manually closing one of the two interlocked breakers. The fifth battery charger is a backup charger for battery 13(23). Manual operation of a circuit breaker is required to place this battery charger in service on the bus. No interlock is provided between the two battery chargers on this bus.

(4) The system and equipment is designed Class 1E from, and including, the batteries to, and including, the molded case distribution panel circuit breakers.

8.3.2.2.2.1 Class 1E Power Distribution System Equipment

The dc power distribution system for each unit consists of three completely metal-enclosed switchgear assemblies, as follows:

(1) Three separate 125-Vdc copper buses 11(21), 12(22), and 13(23) are completely enclosed in their own metalclad switchgear. Each bus is rated at 1200 amperes continuous. There is one 125-Vdc, 60-cell (refer to Section 8.3.2.3.6.3 for 59-cell configuration) battery supplying each 125-Vdc bus. Source protection is provided by fuses rated at 3000 amperes.

(2) Two 125-Vdc circuit breaker distribution panels are connected to each of the 125-Vdc buses 11(21), 12(22), and 13(23). The connection to buses 11(21) and 12(22) is made through drawout, manually operated air circuit breakers[(b)], and bus 13(23) connects directly to the panels. The air circuit breakers are rated 600 amperes with long- and short-time overcurrent elements. One panel per bus is generally utilized for Class 1E loads and the other typically used for non-Class 1E loads. The panels are an integral part of the respective switchgear and, therefore, they are all designed, engineered, and constructed as Class 1E panels. Each panel is ungrounded and has one main bus, rated 600 amperes continuous. Panel branch circuit breakers are molded case, thermal magnetic, quick-make and quick-break, rated 250-Vdc, ≥ 20,000-amperes interrupting capacity.

The two panels on each bus have the same designation (e.g., on buses 11, both panels are called 125-Vdc distribution Panel 11) because they are electrically connected as one panel. However, typically they are physically separated on the left and right side of the switchgear to generally supply Class 1E and non-Class 1E loads, respectively.

The left side panels typically provide power to the following loads:

(a) Class 1E dc power and control

[(b)] These circuit breakers were required for the original design when buses 11(21) and 12(22) were connected in series to provide 250-Vdc non-Class 1E power.

(b) Class 1E dc diesel generator field flashing

(c) Class 1E dc instrumentation.

(d) Main annunciator

(e) UPSs for nuclear instrumentation

The right side panels typically provide power to the following loads:

(a) Non-Class 1E dc power and control

(b) Non-Class 1E dc instrumentation

(c) Auxiliary annunciators

An additional 125-Vdc distribution panel 14(24) is a subpanel of distribution panel 13(23) for non-Class 1E loads.

8.3.2.2.2.2 Class 1E 125-Vdc Battery Chargers

The 125-Vdc battery chargers are Class 1E power supplies. A total of ten battery chargers are supplied, five for Unit 1 and five for Unit 2. Three chargers serve two of the 125-Vdc buses (buses 11(21) and 12(22)) and two chargers serve 125-Vdc bus 13(23). Each of the chargers is connected to a bus through a molded case, manually operated thermal-magnetic 600 ampere breaker located in dc switchgear 11(21), 12(22), and 13(23). Normally, buses 11(21), 12(22), and 13(23) are supplied by one battery charger each. Buses 11(21) and 12(22) share a swing backup battery charger for closing in on bus 11(21) or 12(22) if either primary battery charger on 11(21) or 12(22) is not able to provide service. A second battery charger is a backup charger for bus 13(23). Each charger is constructed of high quality, reliable, solid-state components conservatively rated for long life. The chargers provide rated direct current output continuously at a voltage smoothly adjustable from 118-Vdc to 144-Vdc, and regulated to $\pm$0.5 percent through the entire range of input and local variations. The maximum output current is 110 percent of rated output under any loads or short circuit conditions. The charger is self-protected against transient voltages that may occur on the dc system.

An alarm cutout switch is provided on the outside of each battery charger cabinet. Each cutout switch disables the following battery charger alarms:

(1) ac fuse failure

(2) dc undervoltage and overvoltage

(3) ac breaker trip

(4) dc breaker trip

The cutout switch is used to avoid unnecessary alarms and operator distractions when a battery charger is out of service or receiving maintenance. Proper use of the cutout switches is administratively controlled by operating procedures.

8.3.2.2.2.3 Class 1E 125-Vdc Batteries

The 125-Vdc batteries are Class 1E power supplies. Mean life of the batteries is 20 years (refer to Section 3.10.2.8.1 for battery qualification). Each cell is contained in a sealed, heat resistant, shock absorbing, clear polycarbonate case. Similar cells were tested and met seismic and vibration requirements. A total of six batteries, 11(21), 12(22), and 13(23) are supplied for Units 1 and 2.

Battery racks are provided with an analytically calculated, earthquake-proof, engineered rigid rack design to meet the seismic requirements of the battery room. The battery racks are of Unistrut construction and mounted to the floor and wall for rigid seismic mounting.

Diffusion vents on battery filling openings provide continuous and uniform dispersion of hydrogen produced by the batteries. These vents are designed to prevent localized hazardous concentrations of hydrogen.

8.3.2.2.2.4 Safety-Related Loads

Normally, the battery chargers will supply the total load requirements of the dc system as well as maintain a constant floating charge on the batteries. The batteries are paralleled with the chargers and supply dc power to the system if the ac power fails. The nuclear instrumentation UPSs and the main annunciator are automatically supplied from either the 125-Vdc system or the 480-V system depending on their availability. The voltage level of the rectifier in the UPS unit is set such that the inverter preferentially feeds from the 480-V system via the rectifier. Considering normal starting times for the diesel generators and the battery charger dc output time delay circuit that prevents full charger output for 20 to 30 seconds, the first 40-second loads on each bus are supplied by its respective battery.

The dc loads on the bus after 40 seconds will be carried by the battery charger. The charger has sufficient capacity to carry loads up to 110 percent of its 400-ampere rating. When the chargers are not loaded to maximum rating, then excess capacity charges the battery. Refer to Section 8.3.2.3.6.

8.3.2.3 Safety Evaluation

8.3.2.3.1 General Design Criterion 2, 1967 – Performance Standards

The Class 1E 125-Vdc system is located in the auxiliary building which is a PG&E Design Class I structure (refer to Figure 1.2-5). The auxiliary building is designed to withstand the effects of winds and tornados (Section 3.3), floods and tsunamis (Section 3.4), external missiles (Section 3.5), and earthquakes (Section 3.7), to protect Class 1E 125-Vdc SSCs from damage due to these events to ensure they will continue to perform their safety function.

Loss of the 125-Vdc inverter room ventilation system and Class 1E 125-Vdc raceways located outdoors, and exposed to the effects of tornados, has been evaluated and the consequences of a tornado do not compromise the capability to safely shut down the plant. Refer to Section 3.3.2.3.

Equipment included in the dc system was proved to be acceptable to seismic requirements by testing, analytical calculations, or testing on similar equipment. The manufacturers were required to conform to approved quality assurance procedures. Refer to Section 3.10.2.8 for a description of the seismic qualification for batteries, battery racks, battery chargers and dc switchgear.

Although the ventilating system for the battery rooms is PG&E Design Class II, the supply and exhaust ductwork serving the battery rooms are designed and installed to meet Seismic Category I criteria.

8.3.2.3.2 General Design Criterion 3, 1971 – Fire Protection

The Class 1E 125-Vdc system is designed to the fire protection guidelines of BTP APCSB 9.5.1 (refer to Appendix 9.5B Table B-1).

Ventilation for the Class 1E dc equipment is provided as follows:

(1) Battery rooms are ventilated to prevent accumulation of hydrogen gas and to maintain ambient temperature. For each unit, the three battery rooms are constructed of reinforced concrete and cement block grout walls. Ventilation air is supplied by a common duct and supply fan, and is exhausted through an exhaust fan to a common duct that exhausts directly to the atmosphere. The ventilation system is PG&E Design Class II

(2) The dc switchgear rooms have PG&E Design Class I ventilation supply and exhaust systems and are described in Section 9.4.9. These three separate rooms, housing separate buses, panelboards, and battery chargers, have a common ventilation system.

In case of loss of forced ventilation, the calculated natural ventilation rate due to the thermal stack effect will maintain hydrogen gas below 1 percent by volume. This accumulation is below the allowable limit of 2 percent by volume as recommended by Regulatory Guide 1.128, Revision 1 (Reference 17).

8.3.2.3.3 General Design Criterion 4, 1967 – Sharing of Systems

The Class 1E 125-Vdc system for each unit is not shared with the other unit. The Class 1E 125-Vdc system is a support system for common unit systems and components listed in Section 1.2.2.10.

8.3.2.3.4 General Design Criterion 11, 1967 – Control Room

Each Class 1E bus is provided with a voltmeter and ammeter mounted on the control room main control board for remote indication.

The chargers have voltmeters and ammeters remotely located on the main control board to indicate operational status of battery chargers.

8.3.2.3.5 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Each Class 1E bus is provided with a voltmeter mounted on the switchgear for local indication. Each charger has a locally mounted voltmeter, ammeter, and instrumentation for alarming dc undervoltage, dc overvoltage, ac fuse failure, dc breaker trip, and ac breaker trip (refer to Section 8.3.2.2.2.2), adjustable controls for both normal and equalizing charge settings, and a manually adjustable equalizing timer.

Each of the Class 1E battery rooms is provided with an air temperature monitoring system. Refer to Section 9.4 for details.

8.3.2.3.6 General Design Criterion 17, 1971 – Electric Power Systems

Sufficient physical separation, electrical isolation, system coordination, and redundancy are provided to ensure availability of required dc power and to prevent the occurrence of common mode failure of each unit's Class 1E dc systems.

The codes and standards that have been implemented, where applicable, in the design of the dc systems are listed in Section 8.1.4.

8.3.2.3.6.1 Class 1E 125-Vdc Distribution

The Class 1E dc power circuits from the separate battery rooms 11(21), 12(22), and 13(23) are run in separate conduits to dc equipment rooms 11, 12, and 13. The battery chargers are in these rooms and are connected to the buses in the dc switchgear. The dc buses are connected to the molded case breaker panel board with load circuits

channeled throughout the plant in Class 1E circuit systems with power (600 V and under) and control systems. The non Class 1E dc power feeders are channeled with non-Class 1E (600 V and under) ac power and control systems. DC feeder instrumentation circuits are channeled with low-level instrumentation circuits.

The dc system redundancy follows the redundant lines delineated by the 4.16-kV and 480-V Class 1E Systems:

(1) Battery 11(21), battery charger 11(21), switchgear bus 11(21), and distribution panel 11(21) are associated with 4.16-kV bus 1F(2F) and 480-V bus 1F(2F), and diesel 13(23).

(2) Battery 12(22), battery charger 12(22), switchgear bus 12(22), and distribution panel 12(22) are associated with 4.16-kV bus 1G(2G) and 480-V bus 1G(2G), and diesel 12(21).

(3) Battery 13(23), battery charger 132(232), switchgear bus 13(23), distribution panel 13(23), and distribution Panel 14(24) are associated with 4.16-kV bus 1H(2H) and 480-V bus 1H(2H) and diesel 11(22).

(4) Instrumentation dc circuits are also separated similarly to Items 1, 2, and 3 above.

(5) Breakers on the distribution Panels 11(21), 12(22), and 13(23) can be used to disconnect all non-Class 1E loads from the batteries.

8.3.2.3.6.2 Class 1E 125-Vdc Battery Charger

The input to the chargers is 480-V, 3-phase, 60 Hz. The 480-V buses F, G, and H supply chargers 11(21), 12(22), and 132(232), respectively. Backup battery chargers 121(221) and 131(231) receive their inputs from 480-V buses H and F, respectively. The chargers provide rated output voltage and current with an input voltage range from 432-Vac to 528-Vac. Each input is provided with a manual circuit breaker mounted on the front and an undervoltage alarm relay on the ac side of the rectifiers.

During normal operation, power is furnished by these 480-V battery chargers at approximately 135 Vdc, with the electric storage batteries floating on the dc buses. Sufficient battery charger capacity, 400 amperes per charger, is provided to carry the normal continuous load and to recharge the batteries in a reasonable time with any one charger out of service.

Battery chargers have sufficient capacity to carry the normal continuous load and to recharge the battery within 12 hours. The battery charger sizing is within the guidelines of IEEE-946, IEEE Recommended Practice for the Design of Safety Related DC Auxiliary Power Systems for Nuclear Power Generating Stations and Safety Guide 32, August 1972, B-2 and C-b (Reference 16). Refer also to Section 8.3.2.3.17.

8.3.2.3.6.3 Class 1E 125-Vdc Batteries

The batteries are sized to provide sufficient power to operate the dc loads for the time necessary to safely shut down the unit, should a 480-V source to one or more battery chargers be unavailable. Although each battery consists of 60 cells, the battery sizing calculations are in place to support a 59-cell configuration. The 59-cell configuration may be necessary in case a defective cell needs to be bypassed. The battery cells are lead-acid type with lead-calcium grids. Each battery is rated at 2320 ampere-hours (8-hour rate, discharged to 1.75 V per cell) and has current ratings as follows:

1 minute	1 hour	8 hours
2080 amperes	1120 amperes	290 amperes

Sufficient capacity is provided for all simultaneous loads to be superimposed for the following durations:

(1) Two hours for continuous loads, such as instrumentation and annunciation

(2) One minute for all momentary loads such as dc control power for switchgear devices, inrush to continuous loads, and diesel generator field flashing

The method used to determine battery sizing and recommendation for replacement of batteries is based on IEEE 485-1983 (Reference 15).

If a diesel generator associated with a particular bus fails to start and a redundant charger supplied from another Class 1E 480-V bus is not available, the battery has sufficient capacity to continue to carry dc loads for 2 hours on the associated bus.

8.3.2.3.7 General Design Criterion 18, 1971 – Inspection and Testing of Electric Power Systems

Battery capacity is verified by performing a battery performance test in accordance with IEEE 450-1995 (Reference 18) with the exception that if the battery shows signs of degradation, or if the battery has reached 85 percent of its expected service life and capacity is less than 100 percent of the manufacturer’s rated capacity, the performance test is required on a 24-month frequency to coincide with a refueling outage instead of on an annual frequency as required by IEEE 450-1995. Battery monitoring and maintenance is controlled by a battery monitoring and maintenance program based on the recommendations of IEEE 450-1995.

8.3.2.3.8 General Design Criterion 21, 1967 – Single Failure Definition

DC loads for control of ESFs are divided into three groups, each served from a 125-Vdc battery. The grouping corresponds to the grouping of the ac loads and provides redundant service to ESFs (see Figure 8.3-17).

Should a failure occur on any 125-Vdc distribution circuit on panel 11(21) the associated molded case circuit breaker would trip to isolate this failure while the unaffected circuits in panel 11(21) would remain energized. If the distribution panel molded case circuit breaker failed to trip, the 600 ampere drawout breaker would trip to isolate distribution panel 11(21) from 125-Vdc bus 11(21). This latter event would be a single failure in the ESF panel 11(21). Similar analysis was applied to the 125-Vdc distribution circuits on panel 12(22).

This would result in the loss of 125-Vdc power and control to 4.16-kV bus F and other related bus F power and control circuits. The ESFs would then be performed by 4.16-kV and 480-V buses G and H, and 125-Vdc buses 12(22) and 13(23), respectively.

8.3.2.3.9 General Design Criterion 24, 1967 – Emergency Power for Protection Systems

The safety-related loads on individual dc buses are as listed in Table 8.3-11.

The dc power and control systems are specified, designed, engineered, and manufactured to perform the required ESF functions.

The dc systems for control of ESFs are divided into three groups, each served from a 125-Vdc battery bus. The grouping corresponds to the grouping of the ac loads and provides redundant service to ESFs. Refer to Table 8.3-11. A descriptive analysis of the dc system is provided in Section 8.3.2.2.2.

8.3.2.3.10 General Design Criterion, 40, 1967 – Missile Protection

The portions of the Class 1E 125 Vdc system that are located in zones where provision against dynamic effects must be made, are protected from missiles, pipe whip, or jet impingement from the rupture of any nearby high-energy line (refer to Sections 3.5, 3.6, and 8.3.1.4.10.2).

8.3.2.3.11 General Design Criterion 49, 1967 – Containment Design Basis

The Class 1E 125-Vdc and non-Class 1E 125-Vdc circuits routed through containment electrical penetrations are each provided with electrical protection devices. This arrangement is such that with the failure of one device, the penetration remains protected from high current temperature by the other in-series device to ensure the containment penetration remains functional. Refer to Section 3.8.1.1.3 and 8.3.1.4.8 for additional details.

8.3.2.3.12 10 CFR 50.49 – Environmental Qualification of Electric Equipment

The Class 1E 125-Vdc system SSCs required to function in harsh environments under accident conditions are qualified to the applicable environmental conditions to ensure that they will continue to perform their safety functions. Section 3.11 describes the

DCPP EQ program and the requirements for the environmental design of electrical and related mechanical equipment. The affected components are listed on the EQ Master List.

8.3.2.3.13 10 CFR 50.62 – Requirements for Reduction of Risk from Anticipated Transients Without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants

The ATWS mitigation system actuation circuitry (AMSAC) is designed to comply with 10 CFR 50.62. The AMSAC is required to be powered from a non-Class 1E 125-Vdc electrical power source that is independent from the protection system power supplies. Refer to Section 7.6.2.3 and 7.6.3.5 for additional details.

8.3.2.3.14 10 CFR 50.63 – Loss of All Alternating Current Power

With respect to battery adequacy, for an actual SBO response, procedures would provide battery charging and operation for all Class 1E instrument channels and reactor protection system (RPS) output trains. For purposes of the SBO analysis, it is assumed that operator action is taken within 2 hours to provide at least two input channels of instrumentation to monitor system functions and actuate one train of safeguards equipment. Refer to Section 8.3.1.6 for additional details.

8.3.2.3.15 10 CFR 50 Appendix R (Sections III.G, III.J, and III.L) – Fire Protection Program for Nuclear Power Facilities Operating Before January 1, 1979

Section III.G – Fire protection of Safe Shutdown Capability: The Class 1E 125-Vdc system satisfies the applicable fire protection requirements of 10 CFR Part 50 Appendix R, Section III.G, by either meeting the technical requirements or by providing an equivalent level of fire safety. Refer to Appendix 9.5G.

Section III.J – Emergency Lighting: The 125-Vdc emergency lighting system is energized instantly upon loss of the emergency ac lighting system and is deenergized, after a 5-second time delay, on return of power supply to the emergency ac lighting system. These lights are powered from the non-Class 1E station batteries and will provide sufficient emergency lighting for at least one hour. Refer to Appendix 9.5D.

Section III.L – Alternative and Dedicated Shutdown Capability: Safe shutdown capabilities are provided in the control room and at an alternate location via the hot shutdown panel (refer to Section 7.4) as defined by 10 CFR Part 50, Appendix R, Section III.L. The ability to safely shut down the plant following a fire in any fire area is summarized in Section 4.0 of Appendix 9.5A and Appendix 9.5E.

8.3.2.3.16 Safety Guide 6, March 1971 – Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems

Each of the three 125-Vdc switchgear buses has a battery charger. Batteries 11(21) and 12(22) have an additional swing backup battery charger that can be connected to either bus by manually closing one of the two interlocked breakers. The fifth battery charger is a backup charger for battery 13(23). Manual operation of a circuit breaker is required to place this battery charger in service on the bus. No interlock is provided between the two battery chargers on this bus. Refer to Section 8.3.2.2.2 for additional detail.

8.3.2.3.17 Safety Guide 32, August 1972 – Use of IEEE Standard 308-1971 Criteria for Class 1E Electric Systems for Nuclear Power Generating Stations

The supply to battery chargers is designed using the criteria of Safety Guide 32, August 1972 (Reference 16), paragraphs B-2 and C-b, so that abnormal long-term loads (e.g., hot or cold shutdown and postaccident shutdown) are not greater than the steady state loads during normal operation. The design requirements of the battery charger supply are as covered within GDC 17, 1971. Accordantly the capacity of the battery charger supply is based on the largest combined demands of the various steady-state loads and the charging capacity to restore the battery from the design minimum charge state to the fully charged state, irrespective of the status of the plant during which these demands occur.

8.3.2.3.18 Regulatory Guide 1.63, Revision 1, May 1977 – Electrical Penetration Assemblies in Containment Structures for Light-Water-cooled Nuclear Plants

The Class 1E and non-Class 1E 125-Vdc circuits routed through containment electrical penetrations are designed to provide overcurrent protection. Refer to Section 8.3.1.4.8 for additional details.

8.3.2.3.19 Regulatory Guide 1.97, Revision 3, May 1983 – Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident

Each 125-Vdc Class 1E bus is provided with a voltmeter and ammeter mounted on the control room main control board for remote indication. Refer to Table 7.5-6 for additional detail.

8.3.2.4 Tests and Inspections

Refer to Section 8.3.2.3.7 for test and inspection details.

8.3.2.5 Instrumentation Applications

Refer to Sections 8.3.2.3.4 and 8.3.2.3.5 for instrumentation applications

8.3.3 REFERENCES

1. Deleted in Revision 21.

2. NUREG 0737, Clarification of TMI Action Plan Requirements, November 1980.

3. IEEE 308-1971, Criteria for Class IE Electric Systems for Nuclear Power Generating Stations.

4. IEEE 279-1971, Criteria for Protection Systems for Nuclear Power Generating Stations.

5. Technical Specifications, Diablo Canyon Power Plant Units 1 and 2, Appendix A to License Nos. DPR-80 and DPR-82, as amended.

6. NFPA 12, Carbon Dioxide Extinguishing Systems, 1973.

7. NFPA 37, Installation and Use of Stationary Combustion Engines and Gas Turbines, 1970.

8. Safety Guide 9, Selection of Diesel Generator Set Capacity for Standby Power Supplies, March 1971.

9. Safety Guide 6, Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems, March 1971.

10. National Electric Code (NFPA 70-1968).

11. AIEE S-135-1, Power Cable Ampacities, 1962.

12. Regulatory Guide 1.63, Electric Penetration Assemblies in Containment Structures for Light-Water- Cooled Nuclear Power Plants, USNRC, Revision 1, May 1977.

13. 10 CFR Part 50, Appendix R, Sections III.G, III.J, and III.L, Fire Protection Program for Nuclear Facilities Operating Before January 1, 1979.

14. PG&E, Report on 10 CFR 50 Appendix R Review for DCPP Unit 1, submitted to NRC July 15, 1983, and its subsequent revisions.

15. IEEE 485-1983, Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations.

16. Safety Guide 32, Use of IEEE Standard 308-1971 Criteria for Class 1E Electric Systems for Nuclear Power Generating Stations, August 1972.

17. Regulatory Guide 1.128, Revision 1, Installation Design and Installation of Large Lead Storage Batteries for Nuclear Power Plants, USNRC, October 1978.

18. IEEE 450-1995, Recommended Practice for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generating Stations and Substations.

19. ICEA P-54-440, Cables in Open-Top Cable Trays, 1975.

20. 10 CFR 50.63, Station Blackout (SBO) Rule, Loss of All Alternating Current Power.

21. PG&E Letter DCL-92-084 to USNRC, Revised Response to Station Blackout, April 13, 1992.

22. Supplemental Safety Evaluation of PG&E Response to Station Blackout Rule (10 CFR 50.63) for Diablo Canyon, USNRC, (TAC Nos. M68537 and M68538), May 29, 1992.

23. NUMARC 87-00, Rev. 0, Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors, November 1987.

24. Deleted in Revision 21.

25. Regulatory Guide 1.9, Revision 3, Selection, Design, Qualification Testing, and Reliability of Diesel-Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants, July 1993

26. NRC (Mr. John Stolz) letter to PG&E (Mr. John Morrissey), dated November 22, 1977, Request for Additional Information – Diablo Canyon Nuclear Power Plant, Units 1 & 2.

27. License Amendments 200/201, Technical Specifications Change to Relocate Surveillance Test Intervals to a Licensee-Controlled Program, issued by the NRC, October 30, 2008.

28. License Amendments 105/104, Revision of Technical Specification for Diesel Generator Surveillance Testing, issued by the NRC, June 26, 1995.

29. License Amendments 135/135, Conversion to Improved Technical Specifications, issued by the NRC, May 28, 1999.

30. License Amendments 211/213, Revision to Technical Specification 3.8.1, "AC Sources – Operating," to Incorporate TSTF-163, Revision 2, issued by the NRC, March 29, 2012.

31. Regulatory Guide 1.155, Station Blackout, August 1988.

32. IEEE Standard 317-1971, Electric Penetration Assemblies in Containment Structures for Nuclear Fueled Power Generating Stations, The Institute of Electrical and Electronics Engineers, Inc.

8.3.4 REFERENCE DRAWINGS

Figures representing controlled engineering drawings are incorporated by reference and are identified in Table 1.6-1. The contents of the drawings are controlled by DCPP procedures.

TABLE 8.1-1

APPLICABLE DESIGN BASIS CRITERIA

CRITERIA	TITLE	APPLICABILITY									
Electrical Power System		230-kV	500-kV	25-kV	12-kV	4.16-kV	480-V	120-Vac	EDG	SBO	125-Vdc
Section		8.2.1	8.2.2	8.3.1.1.1	8.3.1.1.2	8.3.1.1.3	8.3.1.1.4	8.3.1.1.5	8.3.1.1.6	8.3.1.6	8.3.2
1. 10 CFR 50 - Domestic Licensing of Production and Utilization Facilities											
50.49	Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants					X	X	X			X
50.55a(g)	Inservice Inspection Requirements								X		
50.62	Requirements for Reduction of Risk from Anticipated Transients Without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants							X			X
50.63	Loss of All Alternating Current Power	X	X	X	X	X	X	X	X	X	X
Appendix R	Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979					X	X	X	X		X
2. General Design Criteria											
Criterion 2, 1967	Performance Standards				X	X	X	X	X		X
Criterion 3, 1971	Fire Protection					X	X	X	X		X
Criterion 4, 1967	Sharing of Systems	X			X		X	X	X		X
Criterion 11, 1967	Control Room				X	X	X	X	X		X
Criterion 12, 1967	Instrumentation and Control Systems				X	X	X	X	X		X

CRITERIA	TITLE	APPLICABILITY									
Electrical Power System		230-kV	500-kV	25-kV	12-kV	4.16-kV	480-V	120-Vac	EDG	SBO	125-Vdc
Section		8.2.1	8.2.2	8.3.1.1.1	8.3.1.1.2	8.3.1.1.3	8.3.1.1.4	8.3.1.1.5	8.3.1.1.6	8.3.1.6	8.3.2
2. General Design Criteria (continued)											
Criterion 15, 1967	Engineered Safety Features Protection Systems				X						
Criterion 17, 1971	Electric Power Systems	X	X	X	X	X	X	X	X		X
Criterion 18, 1971	Inspection and Testing of Electric Power Systems	X	X	X	X	X	X	X	X		X
Criterion 21, 1967	Single Failure Definition					X	X	X	X		X
Criterion 24, 1967	Emergency Power For Protection Systems							X			X
Criterion 40, 1967	Missile Protection					X	X	X			X
Criterion 49, 1967	Containment Design Basis				X		X	X			X
3. Design Basis Functional Criteria											
Transmission Capacity Requirements		X	X								
Single Failure Requirements (Preferred Power Supply)		X	X	X	X						
Protection from High and Moderate Energy Systems and Internal Missiles									X		
4. Atomic Energy Commission (AEC) Safety Guides											
Safety Guide 6, March 1971	Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems					X	X	X			X

TABLE 8.1-1

CRITERIA	TITLE	APPLICABILITY									
Electrical Power System		230-kV	500-kV	25-kV	12-kV	4.16-kV	480-V	120-Vac	EDG	SBO	125-Vdc
Section		8.2.1	8.2.2	8.3.1.1.1	8.3.1.1.2	8.3.1.1.3	8.3.1.1.4	8.3.1.1.5	8.3.1.1.6	8.3.1.6	8.3.2
4. Atomic Energy Commission (AEC) Safety Guides (continued)											
Safety Guide 9, March 1971	Selection of Diesel Generator Set Capacity for Standby Power Supplies								X		
Safety Guide 32, August 1972	Use of IEEE Std 308-1971 "Criteria for Class 1E Electrical Systems for Nuclear Power Generating Stations"	X	X	X	X						X
5. Regulatory Guides											
Regulatory Guide 1.63, May 1977	Electric Penetration Assemblies in Containment Structures for Light Water Cooled Nuclear Power Plants				X		X	X			X
Regulatory Guide 1.97, Revision 3, May 1983	Instrumentation For Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident					X	X		X		X
Regulatory Guide 1.108, Revision 1, August 1977	Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants								X		

CRITERIA	TITLE	APPLICABILITY									
Electrical Power System		230-kV	500-kV	25-kV	12-kV	4.16-kV	480-V	120-Vac	EDG	SBO	125-Vdc
Section		8.2.1	8.2.2	8.3.1.1.1	8.3.1.1.2	8.3.1.1.3	8.3.1.1.4	8.3.1.1.5	8.3.1.1.6	8.3.1.6	8.3.2
6. <u>NRC NUREGs</u>											
NUREG-0737	Clarification of TMI Action Plan Requirements						X	X			
7. <u>NRC Generic Letters</u>											
1984-15	Proposed Staff Actions to Improve and Maintain Diesel Generator Reliability								X		

TABLE 8.3-1

NOTES FOR TABLES

(a) When supplied from the diesel generators, these motors are started automatically in the absence of a safety injection signal.

(b) These motors are two-speed, rated 300 and 100 horsepower, and are fed from the vital 480-V load centers. The low speed is used under loss-of-coolant accident (LOCA) and auto-bus transfer conditions. There are five motors: two on bus F, two on bus G, and one on bus H.

(c) 1. The net power factor on any bus is expected to be not less than 90 percent; since the generators have a rated power factor of 80 percent, the margin is ample.

2. The power factor of the containment fan cooler units (CFCUs) at slow speed, however, is 49.7 percent. In this case, the total demand kW and kVAR are calculated separately using 49.7 percent power factor of the CFCUs and 90 percent power factor for the rest of the loads. The total demand kW and kVAR are vectorially added to calculate the kVA.

(d) Deleted

(e) Demand in kW for motors is equal to the maximum expected horsepower input to the driven device x $\left(\frac{0.746}{\text{Motor Efficiency}}\right)$

(f) For total time, add approximately 1 second for offsite power, and 10 seconds for the diesel generators.

(g) These loads are not required for nuclear safety but will probably operate at the same time to perform other important plant functions.

(h) These items are shared between Units 1 and 2.

(i) Two of the battery chargers are spares. Only one battery charger can be connected to a bus except during an abnormal operating condition which is time limited.

(j) The Technical Support Center, pressurizer heaters, containment hydrogen purge system fans, spent fuel pit pump, internal hydrogen recombiners, and charcoal filter preheater are manually controlled loads that can be added to the vital buses, providing the load demand has diminished and the diesel generators will not be overloaded.

(k) Containment spray is initiated after the time shown, provided "S" and "P" signals are present. All other components are started on the occurrence of an "S" signal.

(l) Deleted in Revision 7.

(m) Does not include loads that are cut off prior to diesel generator connection to bus.

(n) Only one group of control room air conditioning and vent equipment can be connected to a bus at one time.

(o) All tests conducted on all six diesel engine generator units, except as noted.

TABLE 8.3-2

TIMING SEQUENCE AND INTERVALS - NO SAFETY INJECTION SIGNAL

Loads	Starting Delay in Seconds After Power is Restored to the Vital Buses[f]			Minimum Number Required
	Bus F	Bus G	Bus H	
Small loads (480 and 120 V) on vital 480-V load centers	0	0	0	2
Component cooling water pumps	5	5	5	2
Auxiliary saltwater pumps	10	10	-	1
Auxiliary feedwater pumps[a]	14	-	14	1
Centrifugal charging pumps (CCP1 and CCP2)	20	20	-	1
Containment fan coolers[b]	25	25	25	3

TABLE 8.3-3

MAXIMUM STEADY STATE LOAD DEMAND - NO SAFETY INJECTION SIGNAL

Load	Quantity Per Unit	Rating (each)	Maximum BHP	Maximum Demand, kW[e]					
				Bus 1F	Bus 2F	Bus 1G	Bus 2G	Bus 1H	Bus 2H
480-V load exclusive of containment fan coolers, fire pumps, momentary loads, and manually controlled loads[j]	3	1000 kVA		503	503	440	421	694	664
Load Center Transformer and Cable Losses				28	35	27	35	24	32
Component cooling water pumps	3	400 hp	435 hp	342	342	342	342	342	342
Auxiliary saltwater pumps	2	400 hp	465 hp	373	373	373	373	-	-
Auxiliary feedwater pumps[a]	2	600 hp	505 hp	394	394	-	-	394	394
Centrifugal charging pumps (CCP1 and CCP2)	2	600 hp	650 hp	525	525	525	525	-	-
Containment fan coolers[b]	5	100 hp	103 hp	170	170	170	170	85	85
Maximum demand on vital 4160-V buses (c.1)			kW =	2335	2342	1877	1866	1539	1517
			kVAR =	1345	1348	1123	1117	852	842
			kVA =	2695	2702	2187	2175	1759	1735

Diesel Generator Rating:
Continuous = 2600 kW 2000 Hour = 2750 kW 2 Hour = 3000 kW

TABLE 8.3-4

DIESEL GENERATOR LOADING
TIMING SEQUENCE AND INTERVALS - WITH SAFETY INJECTION SIGNAL

Loads	Starting Delay in Seconds After Power is Restored to the Vital Buses[f]			Minimum Number Required
	Bus F	Bus G	Bus H	
Small loads (480 and 120 V) on vital 480-V load centers	0	0	0	2
Centrifugal charging pumps (CCP1 and CCP2)	2	2	-	1
Safety injection pumps	6	-	2	1
Residual heat removal pumps	-	6	6	1
Containment fan coolers[b]	10,14	10,14	10	2
Component cooling water pumps	18	18	14	2
Auxiliary saltwater pumps	22	22	-	1
Auxiliary feedwater pumps	26	-	18	1
Containment spray pumps[k]	-	26	22	1

TABLE 8.3-5

DIESEL GENERATOR LOADING MAXIMUM STEADY STATE LOAD DEMAND FOLLOWING A LOSS-OF-COOLANT ACCIDENT

Load	Quantity Per Unit	Rating (each)	Maximum BHP	Maximum Demand, kW[e]					
				Bus 1F	Bus 2F	Bus 1G	Bus 2G	Bus 1H	Bus 2H
480-V load exclusive of containment fan coolers, fire pumps, momentary loads, and manually controlled loads[j]	3	1000 kVA		503	503	440	421	694	664
Load Center Transformer and Cable Losses				29	36	27	35	25	34
Centrifugal charging pumps (CCP1 and CCP2)	2	600 hp	650 hp	525	525	525	525	-	-
Safety injection pumps	2	400 hp	434 hp	344	344	-	-	344	344
Containment spray pumps	2	400 hp	440 hp	-	-	350	350	350	350
Residual heat removal pumps	2	400 hp	424 hp	-	-	336	336	336	336
Containment fan coolers[b]	5	100 hp	103 hp	170	170	170	170	85	85
Component cooling water pumps	3	400 hp	435 hp	342	342	342	342	342	342
Auxiliary saltwater pumps	2	400 hp	465 hp	373	373	373	373	-	-
Auxiliary feedwater pumps	2	600 hp	505 hp	394	394	-	-	394	394
Maximum demand on vital 4160-V buses upon a loss-of-coolant accident (c.2)			kW =	2680	2687	2563	2552	2570	2549
			kVAR =	1512	1515	1455	1450	1352	1341
			kVA =	3077	3085	2947	2935	2904	2880

Diesel Generator Rating:
Continuous = 2600 kW 2000 Hour = 2750 kW 2 Hour = 3000 kW

VITAL 4160/480-VOLT LOAD CENTERS LOADING

List of Loads (Excluding Manually Operated Loads[j], Momentary Loads, Containment Fan Coolers, and Fire Pumps)	Quantity Per Unit	Rating (each)	Maximum Demand, kW[e]					
			Bus 1F	Bus 2F	Bus 1G	Bus 2G	Bus 1H	Bus 2H
Exhaust fans (auxiliary building including fuel handling area)	2	150 hp	130	130	-	-	130	130
Supply fans (vital dc and low-voltage ac equipment)	2	50 hp	40	40	-	-	40	40
Exhaust fans (vital dc and low-voltage ac equipment)	2	50 hp	40	40	-	-	40	40
Exhaust fans (auxiliary saltwater pump rooms)	2	1 hp	1	1	1	1	-	-
Fuel handling area exhausts (iodine removal)	2	75 hp	61	61	-	-	61	61
Supply fans (fuel handling area) - Fans S1 and S2	2	25 hp	-	-	21	21	21	21
Supply fans (auxiliary building) - Fans S31/33 and S32/34	2	60 hp	-	-	49	49	49	49
Supply fans (4-kV switchgear rooms)	3	1.5 hp	1.5	1.5	1.5	1.5	1.5	1.5
Main turbine-generator lube oil pump	1	60 hp	-	-	47	47	-	-

TABLE 8.3-6

List of Loads (Excluding Manually Operated Loads[j], Momentary Loads, Containment Fan Coolers, and Fire Pumps)	Quantity Per Unit	Rating (each)	Maximum Demand, kW[e]					
			Bus 1F	Bus 2F	Bus 1G	Bus 2G	Bus 1H	Bus 2H
Auxiliary lube oil pumps for component cooling water pumps	3	0.5 hp	0.5	0.5	0.5	0.5	0.5	0.5
Feedwater pumps turning gears	2	1 hp	1	1	-	-	1	1
Makeup water transfer pumps	2[h]	30 hp	-	-	27	-	27	-
Primary water makeup pumps	2	15 hp	13	13	13	13	-	-
Boric acid transfer pumps	2	15 hp	12	12	12	12	-	-
Diesel fuel transfer pumps	2	5 hp	-	-	5	5	5	5
Charging pump (CCP1 and CCP2) auxiliary lube oil pumps	2	2 hp	2	2	2	2	-	-
Control room pressurization and ventilation[n]	2	72 kW	-	-	72	72	72	72
Unit 2 control room pressurization and ventilation(alternate source)[n]	2	72 kW	72	72	-	-	-	-
Containment hydrogen monitor	2	1.5 hp	-	-	2.5	3	2.5	3
Plant ventilation high radiation monitor	1	5 kVA	-	-	-	-	4	4

TABLE 8.3-6

List of Loads (Excluding Manually Operated Loads[j], Momentary Loads, Containment Fan Coolers, and Fire Pumps)	Quantity Per Unit	Rating (each)	Maximum Demand, kW[e]					
			Bus 1F	Bus 2F	Bus 1G	Bus 2G	Bus 1H	Bus 2H
Containment air and gas radiation monitor pump	1	1.5 hp	-	-	1.5	1.5	-	-
Electric heat tracing boric acid system	-	-	10.2	10.1	3.4	9.4	13	18.9
RMS - 120 Vac distribution transformer	2	15 kVA	-	-	12	12	12	12
Electric heaters, boric acid tank	4	7.5 kW	-	-	7.5	8	7.5	8
Diesel generator auxiliary loads	-	-	42	42	42	42	42	42
Control rod position indication	1	-	8	8	-	-	-	-
Instrument ac system[a]	-	-	-	-	12	12	12	12
Battery chargers	5	82.5 kVA	46	46	46	46	46	46
Emergency ac lighting[g]	-	-	-	-	40	40	50	40
Communications	1	15 kVA	-	-	-	-	12	12
Inverter Rectifier	4		22.4	22	22.4	22	44.8	44
480-V load demand in kW, exclusive of the containment fan coolers and momentary loads		kW =	502.6	502.1	440.3	419.9	693.8	662.9

TABLE 8.3-7

VITAL 480-V LOAD CENTERS MAXIMUM DEMAND

Load	Quantity Per Unit	Rating (Each)	Maximum BHP	Maximum Demand, kW[e] Bus 1F	Bus 2F	Bus 1G	Bus 2G	Bus 1H	Bus 2H
480-V load, exclusive of containment fan coolers, momentary loads, manually operated loads[j], and fire pumps	3	1000 kVA		503	503	440	421	694	664
Containment fan coolers[b]	5	100 hp	103 hp	170	170	170	170	85	85
Maximum demand on the vital 480-V load centers			kW =	673	673	610	591	779	749
			kVAR =	540	540	509	500	484	470
			kVA =	863	863	794	774	917	884
Fire pumps (electric drive) None in Unit 2	2	200 hp	186 hp	147	---	---	---	147	---
Maximum load demand on the vital 480-V load centers concurrent with a fire			kW =	820	673	610	591	926	749
			kVAR =	612	540	509	500	556	470
			kVA =	1023	863	794	774	1080	884

TABLE 8.3-8

SUMMARY OF SHOP TESTING OF DIABLO CANYON DIESEL ENGINE GENERATOR UNITS BY ALCO ENGINE DIVISION (Note 1)

Test and Purpose[o]	Conduct of Tests	Results of Test
1. Standard Shop Tests To check out manufacturing and assembly	A. Calibration testing of all meters, switches, and gauges. B. Engine "break in" running and check out pressures. C. Electrical wire-by-wire functional testing. D. Matching tests for engine with governor and generator with regulator.	Engine generator units satisfactorily met all test requirements.
2. Performance Run To prove performance and rating	Unit performance run at 50, 75, 100, and 115% of full load, while recording pressures, temperatures, fuel consumption, etc.	Engine generator units satisfactorily met all test requirements.

TABLE 8.3-8

Test and Purpose[o]	Conduct of Tests	Results of Test
3. Starting Capability To show capacity of starting air systems (conducted on one engine generator unit).	A. Demonstrate 45 seconds of engine cranking for starting, with each of two redundant starting air systems, and without recharging air receivers. B. Demonstrate the number of successful engine starts, with each of two redundant starting air systems, and without recharging air receivers.	A. Forty-five seconds of continuous cranking with each starting air system.
4. Starting Reliability To show reliability of starting (conducted on one engine generator unit).	Demonstrate 100 consecutive engine generator unit starts, 50 with each redundant starting air system.	Fifty consecutive successful unit starts with each start ing air system.
5. Acceleration To show capability of fast starting.	Recorded time to accelerate units from standby condition (zero rpm) to rated speed (frequency) and voltage, with both redundant starting systems and with single failures in redundant start ing systems.	All engine generator units accelerated to rated speed (frequency) and voltage in less than 8.5 seconds with both starting systems, and in less than 12.3 seconds with simulated failure in a redundant starting system.

TABLE 8.3-8

Test and Purpose[o]	Conduct of Tests	Results of Test
6. Motor Start To show capability of starting and accelerating a large induction motor (conducted on one engine generator unit).	Recorded speed (frequency) and voltage decrease and time to recover to nominal when starting and accelerating an 800 hp induction motor, which is larger than any Diablo Canyon LOCA loads.	Maximum voltage decrease did not exceed 75% of nominal, and maximum speed decrease (frequency) did not exceed 95% of nominal. Voltage was restored to within 10% of nominal, speed (frequency) was restored to within 2% of nominal, in less than 2 seconds. Engine generator unit is capable of starting and accelerating an induction motor larger than any for Diablo Canyon.
7. Dead Load Pick Up To show capability of picking up large resistive loads and, by evaluation, to show capability of starting and accelerating large induction motors.	Recorded speed (frequency)and volt age decrease and the time to recover to nominal when picking up large resistive loads, starting with 500 kW and picking up successive loads in 100 kW increments up to at least 1300 kW. Performance of all units evaluated against the performance of the unit tested for motor start capability. (Test No. 6.)	All engine generator units picked up resistive loads with speed (frequency) and voltage decrease and time to recover evaluated to satisfactorily show capability for starting and accelerating the large induction motors of the Diablo Canyon LOCA loads.

Test and Purpose(o)	Conduct of Tests	Results of Test
8. Motor Starting - LOCA Sequence To show capability of starting and accelerating large induction motors in rapid succession. (Conducted on one engine generator unit.)	Recorded speed (frequency) and voltage decrease and time to recover to nominal when starting and accelerating large induction motors, 400, 600, and 800 hp, in rapid succession and in the Diablo Canyon LOCA sequence. Load sequence time interval was 5 seconds.	Maximum voltage decrease did not exceed 75% of nominal, and maximum speed decrease (frequency) did not exceed 95% of nominal. Voltage was restored to within 10% of of nominal, and speed (frequency) was restored to within 2% of nominal, in less than 2 seconds (40% of load sequence time interval). Engine generator units are capable of starting and accelerating large induction motors in rapid succession.
9. Simulated Motor Starting - LOCA Sequence To show capability of picking up resistive loads (simulating induction motors) in rapid succession and, by evaluation, to show capability of starting and accelerating large induction motors in rapid succession.	Recorded speed (frequency) and voltage decrease and time to recover to nominal when picking up resistive loads in rapid succession and in Diablo Canyon LOCA sequence. Load sequence time interval was 5 seconds. Resistive loading schedule simulated the LOCA load demand by the large induction motors. Performance of all units evaluated against the performance of the unit tested for Motor Starting LOCA sequence capability (Test No. 8.)	All engine generator units picked up resistive loads with speed (frequency) and voltage decrease and time to recover evaluated to satisfactorily show capability for starting and accelerating in rapid succession the large induction motors of the Diablo Canyon LOCA sequence.

TABLE 8.3-8

Test and Purpose[(o)]	Conduct of Tests	Results of Test
10. Full Load Drop To show capability of large load step decrease (2,600 kW).	Recorded speed (frequency) and voltage increase and time to recover to nominal following a full load drop (2,600 kW).	Speed of the diesel generator units did not exceed 75% of the difference between the nominal speed, and either the overspeed trip setpoint or 115% of nominal. Engine generator units are capable of recovery from the largest load reduction, a full load drop.

Note 1: Original testing was done using a nominal 5-second load sequence time interval with the KWS relay installed. Since a nominal 4-second load sequence time interval is used in the design basis loading scenario and the EDG loading capability is demonstrated through computer simulation without KWS relays, the test results of Table 8.3-8 are of historical value.

TABLE 8.3-9

SUMMARY OF PREOPERATIONAL TESTING OF DIABLO CANYON DIESEL ENGINE GENERATOR UNITS BY PG&E DURING STARTUP

Test and Purpose	Conduct of Tests
1. Standard Startup Tests To check out installation and onsite performance.	Startup, cleaning, flushing, performance checks, load capability, acceleration tests, etc., were performed on all engine generator units.
2. Integrated Safety Injection To verify capability to accept loads in rapid succession following the LOCA.	Safety injection was initiated manually with offsite power not available. The sequential loading of all engine generator units was monitored by recording voltage and current decrease.
3. Onsite Power Redundancy To prove auxiliary devices of one unit are not affected by failures in other units.	Test procedures used AEC Regulatory Guide 1.41 as an outline. Test was conducted in the same time period and in sequence with the Integrated Safety Injection tests described above.

TABLE 8.3-10

IDENTIFICATION OF ELECTRICAL SYSTEMS

Class 1E Equipment and Associated Buses[a]

	AC Systems		DC Systems	
	Unit 1	Unit 2	Unit 1	Unit 2
Orange	Bus 1F	Bus 2F	Bus 11	Bus 21
Gray	Bus 1G	Bus 2G	Bus 12	Bus 22
Purple	Bus 1H	Bus 2H	Bus 13	Bus 23

Reactor Protection Systems

Red	Channel 1	Reactor protection system instrumentation
White	Channel 2	Reactor protection system instrumentation
Blue	Channel 3	Reactor protection system instrumentation
Yellow	Channel 4	Reactor protection system instrumentation
Brown	Train A	Direct logic inputs
Green	Train B	Direct logic inputs

Power Circuits from Instrument Inverters

Orange	Reactor Protection Channel I
Gray	Reactor Protection Channel II
Purple	Reactor Protection Channel III
Black/Yellow	Reactor Protection Channel IV

(a) Circuits that do not serve a required Class 1E function may also be color-coded. (For instance, the main annunciator circuits are color-coded although the main annunciator system is not mutually redundant or required for safe shutdown.) In such cases, the color coding will normally follow the above conventions. There may, however, be infrequent instances where this is not practical; color coding in these instances will primarily indicate that these circuits were purchased and installed as Class 1E conductors.

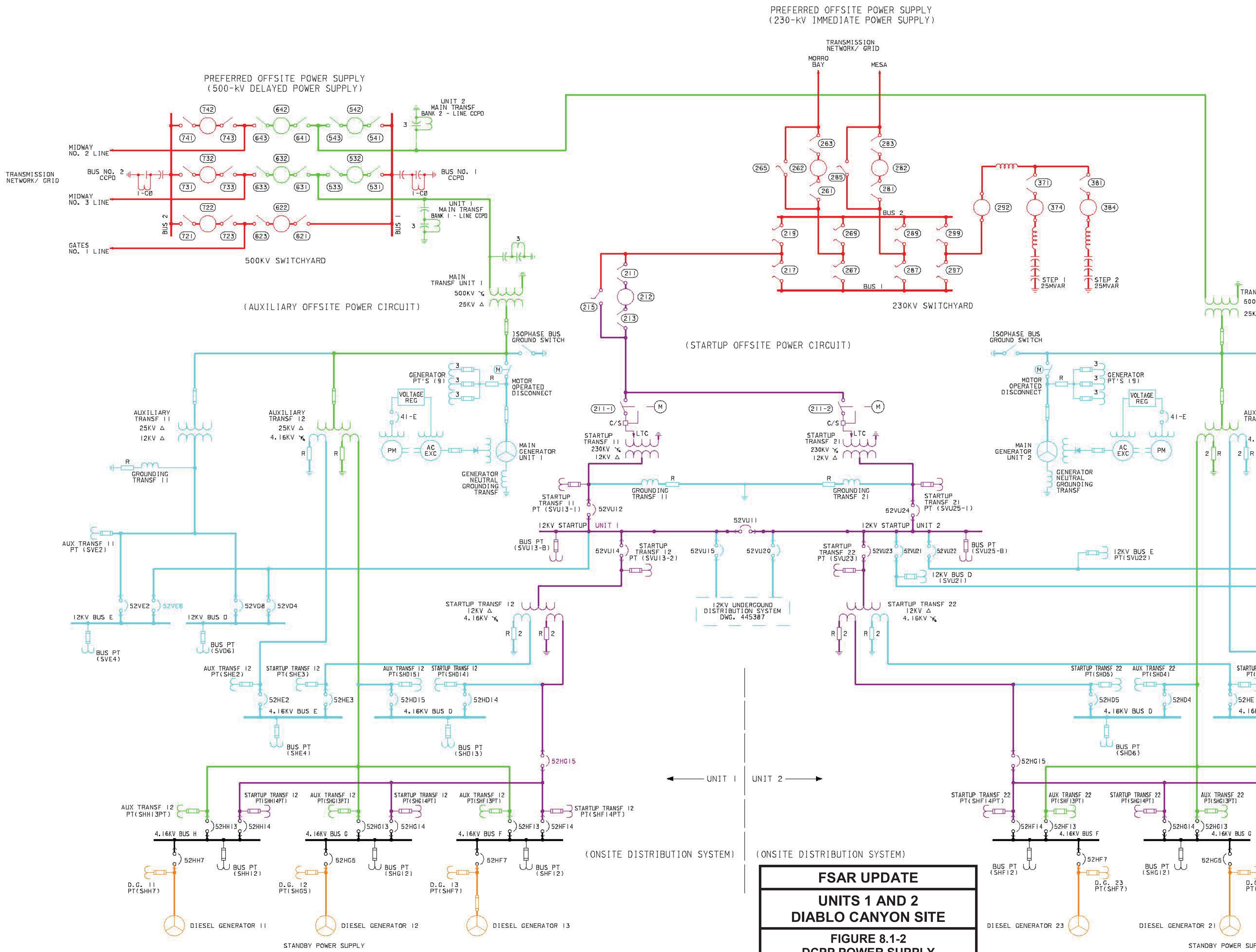
TABLE 8.3-11

UNIT 1 - 125-VDC DISTRIBUTION PANEL SAFETY-RELATED LOADS[a]

DESCRIPTION	Battery 11	Battery 12	Battery 13
Nuclear instrumentation UPS[b]	11	12 & 14	13
4-kV switchgear	Bus F	Bus G	Bus H
DG Gauge Panel Normal Source	DG 13	DG 12	DG 11
DG Gauge Panel Emergency Source	DG 12	DG 11	DG 13
NU safeguards control board solenoid valves	F	G	H
Safeguards relay board	F	G	H
Reactor control board solenoid valves	X	X	X
480-V MCC relay board	F	G	H
Auxiliary safeguards cabinet	Train A	Train B	-
Reactor trip breakers	X	X	-
FWP turbine local control board	12	11	-
Auxiliary relay rack	-	X	-
Dedicated shutdown panel	-	-	X

(a) Unit 2 loads are similar.

(b) UPS fed via 480 V when bus is transferred to the diesel generator.



NOTE

1. FOR CONTROLLED ENGINEERING DRAWING SEE FIGURE 8.1-1
2. CLASS 1E BUS IS ENERGIZED FROM ANY ONE OF THE OFFSITE OR ONSITE POWER SOURCES DEPENDING ON AVAILABILITY OF POWER AND MODE OF PLANT OPERATION.

PURPOSE

FIGURE 8.1-2 IS ISSUED FOR CLARITY OF BOUNDARIES AND MAY DIFFER FROM FIGURE 8.1-1.

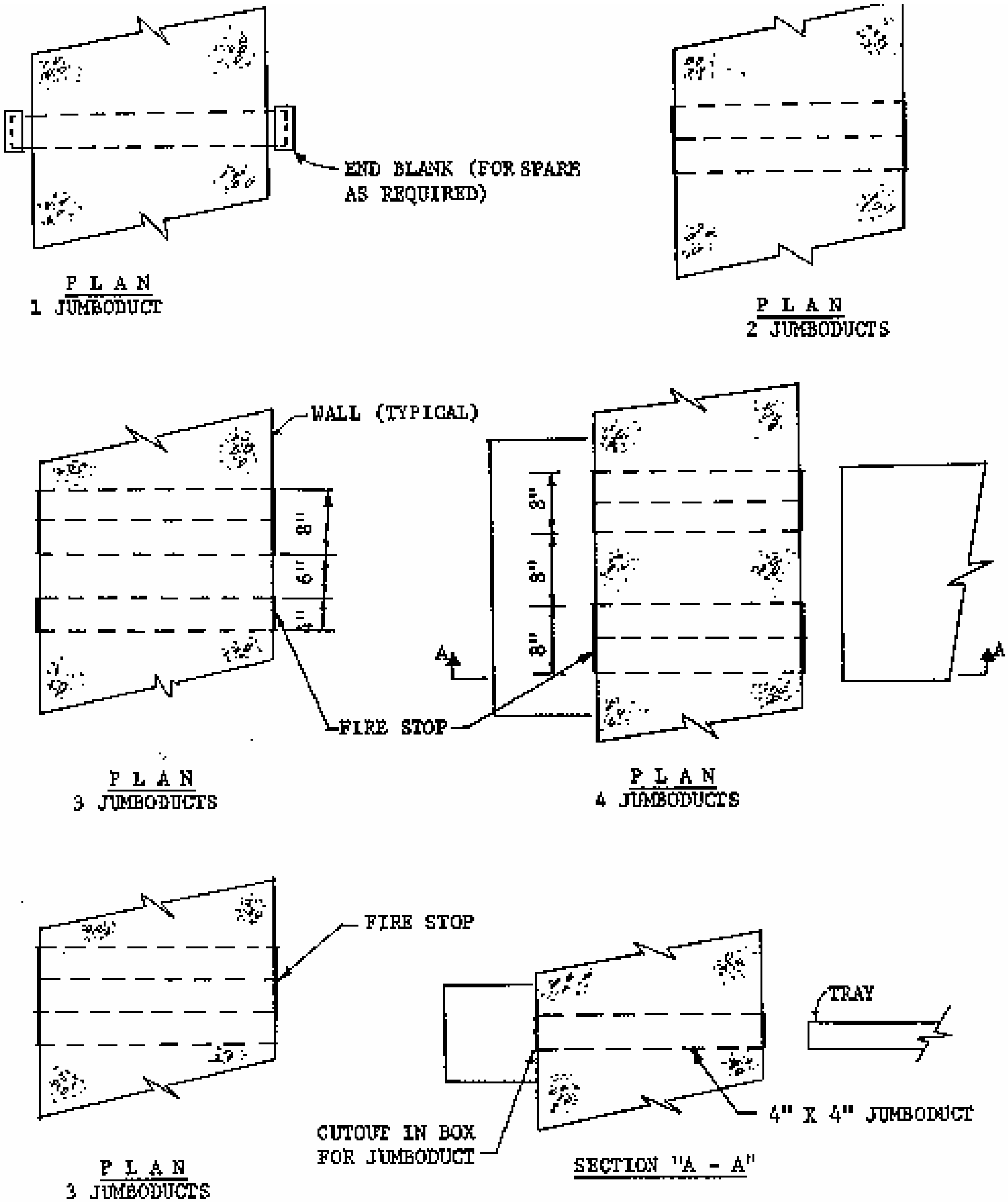
LEGEND

- TRANSMISSION NETWORK/GRID (INCLUDING SWITCHYARD AND TRANSMISSION LINES)
- DCPP PREFERRED POWER SUPPLY (STARTUP OFFSITE CIRCUIT)
- DCPP PREFERRED POWER SUPPLY (AUXILIARY OFFSITE CIRCUIT)
- DCPP STANDBY POWER SUPPLY
- GENERAL POWER SUPPLY CIRCUITS
- CLASS 1E BUS (SEE NOTE 2)

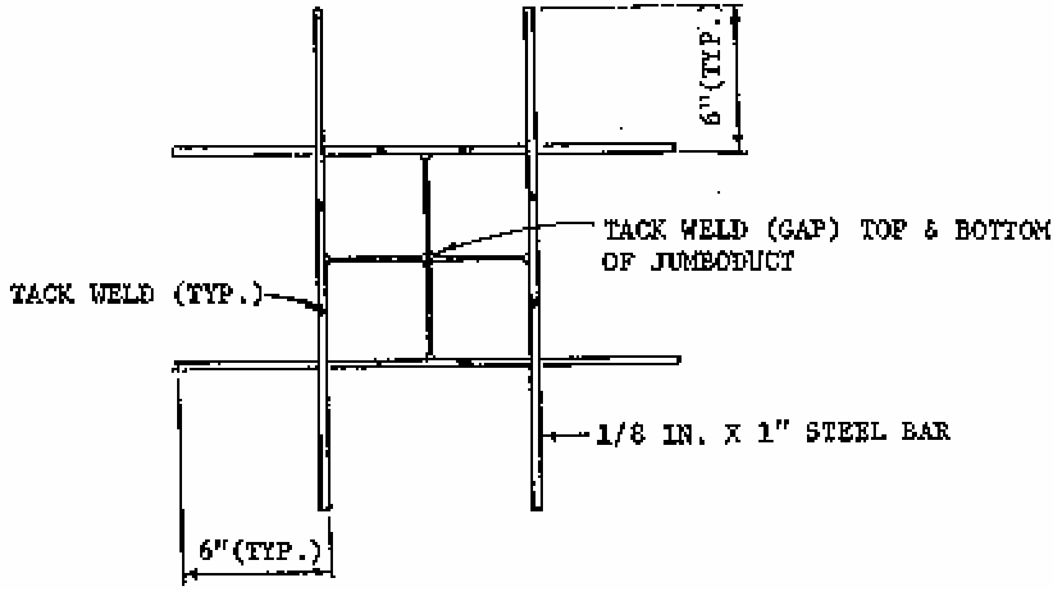
FSAR UPDATE

UNITS 1 AND 2 DIABLO CANYON SITE

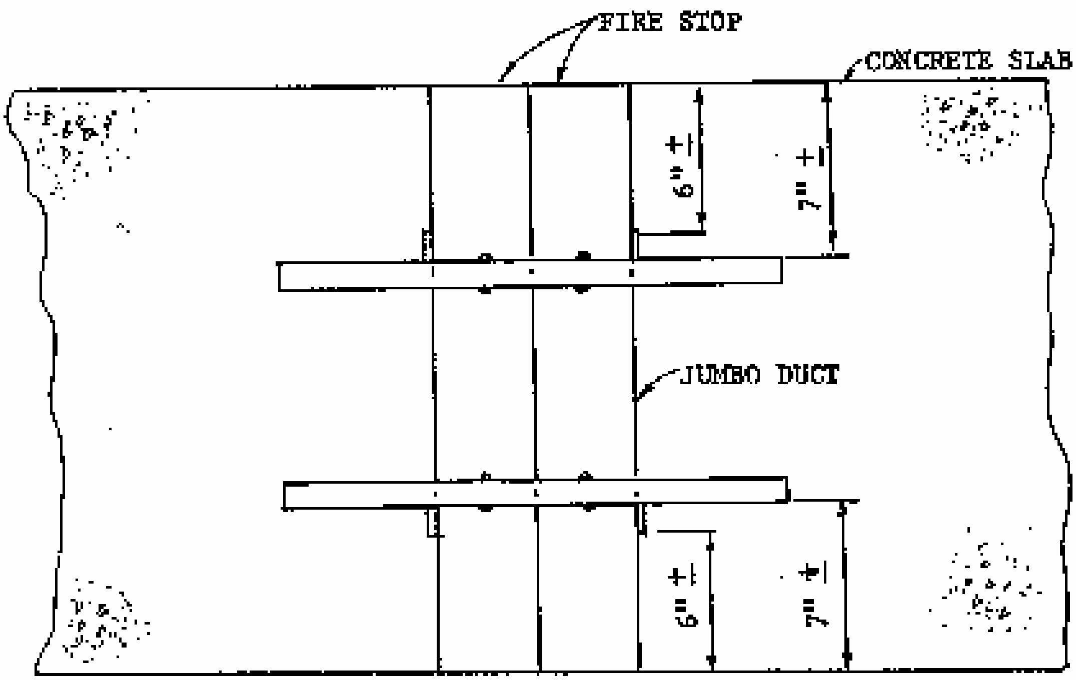
FIGURE 8.1-2 DCPP POWER SUPPLY BOUNDARY DIAGRAM



FSAR UPDATE
UNITS 1 AND 2 DIABLO CANYON SITE
FIGURE 8.3-21 TYPICAL ARRANGEMENT OF JUMBODUCT SLEEVE THROUGH CONCRETE



PLAN

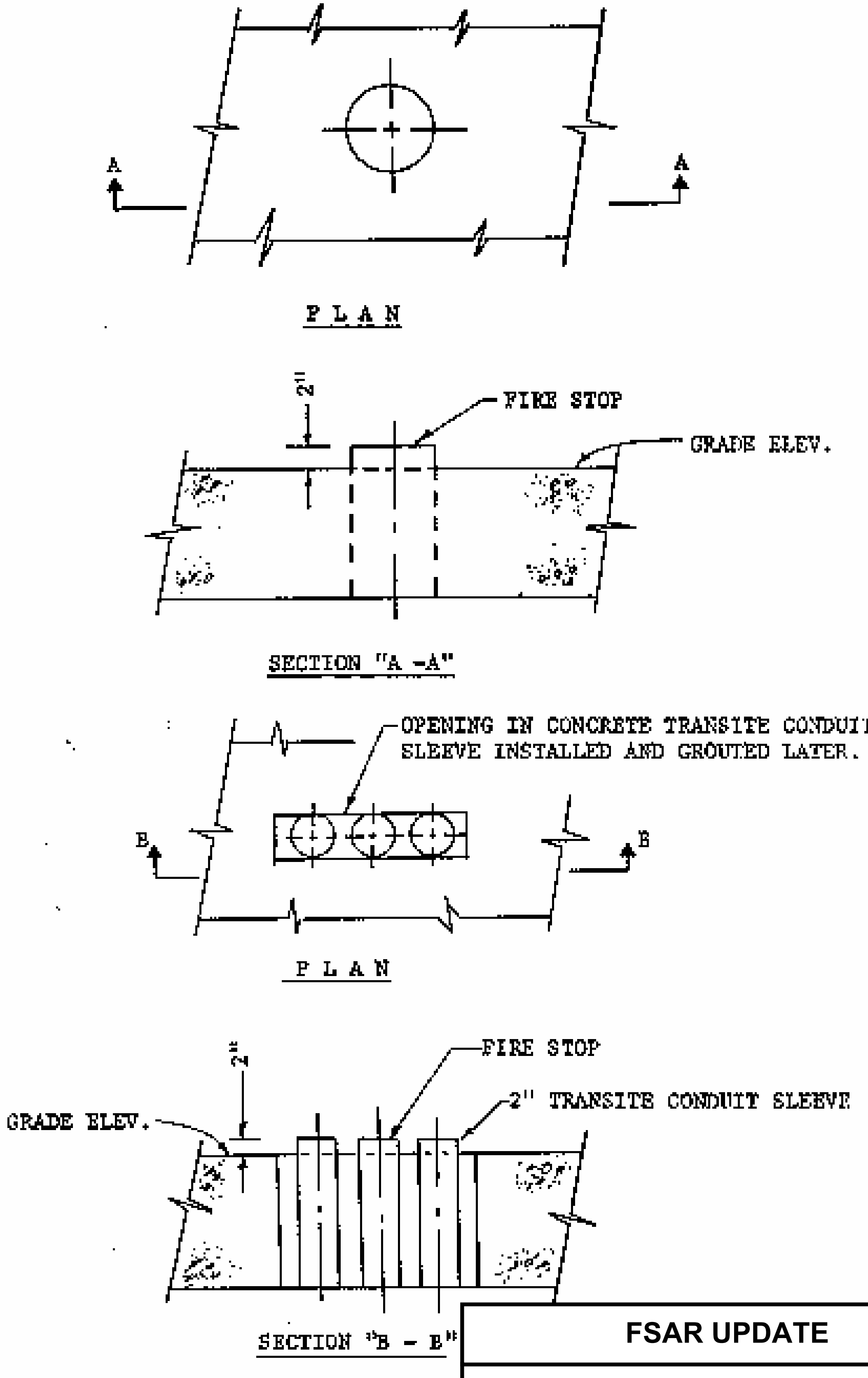


ELEVATION

FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

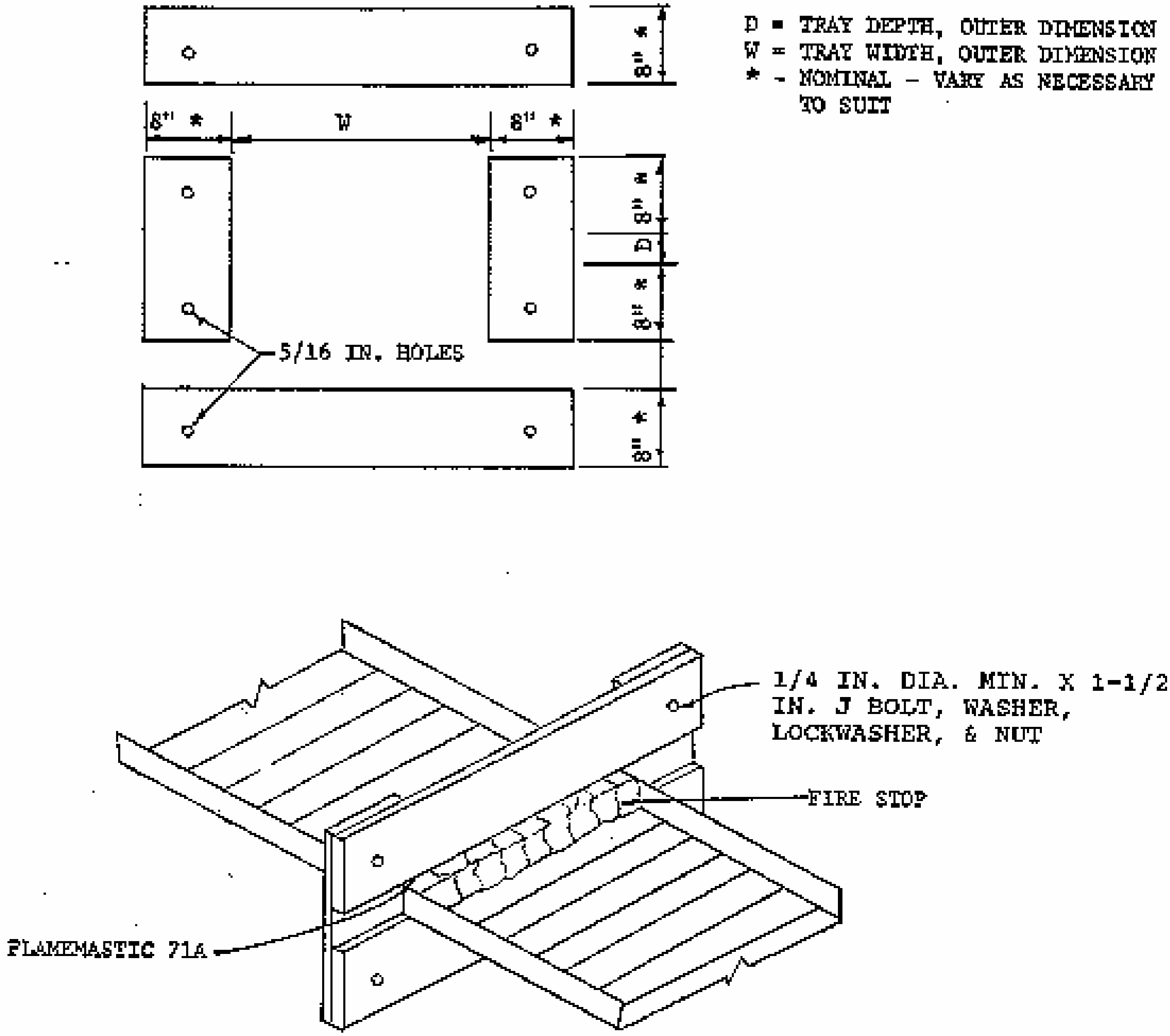
FIGURE 8.3-22
TYPICAL DETAIL OF FOUR OR MORE JUMBODUCTS IN CONCRETE SLAB



FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 8.3-23
TYPICAL ARRANGEMENT OF TRANSITE CONDUIT SLEEVE FOR ELECTRICAL CABLES THROUGH CONCRETE



NOTES:

1. FIRE BARRIER BOARD MATERIAL MIN.- 1/2 IN. MARINITE XL PANEL. ALTERNATE MATERIAL - MIN. 1/2 IN. M BOARD OF CERAMIC FIBER.

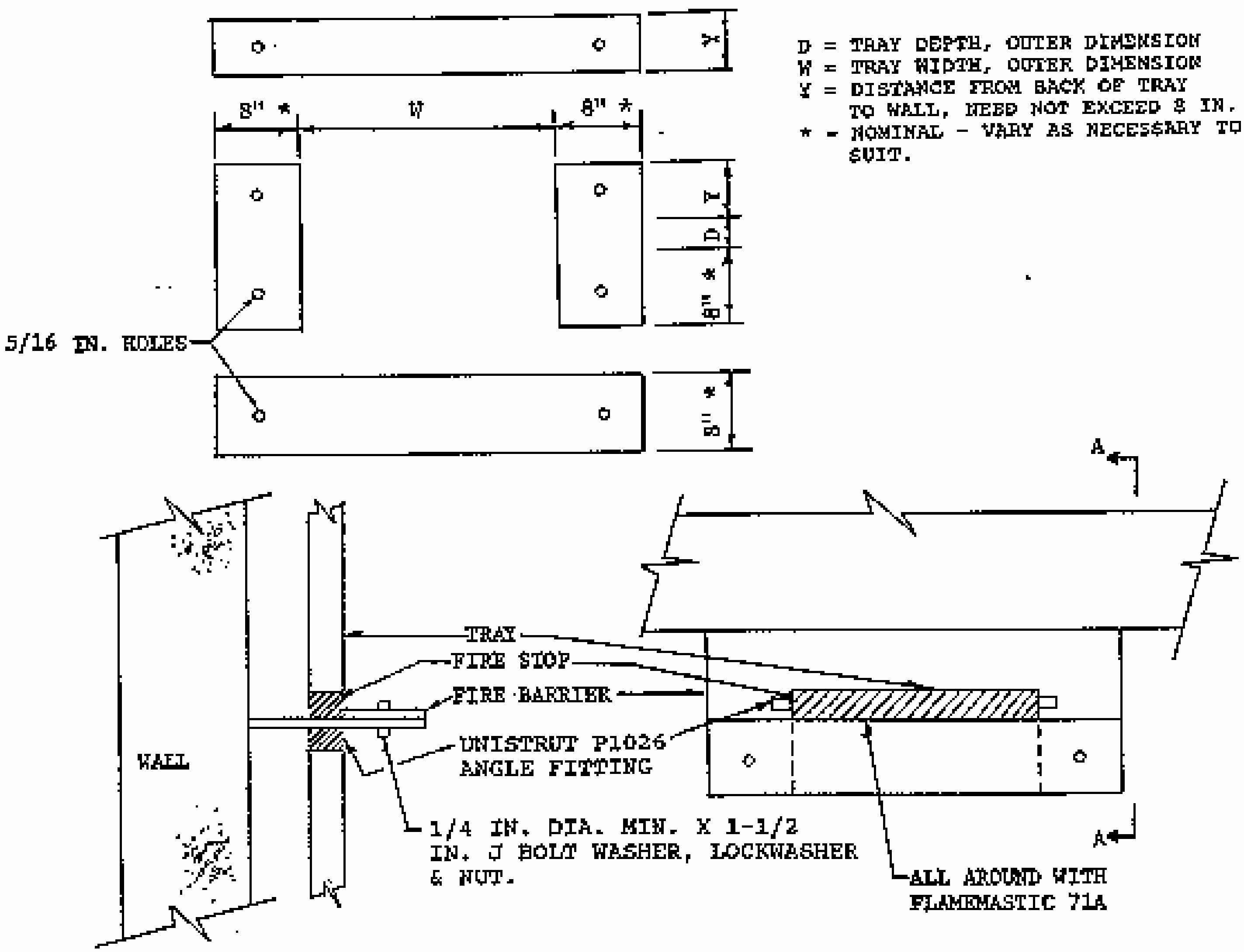
2. FIRE STOP MATERIAL SHALL BE 4 IN. OF LOSE OR 10 IN. RTV 3-6548.

3. FOR ALTERNATE HORIZONTAL TRAY FIRESTOP DESIGN - SEE FIGURE 8.3-28.

FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 8.3-24
TYPICAL FIRE STOP FOR
HORIZONTAL CABLE TRAYS



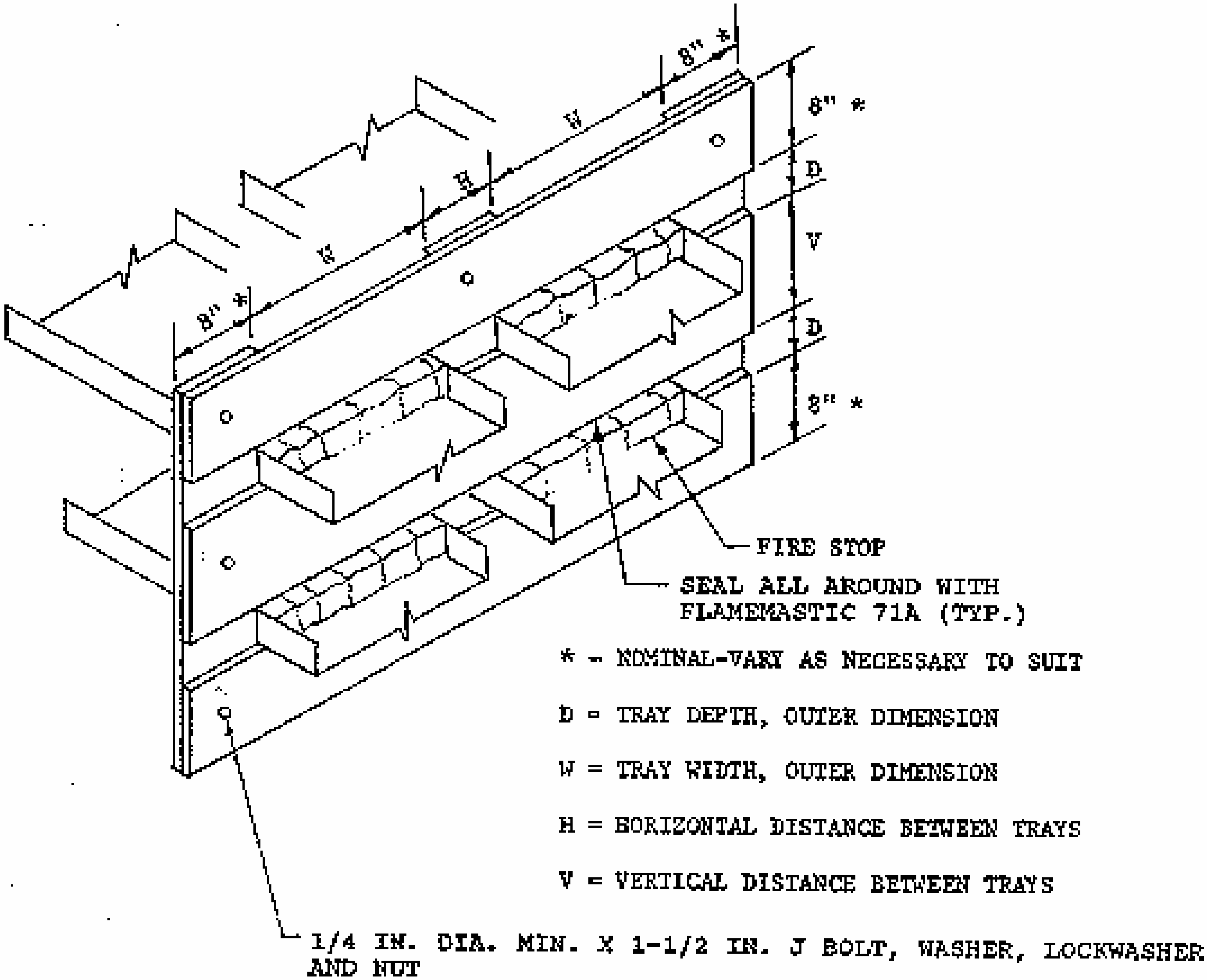
SECTION "A - A"

NOTES:

1. FIRE BARRIER BOARD MATERIAL - MIN. 1/2 IN. MARINITE XL PANEL. ALTERNATE MATERIAL - MIN. 1/2 IN. KAOWOOL M BOARD OF CERAMIC FIBER.

2. FIRE STOP MATERIAL SHALL BE 4 IN. OF LDSE OR 10 IN. RTV 3-6548.

FSAR UPDATE
UNITS 1 AND 2 DIABLO CANYON SITE
FIGURE 8.3-25 TYPICAL FIRE STOP FOR VERTICAL TRAYS

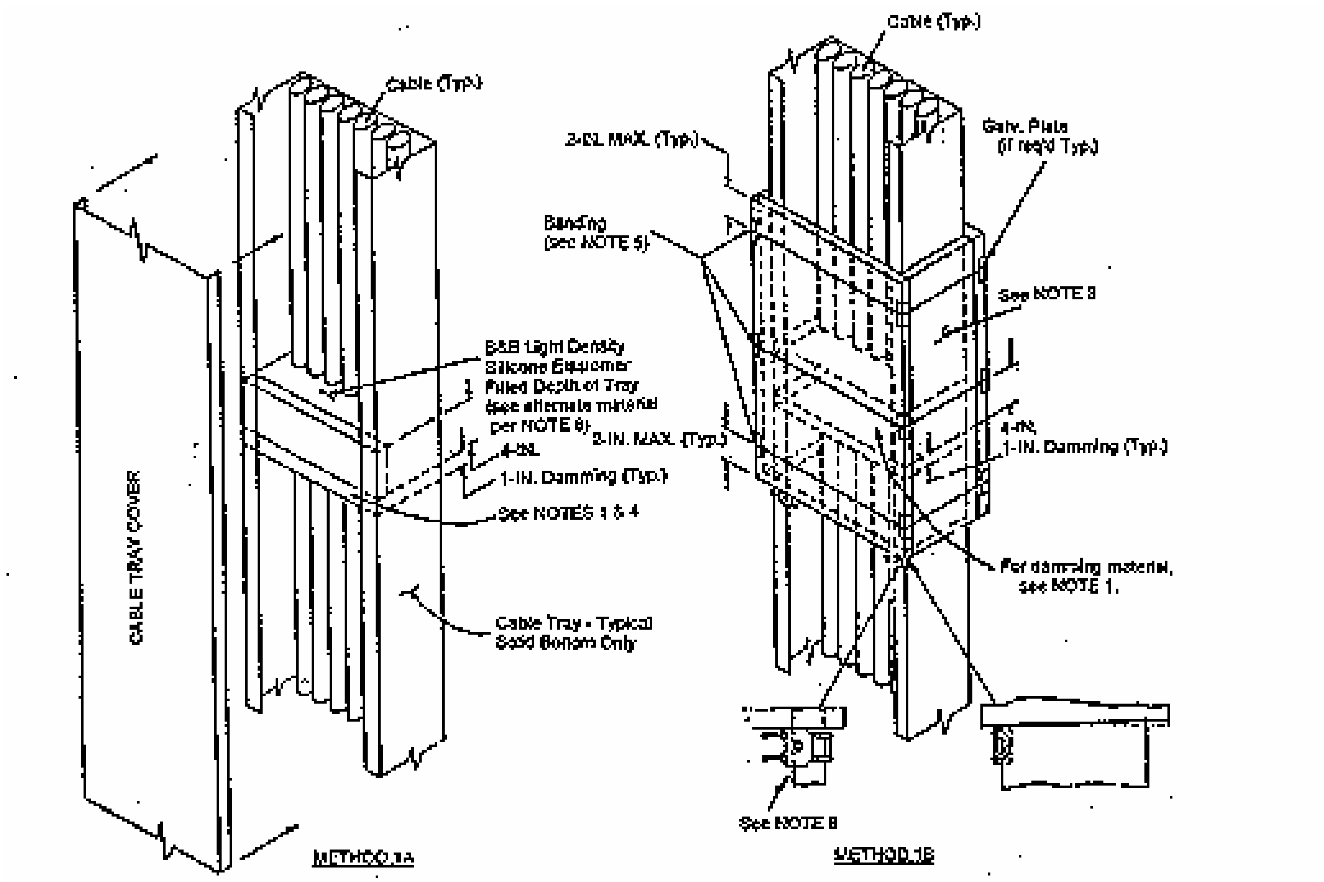


<u>NOTES</u>:

1. FIRE BARRIER BOARD MATERIAL - MIN. 1/2 IN. MARINITE XL PANEL. ALTERNATE MATERIAL - MIN. 1/2 IN. KAOWOOL M BOARD OF CERAMIC FIBER.

2. FIRE STOP MATERIAL SHALL BE 4 IN. OF LDSE OR 10 IN. RTV 3-6548.

FSAR UPDATE
UNITS 1 AND 2 DIABLO CANYON SITE
FIGURE 8.3-26 TYPICAL FIRE STOP FOR PARALLEL TRAYS



NOTE 1 Damming (typ.)
Damming is to be left in place and fire rated materials such as J-M Cera Products or B & W Kaowool Products, shall be utilized. Such products shall be board form only.

NOTE 2 Cable separation
J-M or B & W bulk fiber shall be used at point of damming for cable separation, where possible, to facilitate flow of seal material.

NOTE 3 For open and ladder type trays, enclose tray with 3/4" of fire rated board, as referred in NOTE 1 above, and locate board material to suit field installation, but maintain cover of entire firebreak face.

NOTE 4 For open solid back trays, install firebreak per Method 1A (excluding Cover), and install fire board over open area, using banding material as noted in Method 1B.

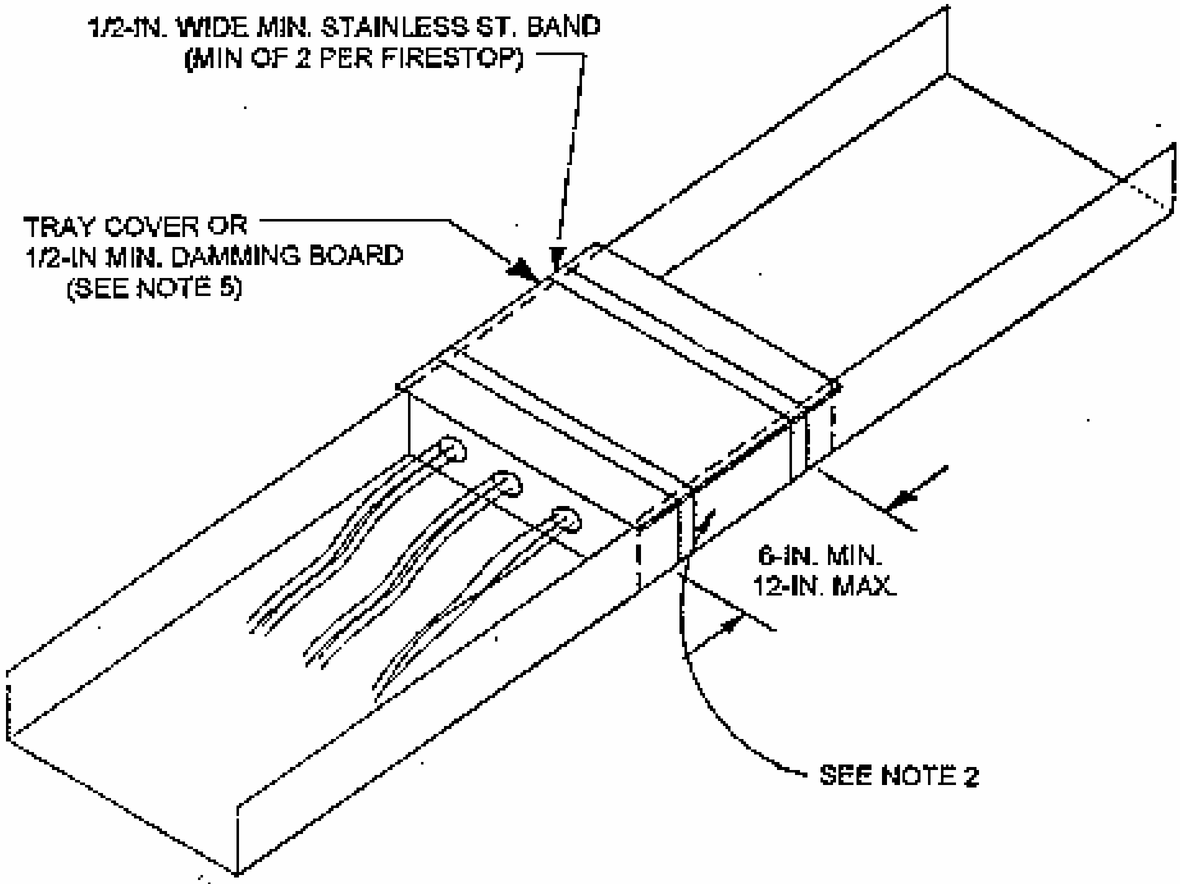
NOTE 5 Banding material shall be 3/4" X 0.020" stainless steel band with stainless steel wing seals. Banding shall be installed at three (3) approx. equally spaced locations.

NOTE 6 Alternate to the 4" of B & B Light Density Silicone Elastomer (LDSE) is 10" of Dow Corning 3-6548 Silicone RTV Foam. All other requirement per the above notes and details, to be incorporated.

NOTE 7 If necessary, add galvanized angle plate (approx. 1" X 2") under banding at corners.

NOTE 8 B-line clamp 0400-101 and/or 97-1555 to be installed in the front side of cable tray on the bottom of the firebreak (for vertical tray only).

FSAR UPDATE
UNITS 1 AND 2 DIABLO CANYON SITE
FIGURE 8.3-27 TYPICAL VERTICAL TRAY FIRE STOP



NOTES:

1. 12 FEET FOR HORIZONTAL RUNS AND WITHIN 5 FEET OF TRAY CROSSINGS.

2. FILL WITH DOW CORNING RTV 3-6548 SILICONE RTV FOAM. ALL CABLES IN TRAY SHOULD BE COVERED WITH FOAM. COVER TRAY VENTILATION OPENING WITH TAPE WHILE FOAM IS CURING. THEN REMOVE TAPE.

3. FOR OTHER "FIRE BARRIER FOR VENTILATED TRAY" DESIGN, SEE FIGURE 8.3-24.

4. IN CASES WHERE DAMMING BOARD CANNOT BE INSTALLED DUE TO AMOUNT OF CABLES, A MINIMUM OF 8 INCHES OF RTV FOAM SHALL BE USED.

5. DAMMING BOARD MATERIAL TO BE 1-INCH KAOWOOL M BOARD OF CERAMIC FIBERS OR EQUIV.

FSAR UPDATE
UNITS 1 AND 2 DIABLO CANYON SITE
FIGURE 8.3-28 TYPICAL FIRE BARRIER FOR HORIZONTAL TRAYS

APPENDIX 8.3B

INSULATED CABLE
CONSTRUCTION AND VOLTAGE RATINGS

Appendix 8.3B

INSULATED CABLE
CONSTRUCTION AND VOLTAGE RATINGS

The insulated cables that externally interconnect separate units of equipment throughout the plant are described below:

(1) High-voltage power cables for 4160- and 12,000-V service are rated 5000 and 15,000 V, respectively, for ungrounded or high-resistance grounded operation. All of these cables are rated 90°C because they are expected to operate only in an environment having a normal maximum temperature of 40 to 50°C. These cables are all single conductor, with ethylene-propylene insulation and a neoprene, hypalon (chlorosulfonated polyethylene (CSPE)), or linear low density polyethylene (LLDPE) jacket. These cables are provided with an extruded semiconducting shield surrounding the conductor and another over the insulation, all covered by a tinned or bare copper tape. A polyester-polypropylene tape and a nylon-neoprene tape are used as a heat shield between the copper tape and the jacket. A stress cone is provided at each terminal, with one of them grounded.

(2) Low-voltage power cables are all of the single conductor type, rated 600 V. Generally, those expected to operate in a maximum ambient temperature of 40 to 50°C are rated 90°C and have ethylene-propylene insulation and a hypalon (CSPE) jacket for sizes 8 AWG and larger. Smaller cables are insulated with flame-retardant cross-linked polyethyelene (XLPE). Those cables located very near or connected to hot equipment and devices, or those required to operate in the atmosphere of the containment during a loss-of-coolant-accident (LOCA), are insulated with silicon rubber, XLPE, Tefzel, or equivalent insulation material and covered by a hypalon (CSPE), XLPE, Tefzel, or equivalent jacket material (except for power cables to the containment fan cooler motors and pressurizer heaters). Cables for the containment fan cooler motors are insulated with a combination of silicone resin-impregnated glass braid, polyimide (Kapton) tapes, an asbestos mat, and a jacket of hypalon. Heat-shrinkable tubing is provided at terminations and splices to seal the cable. Cables for the pressurizer heaters are rated 600 V, 1000°F, and are insulated with a combination of mica and glass tapes with a glass braid jacket.

(3) Cables for control circuits are single and multiple conductor, rated 600 V. Generally, single conductor cables are not less than 12 AWG, and multiple conductor cables are not less than 14 AWG. Cables operating in normal maximum ambient temperature are rated 90°C and are insulated with cross-linked polyethylene with multiple conductor cables having an overall jacket of the same material. Cables that are located very near or connected to hot

equipment and devices, or required to operate in the atmosphere of the containment during a LOCA, are insulated with silicone rubber, XLPE, Tefzel, or equivalent insulation material and covered by a hypalon (CSPE), XLPE, Tefzel, Stilan, or equivalent jacket material.

(4) Instrument cables composed of adjacent conductors have the conductors twisted and shielded with an aluminized mylar tape in continuous contact with a copper drain wire, grounded only at one point. Signal circuits are generally 16 AWG copper, and thermocouple circuits are also 16 AWG. Those cables operating in a normal environment are insulated with cross-linked polyethylene (XLPE) and covered by a jacket of the same material. Cables that are located very near or connected to hot equipment and devices, or required to operate in the atmosphere of the containment during a LOCA, are insulated with silicone rubber and covered by a silicone rubber, Tefzel, Stilan, XLPE, or equivalent jacket material.

(5) Instrument cables of the coaxial and triaxial types have insulations of alkane-imide polymer and cross-linked polyolefin, and jackets of cross-linked polyethylene. Incore thermocouple extension wire is 20 AWG Chromel-Alumel for use in ambient up to 400°F. Primary insulation is a heavy polyimide enamel, and silicone-impregnated fiberglass braid covers the insulation.

APPENDIX 8.3C

MATERIALS FOR FIRE STOPS AND SEALS

Appendix 8.3C

MATERIALS FOR FIRE STOPS AND SEALS

Materials used for fire stops and penetration seals are as follows:

(1) **Refractory Ceramic Damming Materials -** Approved damming material, when required as part of a PG&E Approved penetration seal design, is installed on the bottom of the penetration seal in floors/ceilings and on both sides of the penetration seal in walls. Variations are not allowed without Fire Protection Engineering Approval. Kaowool M board, or engineering approved equivalent, is also used as cable tray fire stop damming. Damming materials consist of the following:

Board:

- Thermal Ceramics Kaowool M Board
- Johns-Manville (JM) Ceraform Board Type 103
- Johns-Manville (JM) Ceraboard Type 126/103
- Fire Protection Design Engineer, or designee, approved equivalent

Blanket:

- Thermal Ceramics Kaowool blanket
- Chemtrol CT-23B alumina silica blanket
- Johns-Manville (JM) Cerablanket
- Fire Protection Design Engineer, or designee, approved equivalent

Bulk Fiber:

- Thermal Ceramics Kaowool bulk fiber
- Chemtrol CT-23F alumina silica bulk fiber
- Johns-Manville (JM) Cerafiber Bulk
- Fire Protection Design Engineer, or designee, approved equivalent

(2) **Marinite Panels -** These panels are composed of calcium silicate and inorganic binders. Can be used as tray fire stop damming or shielding. Can only be used as part of a penetration seal with engineering evaluation. ASTM Specification C5676.

(3) **Flamemastic 77 -** This material, as manufactured by Flamemaster Corporation, is used in conjunction with Kaowool M board or Marinite Panels for tray fire stop construction. This material can only be used as part of a penetration seal design with engineering evaluation.

(4) **Dow Corning 3-6548 Silicone RTV Foam -** This material, as manufactured by Down Corning Corporation, is used in PG&E Engineering approved penetration seal and cable tray fire stop designs.

(5) **Dow Corning Sylgard 170 Silicone Elastomer -** This material, as manufactured by Dow Corning Corporation, is used in PG&E Engineering approved penetration seal designs.

(6) **LDSE (Light Density Silicone Elastomer) -** This material, as manufactured by PROMATEC, Inc., is used in PG&E Engineering approved penetration seal designs.

(7) **TS-MS-45B (Medium Density Silicone Elastomer) -** This material, as manufactured by PROMATEC, Inc., is used in PG&E Engineering approved penetration seal designs and for internal bus duct sealing.

(8) **HDSE (High Density Silicone Elastomer) -** This material, as manufactured by PROMATEC, Inc., is used in PG&E Engineering approved penetration seal designs, typically where gamma radiation shielding is a concern.

(9) **RADFLEX -** This material, as manufactured by PROMATEC, Inc., is used in PG&E Engineering approved penetration seal designs, typically where gamma radiation shielding and mechanical pipe movement is a concern.

(10) **PROMAFLEX -** This material, as manufactured by PROMATEC, Inc., is used in PG&E Engineering approved penetration seal designs, typically where mechanical pipe movement is a concern.

(11) **Approved Boot Fabric Material -** This material is used in conjunction with PG&E Engineering approved penetration seal designs, typically where mechanical pipe movement is a concern.

- Connecticut Hard Rubber (CHR) 1032
- Keene Grade 56493F031
- Fire Protection Design engineer, or designee, approved equivalent

(12) **Silicone Adhesive Sealant -** Approved material is used in conjunction with PG&E Engineering approved penetration seal designs, or as an engineering approved sealant in other specific design applications.

- Dow Corning 732 silicone adhesive sealant
- Dow Corning 96-081 silicone adhesive sealant
- Fire Protection design Engineer, or designee, approved equivalent

(13) **Grout -** This material is used in PG&E Engineering approved penetration seal designs, and as a barrier restoration material for poured n place concrete and concrete block barriers. Typically, the only approved grout material is a cement based grout. With limitation in certain design applications, Ceilcote 658N Epoxy resin grout is approved.

(14) **Pyrocrete -** This material, as manufactured by Carboline, Inc., is used as a PG&E Engineering approved penetration seal design as a barrier restoration material around penetrants through Pyrocrete construction barriers. The specific type, grade, and thickness of Pyrocrete is dependent on the barrier contraction, or engineering evaluated equivalent.

(15) **Plaster -** This material is used as a PG&E Engineering approved penetration seal design as a barrier restoration material around penetrants through Plaster construction barriers. The specific type, grade, and thickness of Plaster is dependent of the barrier construction or engineering evaluated equivalent.

(16) **Epoxy XR5126 -** This material is used where electrical and pressure isolation is required.

Fire barrier penetration seals and credited cable tray fire stops are visually inspected periodically.

Chapter 9

AUXILIARY SYSTEMS

CONTENTS

Section	Title	Page
9.1	FUEL STORAGE AND HANDLING	9.1-1
9.1.1	New Fuel Storage	9.1-1
9.1.1.1	Design Bases	9.1-1
9.1.1.2	System Description	9.1-2
9.1.1.3	Safety Evaluation	9.1-3
9.1.1.4	Tests and Inspections	9.1-6
9.1.1.5	Instrumentation Applications	9.1-6
9.1.2	Spent Fuel Pool Storage System	9.1-6
9.1.2.1	Design Bases	9.1-7
9.1.2.2	System Description	9.1-9
9.1.2.3	Safety Evaluation	9.1-10
9.1.2.4	Tests and Inspections	9.1-18
9.1.2.5	Instrumentation Applications	9.1-18
9.1.3	Spent Fuel Pool Cooling and Cleanup System	9.1-18
9.1.3.1	Design Bases	9.1-18
9.1.3.2	System Description	9.1-20
9.1.3.3	Safety Evaluation	9.1-24
9.1.3.4	Inspection and Testing Requirements	9.1-31
9.1.3.5	Instrumentation Applications	9.1-31
9.1.4	Fuel Handling System	9.1-31
9.1.4.1	Design Bases	9.1-32
9.1.4.2	System Description	9.1-34
9.1.4.3	Safety Evaluation	9.1-54
9.1.4.4	Tests and Inspections	9.1-66
9.1.4.5	Instrumentation Applications	9.1-66
9.1.5	References	9.1-66

CONTENTS (Continued)

Section	Title	Page
9.2	WATER SYSTEMS	9.2-1
9.2.1	Service Cooling Water System	9.2-1
9.2.1.1	Design Bases	9.2-1
9.2.1.2	System Description	9.2-1
9.2.1.3	Safety Evaluation	9.2-2
9.2.1.4	Tests and Inspections	9.2-2
9.2.1.5	Instrumentation Applications	9.2-3
9.2.2	Component Cooling Water System	9.2-3
9.2.2.1	Design Bases	9.2-4
9.2.2.2	System Description	9.2-7
9.2.2.3	Safety Evaluation	9.2-13
9.2.2.4	Tests and Inspections	9.2-23
9.2.2.5	Instrumentation Applications	9.2-23
9.2.3	Makeup Water System	9.2-23
9.2.3.1	Design Bases	9.2-24
9.2.3.2	System Description	9.2-25
9.2.3.3	Safety Evaluation	9.2-26
9.2.3.4	Tests and Inspections	9.2-29
9.2.3.5	Instrumentation Applications	9.2-29
9.2.4	Potable Water System	9.2-29
9.2.5	Ultimate Heat Sink	9.2-30
9.2.5.1	Design Bases	9.2-30
9.2.5.2	System Description	9.2-30
9.2.5.3	Safety Evaluation	9.2-31
9.2.5.4	Tests and Inspections	9.2-32
9.2.5.5	Instrumentation Applications	9.2-32
9.2.6	Condensate Storage Facilities	9.2-32
9.2.6.1	Design Bases	9.2-33
9.2.6.2	System Description	9.2-35
9.2.6.3	Safety Evaluation	9.2-36
9.2.6.4	Tests and Inspections	9.2-39
9.2.6.5	Instrumentation Applications	9.2-39
9.2.7	Auxiliary Saltwater System	9.2-39
9.2.7.1	Design Bases	9.2-39
9.2.7.2	System Description	9.2-41

CONTENTS (Continued)

Section	Title	Page
9.2.7.3	Safety Evaluation	9.2-44
9.2.7.4	Tests and Inspections	9.2-53
9.2.7.5	Instrumentation Applications	9.2-54
9.2.8	Domestic Water System	9.2-54
9.2.8.1	Design Bases	9.2-54
9.2.8.2	System Description	9.2-55
9.2.8.3	Safety Evaluation	9.2-56
9.2.8.4	Tests and Inspections	9.2-56
9.2.8.5	Instrumentation Applications	9.2-56
9.2.9	References	9.2-56
9.3	PROCESS AUXILIARIES	9.3-1
9.3.1	Compressed Air System	9.3-1
9.3.1.1	Design Bases	9.3-1
9.3.1.2	System Description	9.3-1
9.3.1.3	Safety Evaluation	9.3-3
9.3.1.4	Tests and Inspections	9.3-5
9.3.1.5	Instrumentation Applications	9.3-5
9.3.1.6	Backup Air/Nitrogen Supply System	9.3-5
9.3.2	Sampling Systems	9.3-8
9.3.2.1	Nuclear Steam Supply System Sampling System	9.3-8
9.3.2.2	Post Accident Sampling System	9.3-15
9.3.2.3	Secondary Sampling System	9.3-17
9.3.2.4	Turbine Steam Analyzer System	9.3-18
9.3.3	Equipment and Floor Drainage Systems	9.3-18
9.3.3.1	Design Bases	9.3-18
9.3.3.2	System Description	9.3-18
9.3.3.3	Safety Evaluation	9.3-19
9.3.3.4	Tests and Inspections	9.3-20
9.3.3.5	Instrumentation Applications	9.3-20
9.3.4	Chemical and Volume Control System	9.3-20
9.3.4.1	Design Bases	9.3-27
9.3.4.2	System Description	9.3-27
9.3.4.3	Safety Evaluation	9.3-51
9.3.4.4	Tests and Inspections	9.3-66
9.3.4.5	Instrumentation Applications	9.3-67

CONTENTS (Continued)

Section	Title	Page
9.3.5	Failed Fuel Detection	9.3-67
9.3.6	Nitrogen and Hydrogen Systems	9.3-67
9.3.6.1	Design Bases	9.3-67
9.3.6.2	System Description	9.3-67
9.3.6.3	Safety Evaluation	9.3-68
9.3.6.4	Tests and Inspections	9.3-68
9.3.6.5	Instrumentation Applications	9.3-68
9.3.7	Miscellaneous Process Auxiliaries	9.3-69
9.3.7.1	Auxiliary Steam System	9.3-69
9.3.7.2	Oily Water Separator and Turbine Building Sump System	9.3-70
9.3.8	References	9.3-70
9.4	HEATING, VENTILATION, AND AIR-CONDITIONING (HVAC) SYSTEMS	9.4-1
9.4.1	Control Room	9.4-2
9.4.1.1	Design Bases	9.4-2
9.4.1.2	System Description	9.4-5
9.4.1.3	Safety Evaluation	9.4-8
9.4.1.4	Tests and Inspections	9.4-14
9.4.1.5	Instrumentation Applications	9.4-15
9.4.2	Auxiliary Building	9.4-15
9.4.2.1	Design Bases	9.4-16
9.4.2.2	System Description	9.4-19
9.4.2.3	Safety Evaluation	9.4-22
9.4.2.4	Tests and Inspections	9.4-31
9.4.2.5	Instrumentation Applications	9.4-31
9.4.3	Turbine Building	9.4-31
9.4.3.1	Design Bases	9.4-31
9.4.3.2	System Description	9.4-31
9.4.3.3	Safety Evaluation	9.4-33
9.4.3.4	Tests and Inspections	9.4-33
9.4.3.5	Instrumentation Applications	9.4-33
9.4.4	Fuel Handling Area of the Auxiliary Building	9.4-33
9.4.4.1	Design Bases	9.4-34
9.4.4.2	System Description	9.4-37

CONTENTS (Continued)

Section	Title	Page
9.4.4.3	Safety Evaluation	9.4-39
9.4.4.4	Tests and Inspections	9.4-45
9.4.4.5	Instrumentation Applications	9.4-46
9.4.5	Containment	9.4-46
9.4.5.1	Design Bases	9.4-47
9.4.5.2	System Description	9.4-49
9.4.5.3	Safety Evaluation	9.4-54
9.4.5.4	Tests and Inspections	9.4-57
9.4.5.5	Instrumentation Applications	9.4-58
9.4.6	Auxiliary Saltwater Ventilation System	9.4-58
9.4.6.1	Design Bases	9.4-58
9.4.6.2	System Description	9.4-59
9.4.6.3	Safety Evaluation	9.4-60
9.4.6.4	Inspection and Testing Requirements	9.4-34
9.4.6.5	Instrumentation Requirements	9.4-62
9.4.7	Diesel Generator Compartments Ventilation System	9.4-62
9.4.7.1	Design Bases	9.4-63
9.4.7.2	System Description	9.4-64
9.4.7.3	Safety Evaluation	9.4-65
9.4.7.4	Tests and Inspections	9.4-67
9.4.7.5	Instrumentation Application	9.4-67
9.4.8	4.16 kV Switchgear Room	9.4-68
9.4.8.1	Design Bases	9.4-68
9.4.8.2	System Description	9.4-69
9.4.8.3	Safety Evaluation	9.4-70
9.4.8.4	Tests and Inspections	9.4-71
9.4.8.5	Instrumentation Applications	9.4-72
9.4.9	125-Vdc and 480-V Switchgear Area	9.4-72
9.4.9.1	Design Bases	9.4-72
9.4.9.2	System Description	9.4-74
9.4.9.3	Safety Evaluation	9.4-75
9.4.9.4	Test and Inspections	9.4-79
9.4.9.5	Instrumentation Applications	9.4-79
9.4.10	Post-Accident Sample Room	9.4-79
9.4.10.1	Design Bases	9.4-79
9.4.10.2	System Description	9.4-80

CONTENTS (Continued)

Section	Title	Page
9.4.10.3	Safety Evaluation	9.4-81
9.4.10.4	Tests and Inspections	9.4-82
9.4.10.5	Instrumentation Applications	9.4-82
9.4.11	Technical Support Center	9.4-82
9.4.11.1	Design Bases	9.4-82
9.4.11.2	System Description	9.4-83
9.4.11.3	Safety Evaluation	9.4-84
9.4.11.4	Inspection and Testing Requirements	9.4-85
9.4.11.5	Instrumentation Requirements	9.4-85
9.4.12	Containment Penetration Area GE/GW	9.4-85
9.4.12.1	Design Basis	9.4-86
9.4.12.2	System Description	9.4-86
9.4.12.3	Safety Evaluation	9.4-87
9.4.12.4	Tests and Inspections	9.4-87
9.4.12.5	Instrumentation Applications	9.4-87
9.4.13	References	9.4-88
9.4.14	Reference Drawings	9.4-89
9.5	OTHER AUXILIARY SYSTEMS	9.5-1
9.5.1	Fire Protection System	9.5-1
9.5.1.1	Design Bases of the Fire Protection Program	9.5-2
9.5.1.2	Fire Protection System Description	9.5-5
9.5.1.3	System Evaluation	9.5-14
9.5.1.4	Inspection and Testing Requirements and Program Administration	9.5-14
9.5.2	Communications Systems	9.5-14
9.5.2.1	Design Bases	9.5-14
9.5.2.2	Description	9.5-14
9.5.2.3	Inspection and Testing Requirements	9.5-16
9.5.3	Lighting Systems	9.5-16
9.5.4	Diesel Generator Fuel Oil Storage and Transfer System	9.5-17
9.5.4.1	Design Bases	9.5-17
9.5.4.2	System Description	9.5-19
9.5.4.3	Safety Evaluation	9.5-20

CONTENTS (Continued)

Section	Title	Page
9.5.4.4	Tests and Inspections	9.5-25
9.5.4.5	Instrumentation Application	9.5-26
9.5.5	Diesel Generator Cooling Water System	9.5-26
9.5.5.1	Design Bases	9.5-26
9.5.5.2	System Description	9.5-28
9.5.5.3	Safety Evaluation	9.5-28
9.5.5.4	Tests and Inspections	9.5-29
9.5.5.5	Instrumentation Applications	9.5-30
9.5.6	Diesel Generator Starting System	9.5-30
9.5.6.1	Design Bases	9.5-30
9.5.6.2	System Description	9.5-31
9.5.6.3	Safety Evaluation	9.5-32
9.5.6.4	Tests and Inspections	9.5-33
9.5.6.5	Instrumentation Applications	9.5-33
9.5.7	Diesel Generator Lubrication System	9.5-34
9.5.7.1	Design Bases	9.5-34
9.5.7.2	System Description	9.5-35
9.5.7.3	Safety Evaluation	9.5-35
9.5.7.4	Tests and Inspections	9.5-37
9.5.7.5	Instrumentation Applications	9.5-37
9.5.8	References	9.5-37
9.5.9	Reference Drawings	9.5-38

Chapter 9

TABLES

Table	Title
9.1-1	Spent Fuel Pool Cooling and Cleanup System Design Data
9.1-2	Spent Fuel Pool Cooling and Cleanup System Design and Operating Parameters
9.2-1	Auxiliary Saltwater System Component Design Data
9.2-2	Auxiliary Saltwater System Malfunction Analysis
9.2-3	Component Cooling Water System Component Design Data
9.2-4	Components Cooled by the Component Cooling Water System
9.2-5	Component Cooling Water System Nominal Flows (in gpm)
9.2-6	Components With a Single Barrier Between Component Cooling Water and Reactor Coolant Water
9.2-7	Component Cooling Water System Malfunction Analysis
9.2-8	Deleted in Revision 5
9.2-9	Makeup Water System Equipment Design and Operating Parameters
9.3-1	Compressed Air System Equipment
9.3-2	Nuclear Steam Supply System Sampling System Component Design Data
9.3-3	Deleted in Revision 15
9.3-4	Deleted in Revision 15
9.3-5	Chemical and Volume Control System Design Data
9.3-6	Chemical and Volume Control System Principal Component Data Summary
9.3-7	Nitrogen Requirements

TABLES (Continued)

Table	Title
9.3-8	Hydrogen Requirements
9.4-1	Control Room Ventilation System (CRVS) Component Design Data
9.4-2	Compliance With Regulatory Guide 1.52 (June 1973) Design, Testing, and Maintenance Criteria for Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water Cooled Nuclear Power Plants
9.4-3	Deleted in Revision 10
9.4-4	Deleted in Revision 8
9.4-5	Auxiliary Building Heating and Ventilation System Components Design Data
9.4-6	Fuel Handling Area Heating and Ventilation System Components Design Data
9.4-7	Design Values for Turbine Building (General Area) Ventilation System
9.4-8	Design Codes and Standards for Ventilation Systems
9.4-9	Estimated Control Room Area Heat Loads (Normal Operating Conditions - Mode 1)
9.4-10	Design Values for Auxiliary Building Ventilation System
9.4-11	Estimated NSSS Heat Losses Inside Containment
9.4.12	Estimated Total Heat Sources Inside Containment
9.5-1	Fire Protection System Component Design Data
9.5-2	Diesel Generator Fuel Oil System Component Design Data

Chapter 9

FIGURES

Figure	Title
9.1-1	New Fuel Storage
9.1-2	Spent Fuel Storage
9.1-2A	Burnup vs Enrichment (All Cell)
9.1-2B	Burnup vs Enrichment (2x2 Array)
9.1-3	Deleted in Revision 19
9.1-4	HI-TRAC 125D Transfer Cask
9.1-5	Spent Fuel Cask Restraint Spent Fuel Pool
9.1-6	Spent Fuel Pool Transfer Cask Restraint Cup
9.1-7	Heavy Load Handling Paths for the Transfer Cask/MPC
9.1-8	Manipulator Crane
9.1-8a	Deleted In Revision 7
9.1-9	Spent Fuel Pool Bridge
9.1-10	New Fuel Elevator
9.1-11	Fuel Transfer System
9.1-11a	Deleted In Revision 7
9.1-12	Rod Cluster Control Changing Fixture
9.1-12a	Rod Cluster Control Changing Tool
9.1-13	Spent Fuel Handling Tool
9.1-14	New Fuel Assembly Handling Fixture
9.1-15	Reactor Vessel Head Lifting Device

FIGURES (Continued)

Figure	Title
9.1-15A	Deleted in Revision 20
9.1-16	Reactor Internals Lifting Device
9.1-17	Reactor Vessel Stud Tensioner
9.1-18	Fuel Handling Tool Locations
9.1-19	Movable Partition Walls Location Plans
9.1-20	Movable Partition Walls Elevation at Column Line 15[7] or 20[3]
9.1-21	Movable Partition Walls Details Showing Wall, Track, and Vertical Stop
9.1-22	Deleted in Revision 19
9.1-23	Deleted in Revision 19
9.1-24	Cask Washdown Area Restraint
9.1-25	Deleted in Revision 19
9.1-26	Deleted in Revision 19
9.2-1	Deleted in Revision 1
9.2-2	Arrangement of Intake Structure
9.2-3	Arrangement of Auxiliary Saltwater System Piping
9.2-4	Deleted in Revision 11
9.2-5	Deleted in Revision 11
9.2-6	Deleted in Revision 11
9.2-7	Deleted in Revision 11
9.2-8	Deleted in Revision 11
9.2-9	Deleted in Revision 11

FIGURES (Continued)

Figure	Title
9.2-10	Deleted in Revision 11
9.2-11	Deleted in Revision 11
9.2-12	Deleted in Revision 11
9.2-13	Deleted in Revision 11
9.2-14	Deleted in Revision 11
9.2-15	Deleted in Revision 11
9.2-16	Deleted in Revision 12
9.2-17	Deleted in Revision 18
9.2-18	Deleted in Revision 18
9.2-19	Deleted in Revision 6
9.3-1	Deleted in Revision 1
9.3-2	Deleted in Revision 1
9.3-3	Deleted in Revision 1
9.3-4	Deleted in Revision 1
9.3-5	Floor Drain
9.4-1[(a)]	Air Conditioning, Heating, Cooling, and Ventilation Systems - Control Room
9.4-2[(a)]	Air Conditioning, Heating, Cooling, and Ventilation Systems - Auxiliary Building
9.4-3[(a)]	Air Conditioning, Heating, Cooling, and Ventilation Systems - Containment and Fuel Handling Building (Unit 1)
9.4-3a[(a)]	Air Conditioning, Heating, Cooling, and Ventilation Systems - Containment and Fuel Handling Building (Unit 2)

FIGURES (Continued)

Figure	Title
9.4-4	Containment Fan Cooler Unit - Containment Structure
9.4-5	Ventilation System - Intake Structure
9.4-6	Ventilation System - Diesel Generator
9.4-7	Ventilation System - 4 kV Switchgear Rooms
9.4-8[(a)]	Ventilation System - Inverter Rooms and 480 V Switchgear Room in Auxiliary Building
9.4-9	Deleted in Revision 16
9.4-10[(a)]	Ventilation Systems - Technical Support Center and Post-Accident Sampling Room
9.4-11	Ventilation Systems - Containment Area GE/GW
9.5-1	Fire Protection System - Water System
9.5-2	Fire Protection System - Seismically Qualified Portion of Water System
9.5-3	Fire Protection System - Carbon Dioxide System
9.5-4	Deleted in Revision 12
9.5-5	Primary Communications System
9.5-6	Secondary Communications System
9.5-7	Deleted in Revision 1
9.5-8[(a)]	Diesel Fuel Oil Transfer Pump Vaults
9.5-9[(a)]	Diesel Generator Fuel Oil Piping
9.5-10[(a)]	Diesel Generator Arrangement Plan
9.5-11[(a)]	Diesel Generator Arrangement Sections
9.5-12[(a)]	Diesel Engine Generator (Typical)

Figure	Title

NOTE:

[a] This figure corresponds to a controlled engineering drawing that is incorporated by reference into the FSAR Update. See Table 1.6-1 for the correlation between the FSAR Update figure number and the corresponding controlled engineering drawing number.

Chapter 9

APPENDICES

Appendix	Title
9.5A	FIRE HAZARDS ANALYSIS
9.5B	REGULATORY COMPLIANCE SUMMARY
9.5C	RCP OIL COLLECTION SYSTEM - EVALUATION TO 10 CFR 50, APPENDIX R, SECTION III.O
9.5D	EMERGENCY LIGHTING CAPABILITY - EVALUATION TO 10 CFR 50, APPENDIX R, SECTION III.J
9.5E	10 CFR 50, APPENDIX R, SECTION III. L - ALTERNATE AND DEDICATED SHUTDOWN CAPABILITY
9.5F	FIRE BARRIER FIGURES
9.5G	EQUIPMENT REQUIRED FOR SAFE SHUTDOWN
9.5H	INSPECTION AND TESTING REQUIREMENTS AND PROGRAM ADMINISTRATION

Chapter 9

AUXILIARY SYSTEMS

This chapter discusses auxiliary systems installed in Unit 1 and Unit 2 at the DCPP site. Fuel storage and handling systems; water systems; process auxiliaries; and air conditioning, heating, cooling, and ventilation systems are described as well as other auxiliary systems. The design classifications for these various systems and their associated structures and components are discussed in Section 3.2.

9.1 FUEL STORAGE AND HANDLING

The fuel storage and handling systems provide safe and effective means of storing, transporting, and handling new and irradiated nuclear fuel. These systems are located mainly in the fuel handling building, adjacent to the east walls of the containment structures. Separate facilities are provided for each unit.

The fuel storage and handling systems comply with the criticality accident requirements of 10 CFR 50.68(b), “Criticality Accident Requirements,” in lieu of maintaining a monitoring system capable of detecting a criticality as described in 10 CFR 70.24, “Criticality Accident Requirements.” In accordance with 10 CFR 50.68(b)(6), radiation monitors are provided in storage and associated handling areas when fuel is present to detect excessive radiation levels and to initiate appropriate safety actions.

9.1.1 NEW FUEL STORAGE

New fuel is stored in new fuel storage racks (NFSRs), which are in storage vaults in the fuel handling building, located as shown in Figure 9.1-1, or in the spent fuel pool (SFP) storage racks, as discussed in Section 9.1.2. The NFSRs are designed to store, protect, and prevent criticality of new fuel assemblies until used within the reactor.

9.1.1.1 Design Bases

Refer to Section 9.1.1.3.6 for a discussion of k_{eff} limits including allowance for uncertainties.

9.1.1.1.1 General Design Criterion 2, 1967 – Performance Standards

New fuel storage is located in the fuel handling building, which is designed to withstand the effects of, or is protected against, natural phenomena, such as earthquakes, winds, floods and tsunamis, and other local site effects.

9.1.1.1.2 General Design Criterion 3, 1971 – Fire Protection

The NFSRs are designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

9.1.1.1.3 General Design Criterion 11, 1967 – Control Room

The NFSRs are designed to support actions to maintain and control the safe operational status of the plant from the control room.

9.1.1.1.4 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Instrumentation and controls are provided as required to monitor and maintain the NFSR variables within prescribed operating ranges. NFSR area radiation monitoring equipment is provided in the control room.

9.1.1.1.5 General Design Criterion 18, 1967 – Monitoring Fuel and Waste Storage

The NFSRs are provided with monitoring and alarm instrumentation for conditions that might contribute to radiation exposure.

9.1.1.1.6 General Design Criterion 66, 1967 – Prevention of Fuel Storage Criticality

The NFSRs are designed to prevent new fuel criticality through physical systems or processes such as geometrically safe configurations.

9.1.1.1.7 New Fuel Storage Safety Function Requirements

(1) Protection from Missiles and Dynamic Effects

The NFSRs are designed to be protected against missiles and dynamic effects that might result from plant equipment failures.

9.1.1.1.8 10 CFR 50.68(b) – Criticality Accident Requirements

The NFSRs are designed to support compliance with the applicable requirements of 10 CFR 50.68(b) to prevent inadvertent criticality.

9.1.1.2 System Description

There are two NFSRs for each unit. Each NFSR is approximately 9 feet 6 inches wide, 13 feet long, and 13 feet 6 inches high (excluding centering cones). It is built from Type 304 stainless steel.

The storage cells in the NFSRs are in seven rows, five deep, and are spaced to have a nominal center-to-center distance of 22 inches. They are of Type 304 stainless steel and have a cone shaped top entrance to facilitate loading of fuel elements. They are shaped in a 9-inch square (cross section) hollow beam configuration, standing upright. At the base, they have a 1-inch thick bearing plate made of neoprene-impregnated fabric.

The NFSRs are designed in accordance with the American Institute of Steel Construction (AISC) Standard AISC 360-1969, Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, published on February 12, 1969. The ASME BPVC Section III-1983 is used to determine allowable limits for materials not addressed by the AISC specification.

The NFSRs are designed to withstand a vertical (uplift) force of 4000 pounds in the unlikely event that an assembly would bind in the NFSR while being lifted by the SFP bridge crane.

The NFSRs are located in the fuel handling building at elevation 125 feet. Assembly access is from elevation 140 feet.

For each unit, new fuel assemblies with possible inserts (e.g., rod cluster control assemblies [RCCAs]) are stored to facilitate the unloading of new fuel assemblies from trucks. The storage vaults are designed to hold new fuel assemblies in NFSRs and are utilized primarily for the temporary storage of the replacement fuel every cycle. The storage vault for each unit consists of two NFSRs with 35 storage cells per NFSR (70 cells per unit). The cells are arranged in a 5x7 array for each NFSR.

9.1.1.3 Safety Evaluation

9.1.1.3.1 General Design Criterion 2, 1967 – Performance Standards

The NFSRs are located in the fuel handling building which is a PG&E Design Class I structure. This building is designed to withstand the effects of winds (refer to Section 3.3), floods and tsunamis (refer to Section 3.4), and earthquakes (refer to Section 3.7), and to protect PG&E Design Class I SSCs to ensure their safety functions are maintained.

The NFSRs and the anchorage of the NFSRs to the floor are designed for the DE and DDE loading conditions and evaluated for a Hosgri seismic event (Reference 1) with the NFSRs containing fuel assemblies at the corners.

In addition, the NFSRs must be capable of maintaining the horizontal center-to-center spacing of the fuel assemblies, and of supporting assemblies vertically under postulated seismic events. Currently, the NFSRs are seismically qualified to store only four assemblies per NFSR, one at each corner, each with or without insert components (e.g., RCCAs). The seismic qualification is based on an assumed combined weight of

each fuel assembly and insert of 1800 pounds. Also, together with these four corner assemblies, a maximum of two insert components may be stored in each NFSR in cells face-adjacent to the corner cells in diagonally opposite corners. The seismic qualification is based on an assumed weight of each of the two additional inserts of 170 pounds.

9.1.1.3.2 General Design Criterion 3, 1971 – Fire Protection

The DCPP Fire Protection Program is described in Section 9.5.1. The NFSRs are designed to the fire protection guidelines of Branch Technical Position APCSB 9.5-1 (refer to Appendix 9.5B Table B-1).

9.1.1.3.3 General Design Criterion 11, 1967 – Control Room

The area radiation monitoring equipment for the new fuel storage area is annunciated in the control room.

9.1.1.3.4 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Instrumentation and controls are provided to monitor area radiation variables within specified operating ranges.

Radiation levels are monitored locally in the fuel handling building. Signal input is provided to local alarms and main control room annunciators, and to the fuel handling building ventilation system (FHBVS) to automatically initiate Iodine Removal Mode operation (refer to Section 9.4.4.2).

9.1.1.3.5 General Design Criterion 18, 1967 – Monitoring Fuel and Waste Storage

Radiation monitors are provided in storage areas and associated handling areas when fuel is present to detect excessive radiation levels and to initiate appropriate safety actions. New fuel storage is provided with monitoring and alarm instrumentation for conditions that might contribute to radiation exposure (refer to Section 11.4.2.3 and Table 11.4-1).

9.1.1.3.6 General Design Criterion 66, 1967 – Prevention of Fuel Storage Criticality

The fuel storage criticality analysis assumes the NFSRs are completely filled with 5.0 weight percent U-235 fuel with no credit taken for any burnable absorber that may be present in the fuel assemblies (e.g., integral fuel burnable absorber, IFBA). Although the storage vault containing the NFSRs is normally dry, two accident scenarios were considered as part of the NFSRs' design bases: (1) when fully flooded with unborated water, a $k_{eff} \leq 0.95$ must be maintained after allowing for calculational uncertainties, and

(2) when flooded with aqueous foam, a $k_{eff} \leq 0.98$ must be maintained after allowing for calculational uncertainties.

For each case, calculations were made for both the Westinghouse standard and optimized fuel assembly (OFA) designs, which have different fuel rod diameters. The standard fuel gave the higher reactivity for the aqueous foam case whereas the OFA fuel gave the higher reactivity under the fully flooded accident condition. For the fully flooded case, the calculated k_{eff} was 0.9380 ± 0.0069 (95% probability, 95% confidence level). For the aqueous foam case, the calculated k_{eff} was 0.8949 ± 0.0053 (95% probability, 95% confidence level). Thus, allowing for all uncertainties, the maximum k_{eff} was 0.9449 for the flooded case, and 0.9002 for the aqueous foam case. These maximum values are within their respective 0.95 and 0.98 10 CFR 50.68(b)(2) and 10 CFR 50.68(b)(3) limits.

Center-to-center assembly spacing is held to a tolerance of ±1/16 inch to ensure a K_{eff} of less than 0.95, even when the storage vault is flooded with unborated water. After the NFSRs were installed, a dummy fuel element was inserted in each location and critical measurements taken to ensure proper arrangement and support. A metal cap covers the top of the NFSR. If a fuel assembly is accidentally dropped, it will only be able to drop into a holder and could not drop into the space between fuel assemblies. Refer to Section 15.4.5 for a discussion of fuel handling accidents.

9.1.1.3.7 New Fuel Storage Safety Function Requirements

(1) Protection from Missiles and Dynamic Effects

There are no credible missiles outside of containment resulting from plant equipment failure that would prevent the PG&E Design Class I NFSRs from performing their design functions (refer to Section 3.5.1.2). Dynamic effects as a result of plant equipment failure will not prevent the PG&E Design Class I NFSRs from performing their design functions. Protection of the NFSRs from the effects of missiles and protection of PG&E Design Class I SSCs from damage that may result from these events is discussed in Sections 3.5 and 3.6, respectively.

9.1.1.3.8 10 CFR 50.68(b) – Criticality Accident Requirements

The new fuel storage and handling systems comply with the criticality accident requirements of 10 CFR 50.68(b), “Criticality Accident Requirements,” in lieu of maintaining a monitoring system capable of detecting a criticality as described in 10 CFR 70.24, “Criticality Accident Requirements.”

In accordance with 10 CFR 50.68(b)(1), plant procedures prohibit handling and storage at any one time of more fuel assemblies than have been determined to be safely subcritical.

Refer to Section 9.1.1.3.6 for a discussion of implementation of 10 CFR 50.68(b)(2) and 10 CFR 50.68(b)(3), which regard k_{eff} limits for new fuel storage in the NFSRs assuming other-than-dry conditions.

The requirements in 10 CFR 50.68(b)(4) and 10 CFR 50.68(b)(5) regard spent fuel and special nuclear material other than nuclear fuel, respectively, and are therefore not applicable to the NFSRs.

In accordance with 10 CFR 50.68(b)(6), radiation monitors are provided in storage and associated handling areas when new fuel is present to detect excessive radiation levels and to initiate appropriate safety actions (refer to Sections 9.1.1.3.4 and 9.1.1.3.5).

Refer to Section 9.1.1.3.6 for information on implementation of 10 CFR 50.68(b)(7) regarding maximum nominal U-235 enrichment of new fuel assemblies.

Implementation of 10 CFR 50.68(b)(8) was completed with the submittal of Revision 15 of the UFSAR.

9.1.1.4 Tests and Inspections

New fuel is stored in the NFSRs prior to removal for receipt inspection and placement in the SFP. Tests and inspections are conducted in accordance with plant procedures.

9.1.1.5 Instrumentation Applications

The NFSR radiation monitor provides a signal to the ventilation control logic to realign the FHBVS exhaust flow through the charcoal filter banks (Iodine Removal Mode) upon sensing a high radiation condition (refer to Section 9.1.1.3.4).

9.1.2 SPENT FUEL POOL STORAGE SYSTEM

The spent fuel pool (SFP), shown in Figure 9.1-2, is the storage space in the DCPP 10 CFR Part 50 facilities for irradiated spent fuel from the reactor. New fuel may also be stored in the SFP. The figure shows the arrangement of the SFP storage racks. The SFP is not required for any plant operating mode safety-related function. As described in Section 3.2, the SFP concrete structure is PG&E Design Class I. Two pools are provided, one for each unit. The Unit 2 SFP is a mirror image of the Unit 1 SFP, reflected around column line $12^{\underline{9}}$.

The SFP for each unit comprises high density fuel storage racks, the SFP liner, the SFP liner leakage detection system, and key instruments to monitor SFP level, temperature and rate of temperature change, and local radiation levels. The SFP interfaces with the spent fuel pool cooling and cleanup system (refer to Section 9.1.3) and the fuel handling system (refer to Section 9.1.4).

Refer to Section 9.1.4.2.6 for information on the Diablo Canyon independent spent fuel storage installation (ISFSI).

9.1.2.1 Design Bases

9.1.2.1.1 General Design Criterion 2, 1967 – Performance Standards

The SFP is designed to withstand the effects of, or is protected against, natural phenomena, such as earthquakes, winds and tornadoes, floods and tsunamis, and other local site effects.

9.1.2.1.2 General Design Criterion 3, 1971 – Fire Protection

The SFP is designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

9.1.2.1.3 General Design Criterion 11, 1967 – Control Room

The SFP is designed to support actions to maintain and control the safe operational status of the plant from the control room.

9.1.2.1.4 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Instrumentation and controls are provided as required to monitor and maintain the SFP variables within prescribed operating ranges.

9.1.2.1.5 General Design Criterion 18, 1967 – Monitoring Fuel and Waste Storage

The SFP is provided with monitoring and alarm instrumentation for conditions that might contribute to loss of continuity in decay heat removal and to radiation exposures.

9.1.2.1.6 General Design Criterion 66, 1967 – Prevention of Fuel Storage Criticality

The SFP is designed to prevent criticality in SFP-stored new and spent fuel through physical systems or processes such as geometrically safe configurations.

9.1.2.1.7 General Design Criterion 68, 1967 – Fuel and Waste Storage Radiation Shielding

The SFP is designed to provide shielding for radiation protection to meet the requirements of 10 CFR Part 20.

9.1.2.1.8 General Design Criterion 69, 1967 – Protection Against Radioactivity Release from Spent Fuel and Waste Storage

The SFP is designed to provide containment of radioactive releases to the public environs as a result of an accident.

9.1.2.1.9 SFP Storage System Safety Function Requirements

(1) Protection from Missiles and Dynamic Effects

The SFP is designed to be protected against missiles and dynamic effects that might result from plant equipment failures.

9.1.2.1.10 10 CFR 50.68(b) – Criticality Accident Requirements

The SFP is designed to support compliance with the applicable requirements of 10 CFR 50.68(b) to prevent inadvertent criticality, with a noted exemption.

9.1.2.1.11 Safety Guide 13, March 1971 – Fuel Storage Facility Design Basis

Regulatory Position 1:

The SFP is designed to Category I seismic requirements.

Regulatory Position 2:

The PG&E Design Class I fuel handling building (FHB) that houses the SFP is designed to prevent tornadoes and tornado-borne missiles from causing significant loss of watertight integrity of the SFP and to prevent tornado-borne missiles from contacting fuel within the SFP.

Regulatory Position 5.b:

The SFP is designed to withstand, without leakage which could uncover the fuel, the impact of the heaviest load to be carried by the crane from the maximum height to which it can be lifted.

Regulatory Position 7:

The SFP design provides for reliable monitoring equipment that will alarm both locally and in the control room if the SFP water level falls below a predetermined level or if high local radiation levels are experienced.

9.1.2.2 System Description

The SFP for each unit is a reinforced concrete structure with seam-welded stainless steel plate liner. The floor elevation of the SFP is nominally at elevation 99 feet, and the normal water surface is at elevation 137 feet 8 inches. The SFP storage racks rest on bridge plates supported on the floor and have a total height of 14 feet 11 inches. Thus normal water depth over the SFP storage racks is 23 feet 9 inches. DCPP Technical Specifications require that the SFP level be greater than or equal to 23 feet over the top of irradiated fuel assemblies seated in the storage racks during movement of irradiated fuel.

The pool is filled with borated water at a concentration greater than or equal to 2000 ppm boron as discussed in the Technical Specifications (Reference 2). Additional borated water to maintain this concentration is supplied from the refueling water storage tank (RWST) via the refueling water purification (RWP) system, or from other sources within the chemical and volume control system (CVCS).

Each SFP is designed to hold 1324 assemblies in the SFP storage racks, allowing for the concurrent storage of a full core of irradiated fuel assemblies and a managed quantity of spent fuel assemblies from reactor refueling operations. Rod cluster control assemblies (RCCAs) and burnable poison rods requiring removal from the reactor are normally stored in the spent fuel assemblies.

The high density SFP storage racks for each fuel pool consist of a total of 16 stainless steel racks of various sizes, with a total of 1324 fuel assembly storage cells plus 10 miscellaneous storage locations. Individual storage cells have an 8.85-inch (nominal) square cross section, and each is sized to contain and protect a single Westinghouse-type PWR 17x17 fuel assembly. The cells are arranged with a nominal 11-inch center-to-center spacing in the 16 rack modules.

The SFP storage racks are freestanding, with no connection to the SFP floor, walls, or adjacent SFP storage rack modules. The SFP storage rack support feet rest on bridge plates on the SFP floor. Each module is equipped with a girdle bar on the outside of each of the modules' four sides, near the top. Each girdle bar serves as a designated impact location, and each is designed to accommodate impact loads, which may occur during a seismic event. They also maintain a specified minimum gap between the cell walls of adjacent SFP storage rack modules for all loading conditions.

Adjacent to the SFP is the stainless-steel-lined fuel transfer canal, which is connected to the refueling cavity (inside the containment). The transfer canal is separated from the SFP by a gate. An inflatable gate seal provides leak protection.

Almost all components in contact with the SFP water (handling tools, new fuel elevator, etc.) are constructed of stainless steel, which has very good corrosion resistance. There are a few components made of bronze, which also has good corrosion resistance

in aqueous environments. The compatibility of bronze and stainless steel maintains the integrity of the stainless steel components in the SFP.

A cooling and cleanup system for the SFP water is described in Section 9.1.3.

9.1.2.3 Safety Evaluation

Refer to Section 9.1.2.3.10 for a discussion of k_{eff} limits including allowance for uncertainties.

9.1.2.3.1 General Design Criterion 2, 1967 – Performance Standards

The FHB is PG&E Design Class I (refer to Section 3.8) and contains the PG&E Design Class I SFP and SFP storage racks. These components are designed to withstand the effects of winds and tornadoes (refer to Section 3.3); floods and tsunamis (refer to Section 3.4); external missiles (refer to Sections 3.5); and earthquakes (refer to Section 3.7). Note that some metal siding on the FHB may detach during the postulated tornado.

In General Electric Topical Report APED - 5696, Tornado Protection for the Spent Fuel Storage Pool (Reference 5, Section 3.3.3), a highly conservative model demonstrates that removal of more than 5 feet of water by a tornado mechanism is highly improbable. The 20 feet of water cover remaining over the fuel racks is shown to provide adequate protection against both fuel damage and liner penetration from a wide spectrum of tornado-generated missiles ranging up to a 3 inch diameter steel cylinder (7 feet long) or a 14 inch diameter wood pole (12 feet long). A potential for damage can only be shown by arbitrarily assuming long cylindrical objects hurled into the pool by winds acting on their maximum cross-sectional area and then impacting the pool with their minimum cross-sectional area. The probability of such an event is calculated to be about once per 1.4 billion reactor lifetimes. It is therefore concluded that adequate protection against tornado forces and tornado-generated missiles has been provided for the SFP (refer to Section 3.3).

The SFP storage racks are designed for the DE, DDE, and HE with the racks filled with fuel assemblies and as discussed in the DCPP Q-List. The SFP storage racks are designed to withstand a vertical (uplift) force of 4400 pounds in the unlikely event that an assembly would bind in the rack while being lifted by the spent fuel bridge crane. The design classification of the SFP storage racks, as well as the SFP structure, is discussed in Section 3.2.2.1.1, and the design requirements and acceptance criteria are discussed in Section 3.8.8.

Refer to Section 3.8.8.6 for a discussion of the evaluation of the SFP structure for postulated interactions of the SFP storage racks with the structure as a result of a seismic event.

9.1.2.3.2 General Design Criterion 3, 1971 – Fire Protection

The SFP storage system area is designed to the fire protection guidelines of Appendix A, Branch Technical Position APCSB 9.5-1 (refer to Appendix 9.5B Table B-1).

9.1.2.3.3 General Design Criterion 11, 1967 – Control Room

SFP pool level monitoring equipment and area radiation monitoring equipment are provided in the control room to support actions to maintain and control the safe operational status of the plant (refer to Sections 9.1.3.3.5 and 11.4.2.3.2, respectively).

9.1.2.3.4 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Instrumentation is provided to give an alarm in the control room when the water level in the SFP reaches either the high- or low-level alarm setpoint (refer to Section 9.1.3.3.5).

Local instrumentation is provided to measure the temperature of the water in the SFP and provide local indication as well as annunciation in the control room when normal temperatures or rates of temperature change are exceeded (refer to Section 9.1.3.3.5).

Radiation levels are monitored locally in the SFP area (refer to Section 9.1.2.3.5). Signal input is provided to local alarms and control room annunciators, and to the fuel handling building ventilation system (FHBVS) to initiate Automatic Iodine Removal Mode operation (refer to Section 9.4.4.2).

9.1.2.3.5 General Design Criterion 18, 1967 – Monitoring Fuel and Waste Storage

A controlled and monitored ventilation system removes any gaseous radioactivity from the atmosphere above the SFP and discharges it through the plant vent. This system is described in Section 9.4.4.

Radiation monitors RM-14 and RM-14R continuously monitor the gases discharging through the plant vent—including the gases exhausted from the SFP areas—and alarm when the activity level of the gases reaches a preset limit. The alarm alerts the operators to take appropriate action. Refer to Section 9.4.4.2 for a discussion of FHBVS operation, including operation following detection of high activity levels. The radiation monitors for the fuel storage areas, RM-58 or RM-59, change the FHBVS exhaust mode from normal to Automatic Iodine Removal Mode (roughing, HEPA, and charcoal filters) if measured area radiation levels increase to preset alarm levels.

An SFP area radiation monitoring system is provided for personnel protection and general surveillance of the SFP area. This system is described in Section 11.4.2.3. Continuous monitoring and recording readouts and high radiation level alarms in the control room, plus local audible and visual indicators, are provided for use during the movement of irradiated fuel assemblies in the FHB. Refer to Section 9.4.4.2 for

discussion concerning FHBVS modes of operation and Section 15.4 for a discussion of radiation monitoring and ventilation during a fuel handling accident. SFP radiation, temperature, and level instrumentation are discussed in Section 9.1.2.3.4.

9.1.2.3.6 General Design Criterion 66, 1967 – Prevention of Fuel Storage Criticality

Constraints for storing fuel in the high density SFP racks are identified in the DCPP Technical Specifications. Fresh and burned fuel assembly storage in the SFP is maintained such that any four cells are in one of three configurations allowable by the DCPP Technical Specifications. The three allowable storage configurations specified by the DCPP Technical Specifications are: (a) the all cell, (b) the 2x2 array, and (c) the checkerboard configuration. Spent fuel assemblies satisfying the discharge burnup requirements of Figure 9.1-2A can be stored in the all cell configuration in the SFP. One fuel assembly, with an initial enrichment less than or equal to 4.9 weight percent U-235 or with an initial enrichment less than or equal to 5.0 weight percent U-235 and an integral fuel burnable absorber (IFBA) loading equivalent to 16 rods each with 1.5 milligrams B-10 per inch over 120 inches, and three fuel assemblies satisfying the discharge burnup requirements of Figure 9.1-2B can be stored in the 2x2 array configuration. Fresh and spent fuel assemblies not satisfying the initial enrichment, discharge burnup, and IFBA loading requirements for the all cell and 2x2 array configurations must be stored in the checkerboard configuration with water cells or non-fissile material. Figure 9.1-2 shows the arrangement of the rack modules for Unit 1. The Unit 2 SFP is a mirror image of the Unit 1 SFP, reflected around column line 12[9] (south end of Unit 1 SFP).

Potential SFP fuel-mishandling accidents and fuel-drop accidents, which result in a reactivity insertion, were evaluated in the SFP criticality analysis. Examples of such accidents include the misplacement of a fresh fuel assembly in place of a burned fuel assembly within a rack module, the misplacement of a fresh fuel assembly outside the rack module, accidental drop of a fresh fuel assembly outside the rack module, and the T-Bone drop of a fresh assembly. The most limiting SFP accident was determined to be the misplacement of a fresh fuel assembly with 4.9 weight percent U-235 outside the rack module such that it is adjacent to a fresh fuel assembly with 4.9 weight percent U-235 within the rack module, resulting in two fresh assemblies adjacent to each other in the SFP. For the most limiting SFP accident, an SFP soluble boron concentration of 806 ppm is required to maintain K_{eff} less than or equal to 0.95 at a 95 percent probability, 95 percent confidence level. The DCPP Technical Specifications establish that the minimum SFP boron concentration is 2000 ppm. This boron concentration is more than sufficient concentration to maintain 5 percent subcriticality margin in the SFP during the most limiting SFP accident. Administrative procedures to ensure the presence of soluble boron in the SFP during fuel handling operations preclude the possibility of the simultaneous occurrence of two independent accident conditions such as a fuel assembly misplacement and loss of soluble boron.

9.1.2.3.7 General Design Criterion 68, 1967 – Fuel and Waste Storage Radiation Shielding

During transfer of spent fuel assemblies, the borated water level in the SFP is maintained to provide at least 9 feet of water above the top of the active portion of the spent fuel assemblies. Normally, the borated water level in the SFP is maintained to provide at least 23 feet of water over the top of the irradiated fuel assemblies seated in the storage racks, as discussed in the Technical Specifications. This ensures sufficient water depth to remove 99 percent of all the iodine activity that could be released from a rupture of an irradiated fuel assembly. Gaseous radioactivity above the SFP is thus maintained below 10 CFR Part 20 limits. This water barrier also serves as a radiation shield, limiting the gamma dose rate at the pool surface.

SFP concrete walls have been evaluated for effectiveness of shielding in the SFP area including adjacent corridors and stairways.

9.1.2.3.8 General Design Criterion 69, 1967 – Protection Against Radioactivity Release from Spent Fuel and Waste Storage

The SFP containment is provided by maintaining at least 23 feet of water over the top of the irradiated fuel assemblies (refer to Section 9.1.2.3.7). The SFP area is enclosed, and is maintained under negative pressure during normal operation. The plant Technical Specifications prescribe operability requirements for FHBVS equipment that are applicable during movement of recently irradiated fuel assemblies, and a surveillance requirement that periodically tests the ability of the FHBVS, while in the post-accident, iodine removal mode of operation, to maintain a negative pressure in the FHB. All ventilation air is passed through HEPA filters prior to being released to the plant vent. In the event of an accident, high activity would be detected by the radiation monitor and the exhaust air would be diverted through charcoal filters (refer to Sections 9.4.4.2 and 11.4.2).

Refer to Section 9.1.2.3.7 for a discussion of iodine release attenuation attributable to SFP water depth over the top of the irradiated fuel assemblies.

9.1.2.3.9 SFP Storage System Safety Function Requirements

(1) Protection from Missiles and Dynamic Effects

There are no credible missiles outside of containment resulting from plant equipment failure that would prevent the PG&E Design Class I SFP from performing its design functions (refer to Section 3.5.1.2). Dynamic effects as a result of plant equipment failure will not prevent the PG&E Design Class I SFP from performing its design functions.

9.1.2.3.10 10 CFR 50.68(b) – Criticality Accident Requirements

In accordance with 10 CFR 50.68(b)(1), plant procedures prohibit handling and storage at any one time of more fuel assemblies than have been determined to be safely subcritical under the most adverse moderation conditions feasible by unborated water, with the exception that NRC granted an exemption request related to the need to take credit for borated water for the loading, unloading, and handling of the components of the HI-STORM 100 dual-purpose dry cask storage system (refer to Section 9.1.4.3.8).

The requirements in 10 CFR 50.68(b)(2) and 10 CFR 50.68(b)(3) regard storage of fresh fuel in the NFSRs and are therefore not applicable to the SFP.

In accordance with 10 CFR 50.68(b)(4), the high-density SFP storage racks are designed to ensure that, with credit for soluble boron (References 8 and 9) and with fuel of the maximum fuel assembly reactivity, a K_{eff} of less than or equal to 0.95 is maintained, at a 95 percent probability, 95 percent confidence level, if the racks are flooded with borated water, and a K_{eff} of less than 1.0 is maintained, at a 95 percent probability, 95 percent confidence level, if the racks are flooded with unborated water.

The associated spent fuel criticality analysis (Reference 24) modeled a full-pool representation of the storage racks and infinite arrays of fuel using the SCALE-PC computer code, which includes the CSAS25 control module and functional modules BONAMI, NITAWL-II and KENO-Va, and employs the 44-Group Evaluated Nuclear Data File Version 5 (ENDF/B-V) neutron cross section library. SCALE-PC has been validated against 30 critical experiments and the calculations adequately reproduced the data. The DIT computer code was used to generate a set of isotopic concentrations based on ENDF/B-VI. DIT has been benchmarked against Combustion Engineering PWR cores and against other PWR lattice codes, such as CASMO, with very good agreement.

Reference 24 considers the 2x2 array and checkerboard spent fuel configurations and associated fuel type and burnup characteristics specified in the DCPP Technical Specifications. The analysis assumed a fresh fuel assembly, which was a conservative representation of the Westinghouse OFA 17x17 fuel assembly with a nominal enrichment of 4.9 weight percent U-235 and no IFBAs. This fresh assembly conservatively envelopes the characteristics of possible fresh fuel types that may be used. The analysis assumed a burned fuel assembly, which was a conservative representation of a Westinghouse Standard 17x17 fuel assembly. This burned assembly conservatively envelopes the characteristics of burned fuel assemblies stored in the SFP. The analysis evaluated the region of the SFP that does not contain Boraflex panels since the storage requirements for this region are more restrictive and yield more conservative reactivity results than the region containing Boraflex panels. Therefore, the analysis does not credit the negative reactivity associated with the Boraflex panels.

Reference 24 considered biases and uncertainties such that the K_{eff} value was determined at a 95 percent probability, 95 percent confidence level. The biases

considered included a KENO-Va computer code methodology bias and a reactivity bias to account for a range of SFP water temperature. The uncertainties considered included those due to fuel assembly manufacturing tolerances, rack fabrication tolerances, KENO-Va computer code methodology, fuel assembly reactivity, and absolute fuel assembly burnup.

Reference 24 assumed a core moderator average temperature of 579.95°F. Higher moderator temperature affects analysis results for discharged spent fuel in a non-conservative direction (i.e., reduces margin). Since moderator temperature in the core can potentially reach 582.3°F, an evaluation was performed to assess the impact of this higher temperature on the analysis (Reference 25). The evaluation concluded that adequate margin exists such that the potentially higher moderator temperature is acceptable and can be accommodated in the existing SFP criticality analysis.

Reference 24 does not consider the "all cell" storage configuration in the SFP (i.e., all cells filled and all fuel assemblies with discharge burnup in the acceptable area of Technical Specification Figure 3.7.17-2). A Holtec analysis (Reference 26) is the analysis of record (AOR) for that configuration. The core moderator average temperature value assumed for the Holtec AOR is 591.5°F. This value bounds the maximum potential core average temperature of 582.3°F. Therefore, the AOR for the "all cell" storage configuration is bounding for the maximum expected core moderator temperature.

For normal conditions (no SFP fuel mishandling or fuel drop accident), the SFP criticality analysis determined that a K_{eff} of less than 1.0 is maintained, at a 95 percent probability, 95 percent confidence level, if the SFP storage racks are flooded with unborated water.

An SFP boron dilution analysis was performed (refer to Enclosure 6 to Reference 8) to evaluate the time and water volumes required to dilute the SFP from the DCPP Technical Specification required minimum boron concentration of 2000 ppm to approximately 800 ppm. The 800 ppm endpoint was utilized to ensure that the K_{eff} of the SFP storage racks would remain less than or equal to 0.95.

A large volume of pure water (approximately 347,000 gallons) is necessary to dilute the SFP from 2000 ppm to 800 ppm. Dilution sources available which exceed 347,000 gallons (primary water makeup system, makeup water system, and fire protection system) were evaluated against the calculated dilution volumes to determine the potential of an SFP-dilution event. The dilution from seismic events or random pipe breaks is bounded by the primary water makeup system flow. Dilution due to the drain system was not evaluated since backflow through the system is not considered credible. Also, the SFP demineralizer was not evaluated since it cannot provide sufficient dilution.

The boron dilution analysis demonstrates that adequate time is available to identify and mitigate the dilution event before the K_{eff} of the SFP storage racks would exceed 0.95. A dilution event large enough to result in a significant reduction in the SFP boron

concentration would involve the transfer of a large quantity of water from a dilution source and a significant increase in SFP level, which would ultimately overflow the pool. Such a large water volume turnover, and overflow of the SFP, would be readily detected and terminated by plant personnel. In addition, because of the large quantities of water required and the low dilution flow rates available, any significant dilution of the SFP boron concentration would only occur over a long period of time (hours to days). Detection of an SFP boron dilution via SFP level alarms, visual inspection during normal operator rounds, significant changes in SFP boron concentration, or significant changes in the unborated water source volume, would be expected before a dilution event sufficient to increase K_{eff} above 0.95 could occur.

The results of the boron dilution analysis concluded that an unplanned or inadvertent event that would result in the dilution of the SFP boron concentration from 2000 ppm to 800 ppm is not a credible event. However, even if the SFP were diluted to zero ppm boron, which would take significantly more water than evaluated in the dilution analysis, the SFP would remain subcritical, and the health and safety of the public would be protected. Sampling of the SFP boron concentration is required by the DCPP Technical Specifications on a 7-day frequency, which provides adequate assurance that smaller and less readily identifiable boron concentration reductions are not taking place.

Controls over special nuclear material are maintained to prevent a criticality accident. In addition to the controls for both new (fresh) and spent (burned) fuel, as required by 10 CFR 50.68(b)(5) the quantity and forms of special nuclear material other than nuclear fuel that is stored onsite in any given area are less than the quantities necessary for a critical mass. Special nuclear materials are required to be stored in inventory control areas except when in transit.

In accordance with 10 CFR 50.68(b)(6), radiation monitors are provided in storage and associated handling areas when fuel is present to detect excessive radiation levels and to initiate appropriate safety actions (refer to Sections 9.1.2.3.4 and 9.1.2.3.5).

Refer to Section 9.1.1.3.6 for information on implementation of 10 CFR 50.68(b)(7) regarding maximum nominal U-235 enrichment of new fuel assemblies that may be stored in the SFP.

As discussed in Section 9.1.1.3.8, implementation of 10 CFR 50.68(b)(8) was completed with the submittal of Revision 15 of the UFSAR.

9.1.2.3.11 Safety Guide 13, March 1971 – Fuel Storage Facility Design Basis

Regulatory Position 1:

The SFP is designed to accommodate both new and spent fuel assemblies in a subcritical array such that a $k_{eff} < 1.0$ is maintained if flooded with unborated water. It is constructed of reinforced concrete as part of the auxiliary building structure. The design is described in Section 3.8.2. The entire structure and the SFP storage racks have been designed in accordance with PG&E Design Class I seismic requirements. Criteria set by Safety Guide 13, March 1971 (Reference 3), have been followed.

The SFP storage racks are designed in accordance with Safety Guide 13, March 1971, and the ASME BPVC Section III-1983 (Subsection NF).

Regulatory Position 2:

Refer to Section 9.1.2.3.1 for a discussion of the DCPP environmental protections, such as protection from cyclonic winds and external missiles, for the PG&E Design Class I SFP. Refer to Section 3.3 for a broad discussion of wind and tornado loadings on PG&E Design Class I structures.

Regulatory Position 5.b:

PG&E has evaluated the drop of a loaded transfer cask from highest point in the lift to the bottom of the cask recess area in the SFP. The postulated drop consists of 4.67 feet in air followed by 42.83 feet in water. Analysis demonstrates the adequacy of the affected structures during the postulated drop, demonstrating that the drop will not cause (1) loss of building structural function; (2) damage to the SFP resulting in loss of SFP water; or (3) unacceptable damage to other systems or equipment. The SFP stainless steel liner may be damaged in this drop; however, the structural integrity of the concrete forming the SFP is maintained, preventing any uncontrolled leakage.

Refer to Section 9.1.4.3.9 for a discussion of fuel handling area crane design provisions that prevent the movement of heavy loads over the area of the pool that can contain spent fuel.

In addition, protection of nuclear fuel assemblies from overhead load handling is a key element of the Control of Heavy Loads Program described in Section 9.1.4.3.10.

Regulatory Position 7:

Refer to Section 9.1.2.3.4 for a discussion of the alarms provided both locally and in the control room if the water level in the SFP falls below a predetermined level (control room alarm) or if high local radiation levels are experienced (local and control room alarm).

9.1.2.4 Tests and Inspections

After erection of the SFP storage racks, tests were conducted with a dummy fuel assembly by passing it into and out of each storage position to ensure that binding would not occur.

9.1.2.5 Instrumentation Applications

Instrumentation applications are described in Section 9.1.2.3.4.

9.1.3 SPENT FUEL POOL COOLING AND CLEANUP SYSTEM

The piping, valves, pumps, and heat exchanger used to cool the SFP are PG&E Design Class I. Additionally, the piping and components used to transfer water to and from the RWST are PG&E Design Class I. Portions of the SFP Cleanup system are PG&E Design Class I including the refueling water purification filter, SFP resin trap filter, SFP demineralizer, and refueling water purification pump. The piping and components used to transport water to the SFP filter (including the filter itself) are PG&E Design Class II. Refer to the DCPP Q-list for a listing of PG&E Design Class II equipment that is included in the SFP cooling and cleanup system.

The SFP skimmer system, including piping, valves, pumps, strainers, and filters, is PG&E Design Class III.

Section 9.1.3.3.9 provides discussion on PG&E Design Class I systems that are available to provide makeup water to the SFP.

Each unit has a completely independent SFP cooling and cleanup system.

The SFP cooling and cleanup system design parameters are given in Table 9.1-1.

9.1.3.1 Design Bases

9.1.3.1.1 General Design Criterion 2, 1967 – Performance Standards

The PG&E Design Class I portions of the SFP cooling and cleanup system are designed to withstand the effects of, or are protected against, natural phenomena, such as earthquakes, flooding, wind, and other local site effects.

Tornado-induced fuel handling building structural damage does not impair the ability of the plant to achieve safe shutdown.

9.1.3.1.2 General Design Criterion 3, 1971 – Fire Protection

The PG&E Design Class I portions of the SFP cooling and cleanup system are designed and located to minimize, consistent with other requirements, the probability and effect of fires and explosions.

9.1.3.1.3 General Design Criterion 11, 1967 – Control Room

The PG&E Design Class I portions of the SFP cooling and cleanup system are designed to support actions to maintain and control the safe operational status of the plant from the control room.

9.1.3.1.4 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Instrumentation and controls are provided to monitor and maintain the PG&E Design Class I portions of the SFP cooling and cleanup system variables within prescribed operating ranges.

9.1.3.1.5 General Design Criterion 18, 1967 – Monitoring Fuel and Waste Storage

The PG&E Design Class I portions of the SFP cooling and cleanup system are equipped with adequate instrumentation to identify conditions that contribute to a loss of continuity in decay heat removal and to radiation exposures.

9.1.3.1.6 General Design Criterion 67, 1967 – Fuel and Waste Storage Decay Heat

The PG&E Design Class I portions of the SFP cooling and cleanup system provide a reliable and adequate decay heat removal system to prevent damage to the fuel in the SFP that could result in radioactivity release to plant operating areas or the public environs.

9.1.3.1.7 SFP Cooling and Cleanup System Functional Requirements

(1) Missile Protection

The PG&E Design Class I SFP cooling and cleanup system components are designed to be protected against internal missiles generated outside containment and dynamic effects that might result from plant equipment failure.

(2) Water Purification

The SFP cooling and cleanup system purifies and demineralizes SFP water to maintain SFP water quality to ensure access to the SFP storage racks for fuel handling and maintain optical clarity of the SFP water.

9.1.3.1.8 10 CFR 50.55a(g) – Inservice Inspection Requirements

The SFP cooling and cleanup system ASME Code components are inspected to the requirements of 10 CFR 50.55a(g)(4) and 50.55a(g)(5) to the extent practical.

9.1.3.1.9 Safety Guide 13, March 1971 – Spent Fuel Storage Facility Design Basis

The SFP cooling and cleanup system is designed and constructed in accordance with Safety Guide 13, March 1971.

9.1.3.1.10 Generic Letter 96-04, June 1996 – Boraflex Degradation in Spent Fuel Pool Storage

Silica levels in the SFP are monitored using DCPP procedures for trending purposes due to the possible interaction between SFP water and RCS water during refueling outages.

9.1.3.2 System Description

The PG&E Design Class I portions of the SFP cooling and cleanup system maintain a water inventory in the SFP sufficient to keep spent fuel immersed at all times and provide a highly reliable pumped-fluid system to transfer decay heat from the SFP to the component cooling water (CCW) system via the SFP heat exchanger.

The SFP cooling and cleanup system, shown in Figure 3.2-13, removes decay heat from fuel stored in the SFP. Spent fuel is placed in the SFP during the refueling sequence and stored there until it is shipped offsite or loaded into a fuel transfer cask and transported to the Diablo Canyon ISFSI. Refer to Reference 12 for information regarding the Diablo Canyon ISFSI. Heat is transferred through the SFP heat exchanger to the CCW system.

When the SFP cooling and cleanup system is in operation, water flows from the SFP to the SFP pump suction, is pumped through the tube side of the heat exchanger, and is returned to the SFP. The suction line, which is protected by a strainer, is located at an elevation 4 feet below the normal SFP water level, while the return line contains an antisiphon hole near the surface of the water to prevent gravity drainage of the SFP.

While the heat removal operation is in process, a portion of the SFP water may be diverted away from the heat exchanger through the refueling water purification (RWP) filter, spent fuel pit demineralizer, spent fuel pit resin trap filter, and the spent fuel pit filter to maintain water clarity and purity. A resin trap and check valve, located upstream of the demineralizer, prevent backflushing demineralizer resins to the SFP. Transfer canal water may also be circulated through the same demineralizer and filter by opening the gate between the canal and the SFP. This purification loop removes fission products and other contaminants, which could be introduced if a fuel assembly with defective cladding is transferred to the SFP.

The RWP system can be aligned to recirculate the contents of the refueling water storage tank (RWST). The RWP system is placed into service by manual operation of isolation valves and manual RWP pump start. This alignment enables tank mixing and cleanup of the RWST contents via the RWP filter, demineralizer, and resin trap filter. Processing the RWST contents through the RWP system enables the removal of radiological impurities to ensure RWST activities (Reference Table 12.1-13) and radiation exposure rates (Reference Table 12.1-14) are within 10 CFR Part 20 limits and are ALARA.

The RWP system filters and demineralizes the RWST water in order to maintain water quality and clarity for fuel transfer and inspection purposes. Refueling water clarity is both a personnel and equipment safety and radiation ALARA consideration. Also, the RWP system may be used to filter the contents of the RWST prior to employing a reverse osmosis system (ROS). The ROS is a temporary system, connected directly to the RWST, which may be used to reduce silica concentrations in the RWST. Design and administrative controls ensure minimum required RWST volume and boron concentrations are maintained throughout ROS operation.

During refueling outages, connections are provided such that the refueling water may be pumped from either the RWST or the refueling cavity, through the filter, demineralizer, and resin trap and discharged to either the refueling cavity or the RWST. In addition to this flowpath, it is possible to manually align the SFP cleanup system with the RWP system to clean the refueling canal water during fuel movement. The RWP pump may also be utilized to pump down the refueling canal by pumping water to the liquid hold-up tanks (LHUTs) through the RWP filter. To further assist in maintaining SFP water clarity, the water surface is cleaned by a skimmer loop. Water is removed from the surface by the skimmers, pumped through a strainer and filter, and returned to the SFP surface at three locations remote from the skimmers.

Refer to Section 9.1.2.3.6 for discussion on the required boron concentration in the SFP. Additional borated water is supplied from the RWST via the RWP system, or from other sources within the CVCS, to maintain the required boron concentration in the SFP.

A gate is installed between the SFP and the transfer canal so that the transfer canal may be drained to allow maintenance of the fuel transfer equipment. The water in the transfer canal is first pumped, using a portable pump, into the SFP and then is transferred to a holdup tank in the CVCS by the SFP pump. When needed for refueling operations, water is returned directly to the transfer canal by the holdup tank recirculation pump.

In the event of high level in the SFP, water can be removed via the SFP pump and pumped to the LHUTs. Water can also be removed by the RWP pump delivering to the RWST. In the event of low water level, makeup water can be transferred to the SFP from either PG&E Design Class I or PG&E Design Class II sources as described in Section 9.1.3.3.9.

9.1.3.2.1 Component Description

SFP cooling and cleanup system codes and classifications are given in the DCPP Q-List (refer to Reference 8 of Section 3.2). System design and operating parameters are given in Table 9.1-2.

9.1.3.2.1.1 Spent Fuel Pool Pump

The SFP pumps are horizontal, centrifugal units, with all wetted surfaces being stainless steel or an equivalent corrosion-resistant material. The pumps are controlled manually from a local station. There are no Class 1E electrical loads in the SFP system; however, the SFP cooling pumps are powered from a Class 1E source. For Modes 5, 6, and no mode operation during electrical bus outages and maintenance periods, the standby/redundant pump may be temporarily aligned to an alternate Class 1E source, using installed transfer switches, until its primary Class 1E power supply is returned to service. If connection to the alternate Class 1E bus via the transfer switch is necessary in Modes 1 through 4, Engineering will be required to evaluate the acceptability of this configuration on a case by case basis prior to use of the transfer switch.

9.1.3.2.1.2 Spent Fuel Pool Skimmer Pump

The SFP skimmer pump is a horizontal centrifugal unit, with all wetted surfaces being stainless steel or an equivalent corrosion-resistant material. The pump is controlled manually from a local station.

9.1.3.2.1.3 Refueling Water Purification Pump

The RWP pump is a horizontal centrifugal unit, with all wetted surfaces being stainless steel or an equivalent corrosion-resistant material. The pump is operated manually from a local station.

9.1.3.2.1.4 Spent Fuel Pool Heat Exchanger

The spent fuel heat exchanger is of the shell and U-tube type with the tubes welded to the tubesheet. CCW circulates through the shell, and SFP water circulates through the tubes. Construction is carbon steel on the shell-side and stainless steel on the tube side.

9.1.3.2.1.5 Spent Fuel Pool Demineralizer

The SFP demineralizer is a flushable, mixed bed demineralizer. The demineralizer is designed to provide adequate SFP water purity and limit the dose rate at the surface of the SFP.

9.1.3.2.1.6 Spent Fuel Pool Resin Trap Filter

The SFP resin trap filter is designed to prevent resin beads from entering the SFP and connected systems. It is designed to remove particles 5 microns or greater.

9.1.3.2.1.7 Spent Fuel Pool Filter

The SFP filter is designed to improve the SFP water clarity by removing particles 5 microns or greater.

9.1.3.2.1.8 Spent Fuel Pool Skimmer Filter

The SFP skimmer filter is used to remove particles that are not removed by the strainer. It is designed to remove particles 5 microns or greater.

9.1.3.2.1.9 Refueling Water Purification Filter

The RWP filter is designed to improve the clarity of the refueling water in the refueling canal or in the RWST by removing particles 5 microns or greater. The RWP filter also filters the SFP contents and functions as a prefilter to the SFP demineralizer.

9.1.3.2.1.10 Spent Fuel Pool Strainer

A strainer is located within the SFP on the pump suction enclosure for removal of relatively large particles, which might otherwise clog the SFP demineralizer or damage the SFP pump. It is a slotted screen design with stainless steel construction.

9.1.3.2.1.11 Spent Fuel Pool Skimmer Strainer

The SFP skimmer strainer is designed to remove debris from the skimmer process flow. It is an in-line basket strainer of stainless steel construction.

9.1.3.2.1.12 Spent Fuel Pool Skimmers

Two SFP skimmers are provided to remove water from the surface of the SFP. The skimmer heads are manually positioned to take water from near the SFP surface. The skimmer, pipe, and supports are of stainless steel construction.

9.1.3.2.2 Valves

Manual stop valves are used to isolate equipment, and manual throttle valves provide flow control. Valves in contact with SFP water are austenitic stainless steel or equivalent corrosion-resistant material.

9.1.3.2.3 Piping

All piping in contact with SFP water is austenitic stainless steel. The piping is welded except where flanged connections are used to facilitate maintenance.

9.1.3.3 Safety Evaluation

9.1.3.3.1 General Design Criterion 2, 1967 – Performance Standards

The fuel handling building and auxiliary building, which contain the spent fuel cooling and cleanup systems are PG&E Design Class I structures (refer to Section 3.8). The auxiliary building is designed to withstand the effects of winds and tornadoes (refer to Section 3.3) and external missiles (refer to Section 3.5). The basic structure of the fuel handling building is tornado resistant, with damage to non-structural building components. Damage to these components does not adversely impact the plant's ability to achieve safe shutdown (refer to Section 3.3). The auxiliary and fuel handling buildings are designed to withstand the effect of floods (refer to Section 3.4), earthquakes (refer to Section 3.7), and to protect the spent fuel cooling and cleanup system, ensuring its design function will be performed.

Protection of fuel assemblies from tornadoes and external missiles is discussed in Section 9.1.2.3.1.

A piping design analysis, including DE, DDE, and HE seismic loads, was performed to ensure that the cooling loop conforms to PG&E Design Class I piping criteria as indicated in the DCPP Q-List (refer to Reference 8 of Section 3.2). The failure or malfunction of any of the spent fuel cooling and cleanup system components, including failures resulting from the DE, DDE, or a HE will not cause the fuel to be uncovered.

9.1.3.3.2 General Design Criterion 3, 1971 – Fire Protection

The SFP area is designed to the fire protection guidelines of Branch Technical Position (BTP) Auxiliary Power and Chemical System Branch (APCSB) 9.5-1. Refer to the SFP area entry in Appendix 9.5B, Table B-1, for fire protection compliance with the guidelines of BTP APCSB 9.5-1.

9.1.3.3.3 General Design Criterion 11, 1967 – Control Room

Annunciation in the control room is provided when normal SFP temperatures are exceeded. Additionally, instrumentation is provided to give an alarm in the control room when the water level in the SFP reaches either the high or low level setpoint. These instruments support actions to observe the safe operational status of the SFP cooling and cleanup system from the control room.

9.1.3.3.4 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Instrumentation is provided for the SFP cooling and cleanup system as follows:

- Local instrumentation is provided to give indication of the temperature of the SFP water as it leaves the SFP heat exchanger. Refer to Section 9.1.3.3.5 for temperature instrumentation provided for the water in the SFP.

- Local instrumentation is provided to measure and give indication of pressures across the SFP and RWP pumps. Instrumentation is also provided to measure pressure differential on the SFP demineralizer, SFP resin trap filter and RWP filter.

- Local instrumentation is provided to measure and give indication of flows in the outlet line of the SFP filter and the inlet line to the SFP demineralizer.

9.1.3.3.5 General Design Criterion 18, 1967 – Monitoring Fuel and Waste Storage

Local instrumentation is provided to measure the temperature of the water in the SFP and give local indication as well as annunciation in the control room when normal temperatures are exceeded.

As indicated in Section 9.1.3.3.3, instrumentation is provided to give an alarm in the control room when the water level in the SFP reaches either the high or low level setpoint.

The exposure rate at the SFP surface is routinely monitored with radiation surveys and monitoring equipment (refer to Section 12.3). The major contributor to the surface dose is the radioactivity within the SFP water and not the spent fuel assemblies stored in the SFP. The SFP demineralizer will be used as necessary to maintain radiation exposures ALARA.

9.1.3.3.6 General Design Criterion 67, 1967 – Fuel and Waste Storage Decay Heat

The SFP cooling system is designed to remove that amount of decay heat that is produced by spent fuel assemblies that are stored in the SFP following a refueling. A cask pit rack was installed in the SFP of each unit during Cycle 14, prior to the 14th refueling outage. During Cycle 15, the cask pit rack was removed from Unit 1. The cask pit rack in Unit 2 was removed during Cycle 16.

PG&E has updated its SFP thermal-hydraulic analyses as part of the cask pit rack project (Reference 15). These updated analyses were performed using more recent analytical methods that have been previously accepted by the NRC. These analytical methods and the associated full core and emergency offload scenarios discussed below will bound both the installation of the cask pit rack and future DCPP SFP fuel storage

requirements once the cask pit rack has been removed. These new analyses will serve as the new licensing basis of record for future spent fuel storage requirements, including the temporary supplemental spent fuel storage capacity provided by the cask pit rack.

The cask pit thermal-hydraulic analyses are based on the evaluation of three offload scenarios that bound the past and future operating practices at DCPP. For each scenario, the transient and steady state decay heat loads were combined to provide a total decay heat load on the SFP cooling system (Reference 15).

The partial core offload scenario assumes a discharge of 96 fuel assemblies during the 15th refueling outage. All of the 96 fuel assemblies offloaded are conservatively assumed to have a burnup of 52,000 MWD/MTU.

The full core offload scenario assumes a discharge of 193 fuel assemblies during the 15th refueling outage. The 193 offloaded assemblies are separated into two distinct groups; 101 assemblies with 52,000 MWD/MTU burnup and 92 assemblies with 25,000 MWD/MTU burnup.

The emergency full core offload scenario assumes that the 15th refueling outage is completed in 30 days, leaving 104 assemblies in the SFP at restart. After 36 days of operation at 100 percent power in Cycle 16, an emergency full core offload is performed, completely filling all available storage locations. The 193 assemblies are separated into two distinct groups: 113 assemblies with 40,000 MWD/MTU burnup and 80 assemblies with 3,000 MWD/MTU burnup.

All of these scenarios have been evaluated with a base decay heat load contribution from previously discharged fuel assemblies using actual operational data for operating Cycles 1 through 11. The contribution to the base decay heat load from fuel that will be discharged in Cycles 12 through 14 is based on an assumed discharge of 104 assemblies each Cycle using bounding assumptions on fuel assembly burnup and operating power. Cycle lengths assumed for Cycles 12 through 14 are assumed to be 18 months, which conservatively minimizes the decay time and maximizes the base decay heat load. All three of these scenarios assume a core offload rate of four assemblies per hour, starting 100 hours after reactor shutdown, and other appropriately conservative fuel assembly discharge and burnup assumptions.

Conservative values for pump flow and heat exchanger performance were selected to provide bounding calculations for the peak SFP bulk temperature. The thermal performance of the heat exchangers was determined with all heat transfer surfaces assumed to be fouled to their design basis maximum levels and also included an allowance for five percent tube plugging. CCW supplied to the heat exchanger was assumed to be 75°F at a flow rate of 3400 gpm which is bounded by SFP cooling system design parameters. Plant procedures are currently in place to limit the peak SFP temperature to within 140°F. The procedural controls currently suspend offload activities at a SFP temperature of 125°F to maintain peak SFP bulk temperatures less

than 140°F. Past operating experience at DCPP has shown that peak SFP temperatures are less than 115°F during a typical full core offload.

Due to the many variables that can have an impact on peak SFP temperature, DCPP may elect to use a cycle specific offload analysis, following the requirements of Section 3.1 of Attachment 2 to Matrix 5 of Section 2.1 of RS-001, December 2003, in lieu of the operating restrictions of the bounding thermal analyses described above. Consideration will be given to the actual core power history, scheduled offload start time, offload rates, actual CCW temperature, and actual CCW and SFP cooling water flow rates to the SFP heat exchanger in the establishment of the specific control values. If DCPP elects to use a cycle specific analysis, plant procedures will require that core offload be suspended at a temperature, which would ensure that the 140°F limit is not exceeded.

Results of the thermal-hydraulic analyses are described below.

The partial core offload analysis resulted in a maximum SFP bulk temperature of 127°F. The full core offload analysis resulted in a maximum SFP bulk temperature of 157°F. The emergency core offload analysis resulted in a peak bulk temperature of less than 162°F.

The time-to-boil evaluation assumed that forced cooling was lost the moment the peak SFP bulk temperature for each case was reached. The SFP time to boil and corresponding maximum boil-off rates were then determined.

For the worst-case scenario, the emergency core offload, the calculated time-to-boil was determined to be 3.76 hours after a loss of forced cooling at the peak SFP bulk temperature. The corresponding maximum boil-off rate for this condition was approximately 87 gpm.

Given the conservatisms incorporated into the calculations, actual times-to-boil will be higher than these calculated values and actual boil-off rates will be lower than calculated. Based on the time-to-boil, plant personnel will have sufficient time to identify elevated SFP temperatures and adequate time to provide makeup to the SFP, if needed.

Local temperature analyses were also performed to determine maximum local water and fuel cladding temperatures. The worst case peak local water temperature is 188 °F and below the local saturation temperature (240 °F) at the depth of the cask pit. The results also demonstrate that the peak fuel cladding temperature of 213 °F for the hottest fuel assembly is below the local saturation temperature, and the critical heat flux for DNB is not exceeded. Therefore no bulk boiling will occur in the SFP, and the local water and fuel temperatures are acceptable.

The SFP cooling and cleanup system has no emergency function during an accident. This manually controlled system may be shut down for limited periods of time for maintenance or replacement of components. Redundancy of the SFP cooling and

cleanup system components is not required because of the large heat capacity of the SFP and the slow heatup rate. In the unlikely event that the SFP pump should fail, the backup pump can provide circulation of the SFP water through the SFP heat exchanger. If a failure should occur that would prevent the use of the SFP heat exchanger for cooling the SFP water (e.g., severance of the piping which constitutes the cooling recirculation path), natural surface cooling would maintain the water temperature at or below the boiling point. A PG&E Design Class I backup makeup water source is provided to ensure that the water level in the SFP can be maintained.

9.1.3.3.7 SFP Cooling and Cleanup System Functional Requirements

(1) Missile Protection

There are no credible missiles outside of containment resulting from plant equipment failure that would prevent the PG&E Design Class I portions of the SFP cooling and cleanup system from performing their design functions (refer to Section 3.5.1.2). Dynamic effects as a result of plant equipment failure will not prevent the PG&E Design Class I portions of the SFP cooling and cleanup system from performing their design functions.

(2) Water Purification

The system's demineralizer and filters are designed to provide adequate purification of the SFP contents to permit access to the SFP storage area and maintain optical clarity of the SFP water. The optical clarity of the SFP water surface is maintained by use of the system's skimmers, strainer, and skimmer filter. Refer to Section 9.1.3.2 for a description of water purification equipment used to maintain optical clarity of the SFP water. The purification loop is capable of removing fission products and other contaminants from the SFP water, including small quantities of fission products from leaking spent fuel assemblies.

The SFP demineralizer and filter flowpath bypasses the SFP heat exchanger. The demineralizer and filter may be brought into or out of service by manual operation of isolation valves. No other operator action is required. The bypass flowpath can be through the filter only, or through the filter and demineralizer in series, as shown in Figure 3.2-13. The piping configuration allows an alternate flowpath that utilizes the RWP filter upstream of the SFP demineralizer to allow optimization of filter and demineralizer operation. The demineralizer may also be used in conjunction with the RWP pump, filter, and resin trap to clean and purify the refueling water while SFP heat removal operations proceed.

A significant reduction of radioactive effluents is achieved through filtration and ion exchange, and by recycling refueling water as opposed to disposing of and making new refueling water. In addition, by concentrating impurities and radioactive particles on filter medium and demineralizer resin, which are more easily shielded, radiation levels are maintained ALARA.

Only a very small amount of water is interchanged between the refueling canal and the SFP while fuel assemblies are transferred in the refueling process. Whenever a leaking fuel assembly is transferred from the fuel transfer canal to the SFP, a small quantity of fission products may enter the spent fuel cooling water. The purification loop removes fission products and other contaminants from the water, thereby maintaining radioactivity concentration in the SFP water ALARA.

The SFP water meets the following water quality requirements:

Boric acid, ppm as boron, minimum	2000
pH at 77°F	4.1 to 8.0
Chloride, ppm maximum	0.15
Fluoride, ppm maximum	0.15

Boron concentrations in the SFP water are maintained as discussed in the Technical Specifications, and the pH of SFP water is controlled to prevent separation of top nozzles from a fuel assembly as a result of intergranular stress corrosion cracking.

The inservice inspection requirements for the SFP cooling and cleanup system are contained in the ISI Program Plan.

9.1.3.3.8 10 CFR 50.55a(g) – Inservice Inspection Requirements

The inservice inspection requirements for the SFP cooling and cleanup system are contained in the ISI Program Plan.

9.1.3.3.9 Safety Guide 13, March 1971 – Spent Fuel Storage Facility Design Basis

Regulatory Position 1:

The spent fuel storage facilities, including structures and equipment are PG&E Design Class I. Refer to Section 3.2 for a discussion of this issue.

As discussed in Section 9.1.3.3.1, the Fuel Handling Building and Auxiliary Building, which contain the spent fuel cooling and cleanup systems are PG&E Design Class I (refer to Section 3.8). A piping design analysis, including seismic loads, was performed to ensure that the SFP cooling loop conforms to PG&E Design Class I piping criteria and the SFP cooling pumps are powered from a Class 1E source.

Regulatory Position 2:

Analysis of potential water loss from the spent fuel pool shows that the water cover remaining over the fuel provides adequate protection against both fuel damage and pool liner penetration from tornado missiles (refer to Section 3.3.2.3.2.3).

Section 9.1.3.3.1 provides a discussion of the DCPP environmental protections for the SFP cooling and cleanup system.

Regulatory Position 6:

The most serious failure of this system would be complete loss of water in the SFP. To protect against this possibility, the SFP cooling suction connection enters near the normal water level so that the SFP cannot be gravity-drained. The cooling water return line contains an antisiphon hole to prevent the possibility of gravity draining the SFP.

System piping is arranged so that failure of any pipeline cannot inadvertently drain the SFP below the water level required for radiation shielding. This level is maintained by:

(1) SFP suction piping located 20 feet above the top of the fuel assemblies, and

(2) a siphon breaker on the cooling pipe's return line into the SFP.

This design ensures greater than ten feet of water exists over the top of the fuel assemblies should inadvertent drainage occur.

Normal SFP water levels are maintained a minimum of 23 feet over the top of irradiated fuel assemblies seated in the storage racks as discussed in Section 9.1.2.2.

Regulatory Position 7:

Section 9.1.3.3.3 provides a discussion of DCPP capabilities for monitoring water level in the SFP.

Radiation monitoring of the SFP area is discussed in 9.1.1.1.5 and 9.1.2.3.5.

Regulatory Position 8:

Demineralized makeup water can be added directly to the SFP by a PG&E Design Class I source. Water from the condensate storage tank is pumped to the SFP using the makeup water transfer pumps (refer to Section 9.2.6 and Table 9.2-9) and appropriate interconnecting piping and valves. This source has the capability of providing up to 200 gpm of demineralized water, if required. The above tank, pumps, piping, and valves are designed in accordance with Safety Guide 13, March 1971. The transfer tank is another PG&E Design Class I source of SFP makeup, and water can be

pumped to the SFP by the makeup water transfer pumps. However, the flowpath from the transfer tank is not completely PG&E Design Class I. In addition to the above source of makeup water, the PG&E Design Class I fire water tank could provide makeup from local hose reels.

9.1.3.3.10 Generic Letter 96-04, June 1996 – Boraflex Degradation in Spent Fuel Pool Storage

Samples are taken from the SFP monthly and are tested for silica in accordance with the response to Generic Letter 96-04 and as modified in Reference 27. This testing was originally established to trend Boraflex degradation in the SFP. The current method of crediting soluble boron to control reactivity in the SFP precludes the need to monitor Boraflex degradation. However, due to the fact that it is desirable to minimize silica content in water that could interact with RCS water, the silica levels in the RWST and SFP water continue to be monitored. As discussed in Section 9.1.3.2, a reverse osmosis system (ROS) may be used to reduce the silica concentration in the RWST to levels that are compatible for the RCS.

9.1.3.4 Inspection and Testing Requirements

Active components of the SFP cooling and cleanup system are either in continuous or intermittent use during normal system operation. Periodic visual inspection and preventive maintenance are conducted using normal industry practice. Refer to Section 9.1.3.3.8 for SFP cooling and cleanup system inservice inspection requirements.

9.1.3.5 Instrumentation Applications

The instrumentation provided for the SFP cooling and cleanup system is discussed in Section 9.1.3.3.4 and Section 9.1.3.3.5. Alarms and indications are provided as noted.

Local instrumentation is provided to measure and give indication of pressures across the skimmer pumps. Instrumentation is also provided to measure pressure differential on the SFP filter and SFP skimmer filter and strainer.

9.1.4 FUEL HANDLING SYSTEM

The fuel handling system (FHS) consists of equipment and structures utilized for handling new and spent fuel assemblies in a safe manner during refueling and fuel transfer and cask loading operations.

The FHS makes use of components and structures that fall within PG&E Design Class I, PG&E Design Class II, and PG&E Design Class III classifications. The FHS components are PG&E Design Class I with the following exceptions:

(1) The fuel transfer system used to move fuel assemblies between containment and the fuel handling building uses PG&E Design Class III

components, with the exception of the fuel transfer tube and quick opening hatch, which are PG&E Design Class I.

(2) The tools used for fuel handling activities are PG&E Design Class II and PG&E Design Class III.

(3) The fuel handling area movable partition walls are PG&E Design Class II.

(4) The seal ring and assembly between the reactor vessel and the refueling cavity are PG&E Design Class II.

(5) The components used to store damaged fuel rods, debris captured from the fuel nozzles, and spent fuel storage rack poison specimens are PG&E Design Class II.

(6) The containment structure polar crane and portions of the fuel handling area crane are PG&E Design Class I. Note that the cables and hooks for the containment structure polar crane are PG&E Design Class II.

(7) All other cranes and hoists used in the FHS are PG&E Design Class II and PG&E Design Class III.

9.1.4.1 Design Bases

9.1.4.1.1 General Design Criterion 2, 1967 – Performance Standards

The PG&E Design Class I portion of the FHS is designed to withstand the effects of, or is protected against, natural phenomena, such as earthquakes, winds and tornadoes, floods and tsunamis, and other local site effects.

9.1.4.1.2 General Design Criterion 4, 1967 – Sharing of Systems

The FHS and components are not shared by the DCPP units unless safety is shown to not be impaired by the sharing.

9.1.4.1.3 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Instrumentation and controls are provided to monitor and maintain FHS variables within prescribed operating ranges.

9.1.4.1.4 General Design Criterion 49, 1967 – Containment Design Basis

The FHS is designed so that the containment structure can accommodate, without exceeding the design leakage rate, the pressures and temperatures resulting from the largest credible energy release following a loss-of-coolant accident (LOCA), including a

considerable margin for effects from metal-water or other chemical reactions that could occur as a consequence of failure of emergency core cooling systems.

9.1.4.1.5 General Design Criterion 66, 1967 – Prevention of Fuel Storage Criticality

Equipment used to store spent fuel assemblies is designed to maintain the spent fuel assemblies in a subcritical state, even under postulated seismic conditions.

9.1.4.1.6 General Design Criterion 68, 1967 – Fuel and Waste Storage Radiation Shielding

Shielding for radiation protection is provided in the design of the spent fuel facilities as required to meet the requirements of 10 CFR Part 20.

9.1.4.1.7 10 CFR 50.55a(g) – Inservice Inspection Requirements

ASME code components within the PG&E Design Class I portion of the FHS are inspected to the requirements of 10 CFR 50.55a(g)(4) and 10 CFR 50.55a(g)(5) to the extent practical.

9.1.4.1.8 10 CFR 50.68(b) – Criticality Accident Requirements

FHS components that store and transport fuel assemblies are designed in accordance with 10 CFR 50.68, with a noted exemption.

9.1.4.1.9 Safety Guide 13, March 1971 – Fuel Storage Facility Design Basis

Regulatory Position 1:

The FHS is designed to Category I seismic requirements.

Regulatory Position 2:

The PG&E Design Class I portion of the FHS is designed to prevent tornadoes and tornado-borne missiles from causing significant loss of watertight integrity of the SFP and to prevent tornado-borne missiles from contacting fuel within the SFP.

Regulatory Position 3:

Interlocks are provided to prevent cranes from passing over the SFP when fuel handling is not in progress.

Regulatory Position 5(b):

The SFP is designed to withstand, without leakage which could uncover the fuel, the impact of the heaviest load to be carried by the crane from the maximum height to which it can be lifted.

9.1.4.1.10 NUREG-0612, July 1980 – Control of Heavy Loads at Nuclear Power Plants

The FHS is designed and constructed to meet the requirements of NUREG-0612, July 1980, minimizing the probability of dropping a heavy load on spent fuel or equipment necessary for safe shutdown of the plant.

9.1.4.2 System Description

The FHS equipment needed for the refueling of the reactor core consists of cranes, lifting and handling devices including tools, and a fuel transfer system.

The reactor is refueled with fuel handling equipment designed to handle the spent fuel under water from the time it leaves the reactor vessel until it is placed in the SFP racks. Underwater transfer of spent fuel provides an effective, economic, and transparent radiation shield as well as a reliable cooling medium for removal of decay heat. Boric acid is added to the water to ensure subcritical conditions.

The associated fuel handling structures may be generally divided into three areas: (a) the refueling cavity and refueling canal which are flooded only during plant shutdown for refueling, (b) the SFP which is kept full of water and is always accessible to operating personnel, and (c) the new fuel storage area which is separate and protected for dry storage. The refueling canal and the SFP are connected by the fuel transfer tube. This tube is fitted with a quick opening hatch on the canal end and a gate valve on the SFP end. The quick opening hatch is in place, except during refueling, to ensure containment integrity.

The new fuel containers are unloaded from the shipping vehicle and placed on the 115 foot elevation using the fuel handling area crane. New fuel assemblies are removed one at a time from the shipping containers using the new fuel handling tool and the spent fuel bridge hoist such that only one fuel assembly is moved or suspended at a time in a specific area. Plant administrative controls do not permit more than one fuel assembly to be out of storage or in transit between its associated shipping cask and dry storage rack at one time. The assemblies are stored either in the new fuel storage racks in the fuel storage area or in the SFP. Each assembly is inspected for possible shipping damage prior to insertion into the reactor core.

New fuel is delivered to the reactor by first transferring the fuel with the spent fuel bridge hoist to the new fuel elevator. The fuel is lowered into the SFP where the spent fuel

handling tool is interchanged with the new fuel tool. The assembly is then stored in the SFP or transferred to the upender for movement to the reactor.

The upender at either end of the fuel transfer tube is used to pivot a fuel assembly to the horizontal position for passage through the transfer tube. Fuel is carried through the tube on a transfer car. After the transfer car transports the fuel assembly through the transfer tube, the upender at that end of the tube pivots the assembly to a vertical position so that it can be lifted out of the fuel container. Fuel is moved between locations in the reactor vessel and the transfer mechanism by the manipulator crane.

In the SFP, fuel assemblies are moved about by the SFP bridge hoist. A long-handled tool is used with the bridge hoist to prevent the lifting of fuel assemblies any closer than 8 feet from the SFP surface; this ensures that sufficient radiation shielding is maintained. A shorter tool is used to handle new fuel, but the new fuel elevator must be used to lower the assembly to a depth at which the hoist and the long-handled tool can be used to place the new assembly into the upender or into a SFP cell.

When fuel repair or post-irradiation examinations are necessary, the fuel assemblies may be reconstituted in the new fuel elevator. The new fuel elevator is modified temporarily by the insertion of hard stops and resetting the upper electrical limit switch to prevent raising the irradiated fuel assemblies to within eight feet of the SFP surface. The SFP bridge hoist is utilized to transfer fuel rods within the SFP. The tooling on the hoist is configured to maintain nine feet of water shielding over the active fuel.
Decay heat, generated by the spent fuel assemblies in the SFP, is removed by the SFP cooling and cleanup system. Refer to Section 9.1.3.3.6 for discussion on decay heat removal.

The decontamination area has a stainless-steel-lined base, and a curb is provided around it to prevent the water and solvents used during decontamination from spreading over the building floor. Drains in the floor of the area remove the decontaminants to the waste disposal system for processing.

9.1.4.2.1 Component Description

The following sections describe major components of the FHS as they relate to refueling and fuel transfer operations.

In the event of a power failure, no hazardous condition would exist during refueling or spent fuel handling. Electric motors associated with the manipulator crane, SFP bridge, fuel handling area crane, fuel transfer system, and new fuel elevator have solenoid-actuated brakes capable of holding the rated loads during a power failure. When current is interrupted to the motor, the solenoid brake is spring set. During a power failure, a fuel assembly being handled would remain in the position held at the time of failure.

9.1.4.2.1.1 Manipulator Crane

The manipulator crane shown in Figure 9.1-8 is a rectilinear bridge and trolley crane with a vertical mast extending down into the refueling water. The bridge spans the refueling cavity and runs on rails set into the edge of the refueling cavity. The bridge and trolley motions are used to position the vertical mast over a fuel assembly. A long tube with a pneumatic gripper on the end is lowered down out of the mast to grip the fuel assembly. The gripper tube is long enough so that the upper end is still contained in the mast when the gripper end contacts the fuel. A winch mounted on the trolley raises the gripper tube and fuel assembly up into the mast tube. While inside the mast tube, the fuel is transported to its new position.

All controls for the manipulator crane are mounted on a console on the trolley. The bridge is positioned on a coordinate system laid out on one rail. A video indexing system with a camera mounted to the bridge, over an indicating scale, and a monitor on the console indicates the position of the bridge. The trolley is positioned with the aid of a scale on the bridge structure. The scale is read directly by the operator at the console. The drives for the bridge, trolley, and winch are variable speed and include a separate inching control on the winch. Electrical interlocks and limit switches on the bridge and trolley drives prevent damage to the fuel assemblies. The winch is provided with a limit switch and a backup programmable limit switch to prevent a fuel assembly from being raised above a safe shielding depth. In an emergency, the bridge, trolley, and winch can be operated manually by means of handwheels on the motor shafts.

The main and auxiliary hoists are equipped with two independent braking systems. A solenoid release-spring set electric brake is mounted on the motor shaft. This brake operates in the normal manner to release upon application of current to the motor and set when current is interrupted. The second brake is a mechanically actuated load brake internal to the hoist gear box that sets if the load starts to overhaul the hoist. It is necessary to apply torque from the motor to raise or lower the load.

In raising, the motor cams release the brake open; in lowering, the motor slips the brake allowing the load to lower. This brake actuates upon loss of torque from the motor for any reason and is not dependent on any electrical circuits. On the main hoist the motor brake is rated at 350 percent of operating load and the mechanical brake at 300 percent.

The manipulator crane structure is designed for Class C, Moderate Service, as defined by the Overhead Electric Crane Institute Specification No. 61. The electrical interlocks that ensure safe operation are designed to meet the single failure criteria of IEEE-279-1971 (Reference 4). The electrical wiring meets the applicable requirements of the National Fire Code, Electrical, Volume 5, Article 610. The design of the crane meets the applicable requirements of Section 1910.179 of subpart N of the OSHA Code. The bridge, trolley, and hoist drive motors are NEMA Class D induction motors with Class H insulation. The hoist rope is stainless steel, and the load rating is sufficient to support

five times the design load. The crane design class is provided in the DCPP Q-List (refer to Reference 8 of Section 3.2).

The manipulator crane design load is the dead weight plus 4500 lb (three times the fuel assembly weight). The crane was erected in the shop and given a complete functional test including a load test at 110 percent of the design load. The maximum operating load of fuel assembly plus gripper is approximately 2500 lb. The gripper itself has four fingers gripping the fuel, any two of which will support the fuel assembly weight. Test loads during the life of the facility are in accordance with requirements established by the State of California Division of Occupational Safety and Health as part of its responsibilities for implementing OSHA in the state.

9.1.4.2.1.2 Spent Fuel Pool Bridge

The spent fuel pool (SFP) bridge, shown in Figure 9.1-9, is a wheel-mounted walkway spanning the SFP and carrying two monorail hoists on an overhead structure. One hoist has a maximum lift capability of 21 feet. The second hoist has a lift capability of 61 feet. This hoist is used for maintenance of the fuel transfer system and for removing new fuel assemblies from their shipping containers. Fuel assemblies are moved within the SFP by means of a long-handled tool suspended from either hoist. The bridge, trolley, and hoists are all electrically driven. The maximum lift of either hoist, combined with the long-handled tool length, is designed to maintain a safe shielding depth above a spent fuel assembly within the pool.

For fuel repairs and post-irradiation examinations, the fuel rod handling tool configuration on the hoist is required to be physically verified to maintain nine feet of water shielding in the SFP prior to handling irradiated fuel rods. The fuel rod handling tool configuration on the hoist is controlled by an approved administrative control.

The design class of the bridge is given in the DCPP Q-List (refer to Reference 8 of Section 3.2).

9.1.4.2.1.3 Fuel Handling Area Crane

The fuel handling area crane is an overhead bridge crane located in the fuel handling area at elevation 170 feet. This crane, shown in Figure 3.8-59, has a 125 ton capacity main hook for handling spent fuel casks and a 15 ton capacity auxiliary hook for handling new fuel shipping containers. The crane structures and components responsible for lifting of the maximum critical load and distribution of the load to the fuel handling building superstructure have been upgraded to meet single-failure-proof criteria through the replacement of the original trolley and reanalysis of existing structures retained in the new design.

The crane was originally designed and fabricated to the Specification for Electrical Overhead Traveling Cranes for Steel Mill Service, Association of Iron and Steel Engineers Standard No. 6 (tentative) dated May 1, 1969. All members not covered by

that standard are designed and fabricated in accordance with the Specification for the Design, Fabrication and Erection of Structural Steel for Buildings by the American Institute of Steel Construction (AISC), dated February 12, 1969.

The electrical installation and all electrical equipment is in accordance with the National Electrical Code dated 1968, and the National Electrical Manufacturers Association.

Design, fabrication, and erection of the crane rail and crane support structure is in accordance with the AISC specifications. The fuel handling area crane complies with the requirements of OSHA Subpart N, Materials Handling and Storage, of 29 CFR Part 1910, Section 1910.179.

The integrity of the crane load transfer path is ensured by the following measures:

(1) The main hoist sister hook is designed such that the loads imposed by the maximum critical load at both the pin location and the hooks result in factors of safety of 3.45 against yield strength of the hook material. The application of the maximum critical load (MCL) is considered to be fully carried by each of the attachment points. Stresses in the shank and nut are designed to remain below levels resulting in a factor of safety of 10 against the ultimate strength of the hook and nut material.

(2) The main hook and nut is shop tested at 2 times the maximum critical load.

(3) Following the shop test, the main hook receives a volumetric and liquid penetrant inspection.

(4) The main hoist hooks and auxiliary hoist hook are field tested for 10 minutes at 1-1/4 times their rated loads.

(5) The main hoist ropes are designed with greater than 10:1 safety factor against breaking strength. They are part of a four part double reeving system that is designed to withstand the loss of any one of the four ropes without the loss of function and without significant vertical motion of the MCL.

(6) All components in the load transference path that must retain their structural integrity are considered to be Critical Items as defined by ASME NOG-1-2004. These Critical Items have material traceability and are subject to appropriate non-destructive examination to provide assurance against material failure.

(7) The crane is equipped with redundant main hoist drive trains, brakes and reeving. The failure of any one component in the reeving or drive train will not result in a load drop or excessive vertical motion of the load.

(8) The electrical power supply to the crane contains a means for automatic disconnection should a seismic event occur. The loss of power results in the brakes setting to retain any load that may be currently lifted and assures that un-commanded motion due to relay chatter or other interaction will not occur. An emergency lowering procedure is available should this be necessary.

(9) The crane is equipped with redundant protections against overload. A trip signal is provided from the weight monitoring system, which provide direct indication, as well as the main hoist variable frequency drive control system, which provides load sensing by monitoring the motor torque.

(10) The crane is equipped with redundant protections against two-blocking. The first line of protection is provided by a limit switch that provides a trip signal if the bottom block approaches a two-block condition. The second level of protection is provided by the weight monitoring system, which will provide a trip signal if sensed load exceeds a preset value. A third level of protection is provided by the upper block hydraulic support system, which is designed to mitigate the loadings created during an actual two-block event. The upper block pivot arm limit switch functions to assure hoist motion is stopped prior to the end of hydraulic cylinder travel. The two-block protection system is fully shop tested at each protection level to verify the effectiveness of the system.

(11) The crane has been subjected to a Cold Proof Test as allowed in NUREG-0554, May 1979, since verification of the Nil Ductility Transition characteristics of the existing bridge components is not available. The Cold Proof Test provides assurance that the crane will not fail due to brittle fracture. The operation of the crane is administratively controlled such that crane operations are not allowed when the structure temperature is below the temperature at which the Cold Proof Test has been performed.

Conservative fleet angles, drum diameter and sheave diameter are utilized in the design in accordance with ASME NOG-1-2004 and NUREG-0554, May 1979. These conservative design parameters assure wear and fatigue of the ropes is minimized.

The hoisting ropes are 1-1/2 inch Python Power 9 V EEIPS with a 172.8 ton breaking strength. The hoisting rope for the main hook is stainless steel. The hoisting rope for the auxiliary hook (which is configured in four part double reeving) is 3/8 inch Python stainless steel with a breaking strength of 11.2 tons.

Each hoist drive has two brakes, one with time delay application. These brakes are automatically, mechanically applied in the absence of motion command or crane power. A regenerative type brake is also supplied to provide controlled lowering of a load should the main hoist motor fail to operate. Should the regenerative brake fail,

emergency lowering procedures utilizing controlled manual release of the redundant mechanical brakes are available. All hoist brakes are rated at 150 percent of maximum torque that can be developed by its respective system. Trolley and bridge brakes are rated at 100 percent of motor full load torque. The bridge and trolley braking systems are manually adjusted to allow motion in the N-S and E-W directions during a seismic event. The brake adjustment is administratively controlled and is required to ensure the qualification of the fuel handling building superstructure. A vertical stop is provided along the entire length of the runway to prevent bridge uplift and derailing. Vertical restraints are also provided on the trolley to prevent uplift and derailing.

The fuel handling area crane is equipped with a skeleton cab containing a control console chair. The crane may also be controlled by a radio remote control, which may be harness mounted and worn by the operator. Transfer of operation of the crane to the remote control is provided by a control chair mounted transfer switch.

The fuel handling area crane is also used to relocate the movable partition walls, which function to segregate the Unit 1 and Unit 2 SFP areas from the hot shop as described in Section 9.1.4.2.1.4. The crane control chair and radio remote control are equipped with switches to latch and unlatch the mechanism connecting the partition walls to the crane bridge structure. Indication of a latched condition is provided in two locations on the underside of the bridge girders.

Following erection, the hooks, lifting mechanisms, cables, brakes, trolleys, and structural members of the fuel handling area crane are tested at 1/2, 3/4, 1, and 1-1/4 times the rated load. The test loads are maintained for a minimum of 10 minutes prior to changing to a different load.

During fabrication of the upgraded trolley assembly, each hoist was functionally load tested at 1 times the rated load and proof load tested at 1-1/4 times the rated load. The emergency manual load lowering function of the main hoist was tested at 1 times the rated load. Following installation atop the existing bridge crane girders, each hoist was proof load tested at 1-1/4 times the rated load. During the site proof load test of each hoist, the trolley and bridge motions were also tested to the maximum extent practicable.

The State of California assumed responsibility for the implementation of OSHA on January 1, 1974. The crane test loads to be used throughout the life of the facility will meet specific regulations for such loads, as established by the California Division of Industrial Safety.

The conservative design stress limits and redundant design features afforded by the single-failure-proof trolley and reanalyzed crane structures provide the added reliability to justify considering the crane as single-failure-proof. Nonetheless, the travel of both hooks over the SFP is restricted as described in Section 9.1.2.

9.1.4.2.1.4 Fuel Handling Area Movable Partition Walls

Movable partition walls allow the fuel handling area crane access to the fuel handling areas for both units and to the hot shop area, while maintaining proper operation of the fuel handling building ventilation system (FHBVS). The FHBVS is described in Section 9.4.4. Additionally, the moveable wall panel in Unit 1 and the moveable wall panel in Unit 2 (panel 1 and panel 4 as shown in Figure 9.1-19) are equipped with a monorail.

The fuel handling area crane may be used in the fuel handling area for Unit 1, the fuel handling area for Unit 2, or the hot shop area. Two movable partition walls are provided for the plant. These movable walls are repositioned when it is necessary to move the fuel handling area crane from one area to another. This repositioning is accomplished prior to the start of any fuel handling operations. The location of the movable partition walls is shown in Figure 9.1-19. Figure 9.1-20 shows a movable partition wall in place along either column line 15^{7} or column line 20^{3} where the wall serves to isolate the FHBVS from the hot shop area.

A monorail is attached to the side of the moveable wall panels, each with a capacity of 4000 pounds. Travel is limited to the eastern end of these monorails to prevent the lifting of heavy loads over spent fuel. Any lifting of items in the western portions are administratively controlled by the Control of Heavy Loads Program (refer to Section 9.1.4.3.10).

The movable partition walls travel on wheels on the same rail track used by the fuel handling area crane. A movable partition wall is moved by securely attaching it to the fuel handling area crane and moving both the crane and the movable partition wall along the track as an integrated unit.

All members are designed as described in Section 3.8.2. The applicable code used in the design and fabrication is the Specification for the Design Fabrication and Erection of Structural Steel for Buildings, AISC, February 12, 1969. The moveable wall panels have been evaluated for a Hosgri earthquake (HE) concurrent with a maximum lifted load attached.

Wheels for the movable partition walls are double flanged. Additional assurance that derailing cannot take place is provided by a vertical stop running the entire length of each track. Details showing the movable partition wall, track, and vertical stop are shown in Figure 9.1-21.

9.1.4.2.1.5 Containment Structure Polar Crane

The containment structure polar crane (one for each unit) is an overhead gantry crane located on top of the circular crane wall at elevation 140 feet. This polar crane has a main hook capacity of 200 tons and an auxiliary hook capacity of 35 tons. In addition to the main and auxiliary hooks, the polar crane is equipped with a dome service crane.

The dome service crane has a manbasket rated at 750 pounds to lift tools and personnel for inspection and maintenance of the spray ring headers and upper containment structure. It also has an auxiliary hoist rated at 1950 pounds. The arrangement for the polar crane is shown in Figure 3.8-23.

Structural design is in accordance with the Specification for Electrical Overhead Traveling Cranes for Steel Mill Service, Association of Iron and Steel Engineers Standard No. 6 (tentative) dated May 1, 1969. All members not covered by that standard are designed according to the Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, AISC, dated February 12, 1969.

The electrical installation and all electrical equipment are in accordance with the National Electrical Code, dated 1968, and the National Electrical Manufacturers Association. The containment structure polar crane complies with the requirement of OSHA Subpart N, Materials and Handling Storage, of 29 CFR Part 1910, Section 1910.179. Fabrication and erection of the crane support rail is in accordance with the AISC specifications. Design, fabrication, and erection of the concrete supporting structure are described in Section 3.8.1.

The integrity of the crane hooks is ensured by the following measures:

(1) Stresses in the hooks and all other mechanical parts are limited to 80 percent of yield strength for the effect of maximum torque of the motors, braking, or collision of the trolley against the rail stops.

(2) Each hook is shop tested at 1-1/2 times its rated load.

(3) Following the shop test, each hook is magnetic particle inspected.

(4) Both hooks are field tested for 10 minutes at 1/2, 3/4, and 1-1/4 times the rated loads.

The pitch diameter of running sheaves is required to be not less than 24 times the nominal rope diameter. Likewise, the drum diameter is required to be not less than 24 times the nominal rope diameter.

The hoisting ropes are 6 x 37, uncoated, extra flexible, preformed, improved plow steel rope with hemp core or independent wire rope core. The maximum calculated stress in the ropes considering the efficiency of the reeving and weight of the blocks in addition to the crane rated load, is limited to 1/6 of the manufacturer's specified breaking strength.

The entire reeving system is designed so that minimum and commonly accepted fleet angles are maintained, and the rope is guarded against leaving the drum grooves or sheaves.

Each hoist drive on the Unit 1 and Unit 2 polar crane has two sets of brakes. The primary set is an alternating current, quick acting brake and the secondary set is a direct current, inherently slower acting brake. All these brakes are automatic and mechanically applied when the current to the motors is cut off. All hoist brakes are rated at 150 percent of maximum torque that can be developed by its respective system. Trolley and gantry brakes are rated at 100 percent of motor full load torque.

HISTORICAL INFORMATION IN ITALICS BELOW NOT REQUIRED TO BE REVISED.

After installation, the gantry legs and beam were tested as a structure (without running gear) with a load of 414 tons for 1 hour. With a 250 ton load, two 10-minute lifts plus gantry and trolley travel tests of the assembled crane were conducted. The maximum operating load for the containment polar crane is 185 tons.

The conservative design stress limits, the dual braking system, the preoperational tests and the test loads used throughout the life of the facility all combine to provide assurance against the modes of failure that otherwise might be assigned to a gantry crane. Nonetheless, the travel of both hooks over the opened reactor vessel is restricted and controlled by administrative controls.

During plant operation, the polar crane is parked unlocked and provided with guides to prevent derailment due to a seismic event. The guides resist horizontal shear normal to the crane rails. The crane rail is anchored continuously to the concrete by special clamps, capable of resisting forces due to an earthquake.

9.1.4.2.1.6 New Fuel Elevator

The new fuel elevator shown in Figure 9.1-10 consists of a box-shaped elevator assembly with its top end open and sized to house one fuel assembly. Depth of the structure is slightly less than the overall length of the fuel assembly, which rests on the bottom plate. The design class of the new fuel elevator is listed in the DCPP Q-List (refer to Reference 8 of Section 3.2).

The new fuel elevator is used to lower a new fuel assembly to the bottom of the SFP where it is transported to the fuel transfer system by the SFP bridge hoist. It is also used to raise the dummy fuel assembly out of the SFP for transfer between units and occasionally for raising a newly received assembly to the surface for additional inspection.

The new fuel elevator can also be used for handling a spent fuel assembly, for example, during fuel assembly repair or post-irradiation examinations. The restriction imposed by the minimum water shielding requires that:

(1) Administrative controls are imposed to maintain an adequate submergence.

(2) The upper limit switch is adjusted to trip the hoist at a lower elevation to ensure adequate submergence.

(3) Mechanical stops are installed prior to insertion of a spent fuel assembly in the new fuel elevator to physically limit the raising of the elevator to ensure minimum submergence.

(4) No other fuel assembly movement is allowed in the SFP while an assembly is in the new fuel elevator.

9.1.4.2.1.7 Fuel Transfer System

The fuel transfer system (Figure 9.1-11) includes a transfer car that runs on tracks extending from the refueling canal through the transfer tube into the SFP and an upender lifting frame at each end of the transfer tube. The upender in the refueling canal receives a fuel assembly in the vertical position from the manipulator crane. The fuel assembly is then pivoted to a horizontal position for passage through the transfer tube and pivoted to a vertical position by the upender in the SFP. The SFP bridge hoist takes the fuel assembly to a position in the spent fuel storage racks.

A quick opening hatch is used to close the refueling canal end of the transfer tube to seal the reactor containment. The terminus of the tube outside the containment is closed by a gate valve. The design class of the fuel transfer system is given in the DCPP Q-List(refer to Reference 8 of Section 3.2).

9.1.4.2.1.8 Rod Cluster Control Changing

Rod cluster control assemblies (RCCA) inside containment are transferred from one fuel assembly to another by the RCC changing fixture shown in Figure 9.1-12. The five major subassemblies of the changing fixture are: frame and track structure, carriage, guide tube, gripper, and drive mechanism. The carriage is a movable container supported by the frame and track structure. The tracks provide a guide for the four flanged carriage wheels and allow horizontal movement of the carriage during changing operations. Positioning stops on both the carriage and frame locate each of the three carriage compartments directly below the guide tube. Two of these compartments hold individual fuel assemblies while the third supports a single RCCA. The guide tube, situated above the carriage and mounted on the refueling canal wall, provides for the guidance and proper orientation of the gripper and RCCA as they are being raised or lowered. The pneumatically actuated gripper engages the RCCA. Two flexure fingers can be inserted into the top of the RCCA when air pressure is applied to the gripper piston. Normally, the fingers are locked in a radially extended position. Mounted on the operating deck, the drive mechanism assembly includes the manual carriage drive mechanism, revolving stop operating handle, pneumatic selector valve for actuating the gripper piston, and electric hoist for elevation control of the gripper. The fixture is located in the containment refueling canal. The design class of the RCC changing fixture is PG&E Design Class III.

RCCAs in the SFP are transferred from one fuel assembly to another by the RCC changing tool shown in Figure 9.1-12a. The RCC changing tool is portable and functions in a manner similar to the RCC changing fixture described above. This tool is suspended from the SFP bridge crane hoist and is operated from the bridge crane walkway. The tool is lowered by the bridge hoist until it rests upon the nozzle of the desired fuel assembly seated in the spent fuel storage rack. The gripper actuator is then lowered and latched onto the RCC spider which allows the entire RCC to be drawn up inside the guide tube of the tool. Once this operation is completed, the tool may be repositioned over another fuel assembly. The above process is then reversed for reinsertion of the RCC. The RCC changing tool is PG&E Design Class II and is stored on the wall of the fuel transfer canal or SFP as needed. The tool consists of three basic assemblies: the guide tube, the support tube, and the drive mechanism.

The guide tube is the square cross-sectioned tube at the bottom of the tool. Guide plates are provided over the entire length of the tube to prevent damaging the rod clusters and to properly align the gripper. The gripper actuator is also contained within the guide tube. The electro-mechanical RCC changing tool uses a pneumatic gripper, and is operated using controls on the top of the tool. Two limit switches provide upper and lower limits for the motion of the unit. The bottom of the RCC changing tool is equipped with guide pins to insure alignment of the tool with the fuel assembly.

Above the guide tube is the support tube, which gives the proper length to the tool, provides support for the gripper actuator, and supplies protection for the lift cable. Also enclosed within the support tube are the air hose for the gripper and the electrical cable for the limit switches. To prevent tangling of the hose and cable, the cable has been placed inside the coiled air hose with seals at each end to allow separation of the two.

The drive mechanism, at the top of the tool, consists of a winch powered by an ac electric motor, the operator's panel, and four limit switches. One of the limit switches provides overload protection in the event of an RCC hang-up. The other three are geared limit switches; two providing upper and lower limits and the third controls the pneumatic system.

9.1.4.2.1.9 Spent Fuel Handling Tool

The manually actuated spent fuel handling tool, shown in Figure 9.1-13, is used to handle new and spent fuel in the SFP. It is mounted on the end of a long pole suspended from the SFP bridge hoist. An operator on the SFP bridge guides and operates the tool. The tool is stored on the wall of the SFP.

9.1.4.2.1.10 New Fuel Assembly Handling Fixture

The short-handled new fuel assembly handling fixture, shown in Figure 9.1-14, is used to handle new fuel on the operating deck of the fuel storage area, to remove the new fuel from the shipping container, and to facilitate inspection and storage of the new fuel and loading of fuel into the new fuel elevator.

9.1.4.2.1.11 Reactor Vessel Head Lifting Device

The reactor vessel head lifting device, shown in Figure 9.1-15, consists of a welded and bolted structural steel frame with suitable rigging to enable the crane operator to lift the head and store it during refueling operations. The lifting lugs are permanently attached to the reactor vessel head. The reactor vessel head lifting device is a part of the integrated head assembly (IHA), as described in Section 5.4.1.4. During evolutions that require the removal of the reactor pressure vessel head, the entire IHA is lifted at once. The design class of this device is given in the DCPP Q-List (refer to Reference 8 of Section 3.2).

9.1.4.2.1.12 Reactor Internals Lifting Device

The reactor internals lifting device, shown in Figure 9.1-16, is a structural frame suspended from the overhead crane. The frame is lowered onto the guide tube support plate of the internals, and is manually bolted to the support plate by three bolts. Bushings on the frame engage guide studs in the vessel flange to provide guidance during removal and replacement of the internals package. The device is stored on a PG&E Design Class II stand in the containment refueling canal.

9.1.4.2.1.13 Reactor Vessel Stud Tensioner

Stud tensioners, shown in Figure 9.1-17, are employed to secure the head closure joint at every refueling. The stud tensioner is a hydraulically operated device that permits preloading and unloading of the reactor vessel closure studs at cold shutdown conditions. A hydraulic pumping unit operates the tensioners, which are hydraulically connected in series.

9.1.4.2.2 Tool Storage Locations and Supports

The storage locations of miscellaneous fuel handling tools are shown in Figure 9.1-18. The design classifications for these locations (containment structure, fuel handling building, and support racks) are given in the DCPP Q-List (refer to Reference 8 of Section 3.2). Many of the major and miscellaneous tool supports are designed to meet PG&E Design Class I requirements. If not, the tools are stored in an area such that their failure or failure of their supports would not endanger plant operation or prevent safe plant shutdown during a seismic event.

9.1.4.2.3 Refueling Procedure

The refueling operation follows a detailed procedure that provides a safe, efficient refueling operation. The following significant points are ensured by the refueling procedure:

(1) The refueling water and the reactor coolant contain a minimum of approximately 2000 ppm boron (refer to Section 9.1.3.3.7).

(2) The water level in the refueling cavity is high enough to keep the radiation levels within acceptable limits when the fuel assemblies are being removed from the core. This water also provides adequate cooling for the fuel assemblies during transfer operations. Refer to Section 9.1.4.3.6 for discussion regarding methods for maintaining adequate radiation shielding during the fuel handling process.

(3) The potential for grid strap damage during refueling operations is minimized by exercising care during the handling operations. Such care includes proper training of operators, ensuring adequate water clarity and lighting, confirmation of proper functioning and alignment of the fuel handling and transfer equipment, and implementation of appropriate fuel handling precautions.

The refueling operation is divided into four major phases: (a) preparation, (b) reactor disassembly, (c) fuel handling, and (d) reactor assembly. A general description of a typical refueling operation through the four phases is given below:

(1) Phase I - Preparation

The reactor is shut down and cooled to cold shutdown conditions with a minimum boron concentration of 2000 ppm in the reactor coolant and a Keff $\leq$ 0.95. Radiological assessments are performed in accordance with the Radiation protection program prior to general entry into containment. The coolant level in the reactor vessel is lowered to a point slightly below the vessel flange. The fuel transfer equipment and manipulator crane are checked for proper operation.

(2) Phase II - Reactor Disassembly

All cables are disconnected at the 140’ elevation, seismic braces are unpinned, reactor vessel level instrumentation system tubing is disconnected, reactor head flange insulation is removed, head studs are detensioned, and the head studs and nuts are removed. The refueling cavity is then prepared for flooding by sealing off the reactor cavity; checking the underwater lights, tools, and fuel transfer system; closing the refueling canal drain holes; and removing the quick opening hatch from

the fuel transfer tube. With the refueling cavity prepared for flooding, the vessel head is unseated, raised, and placed on the head storage stand. Water from the refueling water storage tank is pumped into the reactor coolant system (RCS) causing the water to overflow into the refueling cavity. The control rod drive shafts are disconnected and, with the upper internals, removed from the vessel. The fuel assemblies and RCCAs are now free from obstructions, and the core is ready for refueling.

Prior to moving the upper internals over fuel, each containment penetration will be in the following status:

(a) Equipment hatch capable of being closed and held in place by a minimum of four bolts

(b) One door in each air lock capable of being closed

(c) Each penetration providing direct access from the containment atmosphere to the outside atmosphere is capable of being closed by manual or automatic isolation valve, blind flange, or equivalent; or be capable of being closed by an operable automatic containment purge and exhaust valve.

Otherwise, all operations involving movement of the upper internals over fuel are suspended.

(3) Phase III - Fuel Handling

The refueling sequence consists of either a full core off-load or a partial core off-load and incore shuffle.

The full core off-load consists of removing all of the fuel assemblies from the core, storing them in the SFP, and then returning the partially spent assemblies, as well as the new assemblies that replace the fully spent assemblies, to the core according to the final reload configuration.

An incore shuffle consists of removing the fully spent fuel assemblies from the core to the SFP, rearranging the remaining partially spent assemblies in the core, and adding new assemblies to replace the removed fully spent assemblies.

The general fuel handling sequence is:

(a) The manipulator crane is positioned over a fuel assembly in the core.

(b) The fuel assembly is lifted by the manipulator crane to a predetermined height to clear the reactor vessel and still leave

sufficient water coverage to eliminate any radiation hazard to the operating personnel.

(c) The fuel transfer car is moved into the upender inside containment.

(d) The fuel assembly container is pivoted to the vertical position by the upender.

(e) The manipulator crane is moved to line up the fuel assembly with the fuel transfer system.

(f) The manipulator crane loads a fuel assembly into the fuel assembly container of the fuel transfer car.

(g) The container is pivoted to the horizontal position by the upender.

(h) The fuel container is moved through the fuel transfer tube to the SFP by the transfer car.

(i) The fuel assembly container is pivoted to the vertical position. The fuel assembly is unloaded by the spent fuel handling tool attached to the SFP bridge hoist.

Crane operations with loads over the SFP are suspended with less than 23 feet of water over the top of irradiated fuel assemblies seated in the storage racks. The water level is specified in the Technical Specifications.

Crane operations with loads containing recently irradiated fuel over the SFP are suspended with no FHBVS trains operable. Recently irradiated fuel is defined as fuel that has been part of a critical reactor within the last 100 hours.

Crane operations with loads containing recently irradiated fuel over the SFP may proceed with one FHBVS train inoperable provided the operable train is capable of being powered from an operable emergency power source and is in operation and discharging through at least one train of HEPA filters and charcoal absorbers.

(j) The fuel assembly is placed in the spent fuel storage rack.

(k) The procedure for off-load is continued until all assemblies identified by the off-load procedure are removed. The core may be either partially or fully off-loaded.

(l) On core reload, assemblies are moved from the SFP storage location (or the new fuel storage vault via the new fuel elevator) to the fuel assembly container according to the reload procedure, and the fuel assembly container is pivoted to the horizontal position and the transfer car is moved back into the refueling canal.

(m) For an incore shuffle, partially spent fuel assemblies are relocated in the reactor core, and new fuel assemblies are added to the core.

(n) Any new assembly or transferred fuel assembly that is placed in a control position will receive an RCCA in the SFP using the RCC change tool.

(o) This procedure is continued until refueling is completed.

(4) Phase IV - Reactor Assembly

Reactor assembly, following refueling, is essentially achieved by reversing the operations given in Phase II - Reactor Disassembly.

9.1.4.2.4 RPVH Lifting Administrative Controls

DCPP administrative controls are used to control the lift and replacement of the RPVH. They establish limits on load height, load weight, and medium present under the load. The administrative controls: (1) use the guidance and acceptance criteria in NEI 08-05, Industry Initiative on Control of Heavy Loads (Reference 21), particularly in regards to Section 2 of the initiative, which addresses criteria for RPVH load drop and consequences analysis; and (2) provide additional assurance that the core will remain covered and cooled in the event of a postulated RPVH drop.

9.1.4.2.5 RPVH Load Drop Analyses

RPVH drop analyses have been performed for DCPP Unit 1 and Unit 2 in accordance with NEI 08-05, which was endorsed by the NRC, with exceptions, in the NRC safety evaluation of NEI 08-05 (Reference 22). The DCPP analyses were performed in accordance with the NRC exceptions, as follows:

(1) “The staff considers the ASME Code, Section III, Appendix F acceptance criteria for limiting events (i.e., Service Level D) acceptable for the analytical methods proposed in the guidance.” Therefore, the NEI 08-05 stress based criteria using ASME Section III, Appendix F, were used in the DCPP head drop analysis evaluation for coolant retaining components.

(2) “For energy balance evaluations using the large-displacement finite element methods described in the guidance, the staff finds the criteria applied to pipe whip restraint evaluations (i.e., one-half of ultimate strain)

acceptable for the analytical methods proposed in the draft guidance." The Standard Review Plan 3.6.2, Revision 1, criteria applicable to pipe whip restraint evaluations is 0.5 of the ultimate uniform strain limit for pure tension members. Therefore, the uniform tensile strain in tensile plus bending support members was limited to 0.5 of the ultimate strain.

The purpose of the analyses was to evaluate the consequences of a postulated heavy load drop of the RPVH in the reactor cavity, while raising or lowering the RPVH during outages at DCPP. The heads weigh 366 Kip, however for analysis purposes, a conservative head weight of 380 Kip dropping a distance of 38 feet in air was assumed. The RPVH centerline is considered concentric with the reactor vessel (RV) centerline. The 38-foot height limit is removed once the RPVH centerline is outside the RV flange outside diameter. The dynamic head drop analysis methodology used for DCPP is an acceptable methodology per NEI 08-05, Section 2.3, and the NRC safety evaluation of NEI 08-05 (Reference 22). Details of the analysis and results are provided in Reference 23.

The dynamic impact model includes a system of non-linear springs and masses of the falling head with the upper service structures, and impact on an integrated spring mass model of the RV target structures. The target structures consist of the RV shell, nozzles, the RCS loop piping, reactor coolant pumps (RCPs), and the steam generators (SGs). An impact damping ratio of 5 percent was applied in the analysis to address the plastic deformation of the contact surfaces of the head and the vessel flanges. The load-deflection curve of the non-linear spring elements are developed from a non-linear finite element analysis model of the components.

The dynamic impact analysis results indicate, for all drop cases, stresses in the RV shell, RV nozzles, RCS loop piping, bottom mounted instrumentation piping and all RCS attached piping meet the allowable stresses per ASME BPVC Section III, Appendix F, for faulted conditions per the NEI 08-05 Guideline as endorsed by the NRC. Stresses in the reactor coolant pressure retaining components are below the ASME Section III, Appendix F, stress limits for faulted conditions.

Concrete under the RV support base steel plate exceeds the local bearing stress limit, thus the RV supports were considered to be ineffective after the concrete crushing. Local concrete under the pipe whip saddle inside the wall penetration also partially crushed, however, the strain in pipe whip support plates remains below the allowable strain. Thus, the RPVH, RV, and RCS piping remain supported after the impact.

The SG and RCP nozzle loads and support loads due to head drop load impact are less than or approximately the same as the component faulted design loads (based on combined LOCA, seismic, pressure, and deadweight loads). Thus, the RCP and SG support structures would remain functional to support the weight of the RCS components after the head drop accident.

9.1.4.2.6 Cask Loading Operations

A summary description of the FHS equipment for cask loading operations is provided in this section. Additional details are included in References 10, 11, and 12. Refer to Section 4.4.1.3 of Reference 12 for the division of safety considerations inside and outside the 10 CFR Part 50 facility.

The FHS equipment needed to load spent fuel into a cask for transfer to the Diablo Canyon ISFSI consists of cranes, lifting and handling devices including tools, a low profile transporter (LPT), and an SFP transfer cask restraint cup. The primary structures associated with this equipment are the SFP, the cask loading area of the SFP, and the Unit 2 cask washdown area (CWA).

Decay heat, generated by the spent fuel assemblies in the SFP, is removed by the SFP cooling and cleanup system. When fuel is to be moved to the Diablo Canyon ISFSI, selected assemblies are removed from the racks and loaded into a multi-purpose canister (MPC) that is located inside a transfer cask (the HI-TRAC 125D cask shown in Figure 9.1-4). The cask handling route within the fuel handling building (FHB) is shown in Figure 9.1-7. The minimum cooling time for fuel to be loaded into the transfer cask is 5 years.

The cranes, lifting and handling devices, and tools used for cask loading operations are essentially the same as those used for refueling and fuel transfer operations (described in Section 9.1.4.2). They are, however, configured differently for cask loading operations, as further described below in Section 9.1.4.2.6.1. The LPT is used to move the empty transfer cask into the FHB. The transfer cask is detached from the LPT and moved into the Unit 2 CWA seismic restraint using the fuel handling area crane. While located in the CWA, the empty transfer cask/MPC is restrained as shown in Figure 9.1-24. When the transfer cask is moved to the cask loading area, it is lowered into the SFP transfer cask restraint cup (Figure 9.1-6), which provides lateral support of the cask while it is lowered, loaded with fuel, and lifted from the SFP. Once the loaded cask is raised out of the SFP, it is moved to the Unit 2 CWA for decontamination, MPC processing, and preparation for transport to the cask transfer facility (CTF). When ready, the loaded cask is lifted out of the Unit 2 CWA, fastened onto the LPT, and moved out of the FHB for subsequent transport to the CTF using the cask transporter.

9.1.4.2.6.1 Component Descriptions

The following sections describe major components of the FHS as they relate to cask loading operations in the FHB. The cranes, lifting and handling devices, and tools described in Section 9.1.4.2.1 for refueling and fuel transfer operations are essentially the same as those used for cask loading operations. There are, however, some configuration differences. The component descriptions in this section focus on the configuration differences for the cranes, lifting and handling devices, and tools, as well as describing those components unique to cask loading and handling in the FHB. Other

FHS components not addressed in this section remain the same as described in Sections 9.1.4.2.1 and 9.1.4.2.2.

9.1.4.2.6.1.1 HI-STORM 100 Interchangeable MPCs

The HI-STORM MPC provides for confinement of radioactive materials, criticality control, and the means to dissipate decay heat from the stored fuel. It is a welded cylindrical canister with a honeycombed fuel basket, which contains a Boral or Metamic neutron absorber for criticality control. Although MPC-24s and MPC-32s are certified for use at DCPP, only the MPC-32 is used. The MPC-32 is designed for intact spent fuel. All MPCs certified for use at DCPP have the same outside dimensions and use the same transfer cask.

9.1.4.2.6.1.2 HI-TRAC 125D Transfer Cask

The HI-TRAC 125D transfer cask (Figure 9.1-4) contains the MPC during loading, unloading, and transfer operations. The physical characteristics of the 125D cask are shown in Table 4.2-3 of the Diablo Canyon ISFSI UFSAR . It provides shielding and structural protection of the MPC in the FHB and from the SFP to the CTF. The transfer cask is a multi-walled (carbon steel/lead/carbon steel) cylindrical vessel with a built-in exterior water jacket. The maximum weight including the lifting yoke during any loading, unloading, or transfer operation does not exceed 125 tons.

9.1.4.2.6.2 Transfer Cask/MPC Loading Process

The transfer cask/MPC loading process is briefly summarized in this section. Additional detail is provided in Section 3.2 of Reference 10 and in Section 5.1 of Reference 12.

An empty MPC is loaded into the transfer cask in the FHB using the fuel handling area crane. Borated water is added to the MPC and the transfer cask is lifted above the SFP wall using the fuel handling area crane. The cask is then traversed into position over the cask loading area of the SFP and SFP transfer cask restraint cup. The cask is lowered into the SFP transfer cask restraint cup, which rests on a platform near the bottom of the cask loading area. The restraint precludes tipping or damage to adjacent fuel racks.

After fuel loading is complete, a lid is placed on the MPC, the transfer cask is lifted out of the SFP, traversed and lowered into the Unit 2 CWA seismic restraint, and decontaminated. The MPC lid is welded to the MPC shell, hydro leak tested, water is drained from the MPC, and the MPC is dehydrated, filled with Helium, isolated, Helium leak tested, and seal welded to closure. The top lid is then installed on the transfer cask.

The fuel handling area crane is then used to lift the loaded transfer cask out of the CWA restraint and to place the loaded transfer cask onto the LPT. The cask is fastened to the LPT and the LPT is moved out of the FHB on removable tracks to a position where it is rigged to the cask transporter for movement to the CTF.

9.1.4.2.6.3 Unloading Operations

While unlikely, certain conditions described in Reference 12 may require unloading of the fuel assemblies from the transfer cask/MPC. The unloading process is generally the reverse order of the loading process.

9.1.4.3 Safety Evaluation

9.1.4.3.1 General Design Criterion 2, 1967 – Performance Standards

The fuel handling building, auxiliary building, and containment structure, which contain the FHS are PG&E Design Class I (refer to Section 3.8). These buildings or applicable portions thereof are designed to withstand the effects of winds and tornadoes (refer to Section 3.3), floods and tsunamis (refer to Section 3.4), external missiles (refer to Section 3.5), and earthquakes (refer to Section 3.7). These designs protect the FHS, ensuring its safety functions are performed.

The cranes and movable partition walls of the FHS have been seismically qualified to either DE, DDE, or HE earthquakes, as discussed in the DCPP Q-List.

The LPT, with a loaded transfer cask attached, is qualified for DE, DDE, and HE events.

Refer to Section 9.1.4.3.9 for further discussion of the seismic qualifications of the FHS equipment.

<u>Tornado Winds and Tornado Generated Missiles</u>

The overall tornado resistance of the FHB is addressed in Section 9.1.2.3.1. The effects of tornado wind loads acting on the cask suspended from the FHB crane are enveloped by the seismic analysis for this configuration. However, cask handling introduces new tornado missile targets. Analysis results demonstrate that the 125-ton transfer cask satisfies all functional requirements under postulated impact scenarios and the system will not be subject to a loss of load due to a missile impact. For discussions of wind and tornado loading and associated tornado generated missiles, refer to Section 3.3 and Section 3.5, respectively.

9.1.4.3.2 General Design Criterion 4, 1967 – Sharing of Systems

The fuel handling building is a steel framed building anchored to the concrete auxiliary building structure (refer to Section 3.8.2.4.1). The fuel handling building encloses the fuel handling areas of Unit 1 and Unit 2 (refer to Figures 1.2-4 and 1.2-10). Therefore, the fuel handling building is a shared structure.

One fuel handling area crane services both units (refer to Section 9.1.4.2.1.3). DCPP administrative controls are used to restrict the path of loads, such as the handling of

spent fuel casks, which could damage fuel assemblies. The restrictions on fuel handling prevent a failure of the fuel handling area crane from negatively impacting the safety of both units. Refer to Section 9.1.4.3.10.

Two movable partition walls are used in the fuel handling building to allow the fuel handling area crane to transition from one unit to the other unit. The movable partition walls serve to separate the Unit 1 and Unit 2 areas of the fuel handling building during fuel handling operations. Refer to Section 9.1.4.2.1.4.

The function of the fuel handling building ventilation system is not impacted by the shared use of the movable partition walls, due to the fact that these walls are moved into their required positions before fuel handling begins. This allows the fuel handling building ventilation system to maintain the required negative atmospheric pressure for the fuel handling process. Refer to Section 9.1.4.2.1.4.

Movement of fuel assemblies is controlled by DCPP administrative controls, ensuring the safe handling of fuel in the shared fuel handling building. When the fuel handling area crane is not needed in the Unit 1 or Unit 2 fuel handling areas, the movable partition walls are positioned such that they provide a ventilation boundary between the hot shop and the fuel handling area of each unit. Refer to Section 9.1.4.2.1.4.

9.1.4.3.3 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Electrical interlocks (i.e., limit switches) are provided for minimizing the possibility of damage to the fuel during fuel handling operations. The electrical interlocks for the manipulator crane are not specifically designed to the requirements of Reference 4 because of the primary dependence on mechanical stops.

The manipulator crane design includes the following provisions to ensure safe handling of fuel assemblies:

(1) Bridge, trolley, and winch drives are mutually interlocked, using redundant interlocks, to prevent simultaneous operation of any two drives.

(2) Bridge and trolley drive operation is prevented except when both gripper tubeup position switches are actuated.

(3) An interlock is supplied that prevents the operation of either the engaging or disengaging solenoid valves unless the load and elevation requirements are satisfied. As backup protection for this interlock, the mechanical weight-actuated lock in the gripper prevents operation of the gripper under load even if air pressure is applied to the operating cylinder.

(4) An excessive suspended weight switch opens the hoist drive circuit in the up direction when the loading is in excess of 110 percent of a fuel assembly weight.

(5) An interlock of the hoist drive circuit in the up direction permits the hoist to be operated only when either the open or closed indicating switch on the gripper is actuated.

(6) An interlock of the bridge and trolley drives prevents the bridge drive from traveling beyond the edge of the core unless the trolley is aligned with the refueling canal centerline. The trolley drive is locked out when the bridge is beyond the edge of the core.

The following safety features are provided for in the fuel transfer system control circuit:

(1) Transfer car operation is possible only when both upenders are in the down position as indicated by the limit switches.

(2) The remote control panels have a permissive switch in the transfer car control circuit that prevents operation of the transfer car in either direction when either switch is open, i.e., with two remote control panels, one in the refueling canal and one in the SFP, the transfer car cannot be moved until both "go" switches on the panels are closed.

(3) An interlock allows upender operation only when the transfer car is at either end of its travel.

(4) Transfer car operation is possible only when the transfer tube gate valve position switch indicates the valve is fully open.

(5) The refueling canal upender is interlocked with the manipulator crane. The upender cannot be operated unless the manipulator crane gripper tube is in the fully retracted position or the crane is over the core.

Fuel handling devices have provisions to avoid dropping or jamming of fuel assemblies during transfer operations.

9.1.4.3.4 General Design Criterion 49, 1967 – Containment Design Basis

The fuel transfer system, where it penetrates the containment, has provisions to preserve the integrity of the containment pressure boundary. The fuel transfer tube that connects the refueling canal (inside the containment) and the SFP (outside the containment) is closed on the refueling canal side by a quick opening hatch at all times except during refueling operations. Two seals are located around the periphery of the quick opening hatch with leak-check provisions between them. The terminus of the tube outside the containment is closed by a gate valve.

The portion of the fuel transfer tube inside the containment is considered to be part of the containment liner and is a Type B containment test penetration (refer to Table 6.2-39). In accordance with Technical Specifications, the fuel transfer tube penetration is tested up to expected LOCA pressure to ensure that the design leakage rate is not exceeded. Other than during refueling operations, the transfer tube remains empty therefore there are no means for affecting the functional design of the penetration.

9.1.4.3.5 General Design Criterion 66, 1967 – Prevention of Fuel Storage Criticality

As discussed in Section 9.1.4.2.6.1.1, the design of the Holtec HI-STORM MPC provides criticality control for spent fuel stored in the MPC.

The boron concentration of the water that communicates with the reactor pressure vessel during the refueling process is controlled by Technical Specifications and DCPP administrative controls to ensure that the fuel assemblies located inside the reactor pressure vessel remain subcritical.

During refueling operations when the SFP water mixes through the fuel transfer tube with the reactor refueling cavity water, SFP chemistry is controlled to ensure compatibility with the RCS and residual heat removal system chemistry requirements to preclude a boron dilution accident.

For the period of time that an MPC is located in the MPC cavity of one of the SFPs, the water is free to communicate between the MPC and the SFP. During cask loading operations in the SFP, boron concentrations in the SFP (and thus, the MPC cavity) are maintained in accordance with the ISFSI Technical Specifications. For an MPC-32, a boron concentration range between 2000 ppm and 2600 ppm is required depending on the initial enrichment (wt%) of the loaded fuel assemblies. Boration levels up to 3,000 ppm in the MPC and SFP have been evaluated and determined to have no adverse effects on materials or thermal performance.

Protection from boron dilution events is discussed in Section 9.1.4.3.8.1.

9.1.4.3.5.1 Fuel Assembly Drop into Loaded Transfer Cask

While very unlikely, analysis of this event shows that a fuel assembly drop into the MPC could result in physical deformation that would challenge criticality margins. However, the results of the analysis show that the criticality margins would continue to meet the licensing basis (k_{eff} <0.95) and that the radiological consequences are enveloped by the existing fuel assembly drop accident described in Section 15.5.22.1.

9.1.4.3.6 General Design Criterion 68, 1967 – Fuel and Waste Storage Radiation Shielding

Cranes and hoists used to lift spent fuel assemblies have a limited maximum lift height so that the minimum required depth of water shielding is maintained. During all phases of spent fuel transfer, the gamma dose rate at the surface of the water is limited by maintaining a minimum of 8 feet of water above the top of the fuel assembly during all handling operations. This corresponds to about 9 feet of water shielding over the active fuel.

The two cranes used to lift spent fuel assemblies are the manipulator crane and the SFP bridge hoist. The manipulator crane contains positive stops, which prevent the top of a fuel assembly from being raised to within 8 feet of the water level in the refueling cavity. The hoist on the SFP bridge moves spent fuel assemblies with a long-handled tool. Hoist travel and tool length likewise limit the maximum lift of a fuel assembly to assure 8 feet of water shielding in the SFP.

When handling irradiated fuel rods, during fuel repairs and post-irradiation examinations, nine feet of water is maintained above the active fuel.

9.1.4.3.7 10 CFR 50.55a(g) – Inservice Inspection Requirements

The FHS has a periodic inservice inspection (ISI) program in accordance with the ASME BPVC, Section XI.

9.1.4.3.8 10 CFR 50.68(b) – Criticality Accident Requirements

Based on the alarms, procedures, administrative controls, assumption of zero burnup fuel, and availability of trained operators described in Reference 13, the NRC has granted an exemption from the criticality requirements of 10 CFR 50.68(b)(1) during loading, unloading, and handling of the MPC in the DCPP SFP (Reference 14).

In accordance with 10 CFR 50.68(b)(1), plant administrative controls prohibit handling and storage at any one time of more fuel assemblies than have been determined to be safely subcritical.

Refer to Section 9.1.4.3.5 for a discussion on measures used during fuel handling activities to ensure the K_{eff} of the fuel assemblies remains below the limits established in 10 CFR 50.68(b)(4).

Implementation of 10 CFR 50.68(b)(8) was completed with the submittal of Revision 15 of the UFSAR.

9.1.4.3.8.1 MPC Boron Dilution

A boron dilution analysis was performed and submitted to the NRC (Reference 13) to determine the time available for operator action to ensure criticality does not occur in an MPC-32 during fuel loading and unloading operations. The analysis results show that operators have approximately 5 hours available to identify and terminate the source of unborated water flow from the limiting boron dilution event to ensure criticality in the MPC-32 does not occur. To minimize the possibility of a dilution event, a temporary administrative control is implemented while the MPC is in the SFP that will require, with the exception of the 1-inch line used to rinse the cask as it is removed from the SFP, at least one valve in each potential flow path of unborated water to the SFP to be closed and tagged out. During the cask rinsing process, the MPC will have a lid in place that will minimize entry of any unborated water into the MPC. The flow path with the highest potential flow rate of 494 gpm is doubly isolated by having two valves closed and tagged out while the MPC is in the SFP.

9.1.4.3.9 Safety Guide 13, March 1971 – Fuel Storage Facility Design Basis

Regulatory Position 1:

The fuel handling building, auxiliary building, and containment structure, which contain the FHS are designed to withstand the effects earthquakes (refer to Section 9.1.4.3.1).

Fuel lifting and handling devices are capable of supporting maximum loads under seismic conditions. The fuel handling equipment will not fail so as to cause damage to any fuel elements should the seismic event occur during a refueling operation. The earthquake loading of the fuel handling equipment is evaluated in accordance with the seismic considerations addressed in Section 9.1.4.3.1. However, several components used in the fuel transfer system are not seismically qualified. This includes the upenders (one inside containment and one inside the fuel handling building), the fuel transfer car, and the rails that the fuel transfer car rides on. Refer to the DCPP Q-List (Reference 8 of Section 3.2) for further details on the classification of the fuel transfer system.

The maximum design stress for the fuel handling area crane structures and for all parts involved in gripping, supporting, or hoisting the fuel assemblies is 1/5 ultimate strength of the material. This requirement applies to normal working load and emergency pullout loads, when specified, but not to earthquake loading. To resist earthquake forces, the fuel handling area crane structures are designed to limit the stress in the load bearing parts to either 0.96 times the yield stress for a combination of normal working load plus DDE forces, or 1 times the yield strength for a combination of normal working load plus HE forces, whichever is greater. To ensure the ability of the lifting and handling devices to support maximum loads under seismic conditions, the design safety factor of the lifting and handling devices has been evaluated against the actual calculated HE loads. The evaluation indicates the inherent design safety factor is sufficient to envelope the combined normal working load plus DDE or HE loads.

For the manipulator crane, restraints are provided between the bridge and trolley structures and their respective rails to prevent derailing due to the HE. The manipulator crane is designed to prevent disengagement of a fuel assembly from the gripper under the HE.

While in the Unit 2 CWA, the HI-TRAC is seismically restrained by the CWA seismic restraint system. This system includes a wall mounted restraint and service platform and a floor restraint plate.

The potential impact of seismic events on cask loading, handling, closure, and transport activities has been considered in the evaluation of the cask system components and in the design and evaluation of the interfaces with 10 CFR Part 50 facilities. Two structures, the SFP transfer cask restraint cup and the Unit 2 CWA seismic restraint structure, are designed to preclude unacceptable movement of the cask system components, assuring all involved SSCs remain within their design bases.

Seismic analyses have been performed that demonstrate the adequacy of the SFP transfer cask restraint cup and Unit 2 CWA restraint to preclude unacceptable movement or impact on the 10 CFR Part 50 facilities.

Regulatory Position 2:

Section 9.1.4.3.1 provides a discussion of the DCPP environmental protections, such as protection from cyclonic winds and external missiles, for the PG&E Design Class I portions of the FHS.

Regulatory Position 3:

Electrical interlocks (i.e., limit switches) are provided for minimizing the possibility of damage to the fuel during fuel handling operations. Mechanical stops are provided as the primary means of preventing fuel handling accidents. For example, safety aspects of the manipulator crane depend on the use of electrical interlocks and mechanical stops. The electrical interlocks for the manipulator are not specifically designed to the requirements of Reference 4 because of the primary dependence on mechanical stops.

Section 9.1.4.3.3 provides a more detailed overview of the interlocks used to ensure that fuel assemblies are safely handled.

Regulatory Position 5(b):

Crane operation in the fuel handling area is such that the heavy loads cannot traverse over the spent fuel storage racks in the SFP. Redundant electrical interlocks are installed on the fuel handling area crane to prevent movement of heavy loads over the area of the SFP which can contain spent fuel. The backup interlock is connected to a different circuit than the primary interlock to preclude heavy loads movement over stored fuel resulting from a single failure.

These limitations on fuel handling area crane travel preclude the possibility of dropping heavy objects from above the spent fuel storage racks. The spent fuel bridge hoist and the moveable partition wall monorail are the only cranes capable of moving objects over the spent fuel storage racks. The rated capacity of the spent fuel bridge hoist is 2000 pounds. An object of this weight dropped on the racks will not affect the integrity of the racks. The rated capacity of the moveable partition wall monorail is 4000 pounds, however, physical restrictions (trolley stops) are provided to prevent movement of loads over the SFP. Lighting fixtures or other components of the building above the racks are not sufficiently massive to cause damage to the racks if they are assumed to fall into the pool. Protection of nuclear fuel assemblies from overhead load handling is a key element of the Control of Heavy Loads Program described in Section 9.1.4.3.10.

9.1.4.3.10 NUREG-0612, July 1980 – Control of Heavy Loads at Nuclear Power Plants

The objective of the Control of Heavy Loads Program is to ensure that all load handling systems are designed, operated, and maintained such that their probability of failure is uniformly small and appropriate for the critical tasks in which they are employed. The program is based on all seven general guideline areas of NUREG-0612, July 1980 Section 5.1.1, also known as Phase I (Safe Load Paths; Load Handling Procedures; Crane Operator Training; Special Lifting Devices; General Lifting Devices; Crane Inspection, Testing and Maintenance, and Crane Design).

The Control of Heavy Loads Program for refueling and fuel transfer operations is described in Section 9.1.4.3.10.1. The Control of Heavy Loads Program for cask loading operations, which includes revisions for loading the HI-STORM System components within the 10 CFR Part 50 facility, complies with the guidelines of NUREG-0612, July 1980. Details specific to cask loading and handling in the FHB are provided in References 10 and 11.

NRC Generic Letter 80-113, December 1980 (Reference 18) required PG&E to review their provisions for handling and control of heavy loads at DCPP to determine the extent to which the guidelines of NUREG-0612, July 1980 Phase I and II were satisfied and to commit to mutually agreeable changes and modifications that would be required to fully satisfy these guidelines. An overview of the DCPP heavy loads program is presented in this section.

PG&E has developed and is maintaining a robust heavy loads control program at DCPP to minimize the potential for adverse interaction between overhead load handling operations and: 1) nuclear fuel assemblies to ensure a subcritical configuration and preclude radiological consequences and; 2) structures, systems and components (SSCs) selected to ensure safe, cold shutdown of the plant following a postulated heavy load drop event. The bases of the NRC-accepted program are summarized in Reference 7.

Implementation of Sections 5.1.2 to 5.1.6 of NUREG-0612, July 1980, also known as Phase II, was determined by the NRC in Generic Letter 85-11, June 1985 to not require NRC review. While not a requirement, the NRC encouraged the implementation of any licensee actions identified in Phase II that are considered appropriate.

To accomplish the program, PG&E defined as heavy load targets nuclear fuel assemblies and selected SSCs necessary to safely shut down the plant and maintain the plant in a safe, cold shutdown condition. Initial plant operating modes of normal operation, shutdown, and refueling were considered in the selection of the target equipment. Overhead load handling operations and heavy load target SSCs were then evaluated for potential interaction. Mitigation measures for minimizing adverse interactions include as applicable: (1) to the extent possible, changing methods, routes or scheduling of the overhead load handling operation to avoid the interaction; (2) analyzing the intervening floor structural capacity for protection of target SSCs against postulated damage due to a load drop, and restricting overhead loads in the plant area by weight and handling height above the intervening floor (i.e., restricted area); and (3) excluding the plant area from non-essential overhead load handling operations (i.e., exclusion area). PG&E plans and capabilities to handle heavy loads at DCPP are described in PG&E correspondence to the NRC in response to NUREG-0612, July 1980 and are summarized in Reference 7. Sections 2.2.4, 2.3.4, and 2.4.2 of PG&E's NUREG-0612, July 1980 submittals (References 19 and 20) provide the results of various load drop analyses.

The results of these evaluations are used to create administrative controls for overhead load handling operations in plant areas where heavy load targets exist. The Plant Staff Review Committee is responsible for reviewing administrative controls for overhead load handling operation in exclusion areas (refer to Section 17.2.4). Additional controls for the training of crane operators, design, operation, maintenance and inspection of rigging, lifting devices, and overhead load handling systems are administered through plant administrative controls.

The movable wall partitions, which have monorail lifting devices attached, are designed and configured as described in Section 9.1.4.2.1.4.

9.1.4.3.10.1 RPVH Load Drop

Controls implemented by NUREG-0612, July 1980 Phase I elements make the risk of a load drop very unlikely, and, in the event of a postulated RPVH drop, the load drop analysis demonstrates that the consequences are acceptable (refer to Section 9.1.4.2.5). Restrictions on load height, load weight, and medium under the load consistent with analysis assumptions are reflected in plant administrative controls.

9.1.4.3.10.2 Cask Loading Operations

Potential spent fuel cask accidents and off-normal events related to handling and loading (or unloading) of the MPC in the HI-TRAC 125D transfer cask, including safe handling as related to use of cranes and lifts; potential drops and tipovers; operational errors and mishandling events; support system malfunctions; and fires, are addressed in this section. Additional details of the methodology, acceptance criteria, and results are provided in Section 4.3 of Reference 10.

9.1.4.3.10.2.1 Defense-in-Depth Measures

9.1.4.3.10.2.1.1 Safe Handling

The safe handling discussion in Section 9.1.4.3.3 for the FHB cranes and lifts applies to cask loading operations. In addition, the FHB crane is configured and operated as described in Section 9.1.4.2.1.3 when performing cask loading and handling operations.

Structural, mechanical, and electrical design of the fuel handling area crane is in accordance with ASME NOG-1-2004, as conformed to the requirements of NUREG-0554, May 1979 per the guidance of NUREG-0612, July 1980, Appendix C. Furthermore, the crane structural design has been demonstrated to envelope the structural requirements of the original design codes as enumerated below. The main hoist, trolley, and bridge members meet ASME NOG-1-2004, Type I, design standards. Original bridge members and components retained for the current single-failure-proof design has been reanalyzed and inspected in accordance with the guidance provided by NUREG-0612, July 1980, Appendix C. The 15-ton auxiliary hoist meets ASME NOG-1-2004, Type II standards and therefore is not considered as single-failure-proof.

9.1.4.3.10.2.1.2 Drops and Tipovers

Upgraded cranes and hoists used during cask handling and loading minimize the potential for load drops. In particular, the FHB crane bridge and main hoist have been upgraded to meet single-failure-proof criteria, as described in Section 9.1.4.2.1.3.

The transfer cask, MPC and its internals, MPC lids, and spent fuel assemblies must be handled in and around the SFP and spent fuel (in the SFP and MPC). With the exception of the spent fuel assemblies, all of these items represent heavy loads.

The potential for drops or tipovers of any of these heavy loads is extremely small due to DCPP's Control of Heavy Loads Program and fuel-handling operations administrative controls. The Control of Heavy Loads Program provides procedures, training, and designs to minimize the potential for load drops, meets PG&E's commitments to NUREG-0612, July 1980, and has been accepted by the NRC (Reference 28). The single-failure-proof upgrade to the FHB crane further reduces the potential for a crane-related failure or mishandling event that could result in the drop of a cask.

Nonetheless, the following potential heavy-load drops have been postulated and evaluated, where credible, in accordance with the guidance of NUREG-0612, July 1980, Section 5.1, demonstrating defense in depth.

9.1.4.3.10.2.2 Cask Loading Accident Analyses

9.1.4.3.10.2.2.1 Loaded Transfer Cask Drops

PG&E has provided defense in depth through crane enhancements (described in Section 9.1.4.2.6) in those locations where a drop could have unacceptable consequences. Use of a single-failure-proof FHB crane ensures that an uncontrolled drop onto the edge of the SFP wall, which could allow the cask to tip or tumble horizontally into the SFP or into the CWA, is not credible. The single-failure-proof FHB crane also precludes drops during the placement of the transfer cask/MPC onto the LPT.

Further, movement of heavy loads over fuel in the SFP, or over any other safe shutdown systems or equipment identified in PG&E's NUREG-0612, July 1980 submittals, is controlled by administrative controls and considers the design of the single-failure-proof crane system and/or travel limit devices.

To ensure the cask does not adversely affect the stored spent fuel in the adjacent racks, the cask is inserted and seated in the transfer cask restraint cup during fuel loading or unloading operations. Structurally separating the transfer cask restraint cup from the fuel storage racks is the spent fuel cask restraint. The restraint is made of 12-inch Schedule 80S Type 304 stainless steel pipe, as shown in Figure 9.1-5.

The evaluations for postulated cask drops do not consider orientations for a tipped cask. This exception to NUREG-0612, July 1980, Appendix A, Consideration (1) is acceptable, due to cask restraints in the SFP and CWA.

9.1.4.3.10.2.2.2 MPC or Transfer Cask Lids, AWS Baseplate Shield, or Lifting Yoke Drops into Loaded Cask

While these components are classified as heavy loads and handling them over the MPC is required for dry fuel operations, drops are not considered credible because they are handled with a single-failure-proof overhead load handling system and rigged in accordance with the Control of Heavy Loads Program.

9.1.4.3.10.2.2.3 Operational Errors and Mishandling Events

The design of the dry cask handling system and associated administrative controls provide assurance that operational errors and mishandling events will not result in an increase in the probability or consequences of an accident previously analyzed. The following operational errors and mishandling events were evaluated and found to either have consequences within the design or licensing basis of DCPP, be precluded by

compliance with the Control of Heavy Loads Program and/or operations procedures, or to not be credible.

- SFP Liner Breach Due to Cask Drop
- Crane Mishandling Operation with Transfer Cask/MPC Resulting in Horizontal Impact or Drops Outside of the Analyzed Lift Points
- Loss of the Transfer Cask Water Jacket Water During MPC and Cask Handling Operations
- Boron Dilution of the SFP and Associated Criticality Concerns
- Loading of an Unauthorized Fuel Assembly

9.1.4.3.10.2.2.4 Support System Malfunctions

The following support system malfunctions have been evaluated and found to not adversely affect plant safety:

- Loss of Electrical Power or Component Failures During Handling Operations
- Rupture of MPC Dewatering, Vacuum, FHD, or Related Closure System Lines or Equipment
- Failure of the Low Profile Transporter or Crane Handling Systems

9.1.4.3.10.2.3 Fires

The DCPP Fire Protection Program is described in Section 9.5.1. The program incorporates the requirements of the ISFSI fire analyses, such that the required controls are provided to ensure the plant and the ISFSI components remain within their licensing bases.

<u>Inside the FHB</u>

The transporter and its associated fuel tank remain outside of the buildings. However, transient materials brought into the FHB associated with dry cask storage activities could provide additional fire loading. These activities and materials are under the control of DCPP's Fire Protection Program. The current program ensures that ignition sources are monitored and that combustible loading requirements for the FHB areas are followed. To the extent practical, combustibles are kept away from the transfer cask to minimize the effects of any potential fire.

Outside the FHB

The Fire Protection Program ensures potential fires during the transport and storage are handled consistently with the plant program requirements and meet the assumptions described in the Diablo Canyon ISFSI UFSAR. Prior to any cask transport, a walkdown is performed to ensure local combustible materials, including transient combustibles, are controlled in accordance with ISFSI fire protection requirements.

9.1.4.4 Tests and Inspections

As part of normal plant operations, the fuel handling equipment is inspected for operating conditions prior to each refueling operation. During the operational testing of this equipment, administrative controls are followed that will affirm the correct performance of the FHS interlocks.

Prior to each cask loading operation, the fuel and cask handling equipment is inspected for operating conditions During operational testing of the equipment, procedures are followed to affirm the correct performance of interlocks and controls.

9.1.4.5 Instrumentation Applications

For instrumentation and control systems for the FHS, refer to Section 9.1.4.3.3.

9.1.5 REFERENCES

1. Seismic Evaluation for Postulated 7.5M Hosgri Earthquake, Units 1 and 2, Diablo Canyon Site, Pacific Gas and Electric Company, 1977.

2. Technical Specifications, Diablo Canyon Power Plant Units 1 and 2, Appendix A to License Nos. DPR-80 and DPR-82, as amended.

3. U.S. Atomic Energy Commission, "Fuel Storage Facility Design Basis," Safety Guide 13, March 1971.

4. IEEE Standard, 279-1971, Criteria for Protection Systems for Nuclear Power Generating Stations, The Institute of Electrical and Electronics Engineers, Inc.

5. NRC letter to PG&E, dated May 30, 1986, granting License Amendments No. 8 to Unit 1 and No. 6 to Unit 2.

6. License Amendment Request 95-01, submitted to the NRC by PG&E letters DCL-95-28, dated February 6, 1995; DCL-95-063, dated March 23, 1995; DCL-95-112, dated May 22, 1995; and DCL-95-178, dated August 22, 1995.

7. PG&E Letter (DCL-96-111) to the NRC, "Response to NRC Bulletin 96-02, 'Movement of Heavy Loads Over Spent Fuel, Over Fuel in the Reactor Core, or Over Safety-Related Equipment,'" dated May 13, 1996.

8. License Amendment Request 01-02, Credit for Soluble Boron in the Spent Fuel Pool Criticality Analysis, PG&E Letter DCL-01-096, dated September 13, 2001, supplemented by PG&E Letter DCL-02-022, dated February 27, 2002.

9. License Amendments 154/154, Credit for Soluble Boron in the Spent Fuel Pool Criticality Analysis, issued by the NRC, September 23, 2003.

10. License Amendment Request 02-03, Spent Fuel Cask Handling, PG&E Letter DCL-02-044, dated April 15, 2002.

11. License Amendments 162 and 163, Spent Fuel Cask Handling, issued by the NRC, September 26, 2003.

12. Diablo Canyon ISFSI Final Safety Analysis Report Update.

13. PG&E Letter (DCL-03-126) to the NRC, "Request for Exemption from 10 CFR 50.68, Criticality Accident Requirements, for Spent Fuel Cask Handling," dated October 8, 2003, supplemented by PG&E Letters (DCL-03-150 and DIL-03-014), "Response to NRC Request for Additional Information Regarding Potential Boron Dilution Events with a Loaded MPC in the DCPP SFP," dated November 25, 2003.

14. NRC Letter to PG&E, dated January 30, 2004, "Exemption from the Requirements of 10 CFR 50.68(b)(1)."

15. License Amendment Request 04-07, Revision to Technical Specifications 3.7.17 and 4.3 for Cycles 14-16 for a Cask Pit Spent Fuel Storage Rack, PG&E Letter DCL-04-149 dated November 3, 2004.

16. Deleted in Revision 20.

17. Deleted in Revision 20.

18. NRC Generic Letter GL 80-113, "Control of Heavy Loads," December 22, 1980.

19. PG&E Letter to NRC, "Control of Heavy Loads (NUREG-0612)," September 30, 1982.

20. PG&E Letter to NRC, "Control of Heavy Loads (NUREG-0612)," May 9, 1983.

21. NEI 08-05 (Rev. 0), "Industry Initiative on Control of Heavy Loads," July 2008.

22. NRC Safety Evaluation, “NEI 08-05, Revision 0, Industry Initiative on Control of Heavy Loads,” September 5, 2008.

23. PG&E Calculation SAP DIR No. 9000040722, Legacy HID-12, Binder No. MR-11 (S&L Calculation 2008-13003, “Analysis of Postulated Reactor Vessel Head Drop for DCPP,” Proprietary and Confidential, Sargent & Lundy, LLC).

24. Westinghouse Calculation No. A-DP1 -FE-0001, "DCPP Units 1 &2 Spent Fuel Criticality Analysis," September 2001.

25. PG&E Vendor Document 6021773-88, "WCAP-16985-P Rev.2, DCPP Tavg & Tfeed Ranges Program NSSS Engineering Report," April 2009.

26. Holtec Report HI-931 077 Rev. 3, "Criticality Safety Evaluation of Region 2 of the Diablo Canyon Spent Fuel storage Racks w/ 5% Enrichment," June 1995.

27. PG&E Letter (DCL-12-117) to NRC, “Summary of Regulatory Commitment Changes January 1, 2011, Through December 31, 2011,” Dated November 20, 2012.

28. NRC Supplemental Safety Evaluation Report (SSER) 31 for Diablo Canyon Power Plant, April 1985.

9.2 WATER SYSTEMS

This section describes all of the auxiliary water supply and cooling water systems in the plant except for the fire protection system, which is discussed in Section 9.5.1 and the seawater supply to the service cooling water (SCW) heat exchangers, which is described in Section 10.4.5. Water used in the plant is a combination of processed seawater and well water.

9.2.1 SERVICE COOLING WATER SYSTEM

The SCW system, shown in Figure 3.2-15, is a closed system used to cool equipment in the secondary portion of the plant. The following sections provide information on (a) design bases, (b) system description, (c) safety evaluation, (d) tests and inspections, and (e) instrumentation applications.

9.2.1.1 Design Bases

The SCW system is used in the secondary or steam and power conversion portion of the plant only. The design classification for the SCW system is given in the DCPP Q-List (see Reference 8 of Section 3.2). The design requirements for flow are based on the heat load demands of the various components cooled by the SCW system. The SCW system does not cool any component required for safe shutdown.

9.2.1.2 System Description

The SCW system is a closed system that supplies buffered cooling water for the following plant equipment:

(1) Plant air compressors and aftercoolers

(2) Main turbine lube oil reservoir coolers

(3) Electrohydraulic control coolers

(4) Condensate pump motor upper bearing

(5) Condensate booster pump lube oil cooler

(6) Generator seal oil coolers

(7) Incore instrument chiller (Supply and return to this system is isolated and is not in use)

(8) Personnel access control room air conditioning

(9) Plant air dryer cooler

(10) Condenser vacuum pump seal water cooler

(11) Heater No. 2 drain pump

(12) Feed pump drive turbine Nos. 1 and 2 lube oil coolers

(13) Fuse wheel cooler

(14) Generator exciter coolers

(15) Isophase bus coolers

(16) Onsite technical support center air conditioning condenser

(17) Post-loss-of-coolant accident (LOCA) sampling system room air conditioning

(18) Air conditioning for traveling crew facilities room (Unit 2 only)

(19) Secondary process isothermal bath water chiller

The service water heat exchangers are cooled by the circulating water system (CWS) described in Section 10.4.5. Makeup water to the system is from the makeup water system (MWS) described in Section 9.2.3. This is controlled automatically by the level in the service water head tank.

9.2.1.3 Safety Evaluation

Since no safety-related (Design Class I) components are cooled by the SCW system, complete shutdown of the system does not affect safe operation or shutdown of the reactor. In all safety analyses where loss of offsite power is postulated, the SCW system is assumed to be unavailable. The low operating pressure and temperature of the system minimize the probability of line failures; and the physical location of the lines and components cooled by the system is such that the failure of a service water header would not create an adverse environment for any Design Class I components.

9.2.1.4 Tests and Inspections

The operating components are in either continuous or intermittent use during normal plant operation, and no additional periodic tests are required. Periodic visual inspections and preventive maintenance are conducted in accordance with normal plant operating practices.

9.2.1.5 Instrumentation Applications

The operation of the system is monitored with the following instrumentation:

(1) High and low level alarms in the service water head tank

(2) Automatic pump start pressure switches on the common pump discharge

(3) Temperature sensing devices at:

  (a) Main turbine reservoir lube oil coolers outlet

  (b) SCW supply header

  (c) Isophase bus cooler fans hot air inlet

  (d) Generator exciter and fuse wheel cooler water return

  (e) Air compressor cooling water returns

  (f) Post-LOCA sampling system room air conditioning system inlet and outlet

(4) Pressure sensing devices at:

  (a) SCW pumps outlet

  (b) CCW Chemical Addition System

  (c) SCW heat exchanger inlets and outlets

  (d) Main turbine lube oil coolers water supply

  (e) Post-LOCA sampling system room air conditioning system inlet and outlet

9.2.2 COMPONENT COOLING WATER SYSTEM

The component cooling water (CCW) system, shown in Figure 3.2-14, is a closed-cycle cooling system that transfers heat from nuclear (primary) plant equipment and other systems/components (Reference Table 9.2-4) during normal plant operation, plant cooldown, and following a LOCA or main steam line break (MSLB) to the auxiliary saltwater (ASW) system. Except for normally closed makeup lines and seal water make-up to the waste gas compressor, there is no direct connection between the CCW system and other systems. The CCW system provides a monitored intermediate barrier

between equipment and components handling radioactive fluids and the auxiliary saltwater (ASW) system.

9.2.2.1 Design Bases

9.2.2.1.1 General Design Criterion 2, 1967 - Performance Standards

The CCW system is designed to withstand the effects of or is protected against natural phenomena, such as earthquakes, tornados, flooding conditions, winds, ice, and other local site effects.

9.2.2.1.2 General Design Criterion 3, 1971 - Fire Protection

The CCW system is designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

9.2.2.1.3 General Design Criterion 4, 1967 - Sharing of Systems

The CCW systems or components are not shared by the DCPP Units unless safety is not impaired by the sharing.

9.2.2.1.4 General Design Criterion 11, 1967 - Control Room

The CCW system is designed to support safe shutdown and to maintain safe shutdown from the control room or from an alternate location if control room access is lost due to fire or other causes.

9.2.2.1.5 General Design Criterion 12, 1967 - Instrumentation and Control Systems

Instrumentation and controls are provided as required to monitor and maintain CCW system variables within prescribed operating ranges.

9.2.2.1.6 General Design Criterion 17, 1967 - Monitoring Radioactivity Releases

The CCW system includes means to detect the presence of in-leakage from interfacing systems that may be radioactive to avoid potential releases to the environment.

9.2.2.1.7 General Design Criterion 53, 1967 - Containment Isolation Valves

CCW system containment penetrations that require closure for the containment isolation function are protected by redundant valving and associated apparatus.

9.2.2.1.8 General Design Criterion 57, 1967 - Provisions for Testing Isolation Valves

The CCW system provides capability for testing functional operability of valves and associated apparatus essential to the containment function for establishing that no failure has occurred and for determining that valve leakage does not exceed acceptable limits.

9.2.2.1.9 10 CFR 50.49 - Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants

CCW system electric components that require environmental qualification (EQ) are qualified to the requirements of 10 CFR 50.49.

9.2.2.1.10 10 CFR 50.55a(f) - Inservice Testing Requirements

CCW system ASME Code components are tested to the requirements of 10 CFR 50.55a(f)(4) and 10 CFR 50.55a(f)(5) to the extent practical.

9.2.2.1.11 10 CFR 50.55a(g) - Inservice Inspection Requirements

CCW system ASME Code components (including supports) are inspected to the requirements of 10 CFR 50.55a(g)(4) and 10 CFR 50.55a(g)(5) to the extent practical.

9.2.2.1.12 10 CFR 50 Appendix R (Sections III.G, III.J, III.L Only) - Fire Protection Program for Nuclear Power Facilities Operating Before January 1, 1979

The CCW system is designed to provide decay heat removal to achieve and maintain a safe shutdown condition for fire events.

9.2.2.1.13 CCW System Safety Function Requirements

(1) *Waste Heat Removal*

The CCW system is designed to remove waste heat from the nuclear (primary) plant equipment and components during normal plant operation, plant cooldown, and design basis accidents.

(2) *Single Failure*

The CCW system and ASW system are essentially considered a single heat removal system for the purpose of assessing the ability to sustain either a single active or passive failure and still perform design basis heat removal.

(3) *Dynamic Effects*

Vital portions of the CCW system are designed, located, or protected against dynamic effects.

(4) *Redundancy*

The CCW system components considered vital are redundant.

(5) *Isolation*

The CCW system includes provision for isolation of system components and may be split into separate trains during long term post-LOCA conditions.

(6) *Leak Detection*

The CCW system serves as an intermediate system between normally or potentially radioactive systems and the ASW system.

9.2.2.1.14 Regulatory Guide 1.97 Revision 3, May 1983 - Instrumentation for Light-Water Cooled Nuclear Power Plants to Assess Plant and Environs Condition During and Following an Accident

The CCW system provides instrumentation to monitor CCW flow and temperature and containment isolation valve (CIV) position indication on the monitor light box (for applicable CCW valves) during and following an accident.

9.2.2.1.15 Generic Letter 89-10, June 1989 - Safety Related Motor-Operated Valve Testing and Surveillance

The CCW system safety related and position changeable motor-operated valves meet the requirements of GL 89-10 and associated GL 96-05.

9.2.2.1.16 Generic Letter 89-13, July 1989 - Service Water System Problems Affecting Safety Related Equipment

The CCW system heat exchangers are subject to monitoring and maintenance programs to ensure capability to perform their safety function as an alternative to a testing program. Maintenance practices, operating and emergency procedures, and training ensure effectiveness of these programs.

9.2.2.1.17 Generic Letter 96-06, September 1996 - Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions

The CCW system is designed so that it is not subject to the hydrodynamic effects of water hammer, reduced cooling effectiveness due to two phase flow conditions, or overpressurization of isolated piping during a LOCA or MSLB event.

9.2.2.1.18 NUREG-0737 II.K.3.25, November 1980 - Effect of Loss of Alternating Current Power on Pump Seals

The CCW system is designed such that the reactor coolant pump seals can withstand a complete loss of offsite alternating current power for at least two hours.

9.2.2.1.19 10 CFR 50.63 - Loss of All Alternating Current Power

The CCW system is required to perform its safety function of waste heat removal in the event of a Station Blackout.

9.2.2.2 System Description

The CCW system is designed to provide cooling water to vital and nonvital components and to operate in all plant operating modes, including normal power operation, plant cooldown, and emergencies, including a LOCA or MSLB.

The CCW system includes three CCW pumps, two CCW heat exchangers, and an internally baffled CCW surge tank as described in Table 9.2-3. The piping system consists of three parallel headers. Two are separable redundant vital service headers A and B, which serve only the unit's ESF equipment and the post-LOCA sample cooler (header A only). A miscellaneous service loop C serves nonvital equipment. Except for normally closed makeup lines and seal water make-up to the waste gas compressor, there is no direct connection between the CCW system and other systems. The equipment cooled is tabulated in Table 9.2-4. Nominal flows for major CCW system operating modes are tabulated in Table 9.2-5.

Cooling water for the CCW heat exchangers is supplied from the ASW system. Together, CCW/ASW support heat transfer to the UHS. The CCW system serves as an intermediate system between the RCS and ASW system, ensuring that any leakage of radioactive fluid from the components being cooled is contained within the plant.

Operation under normal and accident conditions will be as follows:

(1) *Normal Operation*

During normal operation, all loops are in operation. Two CCW pumps and one or two CCW heat exchangers are in use and are capable of serving all

operating components. The third pump and the second heat exchanger generally provide backup during normal operation.

(2) *Plant Cooldown*

During the cooldown phase of a unit shutdown, all loops are operated with two or three pumps and two heat exchangers used for the removal of residual and sensible heat from the RCS through the residual heat removal (RHR) system (see Figure 3.2-10). If one of the pumps or one of the heat exchangers is inoperative, orderly shutdown is not affected, but the time for cooldown is extended.

(3) *Accident Conditions*

In the event of a LOCA or MSLB, three CCW pumps are placed in service to provide protection against an active failure. The safety injection (SI) signal initiates an automatic start signal for the standby CCW pump. When containment pressure reaches the high containment pressure setpoint, a Phase A isolation signal is generated and CCW flow to the excess letdown heat exchanger is isolated. When the containment pressure reaches the high-high containment pressure setpoint (containment Phase B isolation), a signal to close the C (non-vital) header isolation valve is generated because components on the C header are not required for post-accident cooling. The portion of the non-vital header that serves the reactor coolant pumps and vessel support coolers located within the reactor primary shield wall is independently isolated (Phase B), due to its vulnerability during a LOCA, to assure isolation

The CCW system is required to provide cooling water to the ESF pump coolers and the CFCUs during the injection and recirculation phase of a LOCA and during an MSLB. The CCW system is flow balanced to ensure that adequate flow is maintained to each component. Following the post-LOCA injection phase, the CCW system is realigned for the recirculation phase by valving in the RHR heat exchangers to cool the water collected in the containment sump. Additionally, if a containment Phase B isolation signal has occurred but the C header does not automatically isolate during the injection phase, it is manually isolated prior to realignment for recirculation.

The additional heat load on the CCW system is controlled by plant operators by limiting the heat input equipment (operating CFCUs and RHR heat exchangers) based on the available heat removal equipment (operating CCW heat exchangers and ASW pumps) to prevent the CCW system supply temperature from exceeding its design basis limit.

During long-term postaccident recirculation operation, the CCW system may be manually realigned into two separate redundant loops. Each loop has a pump and a heat exchanger and is capable of fulfilling the minimum long-term cooling requirements. This provides protection against a passive failure in one loop. Should one loop fail, the other loop is unaffected, and the ESF components that it serves remain operative.

Due to its vulnerability to a loss of inventory, the CCW system should be split into separate trains as soon as possible after aligning for long-term post LOCA recirculation if plant conditions are acceptable. The decision to split CCW trains will be made by the Technical Support Center based on the physical integrity of the trains, the availability of active components, and the reliability of power systems. This long-term postaccident alignment provides further assurance of the capability to withstand a passive failure. See Reference 8.

Design data for some major CCW system equipment are listed in Table 9.2-3. The CCW system consists of the following major pieces of equipment.

9.2.2.2.1 Component Cooling Water Pumps

The three CCW pumps that circulate CCW through the CCW system are horizontal, double suction, centrifugal units. The pumps operate on electric power from the vital 4.16 kV buses that can be supplied from either normal or emergency sources.

9.2.2.2.2 Component Cooling Water Heat Exchangers

The two CCW heat exchangers are shell and tube type. Seawater circulates through the tube side. The shell is carbon steel, and the tubes are 90-10 Cu-Ni.

9.2.2.2.3 Component Cooling Water Surge Tank

The CCW surge tank, which is connected by two surge lines to the vital headers on the pump suction piping, is constructed of carbon steel. The tank is internally divided into two compartments by a partial height partition to hold two separate volumes of water. This arrangement provides redundancy to accommodate a passive failure when the CCW system is manually realigned into two trains.

The surge tank accommodates thermal expansion and contraction, and in- or out-leakage of water from the system. The tank is normally pressurized with nitrogen to a minimum of 17 psig to provide sufficient static head to prevent boiling and two-phase flow conditions in the CCW to the CFCUs during a postulated large break LOCA coincident with a loss of offsite power. The primary source of nitrogen is the Class II nitrogen system. (Reference 7)

A back-pressure regulator is provided downstream of the surge tank vent valve to prevent the pressure in the surge tank from exceeding the desired pressure range. This back-pressure control valve maintains surge tank pressure at all times at its setpoint by relieving excess nitrogen to the atmosphere. The surge tank vent valve closes when a high radiation level is detected by radiation monitors provided in the CCW pump discharge headers. The monitor also actuates an alarm in the control room.

In the event of a low level in the surge tank, makeup water is automatically added to the system through control valves from the MWS (see Section 9.2.3).

9.2.2.2.4 Chemical Addition System

The closed chemical addition system supplies various treatment chemical solutions to the CCW. The system contains chemical addition tanks, an injection pump, pressure and flow indication, and a fume hood for personnel protection. The system is common to Unit 1 and Unit 2 CCW and also supplies chemicals to the SCW.

9.2.2.2.5 Component Cooling Water Corrosion Monitor

A corrosion test loop is provided to monitor the effectiveness of the corrosion inhibitor used in the CCW system. The test loop consists of four coupon locations and two spare connections for future use. Test coupons of representative materials are exposed to CCW system conditions for a period of time and then analyzed to determine the overall corrosion rates.

9.2.2.2.6 Residual Heat Removal Heat Exchangers

Control room operated air-actuated valves control the CCW flow to the RHR heat exchangers (described in Chapter 5) in order to place these components in service during plant cooldown or after a LOCA. The valves, which open on loss of air, are provided with a Design Class I backup air supply to allow positive operator control after loss of the plant compressed air system.

9.2.2.2.7 Containment Fan Coolers

CCW is supplied to the containment fan coolers (described in Chapter 6) by the two vital headers. Two fan coolers are on loop A and three on header B. Drain and isolation valves are provided on each side of the fan coolers allowing each cooler to be isolated individually for leakage testing. The flow of CCW through the fan coolers is throttled (position fixed) by a manual valve downstream of each fan cooler to ensure adequate flow to support design basis accident analyses as discussed below. The air-actuated temperature control valves, provided originally to limit the flow to the CFCUs, are not required. Therefore, instrument air to these valves has been isolated and the valves remain in the fully open position.

The above valve alignment assures minimum required flow through each fan cooler under accident conditions without any immediate automatic or operator action. The only required manual action would be header C isolation when transferring to post-LOCA recirculation.

The ability of the CCW system to adequately remove heat from containment without overheating the CCW fluid is demonstrated by several transient analyses. For determining adequate containment heat removal, the minimum CCW flow rate to CFCUs is 1600 gpm to the cooling coils. For determining maximum CCW temperature, the maximum CCW flow rate to CFCU cooling coils is 2500 gpm. Data presented in Tables 9.2-5 and 6.2-26 are nominal data that are enveloped by these extremes. CCW is also supplied to a separate cooling coil located in the CFCU motor enclosure. This cooling flow path is in parallel to the CFCU cooling coil flow path.

Specific conditions, such as inlet and outlet temperatures to the CFCUs, are dynamically calculated and vary over the course of the transient according to the scenario assumptions.

9.2.2.2.8 Reactor Vessel Supports

Cooling water is provided to the reactor vessel supports (described in Chapter 3) to prevent overheating and dehydration of the concrete for the reactor vessel support shoes. This is accomplished by the use of water-cooled steel blocks between each of the four vessel support pads and its support shoe. CCW flows in labyrinth flow passages in the blocks providing heat removal sufficient to prevent the concrete from dehydrating.

9.2.2.2.9 Valves

The valves in the CCW system are standard commercial valves constructed of carbon steel with carbon steel, bronze, or stainless steel trim. Since the CCW is normally not radioactive, special features to prevent leakage to the atmosphere are not provided. Self-actuated spring-loaded relief valves are provided for lines and components that may be pressurized to above their design pressure by improper operation or malfunction. The valves associated with CCW pumps, the CCW heat exchangers, large piping and associated instrumentation are located outside the containment and are therefore available for maintenance and inspection during power operation.

CCW valves associated with containment isolation are discussed as a part of the containment isolation system (Section 6.2.4).

The equipment vent and drain lines have manual valves that are normally closed (the surge tank vent line has an automatic back-pressure regulator that is also normally closed) unless the equipment is being vented or drained for maintenance or repair operations.

The relief valves on the CCW lines downstream of the sample, letdown, seal water, spent fuel pool, and RHR heat exchangers are sized to relieve the volumetric expansion occurring if the exchanger shell-side is isolated and high-temperature coolant flows through the tube side. The relief pressures do not exceed 150 psig.

Relief valves for volumetric expansion are provided on the downstream side of the waste gas compressor heat exchanger and the abandoned in place boric acid and waste evaporator condenser. Relief pressures do not exceed 150 psig. Waste gas compressor relief and evaporator packages relief is back to the return line downstream of the respective shutoff valve.

The relief valve on the CCW surge tank is sized to relieve the maximum flow-rate of water that could enter the surge tank following an RHR heat exchanger tube rupture. The discharge from this valve is directed to the skirted area under the surge tank and then enters a floor drain routed to the auxiliary building sump.

9.2.2.2.10 Piping

All piping components of the CCW system are designed to the applicable codes and standards listed in the DCPP Q-List (Reference 8 of Section 3.2). CCW system piping is carbon steel, with welded joints and flanged connections at components, and designed to USAS B31.7 for Class II and Class III pipe. A molybdate blend solution is added to the CCW as a corrosion inhibitor.

9.2.2.2.11 Component Cooling Water Filter Housing

The CCW side-stream filter is provided in order to remove particulates in the CCW system. The filter housing is designed for 150 psig at 200°F.

9.2.2.2.12 Radiation Monitoring

Leaks in components being cooled are detected by radiation monitors located in the two CCW pump discharge headers. Because the discharge of all three CCW pumps is into these two headers, the flow from any combination of pumps placed in operation is monitored continuously. During normal plant operations, the inservice CCW pump discharge header is determined by which of the two CCW heat exchangers is operating (see Figure 3.2-14). A single failure in the radiation monitoring system on the discharge header in operation alarms in the control room. The operator can take action to correct the problem or to put into operation the redundant heat exchanger and header. This action places the redundant radiation monitoring system into operation. During operation with both heat exchangers in service, both radiation monitors are in service continuously. Because of the discharge piping configuration, only the radiation monitor associated with the in-service CCW heat exchanger is sampling flow representative of the bulk system.

The CCW may become contaminated with radioactive water from any of the following sources:

(1) Leakage in any heat exchanger tube or tubesheet in the chemical and volume control system (CVCS), the nuclear steam supply system (NSSS) sampling system, the RHR system, the spent fuel pool cooling system, or the gaseous radwaste system

(2) Leakage in a cooling coil for the thermal barrier cooler on a reactor coolant pump

(3) Leakage in a containment fan cooler coil following an accident

9.2.2.3 Safety Evaluation

Refer to Section 3.1 for a more comprehensive discussion of General Design Criteria applicable to DCPP. In addition to Section 3.1, other UFSAR sections are referenced, where appropriate, for individual design basis requirements discussed under 9.2.2.3.

9.2.2.3.1 General Design Criterion 2, 1967 - Performance Standards

The buildings that contain the majority of the CCW system SSCs (containment, auxiliary and fuel handling building, and the turbine building) are Design Class I or QA Class S (Section 3.8). These buildings or applicable portions thereof are designed to withstand the effects of winds and tornados (Section 3.3), floods and tsunami (Section 3.4), external missiles (Section 3.5), earthquakes (Section 3.7), and other appropriate natural phenomena and to protect CCW SSCs, and their safety functions, from damage due to these events. The loss of CCW components that are not contained within these buildings, and are directly exposed to potential wind and tornado loads, has been evaluated. Loss of this equipment does not compromise the capability to safely shut down the plant (Section 3.3.2.3).

The CCW system SSCs important to safety are designed to perform their safety functions under the effects of earthquakes. The Design Class I portions of the CCW system are safety related and Seismic Category I. The Design Class II portions of CCW (except the chemical addition system) as well as components from other systems served by the non-vital CCW header (header C) have been analyzed to Seismic Category I requirements to ensure pressure boundary integrity is maintained. The chemical addition system is not required for the system to perform its safety function and is normally isolated at the Design Class I to Class II code break boundary.

The makeup water for the CCW surge tank is provided by the makeup water system (MWS). This source is backed up by several alternative sources, including the Condensate Storage Tank (CST). Seismic design capability of makeup sources is discussed in Section 9.2.3.

The primary source of nitrogen pressurization for the CCW surge tank is the nonseismically-qualified Design Class II nitrogen system. If this supply is lost, Design Class I nitrogen is automatically supplied from dedicated bottles. The Class II plant instrument air supply (with a normally closed valve) is also available to provide the required pressurization of the tank.

9.2.2.3.2 General Design Criterion 3, 1971 - Fire Protection

The CCW system is designed to the fire protection guidelines of BTP APCSB 9.5.1 (Appendix 9.5B Table B-1)

9.2.2.3.3 General Design Criterion 4, 1967 - Sharing of Systems

The design basis of the CCW system does not require sharing of SSCs between Units 1 and 2 because each unit has its own CCW system. A means to cross-tie the Unit 1 and Unit 2 CCW systems (valving associated with the spare waste gas compressor piping) is available in the event of a loss of surge tank for supplying CCW from a unit with an operating CCW system to a unit with an inoperable system (e.g., to permit shutdown). However, the associated valves to Unit 2 CCW are normally closed and cross-connection is procedurally controlled. Therefore, safety is not impaired by the sharing.

9.2.2.3.4 General Design Criterion 11, 1967 - Control Room

Appropriate CCW system instruments and controls are provided to permit system operation from the control room. (Section 9.2.2.5) The CCWS pumps are designed to be remotely operated from the hot shutdown panel in the event that the main control room is uninhabitable (Section 7.4.2.1.2.2).

9.2.2.3.5 General Design Criterion 12, 1967 - Instrumentation and Control Systems

Required controls for CCW components are provided for system operation. Instrumentation is provided for monitoring CCW system parameters during normal operations and accident conditions (Section 9.2.2.5).

9.2.2.3.6 General Design Criterion 17, 1967 - Monitoring Radioactivity Releases

A radiation monitor associated with each of the two CCW pump discharge headers monitors the CCW system for radioactive in-leakage. Because the discharge of all three CCW pumps is into these two headers, the flow from any combination of pumps placed in operation is monitored continuously.

9.2.2.3.7 General Design Criterion 53, 1967 - Containment Isolation Valves

The CCW system containment penetrations that are credited as part of the containment isolation system include CCW supply/return for containment fan cooler (Group D), reactor coolant pump (Group A), and excess letdown heat exchangers (Group C). These lines can be isolated remotely from the control room. The configuration / requirements for each Group are described in Section 6.2.4.2 and a description of the isolation valves / piping configuration for each penetration is provided in Table 6.2-39.

9.2.2.3.8 General Design Criterion 57, 1967 - Provisions for Testing Isolation Valves

CCW system piping that penetrates containment is provided with the capability for leak detection and operability testing. Most of the piping, valves, and instrumentation inside the containment, including the vital components, are located outside the crane wall at an elevation above the water level in containment following an accident. Exceptions are the cooling lines for the reactor coolant pumps and the reactor vessel support which are on miscellaneous nonvital header "C." This location affords radiation shielding which permits maintenance and inspection during power operation if required.

9.2.2.3.9 10 CFR 50.49 - Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants

CCW system SSCs required to function in harsh environments under accident conditions are qualified to the applicable environmental conditions to ensure that they will continue to perform their safety functions. Section 3.11 describes the DCPP EQ Program and the requirements for the environmental design of electrical and related mechanical equipment. The affected components include valves, switches and flow transmitters and are listed on the EQ Master List.

9.2.2.3.10 10 CFR 50.55a(f) - Inservice Testing Requirements

The inservice testing (IST) requirements for CCW system components are contained in the IST Program Plan and comply with the ASME Code for Operation and Maintenance of Nuclear Power Plants.

9.2.2.3.11 10 CFR 50.55a(g) - Inservice Inspection Requirements

The inservice inspection (ISI) requirements for CCW system components are contained in the ISI Program Plan and comply with the ASME B&PV Code Section XI.

9.2.2.3.12 10 CFR 50 Appendix R (Sections III.G, III.J, III.L Only) - Fire Protection Program for Nuclear Power Facilities Operating Before January 1, 1979

10 CFR Appendix R requires the evaluation of the safe shutdown capability for DCPP in the event of a fire and the loss of offsite power. The CCW system satisfies the applicable requirements of 10 CFR Appendix R Section III G, fire protection of safe shutdown capability (see Appendix 9.5G), Section III J, emergency lighting (see Appendix 9.5D), and Section III L (alternative dedicated shutdown capability (see Appendix 9.5E), by either meeting the Appendix R technical requirements or by providing an equivalent level of fire safety.

9.2.2.3.13 CCW System Safety Function Requirements

A malfunction analysis of pumps, heat exchangers, and valves is presented in Table 9.2-7.

(1) *Waste Heat Removal*

The CCW system is designed to remove waste heat from nuclear (primary) plant equipment and components during normal plant operation, plant cooldown, and accident conditions. Analytical results show that the CCW system performs adequately during design basis accidents while providing cooling to all safety-related components cooled by CCW. In the event of a LOCA or MSLB, non-vital / unnecessary heat loads are isolated and analyses demonstrate that the CCW system does not exceed its design basis temperature limit under maximum mechanistically calculated heat loads. At least two CCW pumps must be in operation to ensure that the minimum CCW flow rates are achieved.

Safety analyses for containment peak pressure demonstrate that only one ASW pump and one CCW heat exchanger is required to provide sufficient heat removal from containment to mitigate a MSLB or LOCA (see Section 6.2). The analyses were performed assuming minimum CCW flow rate to the CFCUs. Other critical assumptions incorporated into those analyses include the CCW flow rate to the CCW heat exchanger, and CCW heat exchanger UA (heat transfer index and area of the heat exchanger, see Section 6.2).

Analyses that demonstrate the CCW system does not exceed its design basis temperature limit following a LOCA or MSLB credit one or two ASW pumps, depending on the assumed single failure. A single CCW heat exchanger was assumed to be in service throughout the transient (except as noted in Section 9.2.2.2). These analyses assume single failures that maximize heat input to the CCW system and maximum flow rates consistent with the system flow balance. The limiting post-LOCA injection phase CCW temperature transient is an SSPS Train A failure scenario.

The limiting post-LOCA recirculation phase CCW temperature transient results from an SSPS Train A failure scenario that conservatively assumes that only three CFCUs are in operation during the injection phase. The highest peak CCW temperature following an MSLB results from a split rupture at 30 percent power with the failure of a main steamline isolation valve. All of the limiting CCW temperature analyses assume 64°F ocean water and a single CCW heat exchanger in service. A separate set of analyses assuming a 70°F ocean water temperature credit two CCW heat exchangers in service to address operation with an elevated UHS temperature (Reference 3). Technical Specifications require that the second CCW heat exchanger be placed in service when the UHS temperature is greater than 64°F.

The CCW system is qualified for a maximum post-accident supply temperature of 140°F for a period of up to 6 hours, and a long-term continuous supply temperature of 120°F. Therefore, predicted CCW temperatures during both normal and accident conditions are within the limits of the CCW system temperature qualification.

(2) *Single Failure*

The CCW system is designed to continue to perform its safety function following an accident assuming a single active failure during the short-term recovery period and either a single active or passive failure during the long-term recovery period. Refer to Section 3.1.1 for a description of DCPP single failure criteria and definition of terms. During normal operation and up to 24 hours after an accident (the short-term recovery period), the CCW headers are crosstied. This configuration will withstand a single active failure without the loss of safety function. For a passive failure (up to a 200 gpm leak for 20 minutes), operator mitigation action (consisting of valve manipulations) is credited to stop leaks (see Table 9.2-7). The CCW headers are evaluated for separation, per procedure, during long term post LOCA recirculation. When separated during the remainder of the recovery period, this configuration will withstand either an active failure or a passive failure without the loss of safety function.

(3) *Dynamic Effects*

The plant is designed so that a postulated piping failure will not cause the loss of needed functions of safety related systems and structures that would prevent safe shutdown. The measures taken in design and construction of the plant for protection against dynamic effects both inside and outside containment are discussed in Section 3.6.

CCW SSCs important to safety are designed, located, or protected against dynamic effects. With respect to post-accident conditions in containment,

most of the piping, valves, and instrumentation are located outside the crane wall at an elevation above the water level in containment following an accident. Exceptions are the cooling lines for the reactor coolant pumps and the reactor vessel support which are on portions of header C inside the crane wall. The vital portions of the CCW system within the containment are protected during accidents from dynamic effects associated with accidents by routing piping away from high energy lines and from credible internal missiles by separation / barriers (Section 6.2.4.4.6).

The CCW pumps, heat exchangers and associated valves, and all of the large piping and instrumentation are located outside containment. Each CCW pump is protected against flooding due to rupture of another because they are located in separate compartments with a raised curb in the doorway to prevent water in the rest of the auxiliary building from entering the compartment. Check valves are provided on each pump discharge to prevent back leakage into a compartment from an operating pump.

Flooding of the CCW heat exchangers is highly improbable because of their location on the turbine building ground level where there are large door openings to allow water to run out, several floor drains, sumps, and a large condenser pit below the elevation of the heat exchangers. Based on this, operation of the heat exchangers would not be impaired by flooding.

(4) *Redundancy*

The CCW system components that are considered vital are redundant. The redundant vital CCW headers served by headers A and B supply cooling water to the containment fan coolers, the RHR heat exchangers, each redundant set of ESF pumps (safety injection, centrifugal charging, and RHR), and the CCW pumps. The automatic flow cutoff (closure of inlet valve) of the non-vital header (served by header C) on containment Phase B isolation is not redundant and operator action is credited prior to realignment for recirculation if automatic isolation fails. However, analyses that assume a failure to isolate during the LOCA injection phase, or during an MSLB, demonstrate that CCW heat removal capability continues to support post-accident cooling requirements without exceeding design temperature limitations (140°F peak and 120°F for six hours).

The three CCW pump motors are on separate vital 4.16 kV buses that have diesel generator standby power sources. The CCW surge tank, which is connected by two surge lines to the vital headers near the pump suction, is internally divided into two compartments by a partial height partition to hold two separate volumes of water. This arrangement

provides redundancy to accommodate a passive failure when the CCW system is manually realigned into two trains. In the event of loss of the Design Class II nitrogen supply, Design Class I nitrogen is supplied from dedicated bottles, or the plant instrument air system will be available to provide the required pressurization of the tank.

Makeup water is supplied to the CCW system through two redundant makeup valves feeding into the two redundant CCW surge lines, described in Section 9.2.3 and schematically shown in Figure 3.2-16. These air-actuated level control valves open automatically when surge tank level decreases below the associated setpoint, and normal operating conditions for the MWS allow immediate makeup to the CCW system through the makeup valves whenever they open.

Redundant radiation monitors are provided in the system for detection of radioactivity entering the CCW system from the reactor coolant system (RCS) and its associated auxiliary systems.

(5) *Isolation*

The CCW piping design includes valving for isolating cooling water flow associated with individual components and for complete isolation of a header. In addition to facilitating maintenance and testing, valving is used to: 1) stop leaks from / into the CCW system, 2) prevent an unmonitored release in the event of a radiation monitor alarm, 3) isolate non-vital header C to accommodate higher heat load under accident conditions, 4) separate CCW into two trains to enhance protection against passive failure for long term accident recovery.

Leaks from the CCW system arise from open drain valves or severed piping, ruptured heat exchanger tube, or other malfunction. The location of a leak can be determined by sequential isolation or visual inspection of equipment and hence stopped by closing the appropriate valve(s). Refer to Table 9.2-7 for an evaluation of leakage from the system.

Leaks into the CCW system can result from heat exchanger tube failures. For the RCP thermal barrier, the system design is to contain the in-leakage to the CCW system within the containment structure. This is accomplished by closure of the outboard containment isolation valve associated with return of CCW from all reactor coolant pump thermal barriers on a high flow signal. All piping and valves required to contain this in-leakage are designed for an RCS design pressure of 2485 psig. Should a coolant leak develop from the postulated failure mode that does not result in automatic flow isolation, the corresponding increase in CCW volume is accommodated by the relief valve on the CCW surge tank. The four relief valves on the CCW returns from thermal barriers are sized to

relieve volumetric expansion and are set to relieve at RCS design pressure.

Table 9.2-6 shows components in the CCW system with a single barrier between CCW and reactor coolant water.

As shown in Table 9.2-6, the pressure and temperature design requirements of the barriers in the RHR heat exchangers, the letdown heat exchanger, and the seal water heat exchanger are less than the RCS pressure and temperature during full power operation. For the letdown heat exchanger and the seal water heat exchanger, this condition results because the pressure and temperature of the reactor coolant water are reduced to the values shown in the table before the flow reaches the components.

In the case of the RHR heat exchangers and RHR pumps (seal coolers), the RCS pressure and temperature are reduced to less than or equal to 390 psig and 350°F before the RHR system is brought into service to complete the cooldown of the reactor. The RHR system is protected from overpressurization as discussed in Section 5.5.7. The controls and interlocks provided for the isolation valves between the RCS and the RHR system are described in Section 7.6.2.1.

Tube failure in components with design pressures and temperatures less than RCS design condition may initiate a leak into the CCW system. The radioactivity associated with the reactor coolant would actuate the CCW system radiation monitor. The monitor in turn would annunciate in the control room and close the vent valve located just upstream of the CCW surge tank back-pressure regulator to prevent the regulator from venting after sensing high radiation. The operator would then take the appropriate action to isolate the failed component. In addition to the radiation monitoring system, the operator would also receive high level and high-pressure alarms from the surge tank as it filled. If the in-leakage continued after the vent valve closed, the surge tank pressure would increase until the high surge tank pressure alarm was received and then the relief valve setpoint was reached. The relief valve on the surge tank will protect the system from overpressurization. The maximum postulated in-leakage into the CCW system is based on an RHR heat exchanger tube rupture. The relief valve will accommodate this flow. Relief valve discharge from the CCW system surge tank is routed to the skirted area under the surge tank, which then enters a floor drain routed to the auxiliary building sump. Refer to Table 9.2-7 for an evaluation of leakage into the CCW system.

Under accident conditions, automatic isolation is initiated for CCW flow to the excess letdown heat exchanger on a containment Phase A isolation

signal and for the C (non-vital) header on a containment Phase B isolation signal. Independently, the portion of the C header serving the reactor coolant pumps and vessel support coolers is also isolated.

(6) *Leak Detection*

Leakage from the CCWS can be detected by a decreasing level in the component cooling water surge tank. Using the tank geometry, an estimate of leakage rate can be determined by timing the change in indicated level. A maximum 200 gpm leak or rupture is postulated. Refer to Table 9.2-7 for a discussion of leakage from the system.

A radiation monitor associated with each of the two CCW pump discharge headers is provided for the CCW system to detect radioactivity entering the CCW system from the reactor coolant system (RCS) and its associated auxiliary systems. In-leakage from components being cooled is detected by a radiation monitor associated with each of the two CCW pump discharge headers. Because the discharge of all three CCW pumps is into these two headers, the flow from any combination of pumps placed in operation is monitored continuously. Leaks can also be detected by surge tank level instrumentation and alarms.

9.2.2.3.14 Regulatory Guide 1.97 Revision 3, May 1983 - Instrumentation for Light-Water Cooled Nuclear Power Plants to Assess Plant and Environs Condition During and Following an Accident

CCW post-accident instrumentation for meeting RG 1.97 guidelines consist of flow indication for CCW supply headers A & B, temperature indication for each CCW heat exchanger outlet, and containment isolation valve (CIV) position indication on the monitor light box for applicable CCW valves (Section 7.5.3.6).

9.2.2.3.15 Generic Letter 89-10, June 1989 - Safety Related Motor-Operated Valve Testing and Surveillance

CCW system motor operated valves are addressed by the DCPP MOV Program Plan, and the plan applies the recommendations of GL 89-10 and associated GL 96-05.

9.2.2.3.16 Generic Letter 89-13, July 1989 - Service Water System Problems Affecting Safety Related Equipment

The applicable recommendations of GL 89-13 for ongoing surveillance and control have been applied to the CCW system, including a monitoring program combining flow testing, trending, inspection, and frequent preventive maintenance. Corrosion inhibitors and additives to prevent biofouling are included as part of preventive maintenance. The CCW heat exchangers provide pressure differential indication in the control room to

alert operators to the need for cleaning and sample coupons are used to assess conditions and effectiveness of the program.

9.2.2.3.17 Generic Letter 96-06, September 1996 - Assurance of Equipment Operability and Containment Integrity during Design-Basis Accident Conditions

GL 96-06 identified the potential for waterhammer or two-phase flow in the portion of the CCW system serving the containment fan cooler units (CFCUs) and for overpressurization of piping in systems that penetrate containment during accident conditions. The CCW nitrogen pressurization system was installed in response to the waterhammer concern to mitigate the possibility of flashing and subsequent waterhammer.

Subsequent review concluded that a limited amount of cavitation was possible during normal operation in the CCW flow downstream of the exit from the CFCUs, but that postaccident conditions would not result in a significant increase in the condition. Because CCWS flow balance, and thus operability, is not affected, there is no impact on the ability of the CCWS to perform its design basis function.

A comprehensive review identified all containment mechanical piping and tubing penetrations and isolated piping segments inside containment. For CCW, other than the nitrogen pressurization system, no other actions were required to be taken.

9.2.2.3.18 NUREG-0737 II.K.3.25, November 1980 - Effect of Loss of Alternating Current Power on RCP Seals

NUREG-0737 II.K.3.25 required confirmation that RCP thermal barriers can withstand a loss of CCW cooling water to the RCP seal coolers due to a loss of AC power for at least two hours. This requirement is accommodated because the CCW pumps are supplied from vital buses that have emergency on-site backup power (Section 9.2.2.2.1). The associated containment isolation valves are also supplied with emergency on-site backup power or are check valves (Section 6.2.4.2).

9.2.2.3.19 10 CFR 50.63 - Loss of All Alternating Current Power

The CCWS provides for safe shutdown and cooldown of the reactor by removing heat from safety-related system components after a Station Blackout. The CCW system is used to cool the reactor coolant pump RCP thermal barriers to prevent overheating and degradation of the RCP seals following an SBO.

The CCW pumps can be provided with alternate AC power (AAC) within 10 minutes of an SBO event.

9.2.2.4 Tests and Inspections

The active components of the CCW system are in either continuous or intermittent use during normal plant operation, and no additional periodic tests are required. Periodic visual inspections and preventive maintenance are conducted in accordance with normal plant operating practice.

9.2.2.5 Instrumentation Applications

The operation of the system is monitored with the following major or vital instrumentation:

(1) Temperature detectors at the inlet and at the outlet of each CCW heat exchanger, with control room temperature indication and alarm for heat exchanger outlet high/low temperatures

(2) A control room flow indicator and low flow alarm for each header

(3) Low-pressure switches with alarms and auto pump start near the inlet to each vital supply header

(4) Radiation monitor and alarm in the two pump discharge headers

(5) Control room level indicator and high/low level alarm for each half of the CCW surge tank

(6) Flow indication, temperature indication, or pressure indication on the equipment return lines

(7) Surge tank low and high pressure alarms in the control room

(8) Valve position indications in the control room

Design flowrates for normal, loss of coolant, and cooldown conditions are listed in Table 9.2-5.

9.2.3 MAKEUP WATER SYSTEM

The MWS, shown in Figure 3.2-16, supplies demineralized makeup water of the quality and quantity necessary for normal reactor coolant services, secondary system makeup, firewater, and miscellaneous plant uses. The system has the capacity necessary to meet the water requirements of a cold plant shutdown and subsequent startup from cold conditions at a time late in core life. The MWS provides makeup to the CCW surge tank. The MWS also supplies water to the CST, which provides a supply of water for the AFW system. The following sections provide information on (a) design bases,

(b) system description, (c) safety evaluation, (d) tests and inspections, and (e) instrumentation applications.

9.2.3.1 Design Bases

The MWS has two sources of raw water supply: well water and seawater. The well water is filtered and then discharged to the reservoir by a rental pretreatment system. The seawater is treated in the rental seawater reverse osmosis systems and then pumped to the reservoir.

The reservoir water is treated in the rental makeup water system, which consists of filters, a reverse osmosis system, a vacuum deaerator, and mixed bed ion exchangers.

The seawater evaporators are not in service at this time. The water quality produced by the rental MWS meets the specification of various plant operating services, which fall under the following categories:

(1) Makeup water for the primary system

(2) Makeup water for the secondary system

(3) Makeup water for the CCW system and SCW system

(4) Water in adequate quantity for fire fighting

(5) Water supply to the AFW system

(6) Provide an adequate reserve of water for startup and upset conditions for the secondary systems

(7) Supply water for dilution, flushing, and cleanup

The MWS provides the following levels of water quality:

(1) Raw reservoir water

(2) Demineralized water

Most of the piping in the MWS, except the rental system piping, is constructed in accordance with ANSI B31.1, except the lines supplying water to the CVCS, firewater pumps header, AFW pumps, and CCW system. The design classifications for these various systems, structures, and components are discussed in the DCPP Q-List (see Reference 8 of Section 3.2).

9.2.3.2 System Description

The rental seawater reverse osmosis system pumps seawater through a two-stage pressure filtration unit. The filtered seawater flows through ultraviolet sterilizers and cartridge filters. The treated seawater is then pressurized to up to 1000 psig by the high pressure feed pumps and enters the reverse osmosis pressure tubes containing seawater membrane elements. The pressurized water passes through the membrane elements as desalted product water, while nearly all dissolved salts remain in concentrated stream as brine. The desalted product water is pumped to a 5.0 million gallon open reservoir system with plastic lined concrete walls.

The well water is pumped to a 100,000 gallon raw water storage tank. From the raw water storage tank, the water is processed through the rental pretreatment system and then discharged to the open reservoir. The reservoir water is treated with sodium hypochlorite to retard algae growth.

The reservoir water is treated by a rental makeup water system. The system is capable of producing up to 600 gpm of deoxygenated/demineralized water for makeup to the CST or primary water storage tank. The rental makeup water system consists of reverse osmosis, vacuum deaerator, and mixed-bed demineralizers. The system supplies makeup water of the quality and quantity necessary for normal reactor coolant services, secondary system makeup, and miscellaneous plant uses.

The water produced by the rental MWS is distributed to the condensate, primary, or transfer tank for storage. The CST is used to supply the secondary system makeup, the AFW system, the auxiliary boiler, and the CCW system. The primary water storage tank, which has a diaphragm seal to minimize O_2 contact, supplies water for the primary system.

9.2.3.2.1 Raw Water Reservoir

The raw water reservoir has a combined capacity of 5.0 million gallons. It has concrete-lined walls and is primarily intended to serve as fresh water storage for fire protection. The reservoir also serves as a source to the MWS and the AFW pumps, providing a large water storage reserve when the raw water supply is lower than the MWS demand.

9.2.3.2.2 Transfer, Distribution, and Storage

The 200,000 gallon primary water storage tank is diaphragm-sealed to maintain the low oxygen content required for the reactor makeup water. Water may not enter the reactor makeup loop except through the demineralized water system. Design and operating parameters of the primary water storage tank are given in Table 9.2-9.

The primary water storage tanks have been designed and erected to Design Class II standards and should contain only highly purified water. Leakage from the primary

water storage tanks due to a tornado or missile-induced damage will not result in the flooding of PG&E Design Class I equipment in the auxiliary building since essentially watertight cover plates are installed over the pipe entranceway from each tank into the auxiliary building. Gross leakage from the tanks can be detected by level indication or visual inspection. The tank level is continuously monitored by the plant computer, and a high or low water level will initiate a control room alarm.

9.2.3.3 Safety Evaluation

The water for decay heat removal by the AFW pumps is reserved in the CSTs (one for each unit) and supplied to the pump suction through Design Class I piping. The AFW reserved supply of approximately 225,000 useable gallons of water (approximately 13,000 gallons of the CST volume are not usable) is ensured by installed internal plenums at the connections for all other consumers of CST inventory in the usable volume region. Refer to Section 6.5.2.1.1 for additional information on usable inventory. The raw water reservoir source is also used as a backup for the AFW pumps.

There is no direct connection between the raw water supply header in the plant and the CST such that any single failure of a component could cause the loss of both CST AFW and reservoir water. A failure of the normal supply header from the CST to the AFW pumps would require opening the manually-operated valves to use the raw water reservoir as a source of auxiliary feedwater. Check valves prevent back-flow of raw water through the failed header. Back-flow of condensate tank water from the AFW pumps suctions through the connections to a postulated break in the raw water supply header is prevented by check valves and normally closed manually-operated stop valves.

A portion of the suction piping to each of the three AFW pumps for each unit is common to the two feedwater sources, the reservoir, and the CST. A failure in this portion of the suction piping to the AFW pumps could draw from both sources. However, the manual stop valve to the raw water supply header is normally closed so the supply of raw reservoir water to the other unit would be unaffected by such a failure. In the affected unit, only one type of AFW pump, either turbine-driven or motor-driven, would be made inoperable by such a failure.

Makeup water for the CCW system can be provided from various water sources and through various pumps and flowpaths in the MWS.

Normal operating conditions for the MWS allow immediate makeup to the CCW system through the makeup valves whenever they open (shown in the CCW system piping schematic, Figure 3.2-14). These air-actuated level control valves open automatically in the event of low level in the CCW surge tank. They close automatically when the normal operating level in the surge tank is restored or on loss of air or control power. Opening these valves is annunciated in the control room, indicating that CCW system makeup is required. Makeup water to the CCW system is normally supplied from the

transfer tank through the makeup water transfer pumps. The MWS supplies water to the 150,000 gallon transfer tank.

The CST can be aligned as a backup water supply for the CCW system through the makeup water transfer pumps. Both the CST and the transfer path to the CCW system are Design Class I. The CST, which has a maximum capacity of 425,000 gallons, is described in Section 9.2.6. A minimum reserve of approximately 225,000 gallons is provided in this tank for auxiliary feedwater (AFW) pump operation, and approximately 13,000 gallons of the tank volume are not usable. Therefore, up to 187,000 gallons for Unit 1 and 187,000 gallons for Unit 2 may be available for makeup water to the CCW system. Refer to Section 6.5.2.1.1 for additional information on usable inventory.

The most demanding transient on the water inventory of the condensate system and the CST is a full load reduction. After such a transient, as much as 345,000 gallons remain in the CST, leaving 107,000 gallons available for makeup to the CCW system. This inventory provides for more than one complete refill of the CCW system. One refill is considered adequate makeup reserve capacity. Makeup water to the CCW system from the CST cannot be assumed to be available at all times due to the possibility of the AFW system reducing inventory below the CCW system makeup nozzle or the failure of non-seismically qualified Class II piping connections to the CST located at the same elevation as the CCW system makeup water nozzle. The firewater tank, which is also seismically qualified, can be aligned as an additional makeup water supply for the CCW system.

Water from the primary water storage tanks is not used for normal makeup to the CCW system as a result of IE Bulletin No. 80-10. The primary water makeup to CCW system isolation valve is normally locked closed. The lock was installed to preclude opening the valve and contaminating the CCW system with tritiated water. If the valve is to be opened, the plant operator must obtain concurrence from the chemistry and radiation protection group.

The CSTs for Units 1 and 2 are cross-connected so that additional makeup is available from the other unit if required. The makeup water from the CSTs, both Units 1 and 2, is pumped from the tank to the CCW system by the Design Class I makeup water transfer pumps. Two redundant, full capacity, makeup water transfer pumps are each capable of delivering approximately 250 gpm makeup to the CCW system. Each pump is powered from the vital 480 V electrical buses, which are energized by either normal sources or the emergency diesel engine-generator units. All piping and valves in the makeup path from the CSTs (including their cross-connections) through the makeup water transfer pumps up to and including the makeup valves on the CCW system lines, are Design Class I. A 250 gpm makeup rate is considered to be greater than any credible leakage from the CCW system during normal operation or postaccident injection. This conclusion is based on the low operating pressures and the protection afforded large piping and equipment.

The available sources of makeup water to the CCW system are listed below with their respective makeup capacities. The design classification for each of the tanks and pumps is identified in the DCPP Q-List (see Reference 8 of Section 3.2).

Source	Pumps
(1) Transfer tank	Makeup water transfer pumps, two 250 gpm pumps
(2) Condensate storage tank	Makeup water transfer pumps, two 250 gpm pumps
(3) Primary water storage tank (Unit 1)	Primary water makeup pumps (Unit 1), two 150 gpm pumps
(4) Primary water storage tank (Unit 2)	Primary water makeup pumps (Unit 2), two 150 gpm pumps
(5) Firewater tank, 300,000 gallons	Makeup water transfer pumps, two 250 gpm pumps
(6) Rental makeup water system (600 gpm) can supply water to CCW system directly or via other storage tanks (condensate storage, primary water storage and firewater tanks)	Makeup water transfer pumps, two 250 gpm pumps Primary water makeup pumps, four 150 gpm pumps

Flowpaths 1, 3, 4, 5, and 6 are not completely Design Class I, but the number of methods does provide considerable redundancy in backup provisions for makeup water to the CCW system.

The rental makeup water system is common for both units. No safety-related systems are dependent on the output of the makeup water system for their operation. Makeup water to the spent fuel pool is supplied by the MWS as described in Section 9.1.3.2.

Although the raw water reservoir is not a safety-related item, its location, on a bench excavated into the ridge above the power plant at elevation 310 feet, as shown in Figure 1.2-1, poses a small potential flood risk to the site. Since a portion of the reservoir bench drains toward the power plant, the reservoir was lowered by excavating the basin entirely in rock, eliminating the risk of flooding due to dike failure. The discussion of slope stability in Section 2.5.5 provides assurances that the slope between the power plant yard and the reservoir bench will not fail. Slope failure in any other direction, which results in a reservoir rupture will release the water into Diablo Canyon.

The discussion of flooding in Section 2.4.4 provides assurance that the drainage capacity of Diablo Canyon is sufficient to pass the entire reservoir volume safely by the plant in less than 1 minute. The reservoir is lined with Hypalon sheet on reinforced concrete to prevent leakage. The level in the raw water reservoir is indicated in the control room and at the hot shutdown panel and low level is annunciated in the control room.

The two pipelines (12 and 6 inches) between the reservoir and the plant have been examined for their potential for flooding. The maximum combined flow from these lines if ruptured would be 7000 to 8000 gallons per minute. This flow-rate would be intercepted by the site storm drainage systems and diverted from safety-related equipment.

The 8 inch raw water supply header in the auxiliary building presents the potential flooding source with the largest volume of water (the raw water reservoir). Flooding of the auxiliary building from this header would be recognized by the annunciation of the auxiliary building sump high-level alarm. The flow would be terminated by an operator using the appropriate manual isolation valve. A volume of 345,000 gallons in the auxiliary building pipe tunnel for sump overflow storage is available to receive water flooding from this source. This storage capacity allows the operator sufficient time to close the stop valve in the yard to prevent overflooding. The flow rate of water flooding from this line is defined by MELB analysis criteria, and is bounded by that from other HELB/MELB sources.

9.2.3.4 Tests and Inspections

The operating components of the rental MWS are in either continuous or intermittent use during normal plant operation and no additional periodic tests are required. Periodic visual inspections and preventive maintenance are conducted in accordance with plant procedures for plant controlled distribution system components, or in accordance with vendor procedures for the vendor-owned water treatment facilities.

9.2.3.5 Instrumentation Applications

The vendor-owned makeup water treatment facility is equipped with dissolved oxygen, conductivity, silica, and organic carbon monitoring instrumentation. In the event the product from the makeup water plant exceeds the values established in plant procedures, the product is automatically diverted to the raw water reservoir until corrected.

9.2.4 POTABLE WATER SYSTEM

There is no separate potable water system. Potable water is supplied by the domestic water system as discussed in Section 9.2.8.

9.2.5 ULTIMATE HEAT SINK

The ultimate heat sink (UHS) dissipates residual heat after normal and emergency shutdown conditions. The following sections provide information on (a) design bases, (b) system description, (c) safety evaluation, (d) tests and inspections, and (e) instrumentation applications.

9.2.5.1 Design Bases

9.2.5.1.1 General Design Criterion 2, 1967 - Performance Standards

The UHS is designed to withstand the effects of natural phenomena, such as earthquakes, tornadoes, flooding conditions, winds, ice, and other local site effects.

9.2.5.1.2 General Design Criterion 4, 1967 - Sharing of Systems

The UHS (Pacific Ocean) is shared between the DCPP units, but safety is not impaired by the sharing.

9.2.5.1.3 General Design Criterion 11, 1967 - Control Room

The UHS is available to support safe shutdown from the control room or an alternate location if control room access is lost due to fire or other causes.

9.2.5.1.4 General Design Criterion 12, 1967 - Instrumentation and Control Systems

Instrumentation is provided as required to monitor UHS system variables.

9.2.5.1.5 AEC Safety Guide 27, March 23, 1972 - Ultimate Heat Sink for Nuclear Power Plants

The UHS will provide in excess of 30-day supply of cooling water to be available for shutdown and cooldown after normal and emergency conditions.

9.2.5.2 System Description

The Pacific Ocean is the UHS. The Pacific Ocean is the source of cooling water to the safety-related ASW system, along with other non-safety related cooling water systems discussed in Sections 9.2.3 and 10.4.5. The seawater from the Pacific Ocean passes through screening equipment located in the intake upstream of the pumps for which it supplies cooling water.

The ocean water supply to the ASW system provides the cooling and heat absorption capability required to remove waste heat under normal and emergency conditions from the nuclear steam supply system (NSSS). The waste heat from containment and other

plant equipment is transferred to the CCW system. The heat picked up by the CCW system is transferred to the ASW system by the CCW heat exchangers. The auxiliary saltwater flows into the main condenser circulating water discharge structure and then into the ocean.

9.2.5.3 Safety Evaluation

9.2.5.3.1 General Design Criterion 2, 1967 - Performance Standards

The availability of the heat sink to provide cooling when required under severe conditions is discussed in detail in Section 2.4.11.6. The most severe oceanographic phenomenon to consider is a tsunami as discussed in Section 2.4.6.6. Estimates of wave runup on the plant facility are referenced in Section 2.4.6.

The expected downsurge during short periods of time would be to 9 feet below mean lower low water (MLLW). The arrangement of the intake channel and the design of the ASW pumps allow operation down to 17.4 feet below MLLW in the normal one-pump one-heat exchanger alignment. For reference, MLLW equals mean sea level (MSL) minus 2.6 feet. MSL is ground elevation zero.

The auxiliary saltwater portion of the intake structure and piping systems associated with the UHS are designed to the seismic conditions and requirements described in Section 2.5 and Sections 3.7 to 3.10, respectively. These components are constructed of materials compatible with the saltwater environment, or provided with protective features, to ensure the functionality of the components required for delivering the required cooling water supply to the ASW system and CCW heat exchangers.

9.2.5.3.2 General Design Criterion 4, 1967 - Sharing of Systems

The Pacific Ocean is the UHS. The Pacific Ocean is the source of cooling water to the safety-related ASW system. Because of the location of the plant on the ocean and the separation of intake and discharge structures, insignificant recirculation occurs.

9.2.5.3.3 General Design Criterion 11, 1967 - Control Room

Temperature of the UHS is measured at the circulating water pumps discharge and monitored in the control room.

9.2.5.3.4 General Design Criterion 12, 1967 - Instrumentation and Control Systems

Temperature of the UHS is measured at the circulating water pumps discharge and monitored in the control room. Also, the temperature is measured outside the bar racks and recorded near the hot shutdown panel.

9.2.5.3.5 AEC Safety Guide 27, March 23, 1972, - Ultimate Heat Sink for Nuclear Power Plants

Maximum temperature limits exist on the UHS to ensure the heat removal capability of the ASW/CCW system in normal and accident conditions. When the UHS exceeds 64°F, both CCW heat exchangers must be placed in service. Operation with elevated UHS temperatures as high as 70°F is acceptable with two CCW heat exchangers in service. It has also been confirmed that the CCW heat exchangers will operate in a one pump two heat exchanger configuration. The limiting condition for operation and surveillance requirements of the UHS is discussed in the Technical Specifications (Section 3.7.9 of Reference 1).

The ocean as a single water source for the UHS will provide in excess of 30 days of cooling water during normal and emergency shutdown conditions as required by AEC Safety Guide 27, March 23, 1972.

9.2.5.4 Tests and Inspections

Tests and inspections of piping systems between the reactor heat source and the UHS are discussed in their respective sections.

9.2.5.5 Instrumentation Applications

Temperature of the UHS is measured at the circulating water pumps discharge and monitored in the control room. Also, the temperature is measured outside the bar racks and recorded near the hot shutdown panel.

9.2.6 CONDENSATE STORAGE FACILITIES

The engineered safety feature (ESF) function of the condensate storage tank (CST) in support of the auxiliary feedwater (AFW) system is discussed in Section 6.5. The safety function of the CST is to provide condensate storage for reactor coolant system (RCS) cooldown.

The condensate storage facilities, shown in Figure 3.2-16, provide for the storage and transfer of demineralized water from the makeup water system (MWS) to the AFW system and to supply the normal makeup and rejection requirements of the steam plant.

The CST provides, as available, makeup water for component cooling water (CCW) and spent fuel pool (SFP) makeup (refer to Section 9.2.3).

The boundary of the condensate storage facilities consists of one CST per unit, a single makeup water transfer tank, the hydrazine mixing pumps, and interconnected valves and piping.

9.2.6.1 Design Bases

9.2.6.1.1 General Design Criterion 2, 1967 – Performance Standards

The PG&E Design Class I portion of the condensate storage facilities are designed to withstand the effects of, or are protected against, natural phenomena such as earthquakes, flooding, tornadoes, winds, and other local site effects.

9.2.6.1.2 General Design Criterion 3, 1971 – Fire Protection

The condensate storage facilities are designed and located to minimize, consistent with other safety requirements, the probability of fires and explosions.

9.2.6.1.3 General Design Criterion 4, 1967 – Sharing of Systems

The condensate storage facilities are not shared by the DCPP units unless safety is shown to not be impaired by the sharing.

9.2.6.1.4 General Design Criterion 11, 1967 – Control Room

The PG&E Design Class I portion of the condensate storage facilities are designed to support actions to maintain and control the safe operational status of the plant from the control room or from an alternate location if control room access is lost due to fire or other causes.

9.2.6.1.5 General Design Criterion 12, 1967 – Instrumentation and Controls

Instrumentation is provided as required to monitor the condensate storage facilities variables within prescribed operating ranges.

9.2.6.1.6 Condensate Storage Facilities System Safety Functional Requirements

(1) Condensate Storage

The CST is designed to provide condensate storage to support RCS decay heat removal and cooldown and as a backup for makeup water to CCW and the SFP.

(2) Protection from Missiles

The PG&E Design Class I portion of the condensate storage facilities are designed to be protected from missiles.

9.2.6.1.7 10 CFR Part 50, Appendix R (Section III.G, III.J, and III.L) – Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979

Section III.G – Fire Protection of Safe Shutdown Capability

The condensate storage facilities are designed with fire protection features that are capable of limiting fire damage so that the CST inventory necessary to achieve and maintain hot shutdown conditions from either the control room or hot shutdown panel (HSP) is free of fire damage. Fire protection of the condensate storage facilities is provided by a combination of physical separation, fire-rated barriers, and/or automatic suppression and detection.

Section III.J – Emergency Lighting

Emergency lighting or battery operated lights (BOLs) are provided in areas where operation of the condensate storage facilities may be required to safely shut down the unit following a fire.

Section III.L – Alternative and Dedicated Shutdown Capability

Safe shutdown capabilities are provided at an alternate location via the HSP.

9.2.6.1.8 10 CFR 50.55a(f) – Inservice Testing

The condensate storage facilities ASME Code components are tested to the requirements of 10 CFR 50.55a(f)(4) and 50.55a(f)(5) to the extent practical.

9.2.6.1.9 10 CFR 50.55a(g) – Inservice Inspection

The condensate storage facilities ASME Code components are inspected to the requirements of 10 CFR 50.55a(g)(4) and 50.55a(g)(5) to the extent practical.

9.2.6.1.10 10 CFR 50.63 – Loss of All Alternating Current Power

The CST provides a sufficient inventory of water to support RCS cooldown during a station blackout (SBO) event.

9.2.6.1.11 NUREG-0737 (Item II.E.1.1), November 1980 –Clarification of TMI Action Plan Requirements

Item II.E.1.1 – Auxiliary Feedwater Reliability System Evaluation

The CST is designed to provide redundant level indication and low level alarms in the control room to allow the operator 20 minutes to anticipate the need for makeup water or transfer to an alternate water supply to support AFW pump operation.

9.2.6.2 System Description

Design and operating parameters for the condensate storage facilities are given in Table 9.2-9. The condensate storage facilities consist of a CST for each unit and a common transfer tank located outside the east end of the auxiliary building. The CST has a floating roof to minimize oxygen absorption by the stored water. The capacity of each CST is 425,000 gallons, which includes a minimum reserve of approximately 225,000 usable gallons for AFW pump operation and a drainable but not usable volume of approximately 13,000 gallons. Refer to Section 6.5.3.7 for additional information on usable inventory (refer to Section 6.5 for a description of the AFW system). The capacity of the transfer tank is 150,000 gallons. The CST is used for condensate makeup and rejection. The DCPP Unit 1 CST serves as a source of water to the auxiliary boiler. Makeup water to other plant systems can be supplied from the CSTs by use of the makeup water transfer pump (refer to Section 9.2.3). The transfer tank provides a holding storage capacity while transferring water. The condensate storage facilities are shown in Figure 3.2-16.

The CST capacity is based on supplying the normal makeup and rejection requirements of the steam plant, and providing a source of feedwater for the AFW system. The seismic evaluation of these tanks is discussed in Sections 3.7.2.2.1.5, 3.8.3 and 3.9.2.2.3. All outdoor tanks are designed for atmospheric pressure and for 32 to 200°F design temperature.

The PG&E design classifications of the CST and the transfer tank are given in the DCPP Q-List (refer to Reference 8 of Section 3.2).

A gravity flow line is also provided to allow water to flow between the transfer tank and CST when required.

In an emergency, water can be supplied from other sources through a connection to the CST hydrazine recirculation line.

The makeup water transfer pumps can be used to pump water to the CSTs of DCPP Unit 1 and Unit 2 and the transfer tank (refer to Section 9.2.3).

The suction lines from the CSTs to the makeup water transfer pumps, which can supply makeup water to the CCW system are crosstied between DCPP Unit 1 and Unit 2 but are isolated by two manual valves. If necessary, the DCPP Unit 1 and Unit 2 CSTs can provide an additional source of makeup water to the DCPP Unit 1 and DCPP Unit 2 CCW systems. The DCPP Unit 1 and Unit 2 crosstie provides an operating flexibility that minimizes the possibility of system failure. The CST also provides a source of makeup water to the SFP (refer to Section 9.1.3.2).

9.2.6.3 Safety Evaluation

9.2.6.3.1 General Design Criterion 2, 1967 – Performance Standards

The PG&E Design Class I portions of the condensate storage facilities are designed to withstand the effects of winds and tornadoes (refer to Section 3.3), floods and tsunamis (refer to Section 3.4), external missiles (refer to Section 3.5), and earthquakes (refer to Sections 3.7 and 3.8.3).

The tornado wind and associated missiles capability of the CST is given in Table 3.3-2. As discussed in Section 3.3.2.3.2.9, a tornado-induced tank failure causing an instantaneously large leak and flood is extremely unlikely. Loss of this tank does not significantly compromise safe shutdown capability, since the PG&E Design Class II raw water reservoir provides a backup supply of water for the AFW pumps. Leakage from the CSTs and transfer storage tank due to tornado or missile-induced damage will not result in the flooding of PG&E Design Class I equipment in the auxiliary building since essentially watertight cover plates are installed over the pipe entranceway from each tank into the auxiliary building. The water will drain away from the building via the plant yard drainage system.

The storage tanks are located outside the auxiliary building and, therefore, will not be subject to any unusual post-accident environment. The codes to which the tanks were built consider normal atmospheric conditions such as wind and rain in the design guides. Protective coats of paint are applied to the outside of each tank.

9.2.6.3.2 General Design Criterion 3, 1971 – Fire Protection

The condensate storage facilities are designed to the fire protection guidelines of Branch Technical Position (BTP) Auxiliary Power Conversion Systems Branch (APCSB) 9.5.1 (refer to Appendix 9.5B Table B-1, Section F).

9.2.6.3.3 General Design Criterion 4, 1967 – Sharing of Systems

The DCPP Unit 1 and Unit 2 CSTs are crosstied through a 4- inch line. The crosstie lines nozzles on each tank are located above the Technical Specification (Reference 1) volume requirement for AFW, thereby ensuring that failure of the crosstie line cannot reduce the condensate storage capacity for steam generator makeup from the AFW pumps. Additional sources of water for the AFW pumps are described in Section 6.5.2.

9.2.6.3.4 General Design Criterion 11, 1967 – Control Room

The PG&E Design Class I portion of the condensate storage facilities is designed to support actions to maintain and control the safe operational status of the plant from the control room.

The water level in each CST is displayed on a PG&E Design Class I local indicator and redundant PG&E Design Class I recorders in the control room. High, low, and low-low water levels are alarmed in the control room. The low level alarm on both DCPP Unit 1 and Unit 2 annunciates when the tank level is approaching the top of the internal plenums of the PG&E Design Class II nozzles. Refer to Section 6.5.3.7 for additional information on usable inventory. CST water level indication is provided locally at the tank, at the HSP, and in the control room.

9.2.6.3.5 General Design Criterion 12, 1967 – Instrumentation and Controls

Instrumentation is provided as required to monitor the condensate storage facilities variables within prescribed operating ranges as discussed in Section 9.2.6.3.4.

Refer to Section 6.5.3.19 for Regulatory Guide 1.97, Revision 3 CST level indication compliance.

9.2.6.3.6 Condensate Storage Facilities System Safety Functional Requirements

(1) Condensate Storage

The CST provides storage of condensate to support RCS decay heat removal and cooldown as discussed in Section 6.5. The usable minimum reserve in the CST of approximately 225,000 usable gallons is discussed in Section 6.5.3.7. The usable volume CST reserve is ensured by internal plenums at the connections of all consumers of CST inventory in the usable volume region.

(2) Protection from Missiles

The condensate storage facilities design is such that physical protection is adequately provided against physical hazards in areas through which the system is routed. The CSTs and transfer tank are cylindrical steel tanks protected by reinforced concrete encasements (refer to Section 3.5). The location of the tanks also provides protection from physical hazards.

9.2.6.3.7 10 CFR Part 50 Appendix R (Section III.G, III.J, and III.L) – Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979

10 CFR Part 50 Appendix R requires the evaluation of the safe shutdown capability for DCPP in the event of a fire and the loss of offsite power. The condensate storage facilities satisfy the applicable requirements of 10 CFR Part 50 Appendix R, Sections III.G, J, and L. Exceptions to these criteria are documented based on the fire hazard in the area and/or other compensatory fire protection features provided.

Section III.G - Fire Protection of Safe Shutdown Capability: Tables 9.5G-1 and 9.5G-2 for DCPP Unit 1 and Unit 2, respectively, list the minimum equipment required to bring

the plant to a cold shutdown condition as defined by 10 CFR Part 50, Appendix R, Section III.G. Specifically, the CST and CST level transmitter are included in the minimum required equipment to bring the plant to a cold shutdown condition. These SSCs are provided fire protection features appropriate to the requirements of Section III.G. The actions necessary for cold shutdown for fires in certain fire areas involves manually aligning valves.

Section III.J - Emergency Lighting: Appendix 9.5D contains a description and evaluation of the DCPP Unit 1 and Unit 2 emergency lighting system in accordance with 10 CFR Part 50 Appendix R, Section III.J.

Section III.L - Alternative and Dedicated Shutdown Capability: Safe shutdown capabilities are provided in the control room and at alternate locations via the HSP and/or local operation of valves in accordance with 10 Part CFR 50 Appendix R, Section III.L (refer to Section 7.4). CST level can be monitored in the control room or HSP. The ability to safely shut down the plant following a fire in any fire area is summarized in Section 4.0 of Appendix 9.5A.

9.2.6.3.8 10 CFR 50.55a(f) – Inservice Testing

The inservice testing (IST) requirements for the applicable condensate storage facilities components are contained in the DCPP IST Program Plan.

9.2.6.3.9 10 CFR 50.55a(g) – Inservice Inspection

The inservice inspection (ISI) requirements for the applicable condensate storage facilities components are contained in the DCPP ISI Program Plan.

9.2.6.3.10 10 CFR 50.63 – Loss of All Alternating Current Power

During an SBO event, decay heat is removed from the core by natural circulation of the reactor coolant. This heat is then transferred to the secondary side of the steam generators and discharged to the atmosphere through the 10% atmospheric dump valves. The CST provides storage of makeup water to the AFW pumps to support decay heat removal (refer to section 6.5.3.17).

9.2.6.3.11 NUREG-0737 (Item II.E.1.1), November 1980 – Clarification of TMI Action Plan Requirements

Item II.E.1.1 – Auxiliary Feedwater Reliability System Evaluation

The AFW pumps take water from the CST, which is the preferred source of water for AFW. The CST provides redundant level indication and low level alarms in the control room. Additional sources of water for the AFW pumps are described in Section 6.5.2.1.1.

9.2.6.4 Tests and Inspections

The water in the CSTs will be sampled periodically to determine chemical quality. In addition, the activity level of the water will be checked, and if steam generator leakage is suspected, the frequency of the activity samples of water will be increased.

9.2.6.5 Instrumentation Applications

Instrumentation for the condensate storage facilities is discussed in Sections 9.2.6.3.4 and 9.2.6.3.5.

9.2.7 AUXILIARY SALTWATER SYSTEM

The auxiliary saltwater (ASW) system, shown in Figure 3.2-17, is an open-cycle system that supplies cooling water to the CCW heat exchangers from the UHS (UHS), the Pacific Ocean, during normal operation, plant cooldown, and following a LOCA or MSLB. It transfers waste heat from the CCW system, via each CCW heat exchanger to the UHS.

9.2.7.1 Design Bases

9.2.7.1.1 General Design Criterion 2, 1967 - Performance Standards

The ASW system is designed to withstand the effects of or is protected against natural phenomena, such as earthquakes, tornados, flooding conditions, winds, ice, and other local site effects.

9.2.7.1.2 General Design Criterion 3, 1971 - Fire Protection

The ASW system is designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

9.2.7.1.3 General Design Criterion 4, 1967 - Sharing of Systems

The ASW systems or components are not shared by the DCPP Units unless safety is not impaired by the sharing.

9.2.7.1.4 General Design Criterion 11, 1967 - Control Room

The ASW system is designed to support safe shutdown and to maintain safe shutdown from the control room or from an alternate location if control room access is lost due to fire or other causes.

9.2.7.1.5 General Design Criterion 12, 1967 - Instrumentation and Control Systems

Instrumentation and controls are provided as required to monitor and maintain ASW system variables within prescribed operating ranges.

9.2.7.1.6 10 CFR 50.55a(f) - Inservice Testing Requirements

ASW system ASME Code components are tested to the requirements of 10 CFR 50.55 a(f)(4) and a(f)(5) to the extent practical

9.2.7.1.7 10 CFR 50.55a(g) - Inservice Inspection Requirements

ASW system ASME Code components (including supports) are inspected to the requirements of 10 CFR 50.55a(g)(4) and (5) to the extent practical.

9.2.7.1.8 10 CFR 50 Appendix R (Sections III.G, III.J, III.L Only) - Fire Protection Program for Nuclear Power Facilities Operating Before January 1, 1979

The ASW system is designed to provide decay heat removal to achieve and maintain a safe shutdown condition for fire events.

9.2.7.1.9 ASW System Safety Function Requirements

(1) *Waste Heat Removal*

The ASW/CCW systems are designed to remove waste heat from the nuclear (primary) plant equipment and components during normal plant operation, plant cooldown, and design basis accidents.

(2) *Single Failure*

The ASW system and CCW system are essentially considered a single heat removal system for the purpose of assessing the ability to sustain either a single active or passive failure and still perform design basis heat removal.

(3) *Dynamic Effects*

Vital portions of the ASW system are designed, located, or protected against dynamic effects.

(4) *Redundancy*

Vital ASW System components are redundant.

(5) *Isolation*

The ASW system includes provision for isolation of system components and may be split into separate trains during long term post-LOCA conditions.

(6) *Leak Detection*

The CCW system serves as an intermediate system between normally or potentially radioactive systems and the ASW system, which is an open-cycle system that discharges to the UHS (Pacific Ocean).

9.2.7.1.10 Generic Letter 89-10, June 1989 - Safety Related Motor-Operated Valve Testing and Surveillance

The ASW system safety-related and position-changeable motor-operated valves meet the requirements of Generic Letter 89-10 and associated Generic Letter 96-05.

9.2.7.1.11 Generic Letter 89-13, July 1989 - Service Water System Problems Affecting Safety-Related Equipment

The CCW heat exchangers cooled by the ASW system are subject to monitoring and maintenance programs to ensure capability to perform their safety function as an alternative to a testing program. Maintenance practices, operating and emergency procedures, and training ensure effectiveness of these programs.

9.2.7.1.12 Generic Letter 91-13, September 1991 - Essential Service Water System Failures at Multi-Unit Sites

The DCPP procedures establish periodic flow testing, surveillance, and operability of the ASW cross-tie valve FCV-601.

9.2.7.1.13 10 CFR 50.63 - Loss of All Alternating Current Power

The ASW system is configured to provide manual opening of the ASW cross-tie valve FCV-601 in support of the SBO alternate alternating current (AAC) option for recovery from SBO and for decay heat removal for safe shutdown.

9.2.7.2 System Description

There is a separate ASW system for Unit 1 and Unit 2. Each unit is provided with two ASW trains with crosstie capability. Each train consists of a full capacity electric motor-driven pump, the tubeside of the CCW heat exchanger and associated supply and discharge piping for the CCW heat exchanger. Upstream of the pumps, there is a unit ASW traveling water screen and a suction bay gate for each pump. There is a vacuum relief system on each ASW supply header piping to prevent water hammer. In

addition, the Unit 1 and Unit 2 ASW piping system is arranged with interunit crosstie capability.

Each train is designed with the capability of providing adequate cooling to the CCW system during normal operation, plant safe shutdowns following normal operation, and refueling modes. Equipment design margins and system redundancy allow either an active or a passive failure of any component without degrading the system's cooling function under all modes of operation, including a design basis accident.

All system boundary components are located within the turbine building, the vacuum breaker vault, and the intake structure. These locations provide access for inspections and maintenance during either normal or postaccident operation.

The components are connected via buried, plastic-lined, carbon steel pipes between these structures. The buried piping is accessible for inspections and maintenance during train outages of sufficient duration (typically refueling).

9.2.7.2.1 Auxiliary Saltwater Pumps

The ASW pumps are powered from separate Class 1E 4.16-kV buses, which can be energized by either the normal source or the emergency diesel generators. All train components satisfy PG&E Design Class I criteria. The pumps are single stage, vertical, wet pit type driven by 4-kV motors. The design data for the ASW pumps are tabulated in Table 9.2-1. The piping and other essential lines (power, sensing, and control) that pass from the pumps to the main portion of the plant are shown in Figure 9.2-3.

9.2.7.2.2 Electrical Conduits

The route of circuits F, G, and H carrying these Class 1E power and instrument signals to the ASW pumps parallels the piping between the turbine building and the intake structure, as shown in Figure 9.2-3. Embedded plastic (ABS) conduits are used. These conduits are encased in a sand envelope with a reinforced concrete slab cover throughout the entire run except at structure crossings and the portion from bluff penetration to the intake structure where they are encased in reinforced concrete envelopes. All connections to pull boxes or structures are flexible. The electrical aspects of these safety-related circuits are described in Section 8.3.

9.2.7.2.3 Intake Structure and Equipment

The ASW pumps are installed at the intake structure, as shown in Figure 9.2-2. This arrangement provides a separate bay and intake bay gate for each pump. The design classification of the intake structure is given in the DCPP Q-List (see Reference 8 of Section 3.2) and the seismic analysis is presented in Section 3.7.2. The PG&E Design Class I equipment located in the intake structure are the ASW pumps, ASW motor-operated valves, ASW piping, including valves in the piping, ASW pump compartment HVAC, and some ASW instrumentation.

Each unit's pair of ASW pump trains share a common traveling screen to remove floating debris from the incoming seawater. If the common screen for a unit becomes clogged with debris, seawater may be supplied to the ASW pump bays from the unit's circulating water pump bays via the demusseling valves. Level transmitters are provided on both the inlet and outlet of the ASW common traveling screen in each unit for the purpose of indication and annunciation of water level differential across the common screen and for automatic screen start. The level transmitters are shown in Figure 3.2-17.

Provisions exist to control marine fouling buildup in the ASW system pump forebays, piping and the CCW heat exchanger to minimize flow blockage, and slime buildup in tubes. Flow testing is routinely performed and heat exchanger differential pressure is monitored to ensure adequate flow for heat removal capabilities. Biofouling is controlled by continuous chlorination.

The ASW pumps, traveling screens, gates, and guides are cathodically protected to protect the equipment from corrosion.

9.2.7.2.4 Piping

The design classification for all ASW piping is given in the DCPP Q-List (see Reference 8 of Section 3.2). The ASW piping is designed to perform its function and maintain its integrity considering the effects of the environment and load combinations due to varying pressures, temperatures, and seismic conditions. The arrangement of the ASW system buried supply piping between the intake structure and turbine building is shown in Figure 9.2-3. The supply lines exit the east wall of the intake structure and are supported by thrust blocks and surrounding soil in the filled area. The supply lines are typically anchored to the circulating water conduits and are buried in the same trenches except for the new bypass piping just outside of the intake structure that is buried in soil and supported by large reinforced concrete thrust blocks. See Section 2.5.4.8 for discussion of potential liquefaction of soil beneath a portion of buried ASW piping. The supply lines are anchored in concrete to the circulating water conduits at 40-foot intervals. The pipe trench is backfilled with compacted granular fill between the anchors. Within the turbine building, the pipes are embedded in concrete.

A separate ASW line from each CCW heat exchanger discharges to the ocean at the discharge structure.

The pipe used in the ASW system is standard weight ASTM A53 and A106 seamless steel with a 1/8 inch thick layer of polyvinyl chloride thermally bonded to the pipe's interior surface and over the full face of the flanged ends. The exterior surface of the pipe is coated with epoxy for corrosion resistance.

The buried ASW supply pipes are cathodically protected by an impressed current system. In addition, the ASW supply pipes near the turbine building are also protected by a sacrificial anode system.

Due to the vulnerability of the buried portions of the ASW system supply piping to potential corrosion damage, corrosion protection for the piping is provided by an internal lining and external coating applied directly to the piping and cathodic protection systems installed at selected locations.

9.2.7.2.5 Discharge Structure

The discharge structure is a massive energy dissipating device located in the coastal bluff. The arrangement of the structure and the ASW pipe discharge is illustrated in Figure 11.2-9. The structure is divided into two chambers (one for each unit) that are open to the ocean under all conditions. The two ASW return lines for each unit discharge into the chamber of that unit. The base slab of the discharge structure is keyed into and poured on sound rock. Where possible, the walls were formed directly against sound rock.

9.2.7.2.6 Heat Exchangers

The design details of the CCW heat exchangers are given in Table 9.2-3. Performance of the CCW heat exchanger is based on performance curves provided by the manufacturer.

9.2.7.3 Safety Evaluation

9.2.7.3.1 General Design Criterion 2, 1967 - Performance Standards

The design classification for PG&E Class I ASW Structures, Systems, and Components (SSC) is identified in the DCPP Q-List (see Reference 8 of Section 3.2). The PG&E Design Class I equipment located in the intake structure are the ASW pumps, ASW motor-operated valves, ASW piping, including valves in the piping, ASW pump compartment HVAC, and some ASW instrumentation. In order to provide assurance that the function of PG&E Design Class I equipment will not be adversely affected even in the unlikely event of a seismic event, the intake structure (QA Class S) was reviewed to ensure that it would not collapse. The failure analysis was based on the Hosgri earthquake discussed in Section 3.7.2. The capability of the intake structure to withstand winds, tornadoes, and associated missiles is discussed in Section 3.3, and to withstand design flood events is discussed in Sections 2.4 and 3.4.

The invert depth in the ASW channel is 31.5 feet below MSL. The ASW pump's intake bells are at 23 feet below MSL, and the pumps are designed to operate with a water level at 20 feet below MSL, which envelopes the postulated tsunami drawdown conditions (see Section 2.4.6 and 2.4.11). The pump's mounting plates are located at the pump deck 2.1 feet below MSL with the motor drivers at 4 feet above MSL. Pumps and motors are situated in watertight compartments that are ventilated by forced air

through a roof ventilation shaft with vent extensions (snorkels) having a high point of 49.4 feet above MSL and a low point of 45.57 feet above MSL. The ASW pump room vents are extended with steel snorkels to prevent seawater ingestion due to splash-up during the design flood event as described in Section 3.4. PG&E Design Class I equipment is thus ensured of operation during extreme tsunami drawdown and combined tsunami and storm wave runup conditions.

During tsunami drawdown, each ASW pump will deliver about 85 percent of design flow due to increased static head losses. This is a temporary condition and would not result in excessive temperatures in components to be cooled. If a second ASW pump is available, the temporary condition can be avoided by running two pumps in parallel. For operation with two CCW heat exchangers with no second pump available, operator action is required to isolate one of the heat exchangers during the tsunami drawdown as described in Sections 2.4.11.5 and 2.4.11.6.

Design flow can readily be maintained during high water conditions. MSL is ground elevation zero; MSL (mean sea level in feet) equals MLLW (mean lower low water in feet) plus 2.6 feet.

The ASW system is the only safety-related system that has components within the projected sea wave zone. The ASW pumps are housed in watertight compartments in the intake structure. These compartments are ventilated by forced air through a roof ventilator as described in Section 2.4.5.7.

ASW pump vents are extended with steel snorkels that face eastward to prevent seawater ingestion due to splash-up during the design flood event and are described in Section 2.4.5.7. The pump and piping are designed to handle the increased pressure in the system due to the combination of normal system operating and temporary-high wave conditions. The expected downsurge during short periods of time would be to 9 feet below mean lower low water (MLLW). The arrangement of the intake channel and the design of the ASW pumps allow operation down to 17.4 feet below MLLW in the normal one-pump one-heat exchanger alignment. For operation with two CCW heat exchangers in service, operator action would be required to isolate one of the heat exchangers during the tsunami drawdown as described in Sections 2.4.11.5 and 2.4.11.6. PG&E Design Class I equipment is therefore assured of operation during extreme tsunami drawdown and combined tsunami and storm wave runup conditions. For reference, MLLW equals mean sea level (MSL) minus 2.6 feet. MSL is ground elevation zero.

The piping and Class 1E electrical circuits associated with the ASW system are buried except for short exposed portions at the intake structure vacuum breaker vault and at the turbine building, and therefore not subject to damage due to missiles from rotating equipment or tornadoes, or due to collapse of nonseismic structures. Seismic design for the PG&E Design Class I piping (including buried and embedded portions) is provided in the applicable ASW piping stress analysis and discussed in Section 3.7. Since no surface fault movement is postulated for the site (as discussed in Section 2.5) and since consideration has been given to the ductility of the material (as discussed in

Section 3.8.2.5) and the method of construction for the conduit runs, they can be assured to remain in service during and following seismic events.

Wave protection measures at ground level and below to protect the ASW system buried piping and electrical conduits from tsunami/storm conditions include concrete covers, revetments, roadway slabs, pavement and gabion mattresses.

The ASW pumps are housed in watertight compartments preventing flooding from occurring from sources external to the compartments.

Differential rock movement would be required to overload the discharge structure. Differential rock movement or faulting is not a design criterion (see Section 2.5.4). However, if a collapse of the structure were postulated, it is not likely that the ASW flow would be obstructed. There is insufficient rubble from such a postulated collapse to block the flow from both ASW pipes.

9.2.7.3.2 General Design Criterion 3, 1971 - Fire Protection

The ASW system is designed to the fire protection guidelines of NRC BTP Auxiliary Power and Chemical System Branch (APCSB) 9.5.1 (Appendix 9.5B Table B-1). Electrical conductor insulation used for these runs is flame retardant as described in Section 8.3. For exception to the cable jacket material flame retardancy requirement, refer to Appendix 9.5B.

9.2.7.3.3 General Design Criterion 4, 1967 - Sharing of Systems

A normally closed motor-operated valve provides separation between the Unit 1 and Unit 2 ASW supply headers and is shown in Figure 3.2-17. Since the valve is normally closed, the crosstie does not expose either unit to an additional active failure. The unit crosstie provides operating flexibility in that it is possible to have the Unit 2 standby pump provide water to Unit 1 in the event the Unit 1 standby pump is inoperable and vice versa. The operating condition of Unit 2 will be considered before crosstying to prevent jeopardizing the safety of Unit 2. If Unit 2 is already in a shutdown condition during a postulated accident on Unit 1, then the Unit 2 standby saltwater pump can provide backup to Unit 1.

9.2.7.3.4 General Design Criterion 11, 1967 - Control Room

Appropriate ASW system instruments and controls are provided to permit system operation from the control room (Section 9.2.7.5). The ASW pumps are designed to be remotely operated from the hot shutdown panel in the event that the main control room is uninhabitable (Section 7.4.1.2.2).

9.2.7.3.5 General Design Criterion 12, 1967 - Instrumentation and Control Systems

The ASW system is monitored by the instrumentation listed in section 9.2.7.5.

9.2.7.3.6 10 CFR 50.55a(f) - Inservice Testing Requirements

The ASW system contains pumps and valves classified as PG&E Design Class I. The inservice testing requirements for these components are contained in the IST Program Plan and comply with the ASME Code.

9.2.7.3.7 10 CFR 50.55a(g) - Inservice Inspection Requirements

The inservice inspection (ISI) requirements for CCW system components are contained in the ISI Program Plan and comply with the ASME Code.

9.2.7.3.8 10 CFR 50 Appendix R (Sections III.G, III.J, III.L Only) - Fire Protection Program for Nuclear Power Facilities Operating Before January 1, 1979

The ASW system meets the requirements of 10 CFR 50 Appendix R Sections III G, J and L.

Tables 9.5G-1 and 9.5G-2 for DCPP Units 1 and 2, respectively, list the minimum equipment required to bring the plant to a cold shutdown condition as defined by 10 CFR 50, Appendix R, Section III.G.

The ability to safely shutdown the plant following a fire in any fire area is summarized in Section 4.0 of Appendix 9.5A.

The ASW system is a support system for safe shutdown following a fire event. It is protected by fire protection system equipment installed in Fire Zones 30-A-1 and 30-A-2, with additional modifications; e.g., smoke detectors added outside ASW pump rooms in Fire Zone IS-1.

9.2.7.3.9 ASW System Safety Function Requirements

(1) *Waste Heat Removal*

The ASW system is designed to provide sufficient heat removal to maintain the CCW system within its design basis temperature limits for normal operation, plant cooldown and design basis accident conditions.

The CCW system transfers heat from both vital and non-vital systems to the UHS via the ASW system during normal operations and reactor shutdown. During normal operation, both ASW pumps and one supply header are aligned with the operating CCW heat exchanger. Only one

pump is required to run; the second pump, being on standby, provides backup against an active failure. By means of unit and redundant supply header crosstie motor-operated valves, the standby pump for one plant unit may act as a second standby for the other unit.

The ASW system capability to perform its design basis function assumes the ASW pumps are capable of providing the minimum required flow under conditions of low tide, high CCW heat exchanger tube side differential pressure and supply temperatures up to 64°F. As discussed in Section 9.2.5, the Technical Specifications require a second CCW heat exchanger be placed in service when UHS temperature exceeds 64°F. The ASW flow rate and minimum acceptable flow are a function of the number of ASW pumps and CCW heat exchangers in service based on operating conditions and assumed single failure.

The ASW system is designed to provide sufficient heat removal to maintain the CCW system within its design basis temperature limits for normal CCW system conditions.

During plant cooldown the ASW and CCW systems operate together to remove heat from vital equipment as follows:

- Reactor decay heat (RHR)
- Equipment and cooling

During the cooldown phase of a routine plant shutdown, both ASW pumps and CCW heat exchangers are in operation. If one pump or supply header is inoperative during cooldown, cooling would be accomplished safely, but the cooldown time would be extended.

Following design basis accidents with a postulated single active or passive failure, the ASW and CCW systems operate together to remove heat from vital equipment including heat loads as follows:

- Reactor Decay Heat
- Containment Accident Heat Loads
- Vital Loads

The ASW/CCW system must be able to remove the minimum required heat in order to ensure that the containment design pressure and temperature is not exceeded. Additionally, the ASW system must be able to remove sufficient heat from the CCW system so as to not exceed the CCW system design basis temperature limits when the containment heat

removal equipment is operating at maximum predicted heat removal rates. The adequacy of the heat sink provided by the ASW/CCW systems has been evaluated to ensure that the minimum heat removal function is satisfied following a LOCA or MSLB (References 5 and 6). The ability of the ASW/CCW system to support the maximum containment heat removal without exceeding the CCW system design basis temperature limits following LOCA or MSLB has also been demonstrated (Reference 3).

During the safety injection phase or upon loss of the offsite power supply, both ASW pumps receive a start signal. On a bus transfer with no SI signal or loss of the offsite power supply, the previously operating ASW pump will immediately be restarted and the standby pump will receive a start signal. This design ensures both pumps in operation following the event of accident or upset condition, excluding the condition of a Class 1E F or G bus failure.

In the injection and post-LOCA recirculation phases of the accident, no operator action is required for operation or reconfiguration of the ASW system and its components. A decision to split the ASW system into separate trains to mitigate a passive failure would be made by the Technical Support Center if it became required. (Reference 8)

The capacity of the ASW system is based on post-design basis accident heat rejection requirements. The ASW and CCW systems operate together to remove heat from containment and safety-related loads following a design basis accident. Together the ASW and CCW systems must be able to remove the minimum required heat loads to ensure that the containment design pressure and temperature limits are not exceeded. The ASW system is designed to provide sufficient heat removal to maintain the CCW system within its design basis temperature limits for post-accident CCW system conditions.

The ASW system and CCW system are essentially considered a single heat removal system for the purpose of assessing the ability to sustain either a single active or passive failure and still perform design basis heat removal. The heat removal capability of the ASW/CCW system has been evaluated to ensure that the minimum containment heat removal function is satisfied following a LOCA or MSLB (References 5 and 6). A single train of ASW (one ASW pump and one CCW heat exchanger) provides sufficient heat removal from containment to mitigate an MSLB or LOCA. The ability of the ASW and CCW systems to support the maximum containment heat removal without exceeding the CCW maximum supply temperature design basis limit following a LOCA or MSLB has also been demonstrated (Reference 3). The mechanistic analyses credited one or two ASW pumps, depending on the assumed single failure. A single CCW heat exchanger was assumed to be in service throughout the transient

(except when the UHS temperature exceeds 64°F, two CCW heat exchangers are assumed in service). No credit was taken for operator action to align the second CCW heat exchanger or an ASW pump from the opposite unit.

The design basis for ASW system performance to support analysis for peak containment pressure is described in Section 6.2. The design basis for ASW system performance to support the analysis for peak CCW temperature transients is described in Section 9.2.2. Critical ASW system assumptions include maximum ASW temperature, minimum ASW flow rate to the CCW heat exchanger, and single pump/heat exchanger operation. (See References 3, 5, and 6.)

(2) *Single Failure*

A malfunction analysis is presented in Table 9.2-2.

The ASW system and CCW system are essentially considered a single heat removal system for the purpose of assessing the ability to sustain either a single active or passive failure and still perform design basis heat removal. Refer to Section 3.1.1 for a description of DCPP single failure criteria and definition of terms.

During post-LOCA long term recirculation, the ASW trains should remain cross-tied to assure that any active failure in the ASW or CCW system would not result in the loss of CCW system cooling. While vulnerable to a passive failure in this configuration, the ASW system capacity is such that the ASW system function would not be affected. A decision to split the ASW system into separate trains to mitigate a passive failure would be made by the Technical Support Center if it became required. (Reference 8)

The ASW system is comprised of active components for which design classifications are given in the DCPP Q-List (see Reference 8 of Section 3.2). The ASW system can sustain either an active or a passive failure and still perform its function.

(3) *Dynamic Effects*

No systems that are required for safe shutdown are rendered inoperable due to flooding caused by a postulated break in the ASW piping. The low operating pressure and temperature of the saltwater system minimizes the possibility of a line severance. However, a severance would be detected and alarmed to the control room as low differential pressure across the heat exchanger and a high temperature rise across the CCW system, and

possibly a pump motor failure. Sufficient valving is provided to isolate the units and their redundant trains from the failed section of piping.

Most of the ASW piping is buried except for short sections in the intake structure, the vacuum breaker vaults and the turbine building. A pipe break inside an ASW pump room or outside the boundary of both unit rooms in the Intake would not jeopardize the other pump motors. Each pump is housed in its own watertight compartment; therefore a pipe break would only flood one compartment. No components required to be operated for safe shutdown are located in the vacuum breaker vault. Failure of the ASW supply inside the turbine building would result in draining to the turbine building sumps; a break in the ASW system discharge piping to the ocean would not result in flooding of the turbine building unless flow blockage in the line occurs, since the line pressure is negative.

In the event that the entire contents of the hotwell and heater drain tanks are discharged to the turbine building, the operability of PG&E Design Class I equipment (component cooling water heat exchangers) in the building is not endangered. The volume of water that would be discharged is within the capacity of the turbine building drain system. This system includes one 18-inch drain line from the turbine building sump of each unit to the circulating water system discharge structure (see Figure 3.2-27 and refer to Table 1.6-1). If this drain were clogged, the water flow would begin to fill the turbine building sumps and equipment pits below 85 feet (see Figures 1.2-16 and 1.2-20). However, the capacity (58,000 cubic feet) below this elevation is more than the potential flooding volume. Refer to Section 10.4.7 for further discussion of flooding in the turbine building.

The ASW system is physically separated from all piping carrying high-energy fluid. The ASW system is a moderate-energy system as described in Section 3.6.

(4) *Redundancy*

Redundancy is provided by having two ASW pumps, one running and one on standby, and two CCW heat exchangers, with one normally in service and one in standby. The ASW system can be cross-connected within trains and between units so that various pump-heat exchanger combinations can be used for cooling. Redundant vacuum breakers are installed at the vertical bend of each line to eliminate water hammer.

Each unit's pair of ASW pump trains shares a common traveling screen to remove floating debris from the incoming seawater. If the common screen for a unit becomes clogged with debris, seawater may be supplied to the ASW pump bays from the unit's circulating water pump bays via the

demusseling valves. Level transmitters are provided on both the inlet and outlet of the ASW common traveling water screen in each unit for the purpose of indication and annunciation of water level differential across the common screen and for automatic screen start. The level transmitters are shown in Figure 3.2-17.

(5) *Isolation*

The design classification of the CCW heat exchangers is listed in the DCPP Q-List (see Reference 8 of Section 3.2). Rupture of the heat exchanger tubes or channel is considered highly unlikely because of low operating pressures and the use of corrosion-resistant materials. However, a leaking heat exchanger can be identified by sequential isolation or visual inspection. If the leak should be in the operating heat exchanger, the standby heat exchanger will be placed in operation and the leaking heat exchanger isolated and repaired.

(6) *Leak Detection*

Provisions exist to isolate the CCW heat exchanger on both the ASW (tube-side) and CCW (shell-side). Large leakage could be detected by differential pressure across the tube side of the heat exchanger, by a decrease in CCW flow out of the heat exchanger, or by makeup to the CCW system.

The ASW discharges directly to the UHS. The ASW system provides cooling to the CCW heat exchanger. The CCW system is normally non-radioactive; however, the radiation level of the CCW system is monitored and an alarm is provided with a predetermined radiation level setpoint (refer to Section 11.4). In the event of an alarm for radiation on the CCW system, immediate efforts would be made to isolate the in-leakage. If the in-service CCW heat exchanger developed a leak at the same time, the heat exchanger would be isolated and the standby heat exchanger placed in service. Potential radioactive leakage into the CCW system is monitored to prevent/minimize release to the environment, via the ASW System, in the event of a concurrent leak in the heat exchanger.

Molybdate concentration in the CCW system is maintained by procedure for corrosion prevention. In the event of a leak, small or large, the chemical concentration in plant effluent would be greatly reduced by dilution with the ASW system and then by the main CWS.

9.2.7.3.10 Generic Letter 89-10, June 1989 - Safety-Related Motor-Operated Valve Testing and Surveillance

The ASW system motor-operated valves subject to the requirements of GL 89-10 and associated GL 96-05 meet the requirements of the DCPP MOV Program Plan.

9.2.7.3.11 Generic Letter 89-13, July 1989 - Service Water System Problems Affecting Safety-Related Equipment

Design fouling is considered in accident analyses. Fouling is a combination of tube microfouling and tube flow blockage resulting from marine life. Mechanical tube plugging is limited to two percent of the tubes before the performance of the heat exchanger, as defined by the curves, is impacted. As noted in Section 9.2.7.2.3, provisions exist to control marine fouling on the tube side (ASW) of the CCW heat exchanger. Cathodic protection is provided on the tube side of the heat exchanger in the waterboxes.

9.2.7.3.12 Generic Letter 91-13, September 1991 - Essential Service Water System Failures at Multi-Unit Sites

A normally closed motor-operated valve provides separation between the Unit 1 and Unit 2 ASW supply headers and is shown in Figure 3.2-17. Since the valve is normally closed, the crosstie does not expose either unit to an additional active failure. The unit crosstie provides operating flexibility in that it is possible to have the Unit 2 standby pump provide water to Unit 1 in the event the Unit 1 standby pump is inoperable and vice versa. The operating condition of Unit 2 will be considered before crosstying to prevent jeopardizing the safety of Unit 2. If Unit 2 is already in a shutdown condition during a postulated accident on Unit 1, then the Unit 2 standby saltwater pump can provide backup to Unit 1. Equipment Control Guideline 17.1, ”Auxiliary Saltwater Cross-Tie Valve FCV-601,” provides requirements for the valve operability.

9.2.7.3.13 10 CFR 50.63 – Loss of All Alternating Current Power

Inter-unit cross-tying is not credited for additional heat removal capability by the ASW and CCW system for any design basis accident analyses. However, ASW inter-unit crosstie capability via FCV-601 has been credited in the station blackout analysis and in response to NRC Generic Letter 91-13.

9.2.7.4 Tests and Inspections

The operating components are in either continuous or intermittent use during normal plant operation. Periodic testing of the standby feature of the ASW pump, testing of alarm setpoints, and visual inspections and preventive maintenance will be conducted in accordance with normal plant operating practices.

9.2.7.5 Instrumentation Applications

The ASW system is monitored by the following instrumentation:

(1) Differential pressure transmitters for both CCW heat exchangers

(2) ASW header pressure indicators

(3) Automatic start feature of the standby pump on loss of header pressure with pump status indicator in the control room

(4) Temperature indicators on the CCW heat exchanger, ASW (tube side) inlet and outlet

(5) Valve position indicators in the control room

(6) Differential level across the traveling water screens

(7) ASW pump room high water level alarm

(8) ASW pump room watertight door alarm

(9) High-temperature alarm for the ASW pump room

(10) ASW pump motor temperature indicators: upper/lower bearings and motor stator winding

(11) Inlet gate position indicator

(12) CCW heat exchanger, CCW (shell side) outlet temperature indicators

(13) ASW pump bay level indication

(14) ASW pump bay level alarm

9.2.8 DOMESTIC WATER SYSTEM

The domestic water system (DWS) processes raw water from the reservoir to provide water suitable for human consumption. The following sections provide information on (a) design bases, (b) system description, (c) safety evaluation, (d) tests and inspections, and (e) instrumentation applications.

9.2.8.1 Design Bases

The DWS is designed to provide drinking water at the plant. It is a Design Class III system.

9.2.8.2 System Description

The DWS receives its water from the rental domestic water treatment system. The rental domestic water treatment system takes water from the reservoir and processes it through a multi-media filter, a reverse osmosis module, a neutralizing-media filter, an activated carbon filter, and finally through a 10-micron cartridge filter. Prior to transferring the water to the domestic water storage and distribution piping system, it is disinfected using chlorine. The water is then supplied to the plant for drinking.

The radioactively uncontaminated utilities that receive domestic water include:

(1) Lavatories

(2) Water heaters

(3) Showers

(4) Maintenance connections

(5) Water closets

(6) Emergency eye wash

(7) Hose bibs

(8) Kitchen sinks

(9) Chemical laboratory sink in the chlorination building

(10) Drinking fountains

(11) Chemical laboratory sinks in maintenance shop buildings

(12) Landscape irrigation

After use, the domestic water passes into the plant sewage system where it is treated in a sewage treatment plant before being discharged to the ocean.

The potentially radioactively contaminated utilities that use domestic water are:

(1) Hot showers

(2) Laundry facilities

(3) Laboratory sinks

(4) Washdown area in hot machine shop

This water, after being used, drains to the liquid radwaste system (see Section 11.2) for treatment.

9.2.8.3 Safety Evaluation

Failure of this system will not affect nuclear safety. Back-flow preventers are provided to prevent contamination of the domestic water by back-siphonage from potentially radioactively contaminated areas.

9.2.8.4 Tests and Inspections

Water quality tests and system integrity inspections will be performed periodically in accordance with normal plant operating procedures.

9.2.8.5 Instrumentation Applications

Local flow, pressure, and temperature indicators are used to monitor the system condition.

9.2.9 REFERENCES

1. Technical Specifications, Diablo Canyon Power Plant Units 1 and 2, Appendix A to License Nos. DPR-80 and DPR-82, as amended.

2. Deleted in Revision 8

3. Evaluation of Peak CCW Temperature Scenarios for Diablo Canyon Units 1 and 2, WCAP-14282, Revision 1.

4. Deleted in Revision 12.

5. Analysis for Containment Response Following Loss-of-Coolant Accidents for Diablo Canyon Units 1 and 2, December 1993, WCAP-13907.

6. Analysis for Containment Response Following Main Steam Line Break for Diablo Canyon Units 1 and 2, December 1993, WCAP-13908.

7. NRC Letter, dated May 13, 1999, "Issuance of Amendments for Diablo Canyon Nuclear Power Plant, Unit No. 1 (TAC No. M98829) and Unit No. 2 (TAC No. M98830) and Close-out of Generic Letter 96-06 (TAC Nos. M96804 and M96805) (License Amendments 134/132)

8. NRC Letter, dated January 13, 2000, “Issuance of Amendments for Diablo Canyon Nuclear Power Plant Unit Nos. 1 and 2 (TAC Nos. MA 1406 and MA 1407) (License Amendments 138/138)

9.3 PROCESS AUXILIARIES

The process auxiliaries consist of those auxiliary systems associated with the reactor process systems. These systems include the compressed air systems, the backup air/nitrogen supply system, the sampling system, equipment and floor drainage systems, the chemical and volume control system (CVCS), failed fuel detection (performed using the sampling system), nitrogen and hydrogen systems, and miscellaneous process auxiliaries (i.e., the auxiliary steam system, and the oily water separator and turbine building sump system).

9.3.1 COMPRESSED AIR SYSTEM

The compressed air system, shown in Figure 3.2-25, provides compressed air for process control systems and for station service throughout Units 1 and 2 under normal operating conditions. The compressed air system is not required for containment isolation. The compressed air system, excluding the backup air/nitrogen supply system, as described in Section 9.3.1.6, is not required for reactor protection, containment isolation, or engineered safety features (ESF). The following sections provide information on: (a) design bases, (b) system description, (c) safety evaluation, (d) tests and inspections, and (e) instrumentation applications.

9.3.1.1 Design Bases

The compressed air system is shared by Units 1 and 2. The DCPP Q-List (see Reference 8 of Section 3.2) lists its design classification.

9.3.1.2 System Description

The compressed air system arrangement for Units 1 and 2 is shown in Figure 3.2-25. Table 9.3-1 lists design data for the components.

Four reciprocating air compressors, rated 334 scfm each, and two rotary screw compressors, rated 650 scfm each are located in the turbine area of Unit 1, in addition to one rotary compressor, rated at 650 scfm located at the Unit 1 west buttress. These compressors supply instrument air to Units 1 and 2. Normally, one of the rotary screw compressors operates as a base loaded machine and the other rotary compressors and the reciprocating compressors are on automatic standby - start control. A master compressor loading controller automatically loads and unloads the reciprocating compressors at preselected system supply header pressures. Each rotary screw compressor has its own control panel and local loading/unloading switch sensing pressure at the system supply header. Start and stop operation of rotary screw compressors is manual from their local control panel. Once started, these compressors load and unload automatically.

The compressors have nonlubricated cylinders to provide an oil-free air system. (Local oiling units are provided on the service air system where equipment requires

lubricated air.) Except for the rotary screw compressor at the Unit 1 west buttress, each compressor has a water-cooled aftercooler separator. The rotary screw compressor at the Unit 1 west buttress is an air-cooled machine identical to the water-cooled rotary compressors inside the turbine building. An additional water-cooled after cooler and moisture separator with drain trap is provided downstream of the rotary screw compressors in the common line going to pre-filters to further reduce the water load of the air entering the air dryers.

Prefilters upstream of the air dryers protect the desiccant beds from contamination by entrained water, pipe scale etc.; thereby extending desiccant life. The system has two air dryers, one of which is an "adsorbent heat-regenerative" type and the other a "heatless" type. Both air dryers are designed to produce -40°F pressure dewpoint with a dryer inlet air temperature of 100°F and a pressure of 100 psig. However, the system components served by instrument air do not require that the system pressure dewpoint be maintained at -40°F. The air system pressure dewpoint is maintained at least 18°F below the minimum temperature at any point in the instrument air system to preclude water blockage of instrument air lines and to prevent a buildup of rust that can break free and block instrument air lines. The system pressure dewpoint is monitored by a direct reading dewpoint indicator, with a "high moisture content" local alarm and "common trouble alarm" in the main control room.

Dry air leaving the air receiver is filtered through a 1 micron positive seal type after-filter before passing to the instrument air distribution system. The after-filter is provided with differential pressure indication, with a "high differential pressure" local alarm and a "common trouble alarm" in the control room.

The two air receivers provided act as "pulsation dampers" to eliminate the pressure pulses that reciprocating compressors generate. They also provide storage capacity to meet occasional high demands for compressed air.

Alarms in the control room indicate:

(1) "Common trouble" instrument air

(2) "Common trouble" service air

(3) Status of the standby reciprocating air compressors

The "Common Trouble" Instrument Air alarms are comprised of various system and component abnormal operations, which are flashed at the local annunciator "PK-80" located near the compressors at the 85 ft elevation in the turbine building.

The "common trouble" service air alarms are comprised of:

(1) Service air high moisture

(2) Service air low pressure

Local indications for the service air system moisture and pressure are provided near Unit 2 containment access controls at elevation 140 ft of the turbine building.

That portion of the air distribution piping penetrating the containment is isolated automatically following a containment isolation signal.

The service air system - located outdoors east of Unit 2 transformer yard, has two rotary screw compressors: one rated at 650 scfm and the other at 1050 scfm. Power supply to these compressors is from the 12 kV underground distribution system. Normally, one of the rotary compressors operates as a base-loaded machine and the other rotary compressor is on automatic standby – start control. Rotary compressors automatically load and unload at pre-selected system supply header pressures. Each rotary compressor has its own control panel and local loading/unloading switch sensing pressure at the system supply header. Start and stop operation of the compressors is manual from its local control panels. Once started, these compressors load and unload automatically.

The system has three air dryers, two of which are "heatless" type and the other a "heat of compression" type. Like the instrument air system air dryers, these dryers are also designed to produce -40°F pressure dewpoint. The service air system pressure dewpoint is also maintained within the limits stated above for the instrument air system. Dry air leaving the air dryers is filtered through a micron positive seal type after-filter before passing to the service air distribution system.

Additional temporary compressors are used, as appropriate, to supply supplemental service air. During normal operation the service air system is isolated from the instrument air system. A cross-tie line between the service air and the instrument air system can be used to supply instrument air in the event of a failure of the instrument air compressors. To maintain instrument air purity, the backfeed air enters the instrument air system upstream of the instrument air after filters.

9.3.1.3 Safety Evaluation

The compressed air system is required for startup and normal operation of the plant, but it is not required for safe shutdown, reactor protection, containment isolation, or ESFs. Consequently, except for the portion of the backup air/nitrogen supply system described in Section 9.3.1.6, and the portion of the air distribution piping penetrating the containment, the compressed air system is Design Class II. The portion of the air distribution piping penetrating the containment is Design Class I and meets single failure criteria required for containment isolation as described in Section 6.2.4.

Pneumatically operated devices are identified in the piping schematics of the various systems in Section 3.2. Loss of the normal air supply from the compressed air system will result in a safe shutdown of the unit. Most pneumatically operated devices in the

plant that have safety-related functions are designed to maintain a safe position or to assume a safe position upon loss of air pressure. Movement to this safe position (or maintaining this safe position) is accomplished by means of spring-return actuators and compressed gas from the backup air/nitrogen supply system. All such pneumatically operated devices are designed to achieve this safe position in the required time under the most limiting conditions, including gradual loss of the normal air supply from the compressed air system. If an air operated valve is required to operate after an assumed loss of the compressed air system, then that valve is also provided with a backup supply of compressed gas from the backup air/nitrogen supply system. Tables 3.9-9 and 6.2-39 show how valves will fail on loss of air or electrical power and the desired condition for safe shutdown. The tabulations show that most air-operated valves fail in the safe shutdown position upon loss of power or air. The tabulations also show the air operated valves that are required to operate or be maintained in a certain position for safe shutdown after an assumed loss of the compressed air system and that they are supplied with compressed gas from the backup air/nitrogen supply system. Therefore, safe shutdown will not be compromised upon loss of power or the compressed air system.

The main steam isolation valves receive a close signal on indication of a main steam line rupture (low steam line pressure, above P-11 setpoint, or high steam line pressure rate, below P-11 setpoint, in any steam line), or high-high containment pressure. Locally mounted air reservoirs, protected against system failure by check valves, can hold open the main steam isolation valves for a short duration of time to allow for recovery of the air system. However, if the air system cannot be recovered, the plant can still be safely shutdown with the main steam isolation valves closed.

Since the compressed air system is not required for proper operation of pneumatically operated devices which have safety-related functions, the system is not automatically switched to emergency diesel generator power in the event of a loss of power. However, if diesel generator loading conditions permit, the air compressors can be manually restarted on emergency diesel generator power.

In order to ensure that oil, water, or other impurities will not result in the failure of instrumentation or other equipment, the compressed air system is provided with oil-free compressor cylinders, prefilter, moisture separator, air dryers, and 1-micron after-filters.

Since the compressed air system is not required for proper operation of pneumatically operated devices, which have safety-related functions, sharing one air system for both units does not affect plant safety. A major failure of the distribution system for one unit could result in a loss of air pressure for the second unit but would not affect the safety of either unit. Manual isolation valves between units and on all major distribution headers allow isolation of sections of the system without affecting the normal operation of the remainder of the system. Automatic containment isolation will prevent accident conditions from propagating through the air system.

Equipment essential for a safe and maintained reactor shutdown is located near major components of the compressed air system. This equipment is separated from these components by a Design Class I concrete wall. As discussed in Section 3.5.2, the air receiver tanks (shown in Table 3.9-6) are capable of withstanding the thrust developed by failure of the largest pipe connected to them. The stresses in the tank holddown structure relating from this thrust do not exceed yield strength. Thus there is no danger to safe shutdown from postulated missiles created by the compressed air system.

9.3.1.4 Tests and Inspections

The compressed air system was tested and inspected prior to initial plant operation. Provisions are made for functional tests of the low air pressure alarm and containment isolation. Filters, air dryers, and air receivers are periodically inspected.

9.3.1.5 Instrumentation Applications

Instruments are provided to indicate operational status of the major components of the compressed air system. Activation of the standby reciprocating air compressor to full operational status is displayed in the control room.

9.3.1.6 Backup Air/Nitrogen Supply System

The plant can be taken to and maintained at hot shutdown without the use of air-operated valves. However, some air-operated valves are required for going from hot shutdown to cold shutdown.

Section 9.3.1.6.1 describes the backup air/nitrogen supply system, which provides a backup supply of compressed gas to the air-operated valves that are required to take the plant to cold shutdown and for those pneumatic operated valves that require a backup supply of compressed gas for other functions.

9.3.1.6.1 System Description

The backup air/nitrogen supply system supplies the motive force to operate certain pneumatic components in the event of a loss of the compressed gas system. In some cases the backup air/nitrogen supply system supplements the compressed gas system rather than serving as a backup air / nitrogen supply. The backup air/nitrogen supply system utilizes as its source instrument air supplied from the compressed air system, and high pressure nitrogen supplied from the nitrogen system, which is then stored for use in accumulators. In addition, high pressure bottled air, high pressure bottled nitrogen and low pressure nitrogen from the nitrogen system are utilized. Compressed gas from these sources are supplied to pneumatic components that normally use instrument air from the compressed air system or high-pressure nitrogen from the nitrogen supply system.

Most pneumatic-operated valves are designed to fail to their safe position in the event of a loss of the compressed gas system. However, some pneumatic-operated valves are required to operate or be maintained in a certain position after an assumed loss of the compressed gas system and are supplied with compressed gas from the backup air/nitrogen supply system.

The backup air/nitrogen supply system supplies compressed gas to the safety-related pneumatic-operated components that are required to perform an active safety-related function after the loss of the compressed air system. The backup air/nitrogen supply system also supplies air/nitrogen to selected components, pursuant to PG&E's commitments to the NRC to provide a seismically qualified backup air/nitrogen supply; hence these components are classified as safety-related even though operability of the valves is not strictly a safety-related function. Design classifications are included in the PG&E Q-List (see Section 3.2).

In addition to the safety-related components described above, there are a number of nonsafety-related components that have a backup supply of air/nitrogen in the event of loss of the compressed air system to prevent undesirable transients and/or to facilitate normal operation and shutdown. In addition, there are some components, or group of components, that when actuated require more air than can readily be supplied through the air/nitrogen supply connection. In these cases, local accumulators or receivers are provided that contain enough stored gas to allow these components to respond in the desired time. Design classifications are included in the PG&E Q-List (see Section 3.2).

To take the plant to cold shutdown from hot shutdown, compressed gas from the backup air/nitrogen supply system is provided to valves for charging/spray capability, steam dump capability, and reactor coolant system (RCS) boration sample capability. In addition, the operator also will have available the pressurizer power-operated relief valves (PORVs) required for overpressure protection, the capacity of letdown by line isolation valves, and containment fire water isolation valves. Backup air is also supplied to component cooling water (CCW) control valves on the outlet of the residual heat removal (RHR) heat exchanger and the auxiliary saltwater (ASW) control valves on the inlet of the CCW heat exchanger to ensure that these valves may be operated or maintained in the required position for safe shutdown.

Backup air/nitrogen for shutdown is provided in four ways:

(1) RCS boration sample valves are equipped with air accumulators that are protected from back flow into the main system by check valves. These can be used because the number of cycles for each valve is small, the air required for each valve is small, and the valves do not consume air in the quiescent state. The containment fire water isolation valve, the RHR heat exchanger CCW outlet valves and CCW heat exchanger ASW inlet valves are also equipped with accumulators to ensure that the valves can be operated or maintained in the required position for safe shutdown in the event of a loss of offsite power that causes the loss of the compressed air

system. The containment fire water isolation valve is equipped with a seismically qualified accumulator to help ensure the valve can remain open in the event of a fire after an earthquake so that manual fire fighting capabilities are available inside containment to the safety-related equipment.

(2) Throttling valves (the steam generator 10 percent atmospheric steam dump valves, or ADVs) and charging pump valve (the discharge to regenerative heat exchanger) consume air in the quiescent state. These valves are supplied with backup nitrogen supplies. The nitrogen system is capable of supplying motive gas as long as required since the requirements are small compared to the system capacity. The nitrogen system is not seismically qualified, so a second backup system is provided. It is composed of compressed air bottles for the 10 percent ADVs which can supply varying amounts of air via solenoid valves controlled from the control room and a nitrogen accumulator for the charging pump valve. Should the compressed air system and the nitrogen backup systems both fail, the compressed air bottles will be enabled by the operator to allow the operator to position the 10 percent ADVs at any position desired. The charging pump valve (the discharge to regenerative heat exchanger) needs only to be placed in the open or closed position, so its backup consists of a control-room-operated solenoid valve that can supply motive gas from the nitrogen accumulator bypassing the normal control system.

(3) Letdown line isolation valves are supplied with backup nitrogen from the nitrogen system.

(4) The pressurizer PORVs, charging pump valves (to loop 3 and loop 4 of the cold leg), and the pressurizer auxiliary spray valve are special cases of on-off valves. Due to the number of cycles and the size of the valves, normal air receivers would be huge. Therefore, a high pressure nitrogen accumulator for each valve is provided which is supplied by the nitrogen system at approximately 850 psig. These high-pressure accumulators are capable of providing sufficient motive gas to meet all the requirements on loss of both the compressed air and nitrogen systems. (It should be noted that the cycling requirements for the PORVs comes from overpressure protection, not shutdown requirements.)

9.3.1.6.2 Design Requirements

The Class I portion of the backup air/nitrogen supply system is installed in accordance with the quality assurance requirements for Instrument Class IA equipment. The accumulators are fabricated in accordance with the quality assurance requirements for Design Class I, Code Class C piping.

The Class I tubing is installed and protected in accordance with the Design Class I air piping requirements. The equipment is seismically qualified for its location in the plant to the applicable Hosgri spectra as described in Section 3.7. All accumulators and bottles are wall- or column-mounted as close to the application as possible, except for the PORV accumulators, which are mounted at the elevation 140 feet operating deck.

This equipment is not part of a Design Class I pressure boundary, so it is not subject to ASME Section III or ANSI B31.7.

9.3.2 SAMPLING SYSTEMS

The plant sampling systems provide a means for obtaining liquid and gas samples for laboratory analyses of chemical and radiochemical conditions of the designated reactor and secondary plant systems. The systems are designed to permit sampling during all modes of plant operation. The sampling systems provide the means for manual, grab type, sample collection, and where applicable, on-line monitoring of key chemistry parameters. Assurance of a representative sample will be by administrative procedures based on experience and good sampling techniques. These will include purging of sample lines prior to taking a sample and utilizing appropriate precleaned sampling containers.

9.3.2.1 Nuclear Steam Supply System Sampling System

9.3.2.1.1 Design Bases

The nuclear steam supply system (NSSS) sampling system is designed for manual operation on an intermittent basis, under conditions ranging from full power operation to cold shutdown. Pipe internal diameters are sized such that solids do not clog the lines.

Sampling system discharge flows are limited under normal and anticipated fault conditions (malfunctions or failure) to preclude any radioactivity release beyond the site boundary in excess of plant release limitations. Adequate safety features are provided to protect laboratory personnel and prevent the spread of contamination from the sampling room. The reactor coolant hot leg samples are routed through a sufficiently long length of tubing inside containment, and flowrates are controlled to permit decay of the short-lived N^{16} isotope to a level that permits normal access to the sampling room. Equipment required for sampling capability to confirm reactor coolant system boron concentration is seismically qualified to allow the plant to be taken to cold shutdown conditions following a design basis seismic event. Backup air or nitrogen is provided to the required pneumatic-operated valves as described in Section 9.3.1.6.

9.3.2.1.2 System Description

The sampling system, shown in Figure 3.2-11, provides the representative samples for laboratory analyses. The analyses show both chemical and radiochemical conditions and provide guidance in the operation of the RCS, RHR, CVCS. Typical information

obtained includes reactor coolant boron and chloride concentrations, fission product radioactivity level, hydrogen, oxygen, and fission gas content, conductivity, pH, corrosion product concentration, chemical additive concentration, etc. The information is used in regulating boron concentration adjustments, evaluating fuel element integrity and CVCS mixed bed demineralizer performance, and regulating additions of corrosion-inhibiting chemicals to the systems.

Samples are drawn from the following locations:

(1) Inside Containment

(a) The pressurizer steam space (RCS)

(b) The pressurizer liquid space (RCS)

(c) Hot legs of reactor coolant loops (2 points in the RCS)

(d) Each accumulator (safety injection system)

(2) Outside Containment

(a) The letdown line (2 points, upstream and downstream of the demineralizers) (CVCS)

(b) Each RHR heat exchanger outlet (RHRS)

(c) The volume control tank gas and liquid space (CVCS)

Local sample connections are provided at various locations throughout the plant. These connections are not considered part of the sampling system. Samples originating from locations within the containment flow through lines to the sampling room in the auxiliary building. Each line is equipped with a manual isolation valve close to the sample source, a remote air-operated valve immediately downstream of the isolation valve, and containment boundary isolation valves located inside and outside the containment. Manual valves are located inside the sampling room for component isolation, sample flow control, and routing. High-temperature sample lines also contain a sample heat exchanger.

The reactor coolant hot leg samples are routed through a sufficiently long length of tubing inside containment, and flow rates are controlled to permit decay of the short-lived N^{16} isotope to a level that permits normal access to the sampling room. This room has controlled ventilation and drainage to control radioactivity release.

All sample lines originating from locations outside the containment are provided with manual isolation valves. The RHRS sample lines and the VCT liquid sample line have,

in addition, a remote air-operated sampling valve. Manual valves are located in the sampling room for flow control and routing.

The sample sink, which is located in the sampling room, contains a drain line to the waste disposal system. Local instrumentation is provided to permit manual control of sampling operations and to ensure that the samples are at suitable temperatures and pressures before diverting flow to the sample sink. All sample lines are provided with a sample valve located at the sample sink, except for the volume control tank gas sample. The sample sink has a hood that is connected to the building ventilation exhaust system.

9.3.2.1.2.1 Component Description

Component codes and classifications are given in the DCPP Q-List (see Reference 8 of Section 3.2), and component design parameters are listed in Table 9.3-2.

9.3.2.1.2.1.1 Sample Heat Exchangers

The sample heat exchangers are of the shell and coil tube type. Sample flow circulates through the tube side, while component cooling water circulates through the shell-side. The tube side connections have socket-welded joints for connections to the high-pressure sample lines.

9.3.2.1.2.1.2 Sample Pressure Vessels

The sample vessels are sized to provide sufficient gas volume to perform a radiochemical analysis on the volume control tank gas space constituents, or sufficient reactor coolant volume for dissolved hydrogen and fission gas analyses.

Integral isolation valves are furnished with the vessel. Quick disconnect couplings containing poppet-type check valves are connected to nipples extending from the valves on each end.

9.3.2.1.2.1.3 Sample Sink

The sample sink is located in a hooded enclosure equipped with an exhaust ventilator. The work area around the sink and the enclosure is large enough for sample collection and storage, as well as for the radiation monitoring equipment.

The enclosure is penetrated by the various sample lines from the reactor systems and by a demineralized water line, all of which discharge into the sink which drains to the waste disposal system. The sink and work area material is stainless steel.

9.3.2.1.2.1.4 Delay Line

The high-pressure reactor coolant loop sample line has sufficient length to provide at least a 40-second sample transit time within the containment. Additional transit time from the reactor containment to the sampling hood is provided by the sampling line. This allows for decay of the short-lived isotope, N^{16}, to a level that permits normal access to the sampling room.

9.3.2.1.2.1.5 Piping

All liquid and gas sample lines are austenitic stainless steel tubing and are designed for high-pressure service. Lines are so located as to protect them from accidental damage during routine operation and maintenance.

9.3.2.1.2.1.6 Valves

Stop valves within the containment are remotely operated from the sampling room. They are used to isolate all sample points and to route sample flow. A remotely operated isolation valve is provided for samples originating from the RHRS so that the operator need not enter a possibly high radiation area following a loss-of-coolant accident (LOCA). Two isolation valves are provided, one inside and one outside the containment, on all sample lines leaving the containment. The valves trip closed upon actuation of the containment isolation signal. All valves in the system are constructed of austenitic stainless steel or equivalent corrosion-resistant material.

9.3.2.1.2.1.7 Hot Sample Sub-System (Unit 1 only)

The RCS Hot Sample Sub-system provides the capability to collect samples filtered from a side stream of the hot-leg sample flow. Filters to collect solids from the flow are located both upstream and downstream of a heat exchanger. The sub-system includes temperature, flow, and pressure instruments as well as valves and tubing.

9.3.2.1.2.2 System Operation

9.3.2.1.2.2.1 Reactor Coolant Loop and Pressurizer Liquid Samples

Reactor coolant loop and pressurizer liquid samples are obtained by opening the remotely operated isolation valve of the selected sample point. The sample heat exchangers cool the liquid samples.

A valve downstream of each heat exchanger is manually throttled to obtain the correct liquid sample flowrate. The sample stream flows through the sampling system to either sample sink 1-1 and 2-1 or the volume control tank in the CVCS until sufficient volume is purged to ensure that a representative sample will be obtained. When purging is completed, flow is diverted, if necessary, into the sample sink, and a sample is collected in a suitable container.

To obtain a reactor coolant loop liquid or pressurizer liquid sample for dissolved gas content, flow is diverted by opening and closing the appropriate valves into the appropriate sample pressure vessel. A valve is adjusted to the required downstream pressure for obtaining the correct sample flowrate. After the sample pressure vessel is purged and the sample collected by closing the isolation valves, the sample vessel is removed by opening the quick disconnect couplings. Note that pressurized samples of reactor coolant for gas analysis are normally obtained from the CVCS demineralizer inlet sample lines as described below.

9.3.2.1.2.2.2 Pressurizer Steam Space Samples

Pressurizer steam space samples are obtained by opening the remotely operated isolation valves. The sample heat exchanger condenses and cools the steam and the pressure is reduced by a manual valve. The condensate flows through a sample pressure vessel and into either sample sink 1-1 and 2-1 or the volume control tank in the CVCS until sufficient purge flow has been passed. The sample pressure vessel is then isolated and removed.

9.3.2.1.2.2.3 Residual Heat Removal Samples

During plant shutdown operations, samples are withdrawn from the outlet line of the RHR heat exchangers at a maximum temperature of 350°F. The correct sample flowrate is obtained by adjusting the valve downstream of the hot leg sample heat exchanger.

The fluid temperature is reduced in the sample heat exchanger by manual regulation of the sample flow to the heat exchanger. After sufficient volume has been purged to either sample sink 1-1 and 2-1 or the volume control tank in the CVCS to ensure that a representative sample will be obtained, flow is diverted, if necessary, to the sample sink for collection. If the pressure and temperature is low in the RHRS, local samples off the pump discharge can be taken.

9.3.2.1.2.2.4 Letdown Line Samples

Samples are obtained from the letdown line at a point upstream of the mixed bed demineralizers and at a point upstream of the volume control tank. After throttling, the fluid is initially purged to either sample sink 1-1 and 2-1 or the volume control tank in the CVCS and then routed into the sample sink for collection.

9.3.2.1.2.2.5 Volume Control Tank Gas Samples

After the volume control tank gas sample line has been drained of condensate, the gas is sampled by collection with a pressurized sample vessel or laboratory apparatus.

9.3.2.1.2.2.6 Volume Control Tank Liquid Samples

Volume control tank liquid samples are obtained by opening the remotely operated isolation valve and purging the line to the sample sink. Following sufficient purging, a sample may be taken at the sample sink.

9.3.2.1.2.2.7 Accumulator Samples

Accumulator samples are obtained by opening the remotely operated isolation valve of the selected accumulator and purging the line to sample sink 1-1 and 2-1. Following sufficient purging, a sample is drawn at the sample sink.

9.3.2.1.2.2.8 Reactor Coolant Solids Samples (Unit 1 only)

Samples of solids from the reactor coolant system are obtained by opening manual valves on the hot sample panel to direct a small flow through the sampling filters. The filter effluent is directed to the inlet of the CVCS demineralizers. After the sub-system is isolated, collected solids can be dried and examined in onsite or offsite laboratories.

9.3.2.1.3 Safety Evaluation

9.3.2.1.3.1 Availability and Reliability

The sampling system is neither required to function during an emergency nor is it required to take action to prevent an emergency condition. In the event of a LOCA, the system is isolated at the containment boundary. Reactor coolant system sampling capability is available following a design basis seismic event.

9.3.2.1.3.2 Leakage Provisions

Samples are collected under a hood provided with a vent to the building exhaust ventilation system. Liquid leakage in the sample sink is collected in the sink and drained to the waste disposal system. If there is any leakage from the system inside the containment (e.g., valve stem leakage), it is collected in the containment sump.

9.3.2.1.3.3 Exposure Control

The sampling room is equipped with a ventilated sample hood to reduce the potential for airborne radioactivity exposure of operating personnel. Sufficient length and flow control is provided in the reactor coolant sample line to reduce personnel exposure from short-lived radionuclides. Shielding is provided, as necessary, to reduce personnel exposures. The operating procedures specify the precautions to be observed when purging and drawing samples. All sampling operations are conducted with strict adherence to plant health physics safety regulations.

9.3.2.1.3.4 Incident Control

The system is designed to be operated on an intermittent basis under administrative control. The system is normally closed with no flow, except for the pressurizer steam space sample, which may be left open to provide a continuous purge. The reactor coolant hotleg sample may be open for extended periods of time for operation of the Hot Sample Panel Sub-system (Unit 1 only).

Sample lines penetrating the containment are equipped with remotely operated isolation valves that close on receipt of a containment isolation signal. In addition, the isolation valve in the CVCS letdown line outside the containment will close on containment isolation signal, isolating the letdown line sample lines from the containment.

9.3.2.1.4 Tests and Inspections

The sampling system is in use daily. Periodic visual inspection and preventive maintenance are conducted using normal industry practice.

9.3.2.1.5 Instrumentation Applications

The instrumentation provided for the sampling system is discussed below. All of the instrumentation gives local indication.

9.3.2.1.5.1 Temperature

Instrumentation is provided to measure the temperature of the sample flow in the outlet line of each sample heat exchanger.

9.3.2.1.5.2 Pressure

Instrumentation is provided to measure the pressure in the sample lines downstream of each of the three sample vessels: (a) pressurizer steam sample vessel, (b) pressurizer liquid sample vessel, and (c) hot leg sample vessel.

9.3.2.1.5.3 Flow

Instrumentation is provided to measure the sample purge flow of all liquid samples to the volume control tank in the CVCS and also the volume control tank gas sample purge to the vent header in the gaseous waste system.

9.3.2.1.5.4 Chemical

Instrumentation is provided to measure dissolved hydrogen and oxygen in the letdown line sample. These in-line instruments provide an alternate to manual collection.

9.3.2.2 Post Accident Sampling System

The Post Accident Sampling System (PASS) also referred to as the Post-LOCA Sampling System in other plant documentation, provides facilities for sampling and analysis of reactor coolant, containment sump (RHR pumps discharge), and containment atmosphere following an accident. This system may be used to obtain further information on accident conditions in the RCS and containment.

The system is designed and located such that plant personnel are able to obtain the necessary samples and analyses under accident conditions while limiting personnel radiation exposure.

9.3.2.2.1 Design Bases

The PASS system, the sample room enclosure, the electrical supply, and the heating, ventilation, and air conditioning system are all designated as Design Class II.

9.3.2.2.1.2 Personnel Protection

The shielding panels provided in the sampling system cabinets and the 2 foot thick concrete walls that enclose the post accident sampling room and its access ways, provide the necessary shielding to allow occupancy of the sample room and operation of the sampling system following a LOCA.

The ventilation system for the sample room is designed to aid in the protection of plant personnel from radiological contamination. This system is discussed in Section 9.4.10.

An area radiation monitor with local annunciation is installed in the post accident sampling room to warn personnel occupying the sampling room of high or increasing radiation. High radiation in the sampling room is also alarmed at the main control room annunciator.

An eyewash station is provided in the post accident sampling room.

9.3.2.2.2 System Description

The PASS, shown in Figure 3.2-11, is composed of the reactor coolant and containment sump (RHR pumps discharge) liquid sampling system and the containment atmosphere monitoring system. The equipment location for this system is also shown in Figure 3.2-11.

9.3.2.2.2.1 PASS Liquid Sampling System

The PASS liquid sampling system consists of the liquid sample panel and the sample coolers.

The following liquid samples are received at the liquid sample panel:

(1) Reactor coolant hot legs 1 and 4

2) RHR pump discharge

All samples received at the liquid sample panel are taken from existing lines outside of containment.

The liquid samples flow from their sources through the sample cooler to the liquid sample panel.

The liquid sample panel provides the means to purge each sample through its sample line and the sample panel to ensure representative samples are obtained for analysis.

All sample lines can be flushed with makeup water following each sampling operation, thereby reducing the radiation level in the sampling system.
The sample coolers for the liquid sampling system are installed in a sample cooler rack. One sample cooler is provided for each liquid sample line.

The cooling water sides of the sample coolers are arranged into two cooling banks. Each bank consists of five sample coolers connected in series and is provided with the following:

(1) Cooling water overtemperature switch

(2) Cooling water underpressure switch

(3) Cooling water low flow switch

(4) Cooling water relief valve sized to relieve a full bore flow from a broken sample coil

(5) Cooling water isolation valves for the inlet and discharge for each bank

Each sample line is provided with an inlet isolation valve for maintenance purposes.

9.3.2.2.2.2 Containment Atmosphere Monitoring System

The containment atmosphere monitoring system is designed to sample the containment atmosphere for isotopic analysis.

The containment atmosphere samples are collected in the containment and routed through a containment penetration, then through the sample panel, and returned to the containment atmosphere. A containment atmosphere dilution system provides the capability to obtain grab samples of diluted containment atmosphere. For particulate and iodine isotopic analysis, removable particulate and silver zeolite filters are provided in the sampling panel.

The sample flow to the containment atmosphere sample panel is established with a nitrogen gas flow through an eductor.

Special features are employed to prevent particulate and iodine plateout in the inlet line to the first air sample flask. These features include electrical heat tracing on the sample line, minimum radius bends in the sample lines, and the use of plug valves that avoid changes in the sample conditions.

The sampling panel design provides the means to purge or flush the sample system.

9.3.2.2.3 Control Provisions

Controls are provided on the control panel in the post accident sampling room that allow the operator to route these selected samples to the PASS room. Controls are also provided on the control panel to position the electrically operated containment isolation valves on the containment air monitoring system.

Under accident conditions, post accident sampling waste is returned to the containment via a local valve and a remote valve with controls at the control panel in the post accident sample room.

9.3.2.3 Secondary Sampling System

Samples from the secondary side of the steam generators originate at several points in the turbine cycle. These samples are taken from the discharge of condensate pumps, condensate booster pumps, condensate demineralizers, condensate drain pump, feedwater heaters, mainsteam leads and steam generator blowdown lines. Samples may be obtained at various local panels or at the secondary process control room for analysis. The analysis may be used to determine action level, condenser leak detection, corrosion product transport, and/or annunciator alarm signals. The main condensers are equipped with tube sheet and condensate tray salt water leak detection systems. These systems identify sea water ingress to the condenser. The leak detection system consists of eight in-line tube sheet monitors and seven in-line

condensate tray monitors. Each sample point is monitored separately to identify condenser in-leakage.

9.3.2.4 Turbine Steam Analyzer System

A turbine steam analyzer system, which was originally installed to provide continuous direct sampling and analysis of both the low and high pressure turbine steam on Unit 1 and only high pressure steam on Unit 2, is no longer being used at DCPP. Other chemistry methods for evaluating steam chemistry are used.

9.3.3 EQUIPMENT AND FLOOR DRAINAGE SYSTEMS

The equipment and floor drainage systems collect and channel waste liquids to be either reprocessed or discharged from the plant, except for those originating in the turbine building. The equipment and floor drainage systems are part of the liquid radwaste system (LRS) and are described in detail in Section 11.2. Figure 3.2-19 shows detailed piping schematics of these systems.

9.3.3.1 Design Bases

The equipment and floor drainage systems are designed to provide adequate drainage during normal operation and postulated flooding conditions following equipment failure including inadvertent actuation of a single fire water sprinkler head. Provisions are made for: (a) multiple drainage of certain areas, (b) prevention of backflooding, and (c) visual inspection of flow in drain lines wherever space permits, i.e., most lines above elevation 70 feet. The floor drainage systems also provide a detection method in the event of flooding.

However, the water accumulation that will result from any postulated failure of the drain system will not preclude safe shutdown of the plant.

9.3.3.2 System Description

9.3.3.2.1 Equipment Drain or Closed Drain System

The closed drain system is so called because drains from equipment are connected directly to the drainage system. Liquid waste is not exposed to the atmosphere once it leaves the equipment until it reaches its destination, which is either the miscellaneous equipment drain tank or the liquid holdup tanks. The system provides drainage for equipment located both inside and outside containment.

9.3.3.2.2 Floor Drain or Open Drain System

The open drain system, also known as the floor drainage system, drains potentially contaminated areas in the containment and auxiliary building and collects liquids from equipment located in those areas which normally do not handle reactor coolant. The piping systems or trenches used in this system permit exposure of contents to the atmosphere.

The auxiliary building has been divided into a number of drainage zones. Each equipment compartment or area within a zone is drained by several screened outlets as shown in Figure 9.3-5. The individual floor drains are 2 inches in diameter and feed 4 inch diameter headers, which eventually drain to a common collection header leading to the auxiliary building sump. Each header is provided with a check valve and loop seal as it enters the sump to prevent backup of water.

9.3.3.3 Safety Evaluation

An analysis of the consequences of leakage from the liquid radwaste system, including normal operation and postulated accidental releases, is presented in Chapters 11 and 15.

Flooding due to line or equipment failure in the auxiliary building is controlled by the open drain system. Several floor drains are located within each drainage zone and in the immediate vicinity of all safety-related equipment to preclude local flooding should one outlet become plugged. If the sump is filled to capacity due to excessive flow, the sump will overflow to the pipe trench instead of backing up into adjacent zones. In the event of flooding within one equipment area, across-the-floor drainage is acceptable.

The operator would be alerted to equipment failure or pipe rupture leading to flooding by the annunciation of the faulted system's pressure, temperature, flow, level, overcurrent, etc., alarms (located in the control room) in addition to the auxiliary building high-sump level alarm. High-flow alarms are installed in the fire water and makeup water systems since they are high-capacity nonradioactive systems. The location of failures in radioactive systems would be aided by the control room annunciation of area radiation monitors located throughout the auxiliary building as described in Section 11.4. The operator would be alerted to incipient failures by routine visual observation of sight glasses provided for the drainage header of each zone. These sight glasses are located in the corridor adjacent to the auxiliary building sump.

Potential sources of flooding, the consequences of postulated flooding, and other precautions to prevent such flooding are more specifically discussed in subsections on systems with a potential for causing flooding. These systems include:

(1) RHRS (Section 5.5.6)

(2) Auxiliary saltwater system (Section 9.2.7)

(3) CCWS (Section 9.2.2)

(4) Makeup water system (Section 9.2.3)

(5) Condensate storage facilities (Section 9.2.6)

(6) Fire protection water system (Section 9.5.1)

(7) Circulating water system (Section 10.4.5)

(8) Condensate and feedwater system (Section 10.4.7)

(9) Chilled water system, for cable spreading room air conditioning system (Section 9.4.9)

9.3.3.4 Tests and Inspections

The drainage systems were tested and inspected prior to plant operation and are periodically monitored during plant operation.

9.3.3.5 Instrumentation Applications

Flow and level instruments are provided for control, indication, and alarm in the drainage systems piping, collection tanks, and sumps. These instruments are described in Section 11.2.

9.3.4 CHEMICAL AND VOLUME CONTROL SYSTEM

The CVCS, shown in Figure 3.2-8, provides the following services to the RCS:

(1) Control of water chemistry conditions, activity level, soluble chemical neutron absorber concentration, and makeup water

(2) Maintenance of required water inventory in the RCS

(3) Filling, draining, and pressure testing

(4) Maintenance of seal water injection flow to the RCPs

(5) Processing of effluent reactor coolant to effect recovery and reuse of soluble chemical neutron absorber and makeup water

(6) High-head safety injection for the emergency core cooling system (ECCS) (refer to Section 6.3)

The CVCS is required for safe shutdown of the plant (refer to Sections 7.4, 9.3.4.1.5, and 9.3.4.1.25).

Centrifugal charging pumps (CCPs) CCP1 and CCP2 in the CVCS serve as the high-head safety injection pumps in the ECCS. Other than CCP1 and CCP2 and associated piping and valves, the CVCS is not required to function during a LOCA. During a LOCA, the CVCS is isolated except for CCP1 and CCP2 and the piping in the safety injection and seal injection paths. Operation of CVCS components performing ECCS functions to mitigate the effects of accidents is addressed in Section 6.3. CVCS components required to maintain the reactor coolant pressure boundary are discussed in Section 5.2. The remaining functions of the CVCS are discussed within this section.

9.3.4.1 Design Bases

9.3.4.1.1 General Design Criterion 2, 1967 – Performance Standards

The CVCS is designed to withstand the effects of, or be protected against, natural phenomena, such as earthquakes, tornadoes, flooding, winds, tsunamis, and other local site effects.

9.3.4.1.2 General Design Criterion 3, 1971 – Fire Protection

The CVCS is designed and located to minimize, consistent with other safety requirements, the probability and effects of fires and explosions.

9.3.4.1.3 General Design Criterion 4, 1967 – Sharing of Systems

The CVCS is not shared by the DCPP units unless it is shown safety is not impaired by the sharing.

9.3.4.1.4 General Design Criterion 9, 1967 – Reactor Coolant Pressure Boundary

The CVCS design includes provisions for the control of RCS chemistry such that the materials of construction of the pressure-retaining boundary of the RCS are protected from corrosion that might otherwise reduce the system structural integrity during its service lifetime.

9.3.4.1.5 General Design Criterion 11, 1967 – Control Room

The CVCS is designed to support actions for safe shutdown and to maintain and control the safe operational status of the plant from the control room or from an alternate location if control room access is lost due to fire or other causes.

9.3.4.1.6 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Instrumentation and controls are provided, as required, to monitor and maintain the CVCS variables within prescribed operating ranges.

9.3.4.1.7 General Design Criterion 13, 1967 – Fission Process Monitors and Controls

The CVCS design includes means for monitoring and maintaining control over the fission process throughout core life and for all conditions that can reasonably be anticipated to cause variations in reactivity of the core, such as concentration of soluble reactivity control poisons.

9.3.4.1.8 General Design Criterion 21, 1967 – Single Failure Definition

The CVCS is designed to perform its function after sustaining a single failure. Multiple failures resulting from a single event are treated as a single failure.

9.3.4.1.9 General Design Criterion 26, 1971 – Reactivity Control System Redundancy and Capability

The CVCS design includes one of the two independent reactivity control systems which are based on different design principles. The CVCS reactivity control system is capable of reliably controlling the rate of reactivity changes resulting from planned, normal power changes (including xenon burnout) to assure acceptable fuel design limits are not exceeded. The CVCS is capable of holding the reactor core subcritical under cold conditions.

9.3.4.1.10 General Design Criterion 28, 1967 – Reactivity Hot Shutdown Capability

The CVCS design includes one of the two independent reactivity control systems which are capable of independently making and holding the core subcritical from any hot standby or hot operating condition.

9.3.4.1.11 General Design Criterion 30, 1967 – Reactivity Holddown Capability

The CVCS design includes a reactivity control system capable of making and holding the core subcritical under any conditions with appropriate margins for contingencies.

9.3.4.1.12 General Design Criterion 31, 1967 – Reactivity Control Systems Malfunction

The CVCS design includes reactivity control systems capable of sustaining any single malfunction without causing a reactivity transient which could result in exceeding acceptable fuel damage limits.

9.3.4.1.13 General Design Criterion 32, 1967 – Maximum Reactivity Worth of Control Rods

Limits, which include considerable margin, are placed on the maximum rates at which reactivity can be increased by the CVCS to ensure that the potential effects of a sudden or large change of reactivity cannot: (a) rupture the reactor coolant pressure boundary, or (b) disrupt the core, its support structures, or other vessel internals sufficiently to impair the effectiveness of emergency core cooling.

9.3.4.1.14 General Design Criterion 49, 1967 – Containment Design Basis

The CVCS is designed so that the containment structure can accommodate, without exceeding the design leakage rate, the pressures and temperatures resulting from the largest credible energy release following a LOCA, including a considerable margin for effects from metal-water or other chemical reactions that could occur as a consequence of failure of emergency core cooling systems.

9.3.4.1.15 General Design Criterion 54, 1971 – Piping Systems Penetrating Containment

The piping that is part of the CVCS that penetrates containment is provided with leak detection, isolation, redundancy, reliability, and performance capabilities which reflect the importance to safety of isolating this system. The piping is designed with a capability to test periodically the operability of the isolation valves and associated apparatus and to determine if valve leakage is within acceptable limits.

9.3.4.1.16 General Design Criterion 55, 1971 – Reactor Coolant Pressure Boundary Penetrating Containment

Each CVCS line that penetrates the containment is provided with containment isolation valves.

9.3.4.1.17 General Design Criterion 56, 1971 – Primary Containment Isolation

The CVCS contains valving in piping that penetrates containment and that is connected directly to the containment atmosphere. Normally closed isolation valves are provided outside containment and automatic (check) valves are provided inside containment to ensure containment integrity is maintained.

9.3.4.1.18 General Design Criterion 68, 1967 – Fuel and Waste Storage Radiation Shielding

Radiation shielding is provided in the design of CVCS waste storage tanks, as required, to meet the requirements of 10 CFR Part 20.

9.3.4.1.19 General Design Criterion 70, 1967 – Control of Releases of Radioactivity to the Environment

The CVCS design includes those means necessary to maintain control over the plant radioactive effluents, whether gaseous, liquid, or solid. Appropriate holdup capacity is provided for retention of gaseous, liquid, or solid effluents, particularly where unfavorable environmental conditions can be expected to require operational limitations upon the release of radioactive effluents to the environment. The design for radioactivity control is justified on the basis of 10 CFR Part 20 requirements for normal operations and for any transient situation that might reasonably be anticipated to occur.

9.3.4.1.20 Chemical and Volume Control System Safety Functional Requirements

(1) Reactor Coolant System Inventory and Pressure Control

The CVCS is designed to maintain proper coolant inventory in the RCS for all normal modes of operation, including startup from cold shutdown, full power operation, and plant cooldown.

The CVCS is also designed to provide a flowpath to the pressurizer auxiliary spray system for means of cooling the pressurizer vapor volume during plant cooldown conditions.

(2) Protection from Missiles and Dynamic Effects

The PG&E Design Class I portions of the CVCS are designed to be protected against the effects of missiles and dynamic effects which may result from plant equipment failure.

(3) Reactor Coolant Pump Seal Water Injection

The CVCS is designed to provide filtered seal water flow to each RCP seal to provide cooling of the RCP seals and bearings.

9.3.4.1.21 10 CFR 50.49 – Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants

CVCS components that require environmental qualification (EQ) are qualified to the requirements of 10 CFR 50.49.

9.3.4.1.22 10 CFR 50.55a(f) – Inservice Testing Requirements

CVCS ASME Code components are tested to the requirements of 10 CFR 50.55a(f)(4) and a(f)(5) to the extent practical.

9.3.4.1.23 10 CFR 50.55a(g) – Inservice Inspection Requirements

CVCS ASME Code components are inspected to the requirements of 10 CFR 50.55a(g)(4) and a(g)(5) to the extent practical.

9.3.4.1.24 10 CFR 50.63 – Loss of All Alternating Current Power

The CVCS seal water system (supplied by CCP1, powered from the credited alternate alternating current [AAC] bus) is capable of maintaining adequate RCP seal cooling in the event of a station blackout (SBO).

9.3.4.1.25 10 CFR Part 50, Appendix R (Sections III.G, J, and L) – Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979

Section III.G – Fire Protection of Safe Shutdown Capability: Fire protection of the CVCS is provided by a combination of physical separation, fire-rated barriers, and/or automatic suppression and detection.

Section III.J – Emergency Lighting: Emergency lighting or battery operated lights (BOLs) are provided in areas where operation of the CVCS may be required to safely shut down the unit following a fire.

Section III.L – Alternative and Dedicated Shutdown Capability: Safe shutdown capabilities are provided in the control room and at an alternate location via the hot shutdown panel (HSP).

9.3.4.1.26 Regulatory Guide 1.97, Revision 3, May 1983 – Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident

The CVCS provides instrumentation to monitor system variables during and following an accident.

9.3.4.1.27 NUREG-0737 (Items I.C.1, II.B.2, II.K.1.5, III.D.1.1), November 1980 – Clarification of TMI Action Plan Requirements

Item I.C.1 – Guidance for the Evaluation and Development of Procedures for Transients and Accidents: NUREG-0737, Supplement 1, January 1983 provides the requirements for I.C.1 as follows:

Section 7.1(b) – Transients and accidents were reanalyzed for the purposes of preparing technical guidelines and upgrading emergency operating procedures.

Item II.B.2 – Design Review of Plant Shielding and Environmental Qualification of Equipment for Space/Systems Which May Be Used in Postaccident Operations: Plant shielding provides adequate access to, and occupancy of, the switchgear rooms for the

purpose of manually operating CVCS in its normal charging and letdown mode from the HSP, if required, following an MSLB.

Item II.K.1.5 – Safety Related Valve Position: Refer to Section 9.3.4.1.32.

Item III.D.1.1 – Integrity of Systems Outside Containment Likely to Contain Radioactive Material for Pressurized-Water Reactors and Boiling-Water Reactors: Appropriate portions of the CVCS are periodically pressure leak tested and visually inspected for leakage into the building environment.

9.3.4.1.28 Generic Letter 80-21, March 1980 – Vacuum Condition Resulting in Damage to Chemical Volume Control System (CVCS) Holdup Tanks

CVCS low pressure tanks, that can be valved to contain RCS water, are protected against vacuum conditions that could result in tank damage.

9.3.4.1.29 Generic Letter 88-17, October 1988 – Loss of Decay Heat Removal

To meet the requirements of Generic Letter 88-17, October 1988 and associated Generic Letter 87-12, July 1987, the CVCS PG&E Design Class I CCPs serve as the high pressure injection pumps to provide one of the two available or operable means of adding inventory to the RCS, that are in addition to the normal decay heat removal systems, to serve as backup sources to control RCS inventory upon loss of decay heat removal during non-power operation.

9.3.4.1.30 Generic Letter 89-10, June 1989 – Safety-Related Motor-Operated Valve Testing and Surveillance

CVCS PG&E Design Class I and position changeable motor-operated valves (MOVs) meet the requirements of Generic Letter 89-10, June 1989, and associated Generic Letter 96-05, September 1996.

9.3.4.1.31 Generic Letter 95-07, August 1995 – Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves

The CVCS PG&E Design Class I, power-operated gate valves are designed such that they are not susceptible to pressure locking or thermal binding.

9.3.4.1.32 IE Bulletin 79-06A (Positions 8 and 12), April 1979 – Review of Operational Errors and System Misalignments Identified During the Three Mile Island Incident

Position (8) (subsequently NUREG-0737, November 1980, Item II.K.1.5, Safety Related Valve Position): CVCS PG&E Design Class I valve positions, positioning requirements, and positive controls have been assured such that the valves remain positioned (open or closed) in a manner to ensure the proper operation of ESF to satisfy Position (8) of IE

Bulletin 79-06A, April 1979.

Position (12): CVCS design features are provided and procedures are in place during operating modes to deal with hydrogen gas that may be generated during a transient or other accident that would either remain inside the primary system or be released to the containment.

9.3.4.1.33 NRC Bulletin 88-04, May 1988 – Potential Safety-Related Pump Loss

The CVCS is designed such that PG&E Design Class I pumps that share a common minimum flow recirculation line will not be susceptible to the pump-to-pump interaction described in NRC Bulletin 88-04, May 1988.

9.3.4.1.34 NRC Bulletin 88-08, June 1988 – Thermal Stresses in Piping Connected to Reactor Coolant Systems

Unisolable CVCS piping sections connected to the RCS, which have the potential to be subjected to unacceptable thermal stresses due to temperature stratifications induced by leaking valves, have been identified. Means have been provided to ensure that the pressure upstream from block valves, which might leak, is monitored and controlled.

9.3.4.2 System Description

9.3.4.2.1 Reactivity Control

The CVCS regulates the concentration of chemical neutron absorber in the reactor coolant to control reactivity changes resulting from the change in reactor coolant temperature between cold shutdown and hot full power operation, burnup of fuel and burnable poisons, and xenon transients.

9.3.4.2.1.1 Reactor Makeup Control

(1) The CVCS is capable of borating the RCS through either one of two flowpaths and from either one of two boric acid sources.

(2) The amount of boric acid stored in the CVCS always exceeds that amount required to borate the RCS to cold shutdown concentration assuming that the RCCA with the highest reactivity worth is stuck in its fully withdrawn position. This amount of boric acid also exceeds the amount required to bring the reactor to hot shutdown and to compensate for subsequent xenon decay.

(3) The CVCS is capable of counteracting inadvertent positive reactivity insertion caused by the maximum boron dilution accident.

9.3.4.2.2 Regulation of Reactor Coolant Inventory

The CVCS maintains the proper coolant inventory in the RCS for all normal modes of operation including startup from cold shutdown, full power operation, and plant cooldown. This system also has sufficient makeup capacity to maintain the minimum required inventory in the event of minor RCS leaks.

The CVCS flow rate is based on the requirement that it permits the RCS to be either heated to or cooled from hot standby condition at the design rate and maintain proper coolant level.

9.3.4.2.3 Reactor Coolant Purification

The CVCS removes fission products and corrosion products from the reactor coolant during operation of the reactor and maintains these within acceptable levels. The CVCS can also remove excess lithium from the reactor coolant, keeping the lithium ion concentration within the desired limits for pH control.

The CVCS is capable of removing fission and activation products, in ionic form or as particulates, from the reactor coolant to provide access to those process lines carrying reactor coolant during operation and to minimize activity released due to leakage.

9.3.4.2.4 Chemical Additions

The CVCS provides a means for adding chemicals to the RCS to control the pH of the coolant during initial startup and subsequent operation, scavenge oxygen from the coolant during startup, and control the oxygen level of the reactor coolant due to radiolysis during all operations subsequent to startup. The CVCS is capable of maintaining the oxygen content and pH of the reactor coolant within limits specified in Table 5.2-15. There is also a capability to add zinc acetate to inhibit primary water stress corrosion cracking in Alloy 600 RCS components.

9.3.4.2.5 Seal Water Injection

The CVCS is able to continuously supply filtered water to each RCP seal, as required by the RCP design.

9.3.4.2.6 Hydrostatic Testing of the Reactor Coolant System

The CVCS can pressurize the RCS to its maximum specified hydrostatic test pressure to verify the integrity and leaktightness of the RCS through the use of a temporary hydrostatic test pump. The pump is capable of producing a hydrostatic test pressure greater than that required. The hydrostatic test is performed prior to initial operation and as part of the periodic RCS inservice inspection program.

9.3.4.2.7 Emergency Core Cooling

The CVCS components providing ECCS functions are discussed in Section 6.3.

9.3.4.2.8 Subsystems Description

The CVCS is shown in Figure 3.2-8 with system design parameters listed in Table 9.3-5.

The CVCS consists of several subsystems: the charging, letdown, and seal water system; the chemical control, purification and makeup system; and the boron recycle system.

9.3.4.2.8.1 Charging, Letdown, and Seal Water System

The charging and letdown functions of the CVCS are employed to maintain a programmed water level in the RCS pressurizer, thus maintaining proper reactor coolant inventory during all phases of normal plant operation. This is achieved by means of a continuous feed and bleed process during which the feed rate is automatically controlled based on pressurizer water level. The bleed rate can be chosen to suit various plant operational requirements by selecting the proper combination of letdown orifices in the letdown flowpath.

Reactor coolant is discharged to the CVCS from the reactor coolant loop piping between the RCP and the SG; it then flows through the shell-side of the regenerative heat exchanger where its temperature is reduced by heat transfer to the charging flow passing through the tubes. The coolant then experiences a large pressure reduction as it passes through a letdown orifice and flows through the tube side of the letdown heat exchanger where its temperature is further reduced to the operating temperature of the mixed bed demineralizers. Downstream of the letdown heat exchanger a second pressure reduction occurs. This second pressure reduction is performed by the low-pressure letdown valve, the function of which is to maintain upstream pressure, which prevents flashing downstream of the letdown orifices.

The coolant then flows through one of the two mixed bed demineralizers. The flow may then pass through the cation bed demineralizer, which is used intermittently when additional purification of the reactor coolant is required.

The coolant then flows through the reactor coolant letdown filter and into the VCT through a spray nozzle in the top of the tank. The gas space in the VCT is filled with hydrogen. The partial pressure of hydrogen in the VCT determines the concentration of hydrogen dissolved in the reactor coolant.

The CCPs normally take suction from the VCT and return the cooled, purified reactor coolant to the RCS through the charging line. The VCT is located above the CCPs to provide sufficient net positive suction head (NPSH). Normal charging flow is handled by

one of the three CCPs. The bulk of the charging flow is pumped back to the RCS through the tube side of the regenerative heat exchanger. The letdown flow in the shell-side of the regenerative heat exchanger raises the charging flow to a temperature approaching the reactor coolant temperature. The flow is then injected into a cold leg of the RCS. Two charging paths are provided from a point downstream of the regenerative heat exchanger. A flowpath is also provided from the regenerative heat exchanger outlet to the pressurizer spray line. An air-operated valve in the spray line is employed to provide auxiliary spray from the CCPs to the vapor space of the pressurizer during plant cooldown. This provides a means of cooling the pressurizer near the end of plant cooldown, when the RCPs are not operating.

A portion of the charging flow is directed to the RCPs through a seal water injection filter. It enters the pumps at a point between the labyrinth seals and the No. 1 seal. Here the flow splits and a portion enters the RCS through the labyrinth seals and thermal barrier. The remainder of the flow is directed up the pump shaft, cooling the lower bearing, and leaves the pump via the No. 1 seal. Most of the No. 1 seal flow discharges to a common manifold, exits the containment, and then passes through the seal water return filter and the seal water heat exchanger to the suction side of the CCPs, or by alternate path to the VCT. A very small portion of the seal flow leaks through to the No. 2 seal. Seal No. 3 is a double-dam seal, providing a final barrier to leakage to containment atmosphere.

An excess letdown path from the RCS is provided in the event that the normal letdown path is inoperable. Reactor coolant can be discharged from a cold leg and flows through the tube side of the excess letdown heat exchanger. Downstream of the heat exchanger a remote-manual control valve controls the excess letdown flow. The flow normally joins the No. 1 seal discharge manifold and passes through the seal water return filter and heat exchanger to the VCT. The excess letdown flow can also be directed to the reactor coolant drain tank. When the normal letdown line is not available, the normal purification path is also not in operation. Therefore, this alternative condition would allow continued power operation for limited periods of time dependent on RCS chemistry and activity. The excess letdown flowpath may also be used to provide additional letdown capability when needed. This capability may be needed during RCS heatup, as a result of coolant expansion. This path removes some of the excess reactor coolant due to expansion of the system as a result of the RCS temperature increase. In this case, the excess letdown is diverted to the reactor coolant drain tank.

Surges in RCS inventory due to load changes are accommodated for the most part in the pressurizer. The VCT provides surge capacity for reactor coolant expansion not accommodated by the pressurizer. If water level in the VCT exceeds the normal operating range, a proportional controller modulates a three-way valve downstream of the reactor coolant letdown filter to divert a portion of the letdown to the liquid holdup tanks (LHUTs) in the boron recovery system. If the high-level limit in the VCT is reached, an alarm is actuated in the control room and the letdown is completely diverted to the LHUTs.

Liquid effluent in the LHUTs is processed as a batch operation. This liquid is pumped by the gas stripper feed pumps through the evaporator feed ion exchangers. It then flows through the ion exchanger filter, and then the liquid is drained to the liquid radwaste system for processing.

Low level in the VCT initiates makeup from the reactor makeup control system (RMCS). If the RMCS does not supply sufficient makeup to keep the VCT level from falling to a lower level, an emergency low-level signal causes the suction of the CCPs to be transferred to the RWST.

All parts of the charging and letdown system are shielded as necessary to limit dose rates during operation with 1 percent fuel defects assumed. The regenerative heat exchanger, excess letdown heat exchanger, letdown orifices, and seal bypass orifices are located within the reactor containment. All other system equipment is located inside the auxiliary building.

9.3.4.2.8.2 Chemical Control, Purification, and Makeup System

9.3.4.2.8.2.1 pH Control

The pH control chemical employed is lithium hydroxide. This chemical is chosen for its compatibility with the materials and water chemistry of borated water/stainless steel/zirconium alloy/Inconel systems. In addition, lithium is produced in the core region due to irradiation of the dissolved boron in the coolant.

The lithium hydroxide is introduced into the RCS via the charging flow. The solution is prepared in the laboratory and poured into the chemical mixing tank. Primary makeup water is then used to flush the solution to the suction manifold of the CCPs. The concentration of lithium hydroxide in the RCS is maintained in the range specified for pH control (refer to Table 5.2-15). If the concentration exceeds this range, as it may during the early stages of core life, the cation bed demineralizer is employed in the letdown line in series operation with a mixed bed demineralizer. Since the amount of lithium to be removed is small and its buildup can be readily calculated, the flow through the cation bed demineralizer is not required to be full letdown flow.

9.3.4.2.8.2.2 Oxygen Control

During reactor startup from the cold condition, hydrazine is employed as an oxygen-scavenging agent. The hydrazine solution is introduced into the RCS in the same manner as described above for the pH control agent. Hydrazine is not employed at any time other than startup from the cold shutdown state.

Dissolved hydrogen is employed to control and scavenge oxygen produced due to radiolysis of water in the core region. Sufficient partial pressure of hydrogen is maintained in the VCT such that the specified equilibrium concentration of hydrogen is

maintained in the reactor coolant. A pressure control valve maintains a minimum pressure in the vapor space of the VCT. This valve can be adjusted to provide the correct equilibrium hydrogen concentration.

9.3.4.2.8.2.3 Reactor Coolant Purification

Mixed bed demineralizers are provided in the letdown line to provide cleanup of the letdown flow. The demineralizers remove ionic corrosion products and certain fission products. One demineralizer is usually in continuous service for normal letdown flow and can be supplemented intermittently by the cation bed demineralizer, if necessary, for additional purification. The cation resin removes principally cesium and lithium isotopes from the purification flow.

The maximum temperature that will be allowed for the mixed bed and cation bed demineralizers is approximately 140°F. If the temperature of the letdown stream approaches this level, the flow will be diverted automatically so as to bypass the demineralizers. If the letdown is not diverted and temperature increases, there would be a decrease in overall ion removal capacity; however, the resins do not lose their exchange capability immediately.

There would be no safety problem associated with overheating of the demineralizer resins. The only effect on reactor operating conditions would be the possibility of a slight increase in the reactor coolant activity level and RCS chemical contaminants.

The deborating demineralizers are located downstream of the mixed bed and cation bed demineralizers and can be used intermittently to remove boron from the reactor coolant near the end of the core life when boron concentration is low. When the deborating demineralizers are in operation, the letdown stream passes through the mixed bed demineralizers and then through the deborating demineralizers and into the VCT after passing through the reactor coolant letdown filter.

A further cleanup feature is provided for use during cold shutdown and residual heat removal. A remotely operated valve admits a bypass flow from the RHR system into the letdown line upstream of the letdown heat exchanger. The flow passes through the heat exchanger, through a mixed bed demineralizer and the reactor coolant letdown filter to the VCT. The fluid is then returned to the RCS via the normal charging route.

Filters are provided at various locations to ensure filtration of particulate and resin fines and to protect the seals on the RCPs.

Fission gases are removed from the system by venting the VCT to the waste disposal system.

9.3.4.2.8.2.4 Chemical Shim and Reactor Coolant Makeup

The soluble neutron absorber (boric acid) concentration and the reactor coolant inventory are controlled by the RMCS. In addition, for emergency boration and makeup, the capability exists to provide refueling water or 4 weight percent boric acid (7,000 ppm boron) to the suction of the CCPs. All CCPs are capable of providing emergency boration flow; however, only CCP1 and CCP2 are credited with this function during power operation, startup, and hot standby. However, CCP3 can serve as a backup to CCP1 and CCP2 in the event they are lost due to a fire (refer to Section 9.3.4.3.25 and Appendix 9.5H).

The boric acid is stored in two boric acid tanks (also known as boric acid storage tanks). Two boric acid transfer pumps are provided with one pump normally aligned with one boric acid tank running continuously at low speed to provide recirculation of the boric acid system. The second pump is aligned with the second boric acid tank and is considered as a standby pump, with service being transferred as operation requires. This second pump also circulates fluid, as needed, through the second boric acid tank. Manual or automatic initiation of the RMCS will activate the running pump to the higher speed to provide normal makeup of boric acid solution as required.

The primary makeup water pumps, taking suction from the primary makeup water storage tank, are employed for various makeup and flushing operations throughout the systems. One of these pumps also starts on demand from the RMCS and provides flow to the boric acid blender. The flow from the boric acid blender is directed to either the suction manifold of the CCPs or the VCT through the letdown line and spray nozzle.

During reactor operation, changes are made in the reactor coolant boron concentration for the following conditions:

(1) Reactor startup - boron concentration must be decreased from shutdown concentration to achieve criticality.

(2) Load follow - boron concentration must be either increased or decreased to compensate for the xenon transient following a change in load.

(3) Fuel burnup - boron concentration must be decreased to compensate for fuel burnup.

(4) Cold shutdown - boron concentration must be increased to the cold shutdown concentration.

The RMCS instruments provide a manually preselected makeup composition to the CCP suction header or the VCT. The makeup control functions are those of maintaining desired operating fluid inventory in the VCT and adjusting reactor coolant boron concentration for reactivity control.

Automatic Makeup of Reactor Makeup Control System

The automatic makeup mode of operation of the RMCS provides boric acid solution preset to match the boron concentration in the RCS. The automatic makeup compensates for minor leakage of reactor coolant without causing significant changes in the coolant boron concentration.

Under normal plant operating conditions, the RMCS mode and makeup stop valves are set in the "automatic makeup" position. A preset low-level signal from the VCT level controller causes the automatic makeup control action to start a primary makeup water pump, switch a boric acid transfer pump to high-speed operation, open the makeup stop valve to the CCP suction, and throttle the concentrated boric acid control valve and the primary makeup water control valve. The flow controllers then blend the makeup stream according to the preset concentration. Makeup addition to the CCP suction header causes the water level in the VCT to rise. At a preset high-level point, the makeup is stopped, the primary makeup water pump stops, the primary makeup water control valve closes, the boric acid transfer pump returns to low-speed operation, the concentrated boric acid control valve closes, and the makeup stop valve to CCP suction closes.

If the automatic makeup fails or is not aligned for operation and the tank level continues to decrease, a low-level alarm is actuated. Manual action may correct the situation or, if the level continues to decrease, an emergency low-level signal from both channels opens the stop valves in the refueling water supply line and closes the stop valves in the VCT outlet line.

Dilute

The dilute mode of operation permits the addition of a preselected quantity of primary makeup water at a preselected flow rate to the RCS. The operator sets the RMCS mode to "dilute," the primary makeup water flow setpoint to the desired flow rate, the primary makeup water batch to the desired quantity, and initiates system start. This opens the primary makeup water control valve to the VCT and starts a primary water makeup pump that will deliver water to the VCT. From here the water goes to the CCP suction header. Excessive rise of the VCT water level is prevented by automatic actuation (by the tank level controller) of a three-way diversion valve which routes the reactor coolant letdown flow to the LHUTs in the boron recovery system. When the preset quantity of water has been added, the RMCS causes the pump to stop and the control valve to close.

Alternate Dilute

The alternate dilute mode of operation is similar to the dilute mode except a portion of the dilution water flows directly to the CCP suction and a portion flows into the VCT via the spray nozzle and then flows to the CCP suction.

Borate

The borate mode of operation permits the addition of a preselected quantity of concentrated boric acid solution at a preselected flow rate to the RCS. The operator sets the RMCS mode to "borate," the concentrated boric acid flow setpoint to the desired flow rate, the concentrated boric acid batch to the desired quantity, and initiates system start. This opens the makeup stop valve to the CCPs' suction and switches the boric acid transfer pump to high-speed operation, which delivers a 4 weight percent boric acid solution (7,000 ppm boron) to the CCP suction header. The total quantity added in most cases is so small that it has only a minor effect on the VCT level. When the preset quantity of concentrated boric acid solution is added, the RMCS returns the boric acid transfer pump to low-speed operation and closes the makeup stop valve to the suction of the CCPs.

Manual

The manual mode of operation permits the addition of a preselected quantity and blend of boric acid solution to the RCS, to the RWST, or to the LHUTs in the boron recovery system. While in the manual mode of operation, automatic makeup to the RCS is precluded. The discharge flowpath must be prepared by opening manual valves in the desired path.

The operator then sets the RMCS mode to "manual," the concentration of boric acid is set and the required batch gallons are set to the desired flow rates, the boric acid and primary makeup water batch to the desired quantities, and initiates system start. The system start actuates the boric acid flow control valve and the primary makeup water flow control valve to the boric acid blender, starts the preselected primary makeup water pump, and switches the boric acid transfer pump to high-speed operation.

When the preset quantities of boric acid and primary makeup water have been added, the primary makeup water pump stops, the boric acid transfer pump returns to low-speed operation, and the boric acid control valve and the primary makeup water flow control valve close. This operation may be stopped manually by initiating system stop.

If either batch setpoint is satisfied before the other has recorded its required total, the pump and valve associated with the setpoint which has been satisfied will terminate flow. The flow controlled by the other setpoint will continue until that setpoint is satisfied.

Alarm Functions

The RMCS is provided with alarm functions to call the operator's attention to the following conditions:

(1) Deviation of primary makeup water flow rate from the control setpoint.

(2) Deviation of concentrated boric acid flow rate from control setpoint.

(3) High level in the VCT. This alarm indicates that the level in the tank is approaching high level and a resulting 100 percent diversion of the letdown stream to the LHUTs in the boron recovery system.

(4) Low level in the VCT. This alarm indicates that the level in the tank is approaching emergency low level and resulting realignment of CCP suction to the RWST.

9.3.4.2.8.3 Boron Recovery System

The boron recovery system collects borated water that results from the following plant operations. In each of these operations, the excess reactor coolant is diverted from the letdown line to the LHUTs as a result of high VCT level.

(1) Dilution of reactor coolant to compensate for core burnup

(2) Load follow

(3) Hot shutdowns and startups

(4) Cold shutdowns and startups

(5) Refueling shutdowns and startups

Excess liquid effluents containing boric acid and flow from the RCS through the letdown line are collected in the LHUTs. As liquid enters the LHUTs, the nitrogen cover gas is displaced to the gas decay tanks in the waste disposal system through the waste vent header. The concentration of boric acid in the LHUTs varies through core life from the refueling concentration to near zero at the end of the core cycle. An LHUT recirculation pump is provided to transfer liquid from one LHUT to another.

Liquid effluent in the LHUTs is processed as a batch operation. This liquid is pumped by the gas stripper feed pumps through the evaporator feed ion exchangers. It then flows through the ion exchanger filter, and then the liquid is drained to the liquid radwaste system for processing.

9.3.4.2.9 Component Description

A summary of principal CVCS component design parameters is given in Table 9.3-6. CVCS safety classifications and design codes are given in the DCPP Q-List (refer to Reference 8 of Section 3.2). All CVCS piping that handles radioactive liquid is austenitic stainless steel. All piping joints and connections are welded, except where

flanged connections are required to facilitate equipment removal for maintenance and hydrostatic testing.

9.3.4.2.9.1 Centrifugal Charging Pumps

Three CCPs inject coolant into the RCS and are of the single-speed, horizontal, centrifugal type. All parts in contact with the reactor coolant are fabricated of austenitic stainless steel or other material of adequate corrosion-resistance. There is a minimum flow recirculation line on each CCP discharge header to protect them against a closed discharge valve condition.

Charging flow rate is determined from a pressurizer level signal. Charging flow control is accomplished by a modulating valve on the discharge side of the CCPs. CCP1 and CCP2 also serve as the high-head safety injection pumps in the ECCS with induction motors that are powered by the Class 1E 4.16-kV system.

9.3.4.2.9.2 Boric Acid Transfer Pumps

Two horizontal, centrifugal, two-speed pumps with mechanical seals are supplied. The pumps' motors are powered by the Class 1E 480-V system. Normally, one pump is aligned with one boric acid tank and runs continuously at low speed to provide recirculation of the boric acid system. The second pump is aligned with the second boric acid tank, then considered as a standby pump, with service being transferred as operation requires. This second pump also intermittently circulates fluid through the second tank. Manual or automatic initiation of the RMCS will activate the running pump to the higher speed to provide normal makeup of boric acid solution, as required. For emergency boration, supplying of boric acid solution to the suction of the CCPs can be accomplished by manually actuating either or both pumps. The transfer pumps also function to transfer boric acid solution from the batching tank to the boric acid tanks. In addition to the automatic actuation by the RMCS, and manual actuation from the main control board, these pumps may also be controlled locally at the HSP.

The pumps are heat-traced to prevent crystallization of the boric acid solution. All parts in contact with the solution are of austenitic stainless steel.

9.3.4.2.9.3 Gas Stripper Feed Pumps

The two gas stripper feed pumps supply feed through the evaporator feed ion exchangers from the LHUTs and route it to the liquid radwaste system. The non-operating pump is a standby and is available for operation in the event the operating pump malfunctions. These centrifugal pumps are constructed of austenitic stainless steel.

9.3.4.2.9.4 Liquid Holdup Tank Recirculation Pump

The recirculation pump is used to mix the contents of an LHUT for sampling or to transfer the contents of an LHUT to another LHUT. The wetted surface of this pump is constructed of austenitic stainless steel.

9.3.4.2.9.5 Boric Acid Reserve Tank Pumps

The two boric acid reserve tank pumps discharge water from the boric acid reserve tanks to other portions of the CVCS. The pumps are constructed of austenitic stainless steel.

9.3.4.2.9.6 Boric Acid Reserve Tank Recirculation Pumps

Two boric acid reserve tank recirculation pumps are provided for each tank. Only one pump per tank is running at a time with the other on standby. These pumps are used to recirculate boric acid through installed piping, equipment, and an inline heater to maintain a fluid temperature above 80°F. These pumps are seal-less and the wetted surface is constructed of austenitic stainless steel.

9.3.4.2.9.7 Regenerative Heat Exchanger

The regenerative heat exchanger is designed to recover heat from the letdown flow by reheating the charging flow, which reduces thermal shock on the charging penetrations into the reactor coolant loop piping.

The letdown stream flows through the shell of the regenerative heat exchanger, and the charging stream flows through the tubes. The unit is made of austenitic stainless steel and is of an all-welded construction.

9.3.4.2.9.8 Letdown Heat Exchanger

The letdown heat exchanger cools the letdown stream to the operating temperature of the mixed bed demineralizers. Reactor coolant flows through the tube side of the exchanger while CCW flows through the shell-side. All surfaces in contact with the reactor coolant are austenitic stainless steel, and the shell is carbon steel.

9.3.4.2.9.9 Excess Letdown Heat Exchanger

The excess letdown heat exchanger cools reactor coolant letdown flow, which is equivalent to the nominal seal injection flow which flows downward through the RCP labyrinth seals.

The excess letdown heat exchanger can be employed either when normal letdown is temporarily out of service to maintain the reactor in operation or it can be used to supplement maximum letdown during the final stages of heatup. The letdown flows

through the tube side of the unit and CCW is circulated through the shell side. All surfaces in contact with reactor coolant are austenitic stainless steel, and the shell is carbon steel. All tube joints are welded.

9.3.4.2.9.10 Seal Water Heat Exchanger

The seal water heat exchanger is designed to cool fluid from three sources: RCP seal water returning to the CVCS, reactor coolant discharged from the excess letdown heat exchanger, and CCP bypass flow. Reactor coolant flows through the tube side of the heat exchanger, and CCW is circulated through the shell side. The design flow rate is equal to the sum of the excess letdown flow, maximum design RCP seal leakage, and bypass flow from the CCPs. The unit is designed to cool the above flow to the temperature normally maintained in the VCT. All surfaces in contact with reactor coolant are austenitic stainless steel, and the shell is carbon steel.

9.3.4.2.9.11 Volume Control Tank

The VCT provides surge capacity for part of the reactor coolant expansion volume not accommodated by the pressurizer. When the level in the tank reaches the high-level setpoint, the remainder of the expansion volume is accommodated by diversion of the letdown stream to the LHUTs. It also provides a means for introducing hydrogen into the coolant to maintain the required equilibrium concentration, is used for degassing the reactor coolant, and serves as a head tank for the suction of the CCPs.

A spray nozzle located inside the tank on the letdown line nozzle provides liquid-to-gas contact between the incoming fluid and the hydrogen atmosphere in the tank.

For degassing, the tank is provided with a remotely operated solenoid valve backed up by a pressure control valve, which ensures that the tank pressure does not fall below minimum operating pressure during degassing to the waste disposal system. Relief protection, gas space sampling, and nitrogen purge connections are also provided. The tank can also accept the seal water return flow from the RCPs, although this flow normally goes directly to the suction of the CCPs.

9.3.4.2.9.12 Boric Acid Tanks

The combined boric acid tank capacity is sized to store sufficient boric acid solution for a cold shutdown from full power operation immediately following refueling with the most reactive RCCA not inserted, plus operating margins.

The concentration of boric acid solution in storage is maintained between 4.0 and 4.4 percent by weight (7,000 to 7,700 ppm boron). Periodic manual sampling and corrective action, if necessary, ensure that these limits are maintained. As a consequence, measured amounts of boric acid solution can be delivered to the reactor coolant to control the concentration.

Each of two electric heaters in each boric acid tank is designed to maintain the temperature of the boric acid solution at 165°F with ambient air temperature of 40°F, thus ensuring a temperature in excess of the solubility limit. Heater controls maintain the temperature of the boric acid solution at nominally between 110°F and 120°F.

The boric acid tanks can be filled from the batch tank.

9.3.4.2.9.13 Batching Tank

The batching tank is used for mixing a makeup supply of boric acid solution for transfer to the boric acid tanks or the boric acid reserve tanks. The tank may also be used for solution storage.

A local sampling point is provided for verifying the solution concentration prior to transferring it out of the tank. The tank is provided with an agitator to improve mixing during batching operations and a means for heating the boric acid solution.

9.3.4.2.9.14 Chemical Mixing Tank

The primary use of the chemical mixing tank is in the preparation of lithium hydroxide solutions for pH control and hydrazine for oxygen scavenging.

9.3.4.2.9.15 Liquid Holdup Tanks

A total of five LHUTs are provided for DCPP Unit 1 and Unit 2. Two of these tanks serve Unit 1, and two serve Unit 2. The fifth tank can be used with either Unit 1 or Unit 2. The LHUTs hold radioactive liquid, which enters from the letdown line. The liquid is released from the RCS during startup, shutdowns, load changes, and from boron dilution to compensate for burnup. The contents of one tank are normally being processed by the ion exchangers while the other tank is being filled. The tank shared by Unit 1 and Unit 2 is typically kept empty to provide additional storage capacity, when needed, and can be used to store supplemental refueling water.

The total liquid storage capacity of three LHUTs is approximately equal to two RCS volumes. The tanks are constructed of austenitic stainless steel.

9.3.4.2.9.16 Boric Acid Reserve Tanks

Two boric acid reserve tanks are provided for storage of boric acid to meet operational needs for a ready supply of boric acid solution. One tank is maintained on a short recirculation through an inline circulation heater to maintain the tank contents and the associated piping and equipment above 80°F. The other tank is maintained on long recirculation, which also includes the transfer piping in the recirculation loop. Recirculation is normally accomplished by using either one of the two installed recirculation pumps. A transfer pump is provided to send boric acid to the boric acid tank or to the batch tank.

Flush water can be provided from the MWS to flush the boric acid from the piping, through the flush bypass line, to the LHUTs. In addition, water from the boric acid reserve tank can also be pumped to the processed waste receiver or to the LHUTs via installed connections.

The tanks are provided with a Hypalon coated floating cover that will prevent absorption of oxygen by the boric acid solution. In addition, the annular space around the side of the cover between the fluid surface and the bladder attachment point is continuously purged with nitrogen to further reduce the absorption of oxygen by the boric acid. The nitrogen purge vents out vent holes in the bladder attachment bar inside the tank and then vents to the room atmosphere through the tank vent.

9.3.4.2.9.17 Mixed Bed Demineralizers

Two flushable mixed bed demineralizers assist in maintaining reactor coolant purity. A lithium-form cation resin and hydroxyl-form anion resin are charged into the demineralizers. Both forms of resin remove fission and corrosion products. The resin bed is designed to reduce the concentration of ionic isotopes in the purification stream, except for cesium, yttrium, and molybdenum, by a minimum factor of 10.

Each demineralizer nominally has sufficient capacity for approximately one core cycle with 1 percent defective fuel rods. One demineralizer serves as a standby unit for use if the operating demineralizer becomes exhausted during operation.

The normal resin volume is 30 cubic feet per demineralizer. The maximum resin volume is 39 cubic feet per demineralizer. Resin volumes greater than 30 cubic feet cannot be regenerated in the vessel and must be flushed when no longer needed. Resin volumes less than 30 cubic feet may be used for special resins or to meet various requirements.

9.3.4.2.9.18 Cation Bed Demineralizer

The flushable cation resin bed in the hydrogen form is located downstream of the mixed bed demineralizers and is used intermittently to control the concentration of Li^7 which builds up in the coolant from the B^{10} (n, α) Li^7. The demineralizer also has sufficient capacity to maintain the cesium-137 concentration in the coolant below 1 μCi/cc with 1 percent defective fuel. The resin bed is designed to reduce the concentration of ionic isotopes, particularly cesium, yttrium, and molybdenum, by a minimum factor of 10.

The cation bed demineralizer has sufficient capacity for approximately one core cycle with 1 percent defective fuel rods.

9.3.4.2.9.19 Deborating Demineralizers

When required, two anion demineralizers remove boric acid from the RCS fluid. The demineralizers are provided for use near the end of a core cycle, but can be used at any time when boron concentration is low. As an alternative, one of these demineralizers may be filled with a mixed bed and used for removal of radionuclides during forced oxygenation.

The normal resin volume is 30 cubic feet per demineralizer. The maximum resin volume is 39 cubic feet per demineralizer. Resin volumes greater than 30 cubic feet cannot be regenerated in the vessel and must be flushed when no longer needed.

Hydroxyl-based ion exchange resin is used to reduce RCS boron concentration by releasing a hydroxyl ion when a borate is absorbed. Facilities are provided for regeneration. When regeneration is no longer feasible, the resin is flushed to the spent resin storage tank.

The demineralizers are sized to remove approximately 100 ppm of boric acid from the RCS to maintain full power operation near the end of core life should the LHUTs be full.

9.3.4.2.9.20 Evaporator Feed Ion Exchangers

Two trains of ion exchangers purify the feed and routes it to the liquid radwaste system. Each train consists of two demineralizer vessels in series. The resin beds in these demineralizers remove cationic impurities including cesium and molybdenum, and anionic impurities including chlorides, fluorides, and sulfur species. One train is in service during evaporator operation and the other is on standby.

9.3.4.2.9.21 Reactor Coolant Letdown Filter

The reactor coolant letdown filter is located on the letdown line upstream of the VCT. The filter collects resin fines and particulates from the letdown stream. The nominal flow capacity of the filter is equal to the maximum purification flow rate. A redundant reactor coolant letdown filter has been installed as a standby.

9.3.4.2.9.22 Seal Water Injection Filters

Two seal water injection filters are located in parallel in a common line to the RCP seals; they collect particulate matter that could be harmful to the seal faces. Each filter is sized to accept flow in excess of the normal seal water requirements. One filter is normally in operation and the other is in standby.

9.3.4.2.9.23 Seal Water Return Filter

The seal water return filter collects particulates from the RCP seal water return and from the excess letdown flow. The filter is designed to pass flow in excess of the sum of the excess letdown flow and the maximum design leakage from the RCP seals.

9.3.4.2.9.24 Boric Acid Filter

The boric acid filter collects particulates from the boric acid solution being pumped to the CCP suction line or boric acid blender. The filter is designed to pass the design flow of two boric acid transfer pumps operating simultaneously.

9.3.4.2.9.25 Ion Exchange Filter

This filter collects resin fines and particulates from the gas stripper feed pumps and routes the effluent to the LHUTs or the liquid radwaste system.

9.3.4.2.9.26 Boric Acid Reserve Tank Recirculation Heaters

Two, 12-kW heaters are provided in the boric acid reserve tank recirculation paths (one heater per path) to heat the boric acid. This will in turn maintain the tank contents and the associated recirculation piping above 80°F. The heaters are controlled by a temperature controller that senses tank temperature and regulates the power supplied to the heaters accordingly. An over temperature controller is provided which senses heater temperature and cuts power to the heater when a high temperature is sensed at the heating element.

9.3.4.2.9.27 Boric Acid Blender

The boric acid blender promotes thorough mixing of boric acid solution and reactor makeup water for the reactor coolant makeup circuit. The blender consists of a conventional pipe tee fitted with a perforated tube insert. The blender decreases the pipe length required to homogenize the mixture for taking a representative local sample. A sample point is provided in the piping just downstream of the blender.

9.3.4.2.9.28 Letdown Orifices

The three letdown orifices are arranged in parallel and serve to reduce the pressure of the letdown stream to a value compatible with the letdown heat exchanger design. Two of the three are sized such that either can pass normal letdown flow; the third can pass less than the normal letdown flow. One or both standby orifices may be used with the normally operating orifice in order to increase letdown flow such as during reactor heatup operations. This arrangement also provides a full standby capacity for control of letdown flow.

9.3.4.2.9.29 Gas Stripper-Boric Acid Evaporator Package

Liquid effluent in the LHUTs is processed as a batch operation. This liquid is pumped by the gas stripper feed pumps through the evaporator feed ion exchangers. It then flows through the ion exchanger filter, and then the liquid is drained to the liquid radwaste system for processing. The boric acid evaporator system is abandoned in place and no longer in use.

9.3.4.2.9.30 Electric Heat Tracing

Electric heat tracing is installed under the insulation on piping, valves, line-mounted instrumentation, and components normally containing concentrated boric acid solution. The heat tracing is designed to prevent boric acid precipitation due to cooling, by compensating for heat loss. Even though the heat tracing is not required to maintain the 4 percent boric acid solution above the 65°F precipitation temperature, it does provide added assurance against falling below this limit. The existing boric acid heat tracing provides two parallel PG&E Design Class II heater circuits in a bifilar arrangement. One circuit is used for normal operations and the second serves as a backup. The parallel circuits are supplied from different power sources to provide power supply redundancy. The size of the section heated by each pair of circuits is determined by the capacity of the heaters and their feeders, as well as the temperatures required.

There are no heat tracings on:

(1) Lines that may transport concentrated boric acid but are subsequently flushed with reactor coolant or other liquid of low boric acid concentration during normal operation

(2) The boric acid tanks, which are provided with immersion heaters

(3) The boric acid reserve tanks, which are provided with inline recirculation heaters

(4) The batching tank, which is provided with a steam jacket

Each circuit is controlled independently by a thermostat at a location having the most representative temperature of the circuit. The backup circuits are set to operate at a slightly lower temperature than the normal circuits. A thermocouple to detect metal temperature is installed under the thermal insulation near the thermostats. The thermocouple monitor has local indication and stored data memory that may be downloaded to commercial spreadsheet software and printed. The thermocouples are monitored, and both low and high temperatures are alarmed. The low-temperature alarm setpoint is within the operating range of the backup heater.

The boric acid tank sample lines to the sample sink are provided with a single circuit of self-regulating heat trace. Because the precipitation temperature of 4 percent boric acid solution is below normal room temperature, the boric acid line heat tracing functions as a precautionary measure, and is PG&E Design Class II. The circuit is monitored by an indicating light.

9.3.4.2.9.31 Valves

Valves, other than diaphragm valves, that perform a modulating function are equipped with two sets of packing and an intermediate leakoff connection. Valves are normally installed such that, when closed, pressure is not on the packing. Basic material of construction is stainless steel for all valves. Isolation valves are provided for all lines entering the reactor containment. These valves are discussed in detail in Section 6.2.4.

Relief valves are provided for lines and components that might be pressurized above design pressure by improper operation or component malfunction. Relief valves with potentially contaminated effluent are collected and routed to tanks in order to minimize radioactive releases inside the auxiliary building.

<u>Charging Line Downstream of Regenerative Heat Exchanger</u>

If the charging side of the regenerative heat exchanger is isolated while the hot letdown flow continues at its maximum rate, the volumetric expansion of coolant on the charging side of the heat exchanger is relieved to the RCS through a spring-loaded check valve. The spring in the valve is designed to permit the check valve to open in the event that the differential pressure exceeds the design pressure differential of approximately 75 psi.

<u>Letdown Line Downstream of Letdown Orifices</u>

The pressure-relief valve downstream of the letdown orifices protects the low-pressure piping and the letdown heat exchanger from overpressure when the low-pressure piping is isolated. The capacity of the relief valve exceeds the maximum flow rate through all letdown orifices. The valve set pressure is equal to the design pressure of the letdown heat exchanger tube side.

<u>Letdown Line Downstream of Low-pressure Letdown Valve</u>

The pressure-relief valve downstream of the low-pressure letdown valve protects the low-pressure piping, demineralizers, and filter from overpressure when this section of the system is isolated. The overpressure may result from leakage through the low-pressure letdown valve. The capacity of the relief valve exceeds the maximum flow rate through all letdown orifices. The valve set pressure is equal to the design pressure of the demineralizers.

Volume Control Tank

The relief valve on the VCT permits the tank to be designed for a lower pressure than the upstream equipment. This valve has a capacity greater than the summation of the following items: maximum letdown, maximum seal water return, excess letdown, and nominal flow from one reactor makeup water pump. The valve set pressure equals the design pressure of the VCT.

Charging Pump Suction

A relief valve on the CCP suction header relieves pressure that may build up if the suction line isolation valves are closed or if the system is overpressurized. The valve set pressure is equal to the design pressure of the associated piping and equipment.

Seal Water Return Line (Inside Containment)

This relief valve is designed to relieve overpressurization in the seal water return piping inside the containment if the motor-operated isolation valve is closed. The valve is designed to relieve the total leakoff flow from the No. 1 seals of the RCPs plus the design excess letdown flow. The valve is set to relieve at the design pressure of the piping.

Seal Water Return Line (Charging Pumps Bypass Flow)

This relief valve protects the seal water heat exchanger and its associated piping from overpressurization. If either of the isolation valves for the heat exchanger is closed and if the bypass line is closed, the piping may be overpressurized by the bypass flow from the CCPs. It is assumed that all CCPs are running with full bypass flow. The valve is set to relieve at the design pressure of the heat exchanger.

9.3.4.2.9.32 Piping

All CVCS piping handling radioactive liquid is austenitic stainless steel. All piping joints and connections are welded, except where flanged connections are required to facilitate equipment removal for maintenance and hydrostatic testing.

9.3.4.2.9.33 Zinc Injection Sub-systems

The CVCS includes a skid-mounted zinc injection sub-system that provides the capability to inject a zinc acetate solution to a line leading to the VCT. The chemical solution is injected into the PG&E Design Class II portion of the CVCS.

This sub-system includes a storage and mixing tank, three chemical feed pumps with electrical controls, and the associated piping, tubing, valves, controls, and instrumentation. The tank has a divider that separates the chemical supply for Unit 1 and Unit 2. There is one chemical feed pump dedicated to each unit and a common

pump that can serve either Unit 1 or Unit 2. The valves and pumps associated with this sub-system are all manually controlled from the skid. A nitrogen blanket is provided in the tank to exclude oxygen. Make-up water to prepare the zinc acetate solution is provided from the primary water storage tank. Power is provided from a non-Class 1E power source.

9.3.4.2.9.34 Argon Injection Sub-systems

The CVCS includes a wall mounted argon injection sub-system that provides the capability to inject high purity argon into the zinc acetate supply line. The zinc acetate injection sub-system is described in 9.3.4.2.9.33. The argon injection sub-system is PG&E Design Class II and connects to a PG&E Design Class II portion of the CVCS.

Argon injection aids in the identification of small primary to secondary SG tube leaks. Trace amounts of argon is injected to generate a short half-life isotope (Ar-41) that can easily be detected by the condenser off gas steam jet air ejector radiation monitor in the event of an SG tube leak.

This sub-system includes an argon bottle, regulator, valves and controls connected via tubing. A flow indicating controller and relief valve is installed downstream from the regulator to control the injection rate and provide over pressure protection. A check valve is located upstream of the zinc injection system tie-in. Other valves associated with this sub-system are all manually controlled from the skid. Power for the flow controller is provided from a non-Class 1E power source.

9.3.4.2.10 System Operation

9.3.4.2.10.1 CVCS Operation During Reactor Startup

Reactor startup is defined as the operations which bring the reactor from cold shutdown to normal operating temperature and pressure. Reactor pressure vessel heatup and cooldown and compliance with ASME BPVC Section III – 1972 Summer Addenda, Appendix G, is discussed in Section 5.2.

It is assumed that:

(1) Normal residual heat removal is in progress.

(2) RCS boron concentration is at or above the cold shutdown concentration.

(3) RMCS is set to provide makeup at or above the cold shutdown concentration.

(4) RCS is either water-solid or drained to minimum level for the purpose of refueling or maintenance. If the RCS is water-solid, system pressure is

controlled by letdown through the RHR system and through the letdown pressure control valve.

(5) The charging and letdown lines of the CVCS are filled with coolant at the cold shutdown boron concentration. The letdown orifice isolation valves are closed.

If the RCS requires filling and venting, the general process is as follows (depending on plant conditions, the startup process may vary):

(1) One CCP is started, which provides blended flow from the RMCS (or RWST) at the cold shutdown boron concentration.

(2) The vents on the head of the reactor vessel and pressurizer are vented.

(3) The various portions of the RCS are filled and the vents closed.

The CCP and the low-pressure letdown valve continue to pressurize the system. When the system pressure is adequate for operation of the RCPs, seal water flow to the pumps is established (if not already in service) and the pumps are sequentially operated and the RCS is vented until all gases are cleared from the system.

After the filling and venting operations are completed, pressurizer heaters are energized and the RCPs are operated to heat up the system. After the RCPs are started, the RHR pumps are stopped, but pressure control via the RHR system and the low-pressure letdown line is continued. At this point, steam formation in the pressurizer is accomplished by adjusting charging flow and the pressurizer pressure controller. When the pressurizer level reaches the no-load programmed setpoint, the pressurizer level is controlled to maintain the programmed level. The RHR system is then configured in its ECCS alignment.

The reactor coolant boron concentration is now reduced by operating the RMCS in the "dilute" mode. The reactor coolant boron concentration is adjusted to the point where the RCCAs may be withdrawn and criticality achieved. Power operation may then proceed with corresponding manual adjustment of the reactor coolant boron concentration to balance the temperature coefficient effects and maintain the RCCAs within their operating range. During operation, the appropriate combination of letdown orifices is used to provide necessary letdown flow.

Prior to and during the heatup process, the CVCS is employed to obtain the correct chemical properties in the RCS. The RMCS is operated on a continuing basis to ensure correct RCCA position. Chemicals are added through the chemical mixing tank, as required, to control reactor coolant chemistry such as pH and dissolved oxygen content. Hydrogen overpressure is established in the VCT to ensure the appropriate hydrogen concentration in the reactor coolant.

9.3.4.2.10.2 Power Generation and Hot Standby Operation

Base Load

At a constant power level, the rates of charging and letdown are dictated by the requirements for seal water to the RCPs and the normal purification of the RCS. Typically, one CCP is employed and charging flow is controlled automatically from pressurizer level. The only adjustments in boron concentration necessary are those to compensate for core burnup. Rapid variations in power demand are accommodated automatically by RCCA movement. If variations in power level occur, and the new power level is sustained for long periods, some adjustment in boron concentration may be necessary to maintain the RCCAs at their desired position.

During typical operation, normal letdown flow is maintained and one mixed bed demineralizer is in service. Reactor coolant samples are taken periodically to check boron concentration, water quality, pH, and activity level. The CCP flow to the RCS is controlled by the pressurizer level control signal through the discharge header flow control valve.

Load Follow (not normally performed)

A power reduction will initially cause a xenon buildup followed by xenon decay to a new, lower equilibrium value. The reverse occurs if the power level increases; initially, the xenon level decreases and then it increases to a new and higher equilibrium value associated with the amount of the power level change.

The RMCS is used to vary the reactor coolant boron concentration to compensate for xenon transients occurring when reactor power level is changed.

One indication available to the plant operator (enabling him to determine whether dilution or boration of the RCS is necessary) is the position of the RCCAs within the desired band. If, for example, the RCCAs are moving down into the core and are approaching the bottom of the desired band, the operator must borate the reactor coolant to bring the RCCAs outward. If not, the RCCAs may move into the core beyond the insertion limit. If, on the other hand, the RCCAs are moving out of the core, the operator dilutes the reactor coolant to keep the RCCAs from moving above the top of the desired band.

During periods of plant loading, the reactor coolant expands as its temperature rises. The pressurizer absorbs most of this expansion as the level controller raises the level setpoint to the increased level associated with the new power level. The remainder of the excess coolant is let down and may be accommodated in the VCT or LHUTs. During this period, the flow through the letdown orifice remains constant and the charging flow is reduced by the pressurizer level control signal, resulting in an increased temperature at the regenerative heat exchanger outlet. The temperature controller

downstream from the letdown heat exchanger increases the CCW flow to maintain the desired letdown temperature.

During periods of plant unloading, the charging flow is increased to make up for the coolant contraction not accommodated by the programmed reduction in pressurizer level.

Hot Standby

If required for periods of maintenance or following reactor trips, the reactor can be held subcritical, but with the capability to return to full power within the period of time it takes to withdraw RCCAs. During this hot standby period, temperature is maintained at no-load T_{avg} by dumping steam to remove core residual heat.

Following shutdown, xenon buildup and decay results in a variation in the degree of shutdown. During this time, boration and dilution of the system are performed to counteract these xenon variations.

9.3.4.2.10.3 Reactor Shutdown

Reactor shutdown is defined as the operations that bring the reactor to cold shutdown for maintenance or refueling.

Before initiating a cold shutdown, the RCS hydrogen concentration is reduced by reduction of the VCT overpressure and venting the gases to the waste gas vent header.

Before cooldown and depressurization of the reactor plant is initiated, the reactor coolant boron concentration is increased to the value required for the corresponding target temperature. The operator uses the RMCS to add the volume of concentrated boric acid solution necessary to perform the boration. After the boration is completed, the operator uses the RMCS to maintain the desired reactor coolant boron concentration. Subsequent reactor coolant samples are taken to verify that the RCS boron concentration is correct.

Contraction of the coolant during cooldown of the RCS results in actuation of the pressurizer level control to maintain normal pressurizer water level. The charging flow is increased, relative to letdown flow, and results in a decreasing VCT level. The RMCS initiates makeup to maintain the inventory.

Coincident with plant cooldown, a portion of the reactor coolant flow may be diverted from the RHR system to the CVCS for cleanup. Demineralization of ionic radioactive impurities and stripping of fission gases reduce the reactor coolant activity level sufficiently to permit personnel access for refueling or maintenance operations.

9.3.4.3 Safety Evaluation

9.3.4.3.1 General Design Criterion 2, 1967 – Performance Standards

All CVCS components are located within the PG&E Design Class I auxiliary and containment buildings. These buildings, or applicable portions thereof, are designed to withstand the effects of winds and tornadoes (refer to Section 3.3), floods and tsunamis (refer to Section 3.4), external missiles (refer to Section 3.5), earthquakes (refer to Section 3.7), and other natural phenomena, to protect CVCS SSCs, ensuring their safety functions will be performed.

The CVCS is designed to perform its function of providing shutdown capability under DDE and HE loading. The seismic requirements are defined in Sections 3.7 and 3.10, and the provisions to protect the system from seismic damage are discussed in Sections 3.7, 3.9, and 3.10. CVCS components are designed to withstand the appropriate seismic loadings in accordance with their design class. CVCS components required for safe shutdown are PG&E Design Class I.

9.3.4.3.2 General Design Criterion 3, 1971 – Fire Protection

The CVCS is designed to the fire protection guidelines of Branch Technical Position APCSB 9.5.1 (refer to Appendix 9.5B, Table B-1).

As described in Appendix 9.5B, Table B-1, plant layouts isolate PG&E Design Class I systems from unacceptable fire hazards. Automatic sprinkler protection has been provided for the CCPs and the boric acid transfer pumps.

9.3.4.3.3 General Design Criterion 4, 1967 – Sharing of Systems

The CVCS components which are shared by both Unit 1 and Unit 2 are the boric acid batching tank, the boric acid reserve tanks, the boric acid reserve tank pumps, the boric acid reserve tank recirculation pumps, and the zinc injection tank. Other components which can be aligned to either Unit 1 or Unit 2 include the LHUTs (refer to Section 9.3.4.2.9.15), LHUT recirculation pumps, and the zinc injection pumps. Administrative controls are in place to ensure that PG&E Design Class I components are not aligned to both Unit 1 and Unit 2 at the same time through the use of closed isolation valves. These administrative controls ensure that CVCS safety functions are not affected by the sharing.

9.3.4.3.4 General Design Criterion 9, 1967 – Reactor Coolant Pressure Boundary

The CVCS provides a means for controlling the RCS water chemistry to minimize corrosion and protect the RCS pressure boundary (refer to Section 5.2.3.4). The CVCS is designed with provisions for pH control, oxygen control, and purification of the RCS. The CVCS provides a means for adding chemicals to the RCS to control the pH of the coolant during initial startup and subsequent operation (refer to Section 9.3.4.2.8.2.1),

scavenge oxygen from the coolant during startup, and control the oxygen level of the reactor coolant due to radiolysis during all operations subsequent to startup (refer to Sections 9.3.4.2.4 and 9.3.4.2.8.2.2). The CVCS removes fission products and corrosion products from the reactor coolant during operation of the reactor and maintains these within acceptable levels (refer to Sections 9.3.4.2.3 and 9.3.4.2.8.2.3).

9.3.4.3.5 General Design Criterion 11, 1967 – Control Room

Instrumentation, alarms, and controls are provided in the control room for operators to monitor and maintain CVCS parameters. In the event that control room access is lost, CVCS components required for safe shutdown which can be manually controlled from the HSP are: CCP1 and CCP2, boric acid transfer pumps, emergency borate valve 8104, charging flow control valves FCV-128 and HCV-142, and the letdown isolation valves. Refer to Section 7.4.2.1 for additional discussion.

The HSP also provides indication for the following CVCS parameters: RCP seal No. 1 differential pressure, emergency boration flow, VCT level, letdown flow, and charging header pressure and flow.

Instrumentation and alarms for the CVCS is further discussed in Section 9.3.4.3.6.

9.3.4.3.6 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Process control instrumentation is provided to acquire data concerning key parameters about the CVCS. The location of the instrumentation is shown in Figure 3.2-8.

The instrumentation furnishes input signals for monitoring and/or alarming purposes. Indications and/or alarms are provided for the following parameters:

(1) Temperature

(2) Pressure

(3) Flow

(4) Water level

The instrumentation also supplies input signals for control purposes. Some specific control functions are:

(1) Letdown flow is diverted to the VCT upon high-temperature indication upstream of the mixed bed demineralizers

(2) Pressure downstream of the letdown heat exchangers is controlled to prevent flashing of the letdown liquid

(3) Charging flow rate is controlled during CCP operation(refer to Section 9.3.4.2.9.1)

(4) Water level is controlled in the VCT

(5) Temperature of the boric acid solution in the batching tank is maintained

(6) Reactor makeup is controlled

Refer to Section 9.3.4.2.8.2.4 for a discussion of alarm functions.

Reactor coolant samples are taken to verify that the RCS boron concentration is within administrative limits. RCS boron concentration is maintained using the RMCS.

9.3.4.3.6.1 Regenerative Heat Exchanger

The temperatures of both outlet streams from the heat exchanger are monitored with indication given in the control room. High alarm is given on the main control board if the temperature of the letdown stream exceeds desired limits.

Excessive pressure in the letdown line at the regenerative heat exchanger would be indicated in the control room by signals from:

(1) Pressure sensors located on Loop 4 of the RCS

(2) Pressure sensors located on the pressurizer

9.3.4.3.6.2 Letdown Heat Exchanger

The letdown temperature control indicates and controls the temperature of the letdown flow exiting from the letdown heat exchanger. The temperature sensor, which is part of the CVCS, provides input to the controller in the CCW system. The exit temperature is controlled by regulating the CCW flow through the letdown heat exchanger by using the control valve located in the CCW discharge line. Temperature indication is provided on the main control board. Abnormally high temperature on the letdown line downstream of the regenerative heat exchanger or the letdown heat exchanger is indicated by a high-temperature alarm.

Pressure in the letdown line at the letdown heat exchanger is indicated in the control room by signals from the pressure sensor in the letdown line downstream of the letdown heat exchanger. Excessive pressure could lift the relief valve located downstream of the letdown orifices. This would be indicated on the main control board by a temperature sensor located in the relief valve of the relief discharge line.

9.3.4.3.6.3 Excess Letdown Heat Exchanger

A temperature detector measures temperature of excess letdown downstream of the excess letdown heat exchanger. High-temperature alarm and indication are provided on the main control board.

A pressure sensor indicates the pressure of the excess letdown flow downstream of the excess letdown heat exchanger and excess letdown control valve. Pressure indication is provided on the main control board.

9.3.4.3.6.4 Volume Control Tank

VCT pressure and temperature are monitored with indication given in the control room. Alarm is given in the control room for high- and low-pressure conditions and for high temperature. Two level channels govern the water inventory in the VCT. These channels provide local and remote level indication, level alarms, level control, makeup control, and emergency makeup control.

If the VCT level rises above the normal operating range, one channel provides an analog signal to a proportional controller, which modulates the three-way valve downstream of the reactor coolant letdown filter to maintain the VCT level within the normal operating band. The three-way valve can split letdown flow so that a portion goes to the LHUTs and a portion to the VCT. The controller would operate in this fashion during a dilution operation when primary makeup water is being fed to the VCT from the RMCS.

If the modulating function of the channel fails and the VCT level continues to rise, then the high-level alarm will alert the operator to the malfunction and the letdown flow can be manually diverted to the LHUTs. If no action is taken by the operator and the tank level continues to rise, the letdown flow will be automatically diverted to protect the tank from an overpressure condition.

During normal power operation, a low level in the VCT initiates automatic makeup, which injects a preselected blend of boron and water into the CCP suction header. When the VCT is restored to normal, automatic makeup stops.

If the automatic makeup fails or is not aligned for operation and the tank level continues to decrease, a low-level alarm is actuated. Manual action may correct the situation or, if the level continues to decrease, an emergency low-level signal from both channels opens the stop valves in the refueling water supply line and closes the stop valves in the VCT outlet line.

9.3.4.3.6.5 Boric Acid Tanks

A temperature sensor provides temperature measurement of each tank's contents. Local temperature indication is provided as well as high- and low-temperature alarms which are indicated on the main control board. For boric acid heater controls, refer to Section 9.3.4.2.9.12.

A level detector indicates the level in each boric acid tank. Level indication with high, low, and low-low level alarms is provided on the main control board. The low alarm is set to indicate the minimum level of boric acid in the tank to ensure sufficient boric acid to provide for a cold shutdown with one stuck RCCA.

9.3.4.3.6.6 Boric Acid Reserve Tanks

Recirculating flow indication and a low flow alarm are provided for each tank. Also provided are a tank low temperature alarm and a high-low tank level alarm. For controls associated with the boric acid reserve tank recirculation heaters, refer to Section 9.3.4.2.9.26.

9.3.4.3.6.7 Mixed Bed Demineralizers

A temperature sensor measures temperature of the letdown flow downstream of the letdown heat exchanger and controls the letdown flow to the mixed bed demineralizers by means of a three-way valve. If the letdown temperature exceeds the allowable resin operating temperature, the flow is automatically bypassed around the demineralizers. Temperature indication and high alarm are provided on the main control board. The air-operated three-way valve failure mode directs flow to the VCT.

9.3.4.3.6.8 Reactor Coolant Letdown Filter

Two local pressure indicators are provided to show the pressures upstream and downstream of the reactor coolant letdown filter and thus provide filter differential pressure.

9.3.4.3.6.9 Seal Water Injection Filters

A differential pressure indicator monitors the pressure drop across each seal water injection filter and gives local indication with high differential pressure alarm on the main control board.

9.3.4.3.6.10 Seal Water Return Filter

Two local pressure indicators are provided to show the pressures upstream and downstream of the filter and thus provide the differential pressure across the filter.

9.3.4.3.6.11 Boric Acid Filter

The condition of the filter can be ascertained using a local differential pressure indicator.

9.3.4.3.6.12 Ion Exchange Filter

Local pressure indicators indicate the pressure upstream and downstream of the filter and thus provide filter differential pressure.

9.3.4.3.6.13 Letdown Orifices

Letdown flow rate is controlled by orifices, which are placed in and taken out of service by remote-manual operation of their respective isolation valves. A flow monitor provides indication in the control room of the letdown flow rate and high alarm to indicate unusually high flow.

A low-pressure letdown controller controls the pressure downstream of the letdown heat exchanger to prevent flashing of the letdown liquid. Pressure indication and high-pressure alarm are provided on the main control board.

9.3.4.3.6.14 Electric Heat Tracing

For details of the electric heat tracing instrumentation and controls, refer to Section 9.3.4.2.9.30.

9.3.4.3.6.15 Zinc Injection and Argon Injection Sub-systems

For details of the instrumentation and controls associated with the Zinc Injection and Argon Injection Sub-systems, refer to Sections 9.3.4.2.9.33 and 9.3.4.2.9.34, respectively.

9.3.4.3.7 General Design Criterion 13, 1967 – Fission Process Monitors and Controls

Control over the fission process for each reactor will be maintained throughout the core life by the combination of RCCAs (refer to Chapter 4) and chemical shim (boration). Long-term regulation of core reactivity is accomplished by adjusting the concentration of boric acid in the reactor coolant. Periodic samples of boron concentration provide fission process information. Refer to Section 7.7.3.3 for additional discussion.

The boron system maintains the reactor in the cold shutdown state independent of the position of the RCCAs and can compensate for all xenon burnout transients, as discussed in Section 9.3.4.3.9.

9.3.4.3.8 General Design Criterion 21, 1967 – Single Failure Definition

Two separate and independent flowpaths are available for reactor coolant boration; i.e., the charging line and the RCP seal injection. A single failure does not result in the inability to borate the RCS. An alternate flowpath is always available for emergency boration of the reactor coolant. Refer to Section 9.3.4.3.25 for discussion of flowpaths required for safe shutdown.

As backup to the normal boric acid supply, the operator can align the RWST outlet to the suction of the CCPs or safety injection (SI) pumps when all the reactor vessel head bolts are fully detensioned. If an SI pump is used for boration, it is aligned to take suction from the RWST and discharge to the cold legs of the RCS, and the boundary valves from the CVCS to the SI system are closed. At least one flowpath is available for boron injection whenever fuel is in the reactor, and the capability of such injection is adequate to ensure that cold shutdown can be maintained. Redundant Class 1E power supplies are provided for CCP1 and CCP2, the SI pumps, and the valves in the charging injection flowpath from the RWST to the RCS cold legs. Refer to Section 9.3.4.3.11 for additional information.

Since inoperability of a single component does not impair ability to meet boron injection requirements, plant operating procedures allow components to be temporarily out of service for repairs. However, with an inoperable component, the ability to tolerate additional component failure is limited. Therefore, operating procedures require immediate action to effect repairs of an inoperable component, restrict permissible repair time, and require verification of the operability of the redundant component. Boron injection system operability requirements are administratively controlled.

The reactor will not be made critical unless redundant boration capability is available in quantity sufficient to ensure shutdown to cold conditions.

Flow to the RCPs' seals is ensured by the fact that there are three CCPs, any one of which is capable of supplying the normal charging line flow plus the nominal seal water flow.

9.3.4.3.9 General Design Criterion 26, 1971 – Reactivity Control System Redundancy and Capability

Two independent reactivity control systems are provided for each reactor. These are RCCAs (refer to Chapter 4) and chemical shim (boration) provided by CVCS. The CVCS boron system maintains the reactor in the cold shutdown state independent of the position of the RCCAs and can compensate for all xenon burnout transients.

The CVCS reactivity control system is capable of reliably controlling the rate of reactivity changes resulting from planned, normal power changes (including xenon burnout). During normal power operation, routine boration and dilution of the RCS are administratively controlled to assure acceptable fuel design limits are not exceeded.

Any time that the plant is at power, the quantity of boric acid retained in the boric acid tanks and ready for injection always exceeds that quantity required for the normal cold shutdown, assuming that the RCCA of greatest worth is in its fully withdrawn position. This quantity always exceeds the quantity of boric acid required to bring the reactor to hot shutdown and to compensate for subsequent xenon decay. An adequate quantity of boric acid is also available in the RWST to achieve cold shutdown. Refer to Section 9.3.4.2 for additional detail on xenon transients, CCP NPSH, and boric acid solution concentration and temperatures.

9.3.4.3.10 General Design Criterion 28, 1967 – Reactivity Hot Shutdown Capability

The chemical shim control provided by CVCS is one of two independent systems capable of making and holding the core subcritical, but at a slower rate than the other system (RCCAs), and is not employed as a means of compensating for rapid reactivity transients. Refer to Chapter 4 for the details of the RCCA system which is used in protecting the core from fast transients. For additional discussion, refer to Sections 9.3.4.2.1.1 and 9.3.4.2.8.2.4.

An upper limit to the boric acid tank boron concentration and a lower limit to the temperature for the tank and for flowpaths from the tank are specified in order to ensure that solution solubility is maintained. Refer to Section 9.3.4.2.9.12 for additional detail on boric acid tank concentration and temperature.

9.3.4.3.11 General Design Criterion 30, 1967 – Reactivity Holddown Capability

The CVCS boron reactivity (chemical shim) control system is the reactivity control system capable of making and holding the core subcritical under any anticipated condition and with appropriate margin for contingencies. Normal reactivity shutdown capability is provided by rapid RCCA insertion (refer to Chapter 4). The chemical shim control system permits the necessary shutdown margin to be maintained during long-term xenon decay and plant cooldown. For additional discussion, refer to Section 9.3.4.3.9.

When the reactor is subcritical - i.e., during cold or hot shutdown, refueling, and approach to criticality - the neutron source multiplication is continuously monitored and indicated. Any appreciable increase in the neutron source multiplication, including that caused by the maximum physical boron dilution rate, is slow enough to give ample time to start a corrective action (boron dilution stop and boration) to prevent the core from becoming critical. The rate of boration, with a single boric acid transfer pump operating, is sufficient to take the reactor from full power operation to 1 percent shutdown in the hot condition, with no RCCAs inserted, in 150 minutes. In an additional 3 hours, enough boric acid can be injected to compensate for xenon decay, although xenon decay below the full power equilibrium level will not begin until approximately 25 hours after shutdown. Additional boric acid is employed if it is desired to bring the reactor to cold shutdown conditions. Boric acid can also be added by injection through the RCP

seals at approximately 5 gpm per pump (20 gpm total). At this rate, enough boric acid solution to compensate for xenon decay is added in less than 5 hours. Refer to Sections 9.3.4.2.1.1 and 9.3.4.2.8.2.4 for additional detail on xenon transients.

In the event of loss of offsite power, the safety (boration) function of the CVCS would be maintained. Power to CCP1 and CCP2 or SI pumps and associated valves would be available from the diesel generators. CCP1 or CCP2 or an SI pump is sufficient to meet boron injection requirements for shutdown. Since each CCP (CCP1 and CCP2) or SI pump is loaded on a separate diesel generator, a single failure of any one diesel generator will not impair the safety function of the pumps. A natural circulation test program was conducted during startup testing to demonstrate that the boron mixing and cooldown functions associated with taking the plant to cold shutdown can be accomplished under natural circulation.

9.3.4.3.12 General Design Criterion 31, 1967 – Reactivity Control Systems Malfunction

For postulated boron dilution during refueling, startup, or with the reactor in manual or automatic operation at power, the operator has ample time to determine the cause of dilution, terminate the source of dilution, and initiate boration before the shutdown margin is lost. The facility reactivity control systems are discussed further in Chapter 7, and analyses of the effects of the other possible malfunctions are discussed in Chapter 15. For additional discussion on boron dilution, refer to Sections 9.3.4.2.1.1 and 9.3.4.2.8.2.4.

9.3.4.3.13 General Design Criterion 32, 1967 – Maximum Reactivity Worth of Control Rods

The maximum rates of reactivity insertion employing boron removal are limited to values that could not cause rupture of the RCS boundary or disruptions of the core or vessel internals to a degree that could impair the effectiveness of emergency core cooling.

The appropriate reactivity insertion rate for the dilution of the boric acid in the RCS is determined by safety analyses for the facility. The data on reactivity insertion rates and dilution, together with RCCA withdrawal limits, are discussed in Section 4.3. The CVCS has the capability to avoid an inadvertent excessive rate of boron dilution. The core and RCS are not adversely affected by the maximum rate of reactivity increase due to boron dilution, which is less than that assumed for RCCA withdrawal analyses (refer to Section 15.2). For additional discussion on boron dilution, refer to Sections 9.3.4.2.1.1 and 9.3.4.2.8.2.4. The reactivity insertion rates due to uncontrolled boron dilution and the evaluation of plant safety is discussed in Section 15.2.4.

9.3.4.3.14 General Design Criterion 49, 1967 – Containment Design Basis

The CVCS penetrations are designed to withstand the pressures and temperatures that could result from a LOCA without exceeding the design leakage rates. Refer to Section 3.8.1.1.3 for additional details.

9.3.4.3.15 General Design Criterion 54, 1971 – Piping Systems Penetrating Containment

The CVCS containment isolation valves are periodically tested for operability and leakage. Testing of the components required for the Containment Isolation System (CIS) is discussed in Section 6.2.4. Test connections are provided in the penetration and in the piping to verify valve leakage and penetration leakage are within prescribed limits.

9.3.4.3.16 General Design Criterion 55, 1971 – Reactor Coolant Pressure Boundary Penetrating Containment

The CVCS penetrations that are part of the CIS include the regenerative heat exchanger to the letdown heat exchanger, normal charging to the regenerative heat exchanger, and the RCP seal water supply and return lines, which comply with the requirements of GDC 55, 1971, as described in Section 6.2.4 and Table 6.2-39.

9.3.4.3.17 General Design Criterion 56, 1971 – Primary Containment Isolation

The CVCS penetrations that are part of the CIS include the relief valve header lines, which comply with the requirements of GDC 56, 1971, as described in Section 6.2.4 and Table 6.2-39.

9.3.4.3.18 General Design Criterion 68, 1967 – Fuel and Waste Storage Radiation Shielding

Radiation shielding is provided, as required to meet the requirements of 10 CFR Part 20, for the LHUTs which store radioactive liquid until the batch processing for each tank begins. The radiation shielding is provided by the concrete walls, ceiling, and ground in the auxiliary building. Refer to Section 12.1.2.5 and Table 12.1-2 for details of radiation shielding for CVCS components, including the LHUTs.

9.3.4.3.19 General Design Criterion 70, 1967 – Control of Releases of Radioactivity to the Environment

The CVCS is designed with provisions for maintaining control over radioactive liquid and gaseous effluents. Relief valves with potentially contaminated effluent are collected and routed to tanks in order to minimize radioactive releases inside the auxiliary building. The CVCS is designed with tanks (VCT and LHUTs) that allow for processing and/or appropriate confinement of radioactivity associated with the liquid and gaseous effluents

from normal operation. Fission gases are removed from the system by venting the VCT to the waste disposal system. When the level in the VCT reaches the high-level setpoint, the remainder of the expansion volume is accommodated by diversion of the letdown stream to the LHUTs. As liquid enters the LHUTs, the nitrogen cover gas is displaced to the gas decay tanks in the waste disposal system through the waste vent header. Liquid effluent in the LHUTs is processed as a batch operation in the CVCS and then the liquid is drained to the liquid radwaste system for processing.

The CVCS is capable of reducing the concentration of ionic isotopes in the purification stream, as required in the design basis, to minimize activity released due to leakage. This is accomplished by passing the letdown flow through the mixed bed demineralizers that remove ionic isotopes, except those of cesium, molybdenum, and yttrium, with a minimum decontamination factor of 10. Through occasional use of the cation bed demineralizer, the concentration of cesium can be maintained below 1 µCi/cc, assuming 1 percent of the power is being produced by defective fuel. The cation bed demineralizer is capable of passing the normal letdown flow, though only a portion of this capacity is normally utilized. Each mixed bed demineralizer is capable of processing the maximum letdown flow rate. If the normally operating mixed bed demineralizer's resin has become exhausted, the second demineralizer can be placed in service. Each demineralizer is designed, however, to operate for one core cycle with 1 percent defective fuel.

Administrative and engineering controls are in place for the control of radioactive effluents, as required to meet the requirements of 10 CFR Part 20 (refer to Sections 9.3.4.3.18, 9.4.2.3.13, and 12.2). The LHUTs and VCT are located in containment vaults in the auxiliary building that are sized to contain the full volume of liquid effluents for its respective tank. The VCT is designed with a spray nozzle inside the tank to strip part of the noble gases from the incoming liquid and retain these gases in the VCT vapor space. Gaseous effluents from an LHUT or VCT rupture will be released through the plant vent via the auxiliary building ventilation system (refer to Section 9.4.2.3.13). The radiological consequences of LHUT and VCT ruptures are analyzed in Sections 15.5.25 and 15.5.26, respectively. For additional discussion on CVCS leakage, refer to Section 9.3.4.3.27 (Item III.D.1.1).

9.3.4.3.20 Chemical and Volume Control System Safety Functional Requirements

(1) <u>Reactor Coolant System Inventory and Pressure Control</u>

The CVCS maintains the proper coolant inventory in the RCS for all normal modes of operation including startup from cold shutdown, full power operation, and plant cooldown. The VCT provides surge capacity for reactor coolant expansion not accommodated by the pressurizer. For additional discussion, refer to Sections 9.3.4.2.2, 9.3.4.2.8.1, and 9.3.4.2.8.2.4. Pressurizer level control is discussed in Section 9.3.4.2.10.2.

The CVCS, coincident with RHR system operation during plant startup and shutdown,

controls the RCS pressure. The CVCS regulates the flow rate to the low-pressure letdown line and the charging flow to control RCS pressure during these modes of operation. Refer to Section 5.5.6.2 for additional details.

The CVCS design includes a flowpath from the regenerative heat exchanger outlet to the pressurizer spray line. An air-operated valve in the spray line is employed to provide auxiliary spray from the CCPs to the vapor space of the pressurizer during plant cooldown. This provides a means of cooling the pressurizer near the end of plant cooldown, when the RCPs are not operating. Refer to Section 5.5.9.3.4 for additional details.

(2) Protection from Missiles and Dynamic Effects

The provisions taken to protect the system from missiles are discussed in Section 3.5. Missile protection for portions of the CVCS which also serve ECCS functions are addressed in Section 6.3.3.8.

The provisions taken to protect the CVCS from damage that might result from dynamic effects associated with a postulated rupture of piping are discussed in Section 3.6.

(3) Reactor Coolant Pump Seal Water Injection

The CVCS is able to continuously supply filtered water to each RCP seal, as required by the RCP design. Flow to the RCPs' seals is ensured by the fact that there are three CCPs, any one of which is capable of supplying the normal charging line flow plus the nominal seal water flow. Refer to Section 9.3.4.2.8.1 for a detailed discussion on the seal water system.

9.3.4.3.21 10 CFR 50.49 – Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants

The CVCS SSCs required to function in harsh environments under accident conditions are qualified to the applicable environmental conditions to ensure that they will continue to perform their safety functions. Section 3.11 describes the DCPP EQ Program and the requirements for the environmental design of electrical and related mechanical equipment. The affected equipment list includes: pump motors, valve motors, valve operators, solenoid valves, heaters, switches, transmitters, local starters, and indicators and are listed in the EQ Master List.

9.3.4.3.22 10 CFR 50.55a(f) – Inservice Testing Requirements

The IST requirements for the CVCS are contained in the DCPP IST Program Plan.

9.3.4.3.23 10 CFR 50.55a(g) – Inservice Inspection Requirements

The ISI requirements for the CVCS are contained in the DCPP ISI Program Plan and comply with ASME BPVC Section XI-2001 through 2003 Addenda.

9.3.4.3.24 10 CFR 50.63 – Loss of All Alternating Current Power

In conjunction with CCW seal cooling (refer to Section 9.2.2.3.19), the CVCS is designed to provide RCP seal injection to protect the RCP seals from overheating in the event of an SBO event. CCP1 is available on credited AAC Class 1E Bus F during the SBO event.

9.3.4.3.25 10 CFR Part 50, Appendix R (Sections III.G, J, and L) – Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979

Section III.G – Fire Protection of Safe Shutdown Capability: A fire protection review of the CVCS electrical cable and control wiring has shown that no single postulated fire can prevent the CVCS from performing its design function to supply borated water to the reactor core. This is due to physical separation of redundant electrical buses, combined with the ability to control the required CVCS components from either the main control board or the HSP.

Tables 9.5G-1 and 9.5G-2 for DCPP Unit 1 and Unit 2, respectively, list the minimum equipment required to bring the plant to a cold shutdown. Specifically, 1 of 3 CCPs, one flowpath to the RCS (through the regenerative heat exchanger, RCP seal injection, or charging injection), and one borated water source and flowpath to the CCP with associated valving from either the RWST or two boric acid tanks (including one boric acid transfer pump) are the minimum required CVCS equipment to bring the plant to a cold shutdown condition. For additional discussion, refer to Tables 9.5G-1 and 9.5G-2.

Section III.J – Emergency Lighting: Emergency lighting or BOLs are provided in areas where operation of the CVCS may be required to safely shutdown the unit following a fire.

Section III.L – Alternative and Dedicated Shutdown Capability: Safe shutdown capabilities are provided in the control room and at an alternate location via the HSP (refer to Section 7.4). The alternative and dedicated shutdown capability is summarized in Appendix 9.5E. The ability to safely shut down the plant following a fire in any fire area is summarized in Section 4.0 of Appendix 9.5A and Appendix 9.5E.

9.3.4.3.26 Regulatory Guide 1.97, Revision 3, May 1983 – Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident

CVCS post-accident instrumentation for meeting Regulatory Guide 1.97, Revision 3, requirements consist of CCP1 and CCP2 injection header flow indication, RCS makeup flow indication, RCS letdown flow indication, VCT level indication, and containment isolation valve position indication (refer to Table 7.5-6).

9.3.4.3.27 NUREG-0737 (Items I.C.1, II.B.2, II.K.1.5, III.D.1.1), November 1980 – Clarification of TMI Action Plan Requirements

Item I.C.1 – Guidance for the Evaluation and Development of Procedures for Transients and Accidents: NUREG-0737, Supplement 1, January 1983 provides the requirements for I.C.1 as follows:

Section 7.1(b) – Upgraded emergency operating procedures, which include guidance for initiating normal charging and emergency boration, have been implemented in accordance with the Westinghouse Owners Group (WOG) developed generic emergency response guidelines.

Item II.B.2 – Design Review of Plant Shielding and Environmental Qualification of Equipment for Space/Systems Which May Be Used in Postaccident Operations: The switchgear rooms are sufficiently shielded from external sources of radiation such that personnel access and occupancy would not be unduly limited by the radiation environment caused by a degraded core accident.

Item II.K.1.5 – Safety Related Valve Position: Refer to Section 9.3.4.3.32.

Item III.D.1.1 – Integrity of Systems Outside Containment Likely to Contain Radioactive Material for Pressurized-Water Reactors and Boiling-Water Reactors:

CVCS components, valves, and piping that see radioactive service are designed to permit essentially zero leakage to the atmosphere. The components are provided with welded connections except where flanged connections are provided to permit removal for maintenance.

The VCT in the CVCS provides an inferential measurement of leakage from the CVCS as well as the RCS. Low level in the VCT actuates makeup at the prevailing reactor coolant boron concentration. The amount of leakage can be inferred from the amount of makeup added by the RMCS.

Pressure containing portions of the CVCS are tested periodically to check for leakage. This testing includes the portions of the system flowpath that would circulate radioactive water from the RCS.

The requirements for a leakage reduction program from reactor coolant sources outside containment are included in the Technical Specifications (Reference 1). Inservice valve leak testing requirements are specified in the DCPP IST Program Plan. Refer to Section 6.2.4 for additional information on the CIS.

9.3.4.3.28 Generic Letter 80-21, March 1980 – Vacuum Condition Resulting in Damage to Chemical Volume Control System (CVCS) Holdup Tanks

The CVCS low pressure tanks that can be valved to contain RCS water are the VCT and the LHUTs. Both tanks are protected against failure under vacuum conditions. The VCT is structurally designed to withstand 15 psig external pressure. The LHUTs rely on at least one of several design features functioning to protect the tanks from vacuum conditions. These features include an LHUT discharge pump trip on negative tank pressure, control valves on the independent cover-gas supplies, and a vacuum relief valve on each tank set to open prior to reaching the LHUT allowable external pressure. This meets the requirements of Generic Letter 80-21, March 1980, which was issued as IE Bulletin 80-05, March 1980.

9.3.4.3.29 Generic Letter 88-17, October 1988 – Loss of Decay Heat Removal

The CVCS PG&E Design Class I CCPs are one of the two required available or operable means of adding inventory to the RCS, that are in addition to the normal decay heat removal systems, to meet the requirements of Generic Letter 88-17, October 1988. Makeup to the RCS is provided by a CCP, gravity feed from the RWST, and an SI pump which can quickly be put in service should RHR be lost. Each of these backup sources can provide enough water for decay heat removal in addition to continued core coverage. PG&E updated procedures to ensure these pumps are available prior to entering RHR mid-loop operation.

9.3.4.3.30 Generic Letter 89-10, June 1989 – Safety-Related Motor-Operated Valve Testing and Surveillance

CVCS MOVs are subject to the requirements of Generic Letter 89-10, June 1989, and associated Generic Letter 96-05, September 1996, and meet the requirements of the DCPP MOV Program Plan.

9.3.4.3.31 Generic Letter 95-07, August 1995 – Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves

PG&E Design Class I power-operated gate valves in the CVCS were evaluated and determined to not be susceptible to pressure locking or thermal binding.

9.3.4.3.32 IE Bulletin 79-06A (Positions 8 and 12), April 1979 – Review of Operational Errors and System Misalignments Identified During the Three Mile Island Incident

Position (8) (subsequently NUREG-0737, November 1980, Item II.K.1.5, Safety Related Valve Position): Critical manual valves in the CVCS are sealed in position and a check list is maintained for inspection on a typical audit basis. All CVCS PG&E Design Class I valves which are operated remotely and whose purpose is to open or close (rather than throttle flow) have position indicating lights on the main control board.

Position (12): During normal operating modes, hydrogen can be removed from the RCS by the letdown line and stripped in the VCT where it enters the waste gas system.

9.3.4.3.33 NRC Bulletin 88-04, May 1988 – Potential Safety-Related Pump Loss

The CVCS is designed such that PG&E Design Class I pumps that share a common minimum flow recirculation line are not susceptible to the pump-to-pump interaction described in NRC Bulletin 88-04, May 1988, and the existing minimum flow rates for CVCS PG&E Design Class I pumps are adequate.

9.3.4.3.34 NRC Bulletin 88-08, June 1988 – Thermal Stresses in Piping Connected to Reactor Coolant Systems

The unisolable CVCS lines connected to the RCS which are subject to thermal stresses are the charging injection headers, for both DCPP Unit 1 and Unit 2. A recirculation line was added to the charging injection header that provides continuous vent capability of the charging injection header back to the CCP suction. The charging injection header recirculation line is sized such that 1) during normal operation (charging injection header not in service), this passive recirculation line continuously vents valve seepage and accompanying pressure build-up in the charging injection header, and 2) during ECCS operation, charging injection header recirculation line flow is low enough such that ECCS flows are maintained within their required ranges. For additional discussion, refer to Section 6.3.3.39.

9.3.4.4 Tests and Inspections

As part of plant operation, periodic tests, surveillance inspections, and instrument calibrations are made to monitor equipment condition and performance.

Most components are in use regularly; therefore, assurance of the availability and performance of the systems and equipment is provided by control room and/or local indication. Refer to Sections 9.3.4.3.5 and 9.3.4.3.6 for details regarding local and remote indication.

Technical specifications have been established concerning calibration, checking, and sampling of the CVCS.

Refer to Sections 9.3.4.3.15, 9.3.4.3.22, 9.3.4.3.23, and 9.3.4.3.27 (Item III.D.1.1) for details regarding tests and inspections of the CVCS.

Refer to Section 9.3.4.2.6 for details of hydrostatic testing of the RCS.

9.3.4.5 Instrumentation Applications

Refer to Section 9.3.4.3.6 for the instrumentation applications related to CVCS.

9.3.5 FAILED FUEL DETECTION

Failed fuel detection is provided by analyzing reactor coolant grab samples via the nuclear steam supply sampling system.

9.3.6 NITROGEN AND HYDROGEN SYSTEMS

9.3.6.1 Design Bases

The nitrogen and hydrogen systems supply gases required for cover gases, accumulator fill, certain instrumentation operations, degasification purging, layup of steam generators and feedwater heaters, and generator cooling. The nitrogen and hydrogen systems are not required for reactor protection, containment isolation, or ESFs. The following sections provide information on: (a) design bases, (b) system description, (c) safety evaluation, (d) tests and inspections, and (e) instrumentation applications for the nitrogen and hydrogen systems. The design classifications for these systems are given in the DCPP Q List (see Reference 8 of Section 3.2). The supply sources of nitrogen and hydrogen are shared by both units but delivered by separate supply headers. The backup air/nitrogen supply system is described in Section 9.3.1.6.

9.3.6.2 System Description

9.3.6.2.1 Nitrogen System

The nitrogen system consists of a liquid nitrogen storage facility, which is the nitrogen source for both the low pressure gaseous nitrogen header and a series of high pressure gaseous nitrogen storage bottles. Nitrogen from the liquid supply tank is (a) gasified and supplied directly to the low pressure header or (b) compressed, then gasified, and supplied to the high pressure storage bottles.

The nitrogen system is capable of delivering nitrogen gas for various purposes. Pressure regulators are capable of reducing the pressure down to 1 psig. This is accomplished through a series of regulators from the supply source to the required equipment. Relief valves are set appropriately to prevent overpressure on the equipment. See Table 9.3-7 for the list of equipment requiring nitrogen and their supply

pressures and flows. The pressure and flow data envelope the actual operating conditions.

All piping penetrating the containment is isolated automatically by a containment isolation signal.

9.3.6.2.2 Hydrogen System

The hydrogen system is capable of delivering hydrogen gas for various purposes at a supply pressure of 2200 psig and reduced by pressure regulators in series to the required pressures. Relief valves are set at 2400 psig on the supply header. Other relief valves downstream of pressure regulators are set appropriately to prevent overpressure on the equipment. See Table 9.3-8 for the list of equipment requiring hydrogen and their supply pressures and flows.

No piping associated with the hydrogen system penetrates the containment.

In fire zones containing equipment required for safe shutdown, the hydrogen system is enclosed in guard pipes and enclosures such that if leaks occur, the leakage is vented to areas that do not contain equipment required for safe shutdown. Enclosures containing valves and instrumentation have flanges or doors that make the instrumentation and valves accessible for operation and maintenance.

9.3.6.3 Safety Evaluation

That portion of the nitrogen system piping penetrating the containment is Design Class I and meets the single failure criterion required for containment isolation as described in Section 6.2.4. The remainder of the hydrogen and nitrogen systems is Design Class II.

9.3.6.4 Tests and Inspections

Periodic inspections will be made on the system. Periodic visual inspection and preventive maintenance will be made using normal industry practice. Functional and leakage tests are performed on the containment isolation valves.

9.3.6.5 Instrumentation Applications

The instrumentation for the nitrogen and hydrogen systems is given below.

9.3.6.5.1 Temperature

Local temperature indicators measure the temperature of the nitrogen and hydrogen supply.

9.3.6.5.2 Pressure

Local pressure indicators measure the pressures in the various lines of the nitrogen and hydrogen systems.

Pressure transmitters located on the nitrogen and hydrogen supply headers are used to transmit the pressure to indicators on the auxiliary building control board. Pressure switches also located on the headers give a low-pressure alarm on the auxiliary building control board. Low pressure nitrogen header pressure is also alarmed in the control room of each unit.

9.3.6.5.3 Flow

An excess flow check valve, FCV-39/40, is provided in the hydrogen supply header at each unit. The excess flow check valve (flow fuse) is a flow control device that limits the flow of hydrogen to the plant loads.

9.3.7 MISCELLANEOUS PROCESS AUXILIARIES

The process auxiliary systems not associated with the reactor process system but necessary for plant operation are:

(1) Auxiliary steam system

(2) Oily water separator and turbine building sump system

Their design classification is given in the DCPP Q-List (see Reference 8 of Section 3.2).

9.3.7.1 Auxiliary Steam System

This system is required to supply steam to certain pieces of equipment and plant locations. Steam is required for the following:

(1) Cask decontamination area

(2) Caustic storage tank

(3) Boric acid batching tank and water preheater

(4) Waste concentrator (abandoned)

(5) Boric acid evaporators and preheaters (abandoned)

(6) Gland steam supply for the main turbine and main feedwater pump drive turbines

(7) Makeup water evaporator air ejector (abandoned)

(8) Steam jet air ejector (main condenser)

(9) Containment atmosphere

(10) Steam for service cleaning and equipment maintenance inside containment

(11) Building heating reboiler:

   (a) Containment purge air

   (b) Fuel handling area

   (c) Auxiliary building

   (d) Machine shop

(12) Main condenser deaeration steam

(13) Caustic regeneration system

(14) Carbon dioxide vaporizer

An auxiliary boiler, used primarily during refueling or other outages of the unit or startup, is capable of supplying the 100 psig steam when main steam is not available. During shutdown, it will be necessary to supply steam to the boric acid batch tank. All pressure parts and accessories are designed, constructed, inspected, and stamped in accordance with applicable ASME Boiler and Pressure Vessel codes. The net steam output is 57,000 1b/hr at 110 psig. No. 2 fuel oil will be burned.

9.3.7.2 Oily Water Separator and Turbine Building Sump System

The oily water separator, common to both units, is designed to separate oil and floating material from drains originating from the turbine building sumps (Units 1 and 2). The clear water effluent normally is discharged to the condenser circulating water discharge tunnel. If required, it can be routed to the auxiliary building floor drain receivers. The radioactive content of liquids discharged from the turbine building is monitored by a radiation monitor and flow element in the process lines to the oily water separator.

9.3.8 REFERENCES

1. Technical Specifications, Diablo Canyon Power Plant Units 1 and 2, Appendix A to License Nos. DPR-80 and DPR-82, as amended.

2. NUREG-0737, Clarification of TMI Action Plan Requirements, U. S. Nuclear Regulatory Commission, November 1980.

9.4 HEATING, VENTILATION, AND AIR-CONDITIONING (HVAC) SYSTEMS

The design outdoor ambient air temperature for the HVAC systems described in this section is 76°F.

DCPP design outdoor ambient temperature is based on Recommended Outdoor Design Temperatures, Southern California, Arizona, and Nevada, Third Edition, Southern California Chapter, American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc., March 1964 (Reference 5). The most conservative temperature probability considered in that report is 1.0%, which are the temperature values that will be equaled or exceeded for 88 hours over a full year (8760 hours). PG&E has reviewed 40 years of onsite hourly ambient outdoor temperature data for the period May 1973 through April 2014 and determined the 1.0% probability of temperature occurrence is 70.5°F. Rounded up to 71°F and adding a 5°F margin to accommodate missing data and potential data uncertainties results in a design value of 76°F.

With a design value of 76°F and an allowable 26°F rise, the ambient indoor air temperatures will be maintained at or below 104°F at all times, except for areas as noted in subsequent sections. Outdoor ambient temperatures could exceed the design temperature for 88 hours per year; however, the 88 hours would not be continuous and would occur for a small portion of any given day. In fact, the above room temperature conditions are unlikely to be reached every year. The Class 1E electrical equipment is capable of operating for short periods at temperatures in excess of 117°F. This will have an insignificant effect on the aging of the electrical insulation.

The DCPP Equipment Control Guidelines identify rooms/areas monitored by the area temperature monitoring system, along with their corresponding temperature limits. The ambient air temperatures in these areas are monitored continuously. Air temperatures exceeding the established setpoints are recorded along with the times. An alarm is also transmitted to the control room. The cause and effects of high temperature are investigated and corrected in accordance with the DCPP Equipment Control Guidelines.

The criteria for monitoring air temperature are given below:

(1) Where only one Class 1E redundant train or division of PG&E Design Class I electrical equipment is in a given room or area and the ventilation there is neither redundant nor Class 1E, the ambient air temperature monitoring system will be redundant. The temperature monitor will meet Class 1E requirements for supply and separation or have two reliable and redundant non-Class 1E supplies

(2) Where only one Class 1E redundant train or division is in a given room or area and the ventilation is Class 1E, but is not redundant within the area, one temperature monitor will be used to monitor the area ambient temperature. The temperature monitor will meet Class 1E requirements for supply and separation or have two reliable and redundant non-Class 1E supplies.

(3) Where one or more Class 1E redundant trains or divisions are in a given room or area and the ventilation is Class 1E and redundant, one non-redundant temperature monitor will be supplied.

In calculating the performance of ventilating and air conditioning systems, no credit was taken for wind cooling of buildings and structures and heat absorption by equipment at elevated temperatures. The maximum solar load was checked for selected areas that housed safety-related equipment and was found to have negligible effect on the calculated indoor temperatures in these areas.

The design classifications for the various HVAC systems are given in the DCPP Q-List (refer to Reference 8 of Section 3.2).

9.4.1 CONTROL ROOM

The control room ventilation system (CRVS) functions during all design accident conditions. The system permits continuous occupancy of the control room under normal and design basis accident conditions.

9.4.1.1 Design Bases

9.4.1.1.1 General Design Criterion 2, 1967 - Performance Standards

The CRVS is designed to withstand the effects of or is protected against natural phenomena, such as earthquakes, flooding, tornados, winds, and other local site effects.

9.4.1.1.2 General Design Criterion 3, 1971 - Fire Protection

The CRVS is designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

9.4.1.1.3 General Design Criterion 4, 1967 - Sharing of Systems

The CRVS components are not shared by the DCPP Units unless safety is shown not to be impaired by the sharing.

9.4.1.1.4 General Design Criterion 11, 1967 - Control Room

A control room is provided from which actions to maintain safe operational status of the plant can be controlled. The control room is designed to support safe operational status and to maintain safe operational status from the control room or from an alternate location if control room access is lost due to fire or other causes. The control room provides adequate radiation protection to permit access without radiation exposures of personnel in excess of 10 CFR Part 20 limits under normal conditions.

9.4.1.1.5 General Design Criterion 12, 1967 - Instrumentation and Control Systems

Instrumentation and controls are provided as required to monitor and maintain the CRVS variables within prescribed operating ranges.

9.4.1.1.6 General Design Criterion 17, 1967 - Monitoring Radioactivity Releases

Means shall be provided for monitoring the containment atmosphere, the facility effluent discharge paths, and the facility environs for radioactivity that could be released from normal operations, from anticipated transients, and accident conditions.

9.4.1.1.7 General Design Criterion 19, 1971 - Control Room

The control room is designed to permit access and occupancy for operating the plant without personnel receiving radiation exposures in excess of GDC 19, 1971, limits for the duration of a design basis accident.

9.4.1.1.8 General Design Criterion 21, 1967 Single Failure

The PG&E Design Class I control room ventilation system is designed to remain operable after sustaining a single failure. Multiple failures resulting from a single event shall be treated as a single failure.

9.4.1.1.9 General Design Criterion 37, 1967 - Engineered Safety Features Basis for Design

The CRVS is designed to provide backup to the safety provided by the core design, the reactor coolant pressure boundary, and their protection systems.

9.4.1.1.10 General Design Criterion 38, 1967 - Reliability and Testability of Engineered Safety Features

The CRVS is designed to provide high functional reliability and ready testability.

9.4.1.1.11 General Design Criterion 40, 1967 - Missile Protection

The CRVS is designed to be protected against dynamic effects and missiles that might result from plant equipment failures.

9.4.1.1.12 General Design Criterion 41, 1967 - Engineered Safety Features Performance Capability

The CRVS is designed to provide sufficient performance capability to accommodate a partial loss of installed capacity, such as a failure of a single active component, and still perform its required safety function.

9.4.1.1.13 Control Room Ventilation Safety Function Requirement

(1) <u>Cooling of PG&E Design Class I Equipment</u>

The CRVS is designed to provide cooling to PG&E Design Class I equipment.

9.4.1.1.14 10 CFR 50.63 - Loss of All Alternating Current Power

The CRVS is designed to continue to support control room (CR) habitability to support systems that assure core cooling and containment integrity is maintained following a station blackout (SBO) event.

9.4.1.1.15 Regulatory Guide 1.52, June 1973 - Design, Testing, and Maintenance Criteria for Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants

The CRVS design and maintenance comply with applicable Regulatory Guide 1.52, June 1973 requirements with exceptions noted in Table 9.4-2.

9.4.1.1.16 Regulatory Guide 1.52, Revision 2 - Design, Testing, and Maintenance Criteria for Post-Accident Engineered-Safety-Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants

The CRVS filter testing program complies with applicable Regulatory Guide 1.52, Revision 2, Regulatory Position C.5.a, C.5.c, C.5.d and C.6.a requirements as described in Table 9.4-2. The CRVS filter testing program also meets the requirements of Generic Letter 83-13.

9.4.1.1.17 NUREG-0737 (Item II.B.2), November 1980 - Clarification of TMI Action Plan Requirements

Item II.B.2 – Design Review of Plant Shielding and Environmental Qualification of Equipment for Spaces/Systems Which May Be Used in Post-accident Operations: Adequate access to the control room is provided by design changes, increased permanent or temporary shielding, or post-accident procedural controls.

9.4.1.2 System Description

The CRVS is composed of three systems:

(1) Control room heating, ventilation, and air conditioning (CRHVAC) system

(2) Control room pressurization system (CRPS)

(3) Plant process computer (PPC) room air conditioning system

The CRVS has four operating modes (Modes 1-4, described below). There are two CRVS trains, both of which are operating during normal operations. These serve the common control room, one associated with the Unit 1 area and one associated with the Unit 2 area. Each train, utilizes a single filter bank for removal of particulates and toxic or radioactive gases (Modes 3 or 4) and two redundant subtrains of air handling components. Each subtrain consists of a CRPS supply fan and electrical humidity control heater (Mode 4); CRHVAC supply fan (all modes) and filter booster fan (Modes 3 and 4); and an air conditioning unit (all modes). Ducting, valves or dampers, and monitoring instrumentation are included in the system (refer to Table 9.4-1). The arrangement is shown in Figure 9.4-1. The isolation dampers are bubble-tight-type and are PG&E Design Class I. The ductwork, ventilation fans, and filter units are PG&E Design Class I. The associated design classifications are given in the DCPP Q-List (refer to Reference 8 of Section 3.2). The design data for the system components are given in the itemized list in Table 9.4-1. Design codes and standards are given in Table 9.4-8.

The Unit 1 area served by the system includes one computer room, one instrument safeguards room, one records storage room, one office, one kitchen area, one control room area, and one mechanical equipment area. The Unit 2 area served by the system includes one computer room, one instrument safeguards room, one toilet room, one control room area, one office, and one mechanical equipment area. CRPS intakes are located at the southwest and northwest ends of the turbine building.

A small PG&E Design Class II exhaust fan (also itemized in Table 9.4-1) and a PG&E Design Class I electric duct heater (the duct heater housing is PG&E Design Class I, the coil may be PG&E Design Class II) per unit are provided. The exhaust fan provides control room exhaust during normal operations (Mode 1) and for smoke removal (Mode 2).

The system is designed to provide a normal ambient temperature of 75°F with one set of redundant air conditioning equipment of each train operating. Inside air temperature will be less than 85°F except in the computer room, which is designed to have a temperature of 72 ±4°F. The cooling capacity of each HVAC train is 31 tons based on normal operating conditions. The estimated cooling load for each unit area, including a portion of the computer room load, is 19.0 tons under normal operating conditions. The air flow into each unit area is 7475 cfm which provides nine control room and fifteen computer room air changes per hour. The system also provides 325 cfm to the HVAC equipment room of each unit to maintain the ambient temperature below 104°F. Electric duct heaters reheat or temper the air as necessary to maximize personnel comfort control. The heaters are not redundant and are provided only to help balance the cooling system. In the event of heater malfunction, no vital control room air normalization functions are adversely affected.

Additionally, the computer room in each Unit is provided with a supplemental PG&E Design Class II air conditioning system. The system consists of three air conditioning units, air cooled condensing units, and interconnecting refrigeration piping. The air conditioning units are staged by associated room thermostats. These units provide a suitable environment for the non-safety-related computers. All redundant equipment receives power from Class 1E buses separated to meet single failure criteria.

The four modes of operation for the CRVS are:

Mode 1: Conditioned air is supplied and returned through ducts to the designated service area of each unit. Approximately 27 percent of the return air is normally exhausted to the atmosphere and 73 percent of the return air is normally recirculated. The recirculated air is mixed with outdoor makeup air and filtered through roughing filters, cooled (or heated), and supplied to the control room.

Estimated control room area heat loads for this mode of operation are listed in Table 9.4-9.

Mode 2: In the event of a fire in the control room, provisions are made for once through, 100 percent outdoor air operation. This mode exhausts the smoke from the room, thereby making it habitable. Roughing filters are used for filtering the outdoor air. The mode is manually initiated.

Mode 3: In the event of toxic gas outside the control room, provisions are made for manual zone isolation, 100 percent recirculated air with 27 percent passing through the high-efficiency particulate air (HEPA) filters and charcoal banks. Human detection (odor/smell) is used to identify the potential hazard and the mode is manually initiated.

Mode 4: This mode of operation is used in the event of airborne radioactivity and the requirement of long-term occupancy of the control room. Mode 4 isolates

and pressurizes the control room and mechanical equipment room through the HEPA and charcoal filters with air from a low activity region to reduce local infiltration. The opposite control room HVAC train operates concurrently in Mode 3 recirculation. The flow rate of return air recirculated through the HEPA and charcoal filters is controlled by technical specifications. (Reference 10) In the event an accident occurs in one unit, the system automatically selects the pressurization intake train of the opposite unit. With radiation detected at both pressurization intakes, one of the trains will start. However, the operator manually switches to the intake with lower airborne radioactivity.

For each Unit, two manual mode selector switches (one for each subtrain) are used to place the CRVS in the desired operating mode and two manual bus selector switches (one for each subtrain) are used to place the desired subtrain in service. In addition, manual transfer switches are provided for the control, logic and power circuits that enable operation of the CRVS from either Unit 1 or Unit 2 power in the event that one Unit is not operable.

The influx of airborne contaminants through the normal supply duct is limited by monitoring devices, which, upon detection of radioactive contaminants, automatically initiate CRVS Mode 4 operation. Closure of isolation dampers for CRVS Modes 3 and 4 (Figure 9.4-1) is required within 10 seconds after manual initiation. A common warning light is provided on the control room panel to alert the operator if a ventilation damper is out of position. The position of each damper is indicated on a panel in the ventilation equipment room. Flow characteristics of the dampers are such that the average flow over the closure time is less than 60 percent of full flow.

Both the Unit 1 and Unit 2 CRVSs are designed to initiate Mode 4 operation, and Mode 3 operation on the opposite unit, automatically upon any one of the following signals:

(1) Containment phase A isolation from safety injection Unit 1

(2) Containment phase A isolation from safety injection Unit 2

(3) High outside air activity from Unit 1 normal air intake radiation monitor

(4) High outside air activity from Unit 2 normal air intake radiation monitor

The control room area is provided with minimum leakage dampers, weather-stripped doors, door vestibules, and absence of outdoor windows. Administrative controls ensure that all control room entranceways are normally closed.

Further protective options are provided by self-contained breathing apparatus located in the control room as stated in Section 6.4.1.

9.4.1.3 Safety Evaluation

9.4.1.3.1 General Design Criterion 2, 1967 - Performance Standards

The CRVS components are contained in the auxiliary and turbine buildings. These structures are PG&E Design Class I and PG&E Design Class II respectively (refer to Section 3.8). These buildings or applicable portions thereof are designed to withstand the effects of winds and tornados (refer to Section 3.3), floods and tsunami (refer to Section 3.4), external missiles (refer to Section 3.5), earthquakes (refer to Section 3.7), and to protect control room habitability SSCs from damage that may result from these events; ensuring their design function will be performed.

The portions of the CRVS that have the potential of being damaged by a tornado missile are the normal intake and exhaust louvers and the CRPS fans, ductwork, dampers and associated controls located on the turbine building operating deck and the auxiliary building roof. The ability of the normal intake and exhaust louvers to sustain tornado wind and missile damage is detailed in Section 3.3.2.3.2.1. The tornado missile design features of the CRPS components are detailed in Section 3.3.2.3.2.12.

The CRVS, a PG&E Design Class I system, is designed to perform its safety functions under the effects of earthquakes (refer to Section 3.10.2.20).

9.4.1.3.2 General Design Criterion 3, 1971 - Fire Protection

The CRVS is designed to the fire protection guidelines of Appendix A of Branch Technical Position (BTP) Auxiliary and Power Conversion Systems Branch (APCSB) 9.5-1 (refer to Appendix 9.5B Table B-1, Section F).

9.4.1.3.3 General Design Criterion 4, 1967 - Sharing of Systems

The control room is common to DCPP Unit 1 and Unit 2, and therefore requires sharing of SSCs between Units. Mechanically interlocked transfer switches allow for the transfer of power between Unit 1 and Unit 2 480-V, Class 1E switchgear buses. Refer to section 8.3.1.1.4.3.3 for the sharing of electrical power and equipment. Safety of the CRVS is not impaired by the sharing because the two-train CRVS meets redundancy and single failure criteria for the common control room.

In addition, the CRPS is shared between the control room and the technical support center (TSC). This sharing does not impair safety functions because each of the two pressurization trains independently have the capability to provide makeup air to the entire common control room area as well as to the TSC.

9.4.1.3.4 General Design Criterion 11, 1967 - Control Room

Under normal conditions (Mode 1), the Unit 1 and Unit 2 CRHVAC system supplies conditioned air consisting of recirculated air mixed with outdoor makeup air. In the event of a fire in the control room envelope, a smoke detector located in the return air duct is capable of detecting combustion products before visible smoke is present. The presence of combustion products would be alarmed in the control room where the operator would take corrective action. In the event of a large amount of smoke, the operator has the option to switch the CRVS into the 100 percent outdoor air mode of operation (Mode 2). This mode would purge the room of smoke. The control room is equipped with an adequate number of proper types of fire extinguishers and is manned by an operator(s) trained in fire-fighting procedures.

In the event that either damper 7 or 8 (Figure 9.4-1) failed to open during Mode 2 ventilation, the rate of air removal from the control room would be reduced. If damper 7 failed to open, the air removal rate would be approximately 2100 cfm. If damper 8 failed to open, the air removal rate would be approximately 5375 cfm. Reduced air removal rates would result in slower removal of smoke.

In the event of toxic gas outside the control room, 100 percent of the air would be recirculated air with a portion passing through the HEPA filters and charcoal banks (Mode 3). Mode 3 operation of the CRVS may be manually initiated on human detection of toxic gas by the control room operators. Intake closure occurs within 10 seconds after manual actuation. Infiltration of the toxic gas from outdoors and other areas of the auxiliary building would be limited by minimum leakage dampers, zero leakage penetrations, weather-stripped doors, vestibules, and the absence of outside windows. Administrative controls ensure that all control room entranceways are normally closed. The plant complies with NRC Regulatory Guide 1.78 (Reference 16).

With complete recirculation of the ventilation air, the carbon dioxide buildup is not expected to exceed an acceptable concentration of 1 percent by volume during 800 manhours of occupancy in the control room complex (e.g. 20 persons for 40 hours). Mode 4 operation maintains acceptable CO_2 levels inside the control room area due to the influx of filtered, outside air and exfiltration.

Refer to Section 9.4.1.2 for a general discussion of CRVS modes of operation. Mode 4 is governed by GDC 19, 1971 and is evaluated in Section 9.4.1.3.7.

9.4.1.3.5 General Design Criterion 12, 1967 - Instrumentation and Control Systems

Monitoring devices for control room HVAC Systems are capable of detecting low levels of airborne contaminants:

(1) Smoke detectors have sensitivity to detect trace amounts of combustion products.

(2) The two outside air activity area monitors per intake that sample air entering the pressurization system duct are Geiger Muller tube-type general purpose monitors with a 10^{-2} to 10^{4} mR/hr range. Each monitor has a control room readout module with instrument failure alarm. A high radiation signal provides control room annunciation, shuts down the operating CRPS train, and automatically starts the opposite Unit's CRPS.

(3) One area monitor is mounted on the radiation monitoring racks in the control room. This monitor is a Geiger Muller tube-type general-purpose monitor with a 10^{-1} to 10^{4} mR/hr range. This monitor has a control room readout with instrument failure alarm, local alarm, and control room annunciation.

(4) The chlorine monitors at the pressurization outside air duct are abandoned in place as there is no bulk chlorine on site.

High smoke or airborne radioactivity is annunciated in the control room so that the operator can take appropriate action.

9.4.1.3.6 General Design Criterion 17, 1967 - Monitoring Radioactivity Releases

Monitoring devices for control room HVAC systems are capable of detecting low levels of airborne radioactivity. Two outside air activity monitors per intake sample air entering the control room supply duct. Two outside air activity area monitors per intake sample air entering the pressurization system duct. (refer to Section 9.4.1.3.5) One area monitor is mounted on the radiation monitoring racks in the control room. (refer to Sections 9.4.1.3.5)

9.4.1.3.7 General Design Criterion 19, 1971 - Control Room

CRVS Mode 4 operation is automatically initiated on a containment phase A isolation (safety injection) or normal air intake radiation monitor signal. Initiation of Mode 4 operation on a CRVS train initiates Mode 3 operation on the opposite train. Intake closure is designed to occur within 10 seconds or less after initiation of closure signal. Infiltration of activity from outdoors and other areas of the auxiliary building is limited by positive pressure, minimum leakage dampers, zero leakage penetrations, weather-stripped doors, door vestibules, and the absence of outside windows. Administrative controls ensure that all control room entranceways are normally closed.

The CRVS, in conjunction with shielding and administrative controls, is designed to permit access and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 5 rem whole body, or its equivalent to any part of the body, for the duration of the most severe design basis accident. An evaluation of post-accident control room radiological exposures is presented in Section 15.5. (Note that for the fuel handling accident in the fuel handling building, a source term is assumed as described in Section 15.5.22).

9.4.1.3.8 General Design Criterion 21, 1967 Single Failure

The PG&E Design Class I control room ventilation system is designed to remain operable after sustaining a single failure. Refer to section 9.4.1.3.12.

9.4.1.3.9 General Design Criterion 37, 1967 - Engineered Safety Features Basis for Design

The CRVS is an ESF system designed to provide control room habitability in order to support systems that provide backup to the safety provided by the core design, the reactor coolant pressure boundary, and their protection systems. Refer to discussion of ESF design bases under Sections 9.4.1.3.4 and 9.4.1.3.7.

9.4.1.3.10 General Design Criterion 38, 1967 - Reliability and Testability of Engineered Safety Features

The CRVS has been designed with provisions for periodic tests, inspections, and surveillance to ensure that the systems will be dependable and effective when called upon to function. Refer to Section 9.4.1.4 for a discussion of inspection and testing requirements.

9.4.1.3.11 General Design Criterion 40, 1967 - Missile Protection

PG&E Design Class I structures and equipment outside the containment were reviewed to determine those that could be affected by potential missiles. For postulated missile sources, it was determined that release of a missile would not endanger the nuclear safety of the DCPP Unit 1 or Unit 2 control room ventilation system (refer to Section 3.5.1.2).

DCPP is designed so that a postulated piping failure will not cause the loss of needed functions of PG&E Design Class I SSCs, so that the plant can be safely shut down in the event of such failure (refer to Section 3.6). The CRVS is not required to be protected from moderate energy line breaks because the primary instrumentation and control functions required for shutdown are located on the hot shutdown panel (refer to Section 7.4), in addition to being available in the control room, and are provided for the purpose of achieving and maintaining a safe operational status in the event that an evacuation of the control room is required (refer to Section 3.6.2.2.4).

9.4.1.3.12 General Design Criterion 41, 1967 - Engineered Safety Features Performance Capability

The CRHVAC system consists of two trains. Each train comprises two redundant sets of full capacity active components. The two pressurization fans for each of the air intakes associated with the CRPS and the charcoal adsorber filter units are common to Unit 1 and Unit 2, and are fully redundant. Two independent and redundant control room HVAC trains, i.e. one train for each unit, are provided to ensure that at least one is available if a single active failure disables the other train. The source of the electrical power for each of the redundant active components is from a Class 1E bus, and active components are powered from separate Class 1E buses.

Pneumatic dampers have a designated position that they will assume upon loss of the control air supply. This position would be the same for Mode 3 or Mode 4 operation. Electric dampers that must assume a position in any mode of operation are supplied with power from vital buses. Separation of the electrical supply from the Class 1E buses has been followed throughout the installation.

9.4.1.3.13 Control Room Ventilation Safety Function Requirement

(1) Cooling of PG&E Design Class I Equipment

The design indoor ambient temperatures are:

(a) Control room and safeguard rooms	85°F
(b) HVAC equipment rooms	104°F

The upper limit of temperature environment for the control room instrumentation is 120°F. Below this point, degradation of the equipment will not be an important factor. The system is designed to meet single failure criteria, so that one train of cooling is available at all times. With only one train of cooling equipment operating, the calculated temperature in the control room area is approximately 89°F and in the instrument safeguard room of the unit without air conditioning is approximately 116°F. Local hot areas within the equipment cabinets will be identified under operating conditions and provisions made for ventilation.

9.4.1.3.14 10 CFR 50.63 - Loss of All Alternating Current Power

The CRVS is designed to continue to support control room habitability in the event of SBO. The CRVS equipment is powered from the alternate AC Class 1E buses (refer to Section 8.3.6). In addition, manual transfer switches are provided for the control and power circuits that enable operation of the CRVS from either Unit 1 or Unit 2 power in the event that AC power from one Unit is not available (refer to Section 8.3.1.1.5.3.3).

9.4.1.3.15 Regulatory Guide 1.52, June 1973 - Design, Testing, and Maintenance Criteria for Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants

The CRVS provides the capability to control airborne radioactive material that could enter the control room atmosphere during a design basis event to acceptable levels. The CRVS is an ESF habitability system. These systems are analyzed to the positions in NRC Regulatory Guide 1.52, June 1973 (Reference 11) as discussed in Table 9.4-2, with exceptions noted for specific items. Requirements for the performance of ventilation filter testing are stated in DCPP Technical Specifications.

Individual HEPA filters have been tested and are specified by the manufacturer to be able to remove 99.97 percent of particles 0.3 microns and larger, based on dioctyl phathalate (DOP) particles in a standard test procedure. The overall efficiency of the filter bank is dependent on the initial efficiency of the individual filters, the care with which the filters have been stored and installed, and the sealing effectiveness of the filter frames with the supporting members of the bank. A penetration and leakage test was performed in place prior to putting the system in operation. Plant procedures for receiving, storing, and handling HEPA filters are employed to ensure factory performance of all HEPA filters.

Individual charcoal filters have been tested and are specified by the manufacturer to be able to remove 99 percent of radioactive iodine in the form of elemental iodine and 95 percent of radioactive iodine in the form of methyl iodide. A bypass leakage test was performed in place prior to putting the system in operation.

9.4.1.3.16 Regulatory Guide 1.52, Revision 2 - Design, Testing, and Maintenance Criteria for Post Accident Engineered-Safety-Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants

The DCPP ventilation filter testing program (VFTP) provides the requirements for the testing of charcoal samples from the CRVS charcoal adsorbers in accordance with ASTM D 3803-1989, which complies with Regulatory Guide 1.52, Revision 2 and Generic Letter 83-13 for laboratory testing of charcoal samples and in-place penetration and bypass leakage testing in accordance with ANSI N510-1980. The VFTP complies with Regulatory Positions C.5.a, C.5.c, C.5.d, and C.6.a requirements as described in Table 9.4-2, with exceptions noted.

9.4.1.3.17 NUREG-0737 (Item II.B.2), November 1980 - Clarification of TMI Action Plan Requirements

Item II.B.2 **-** Design Review of Plant Shielding and Environmental Qualification of Equipment for Spaces/Systems Which May Be Used in Postaccident Operations:

Plant shielding has been evaluated with regard to both radiation doses at equipment locations and vital area access/occupancy requirements for post-accident plant operations. Specifically for the CRVS, dose analyses were performed to determine gamma doses for an operator during access and occupancy of the HVAC mechanical room. Occupancy for reading the differential pressure gauge is limited by the exposure from radioactivity buildup on the ESF HVAC filter. Total dose for this activity (the only anticipated activity) is acceptable in consideration of the overall GDC 19, 1971, dose limits for duration of the accident.

9.4.1.4 Tests and Inspections

9.4.1.4.1 Initial System Inspection and Tests

Initial checks of the motors, dampers, compressors, controls, monitors, etc., are made at the time of installation. A system air balance test and adjustment to design conditions are conducted. The final tests performed prior to actual operation of the CRVS are the in-place tests of the HEPA and charcoal filter banks. Refer to Table 9.4-2 for additional testing requirements.

9.4.1.4.2 Routine System Tests

The CRVS is functionally tested periodically as required by the DCPP Technical Specifications (Reference 10) for proper operation of the modes of operation. This testing includes checking the function of the dampers in Modes 1, 3, and 4 and measuring air flow through the filter.

Control room radiation monitors are periodically tested and calibrated as required by the DCPP Technical Specifications and Equipment Control Guidelines.

The control room ventilation smoke detectors are tested and demonstrated "operable" as required by the Equipment Control Guidelines.

An in-place test of the HEPA and charcoal filter banks is performed periodically as required by the DCPP Technical Specifications. Refer to Table 9.4-2 for additional testing requirements.

9.4.1.5 Instrumentation Applications

Required controls for CRVS components for system operation and instrumentation for monitoring CRVS parameters during normal operations and accident conditions are provided (refer to Sections 9.4.1.2 and 9.4.1.3.5).

9.4.2 AUXILIARY BUILDING

The following rooms/areas of the auxiliary building are provided with separate ventilation systems and are described in the referenced sections below:

(1) Control room - Section 9.4.1

(2) 125-Vdc and 480-V switchgear rooms - Section 9.4.9

(3) Battery charger and inverter rooms - Section 9.4.9

(4) Hot shutdown panel area - Section 9.4.9

(5) Cable spreading rooms - Section 9.4.9

The PG&E Design Class I auxiliary building ventilation system (ABVS) described in this section includes the following rooms/areas:

(1) Engineered safety features (ESFs) and PG&E Design Class I electrical equipment areas: Component cooling water (CCW) pump area, safety injection (SI) pumps room, containment spray pumps area, residual heat removal (RHR) pump room, boric acid transfer pump area, and centrifugal charging pumps CCP1 and CCP2 rooms

(2) Radwaste areas

The ABVS provides the following functions:

(1) The ESF function to reduce the amount of volatile radioactive materials that could be released to the atmosphere in the event of leakage from the RHR circulation loop following a LOCA (refer to Sections 6.1.2, 6.3.3.5.3.2, and 15.5.17)

(2) The PG&E Design Class I function of maintaining the temperature of the ESF pump motors within acceptable limits during their operation

(3) Ventilation to the auxiliary building

(4) A filtered flowpath which serves as a portion of one train of the containment hydrogen purge system and the containment excess pressure relief system

9.4.2.1 Design Bases

9.4.2.1.1 General Design Criterion 2, 1967 – Performance Standards

The PG&E Design Class I portion of the ABVS is designed to withstand the effects of, or is protected against natural phenomena such as earthquakes, tornadoes, flooding, winds, tsunamis, and other local site effects.

9.4.2.1.2 General Design Criterion 3, 1971 – Fire Protection

The ABVS is designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

9.4.2.1.3 General Design Criterion 4, 1967 – Sharing of Systems

The ABVS is not shared by the DCPP units unless it is shown safety is not impaired by the sharing.

9.4.2.1.4 General Design Criterion 11, 1967 – Control Room

The PG&E Design Class I portion of the ABVS is designed to support actions to maintain and control the safe operational status of the plant from the control room or from an alternate location if control room access is lost due to fire or other causes.

9.4.2.1.5 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Instrumentation and controls are provided as required to monitor and maintain the ABVS variables within prescribed operating ranges.

9.4.2.1.6 General Design Criterion 17, 1967 – Monitoring Radioactivity Releases

Means are provided for monitoring the effluent discharge paths of the ABVS for radioactivity that could be released from normal operations, anticipated transients, and accident conditions.

9.4.2.1.7 General Design Criterion 21, 1967 – Single Failure Definition

The PG&E Design Class I portion of the ABVS is designed to remain operable after sustaining a single failure. Multiple failures resulting from a single event are treated as a single failure.

9.4.2.1.8 General Design Criterion 37, 1967 – Engineered Safety Features Basis for Design

The ESF portion of the ABVS is designed to provide backup to the safety provided by the core design, the reactor coolant pressure boundary, and their protection systems.

9.4.2.1.9 General Design Criterion 38, 1967 – Reliability and Testability of Engineered Safety Features

The ESF portion of the ABVS is designed to provide high functional reliability and ready testability.

9.4.2.1.10 General Design Criterion 40, 1967 – Missile Protection

The ESF portion of the ABVS is designed to be protected against dynamic effects and missiles that might result from plant equipment failures.

9.4.2.1.11 General Design Criterion 41, 1967 – Engineered Safety Features Performance Capability

The ESF portion of the ABVS is designed to provide sufficient performance capability to accommodate a partial loss of installed capacity, including a single failure of an active component, and still perform its required safety function.

9.4.2.1.12 General Design Criterion 42, 1967 – Engineered Safety Features Components Capability

The ESF portion of the ABVS is designed so that capability of each component and system to perform its required function is not impaired by the effects of a LOCA.

9.4.2.1.13 General Design Criterion 70, 1967 – Control of Releases of Radioactivity to the Environment

The ABVS is designed with provisions for maintaining control over the plant’s radioactive gaseous effluents. Appropriate holdup capacity is provided for retention of gaseous effluents, particularly where unfavorable environmental conditions can be expected to require operational limitations upon the release of radioactive effluents to the environment.

9.4.2.1.14 Auxiliary Building Ventilation System Safety Function Requirements

(1) Protection from Missiles and Dynamic Effects

The non-ESF portion of the ABVS is designed to be protected against internal missiles generated outside containment and dynamic effects that might result from plant equipment failure.

(2) Cooling of PG&E Design Class I Equipment

The ABVS is designed to provide heat removal to ESF equipment to maintain the environment within design conditions.

9.4.2.1.15 10 CFR 50.49 – Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants

The ABVS components that require environmental qualification are qualified to the requirements of 10 CFR 50.49.

9.4.2.1.16 Regulatory Guide 1.52, June 1973 – Design, Testing, and Maintenance Criteria for Atmosphere Cleanup Systems Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants

The ABVS design and maintenance conforms with the guidance provided in Regulatory Guide 1.52, June 1973 with exceptions noted in Table 9.4-2.

9.4.2.1.17 Regulatory Guide 1.52, Revision 2, March 1978 – Design, Testing, and Maintenance Criteria for Post-Accident Engineered Safety Feature Atmosphere Cleanup Systems Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants

The ventilation filter testing program (VFTP) conforms with the guidance provided in Regulatory Guide 1.52, Revision 2, Regulatory Positions C.5.a, C.5.c, C.5.d, and C.6.a as described in Table 9.4-2. The VFTP also conforms with the guidance provided in Generic Letter 83-13.

9.4.2.1.18 Regulatory Guide 1.97, Revision 3, May 1983 – Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident

The ABVS provides instrumentation to monitor system variables during and following an accident.

9.4.2.1.19 NUREG-0737 (Item II.F.1), November 1980 – Clarification of TMI Action Plan Requirements

Item II.F.1 – Additional Accident Monitoring Instrumentation:

Position (1) – The ABVS is designed with noble gas effluent monitors that are installed with an extended range designed to function during accident conditions.

Position (2) – The ABVS is designed with provisions for sampling of plant effluents for post-accident releases of radioactive iodines and particulates and onsite laboratory capabilities.

9.4.2.2 System Description

The auxiliary building ventilating system provides all outside air supply for the auxiliary building under all operating conditions. It also serves its primary purpose of providing cooling air for the ESF pump motors.

The supply system consists of two full capacity fans, roughing filters, and duct work for distribution. The exhaust system consists of two full capacity fans, two full capacity combined roughing and HEPA filter banks, one full capacity combined electric heater, roughing, HEPA and charcoal (may also be referred to as carbon) filter bank, and exhaust duct network (as shown in Figures 9.4-2 and 9.4-3). The major equipment for the system is listed in Table 9.4-5. The containment hydrogen purge line connects to the inlet plenum for the filter bank containing the charcoal filter (refer to Section 6.2.5 and Figures 6.2-15, 9.4-3 and 9.4-3A). Manually controlled valves in this line allow flow to leave the containment and exhaust to the plant vent through the charcoal filter. The containment excess pressure relief line and the alternate path for the containment hydrogen purge discharge into the plant vent through the ABVS charcoal filter.

Air Distribution

The air flow pattern is arranged so that the air flows from areas of lower potential contamination to areas of higher potential contamination, and is then discharged to the plant vent. This is accomplished by supplying air to the occupied areas then exhausting the air from each equipment area separately. The system is balanced so that the building is normally under a slight negative pressure. The exhaust ducts from potentially high activity areas are so routed as to minimize exposure to normally occupied areas.

All ductwork serving ESF equipment has been designed to withstand any internal pressure that may be generated by any fan in the system, and braced according to PG&E Design Class I criteria to prevent earthquake damage to the ducts (refer to Section 9.4.2.3.1). All static ventilation components (i.e., volume dampers and air diffusers) have locking devices to prevent accidental closing. No duct liner or other insulating substance, which might sag or fall down, thereby blocking the duct, has been installed in any ductwork.

Electrical Power

The fans for the system receive power from the Class 1E 480-V buses. The supply system consists of two full capacity fans (each powered from a separate Class 1E bus). The exhaust system consists of two full capacity fans (each powered from a separate Class 1E bus).

Modes of Operation

The ABVS has three modes of operation:

Building Only Mode: During normal plant operation the system is designed to be in the "Building Only" mode. In this mode, one of two 100 percent capacity supply fans and one of two 100 percent capacity exhaust fans operates. Outside air is drawn through intake louvers, roughing filters, and ducted to the building space through the building only ventilation mode supply duct system. In the building only ventilation operating mode, exhaust air passes through the roughing and HEPA filter train. In any mode of operation the exhaust air is discharged through the plant vent.

Building and Safeguards Mode: The system automatically shifts to Building and Safeguards Mode when the control logic receives:

(1) A safety injection signal

(2) An indication that any one of the motors for the centrifugal charging pumps CCP1 or CCP2, RHR pumps, safety injection pumps, or containment spray pumps has started

Building and Safeguards Mode may also be manually selected from the control panel in the control room for test or for operation. In this mode, the redundant set of supply and exhaust fans are designed to operate so that two supply and two exhaust fans are operating simultaneously. As in Building Only Mode, outside air is drawn through intake louvers, roughing filters and ducted to the building via the building only ventilation mode supply duct system and also through the ESF supply duct system. Depending on the presence of a safety injection signal, the exhaust air is handled as follows:

(1) If the system receives a safety injection signal, the exhaust air from the ESF pump rooms and RHR heat exchanger rooms passes through the manually actuated electric heater, roughing, HEPA, and charcoal filters, and the exhaust air from all other areas passes through the redundant roughing and HEPA filter trains.

(2) In the absence of a safety injection signal, the exhaust air from all areas passes through the roughing and HEPA filter trains.

Safeguards Only Mode: This mode is automatically actuated if a supply or an exhaust fan fails while the system is in Building and Safeguards Mode. The system supplies air only through the ESF supply duct system utilizing one exhaust fan and one supply fan. Depending on the presence of a safety injection signal, the exhaust is handled as follows:

(1) If the system receives a safety injection signal, the exhaust air from the ESF pump rooms and RHR heat exchanger rooms passes through the manually actuated electric heater, roughing, HEPA, and charcoal filters.

(2) In the absence of a safety injection signal, the exhaust air from all areas passes through the roughing and HEPA filters trains.

Design values for the ABVS are listed in Table 9.4-10.

The design classification for the ABVS is given in the DCPP Q-List (refer to Reference 8 of Section 3.2). The design codes and standards are given in Table 9.4-8.

ESF Air Flow Relative Humidity

In the unlikely event of a LOCA accompanied by RHR loop leakage in the auxiliary building, flashing of leakage water would increase the relative humidity of the auxiliary building ESF exhaust air flow. To enhance the efficient performance of the charcoal filters, a manually actuated, 54 kW electric heater located upstream of the auxiliary building charcoal filters is sized to reduce the relative humidity of the ESF air flow. Operation of this heater is not required for this system to perform its safety function.

This heater is sized on the following assumptions:

(1) Outside air conditions of 45°F and 100 percent relative humidity. These conditions represent a reasonable bound on expected conditions that maximizes the relative humidity of ESF air flow entering the auxiliary building charcoal filters.

(2) Auxiliary building heat loads that result in a temperature rise of 16.5°F due to an increase in sensible heat of the 73,500 cfm ESF air flow. The only heat loads included are those associated with equipment that is required to operate following a LOCA and that would be expected to be operating during the period of postulated RHR loop leakage. These heat loads include motor losses and heat losses from piping and equipment associated with emergency core cooling systems (ECCS) and ESF ventilation system operation. Two trains of ECCS pumps, one containment spray system train, and two CCW pumps are assumed to be operating.

(3) Adiabatic mixing of 738 lb/hr steam (3.1 percent flashing of 50 gpm leakage, refer to Section 15.5.17) with that portion of the ESF air flow which passes through the RHR pump rooms. Condensation is assumed that results in 100 percent relative humidity prior to mixing this portion of the ESF airflow with the remainder of the ESF air.

Using these assumptions, and assuming operation of the 54 kW electric heater, results in less than 70 percent relative humidity for ESF air flow entering the auxiliary building charcoal filters. However, the charcoal used in the filters is tested to 95 percent relative humidity and the electric heater is not required for filter operability (refer to Section 9.4.2.3.17 and Table 9.4-2).

Differential Pressures

Regarding the differential pressures, the total auxiliary building was considered as an open building. However, the exhaust system will remove approximately 9 percent more air than the supply system will provide. The extra air quantity must be made up by infiltration. Each equipment compartment is exhausted separately or through another compartment of higher potential contamination. This flow distribution, combined with the system air flow balance, will establish a slight negative pressure within the compartments. No provision other than this has been made to maintain or monitor this negative pressure.

Containment Hydrogen Purge and Pressure Relief

The ABVS provides a filtered flow path, to the plant vent, which serves as a portion of one train of the containment hydrogen purge and the containment excess pressure relief systems. Refer to Sections 6.2.5 and 9.4.5, respectively.

Containment hydrogen purging is manually controlled and, when required, operates only intermittently. No single failure can accidentally initiate flow.

Containment hydrogen purge is required for plant safety but is not required until several weeks following a LOCA (refer to Section 6.2.5.2.3). By this time, most of the ESF pumps are no longer in operation and the heat load on the ventilation system is well below its maximum. In addition, purging would be conducted only about 2 hours a day, at times desired by the operator. This further guarantees the ability to avoid peak load periods on the ventilation system. In any case, the maximum expected purge flow of only 300 cfm would not have a significant effect on the ventilation system.

9.4.2.3 Safety Evaluation

9.4.2.3.1 General Design Criterion 2, 1967 – Performance Standards

The ABVS is designed to perform its safety functions under the effects of earthquakes (refer to Section 3.10.2.30), winds and tornadoes (refer to Section 3.3.2.3.2.1), and external missiles (refer to Section 3.5.1.2). The ABVS may be vulnerable to tornado effects but does not need to be operational while the plant is brought to a safe operational status.

Various ventilation systems exhaust to the plant vent; a PG&E Design Class I structure. The plant vent is designed to perform its safety functions under the effects of

earthquakes (refer to Section 3.8.1.1), winds and tornadoes, and external missiles. The plant vent may also be vulnerable to tornado effects; however the plant can be safely shutdown without additional radiation exposure to the public even if the plant vent and its radiation monitors are rendered inoperable by a tornado. Refer to Section 3.3.2.3.2.5 for further discussion of wind, tornado, and external missile effects on the plant vent.

ABVS equipment is located within the auxiliary and fuel handling buildings which are PG&E Design Class I structures (refer to Section 3.8.2). The auxiliary building, including the relevant portions of the fuel handling building, is designed to withstand the effects of winds and tornadoes (refer to Section 3.3), floods and tsunamis (refer to Section 3.4), external missiles (refer to Section 3.5), and earthquakes (refer to Section 3.7). This design protects the ABVS, ensuring its design functions can be performed during these events.

9.4.2.3.2 General Design Criterion 3, 1971 – Fire Protection

The ABVS is designed to the fire protection guidelines of Branch Technical Position APCSB 9.5-1 (refer to Appendix 9.5B, Table B-1, Sections D and F).

9.4.2.3.3 General Design Criterion 4, 1967 – Sharing of Systems

No ABVS equipment is shared between DCPP Unit 1 and Unit 2. However, common auxiliary building areas are ventilated by both the Unit 1 and Unit 2 ABVSs.

The Building and Safeguards Mode of operation provides sufficient cooling to PG&E Design Class I equipment in the auxiliary building at all times (refer to Section 9.4.2.2). In the event of failure of a supply or exhaust fan while the system is in Building and Safeguards Mode, Safeguards Only Mode is automatically actuated to continue to provide sufficient cooling to ESF equipment (refer to Section 9.4.2.2).

Each unit's ABVS is designed for single failure protection ensuring at least one train per unit is operational at all times providing full ventilation flow to all areas of the auxiliary building (refer to Section 9.4.2.3.7).

Therefore safety is not impaired by the shared ventilation.

9.4.2.3.4 General Design Criterion 11, 1967 – Control Room

The ABVS is normally controlled from the control room. Controls are provided on the main control board which allow for system startup and shutdown, fan selection, and for the selection of system operating configuration and modes (refer to Section 9.4.2.2).

Indication is provided on the main control board to indicate fan failure or damper out of position. Annunciators in the control room alert operators to abnormal conditions and system or equipment failures (refer to Section 9.4.2.3.5).

The ABVS can be operated remotely from the ventilation control logic and relay cabinet in the cable spreading room.

9.4.2.3.5 General Design Criterion 12, 1967 – Instrumentation and Control Systems

The operation of the system is initiated from the ventilation control board in the control room. The logic control will position the dampers and start the system for normal operation. The supply fan and exhaust fan are interlocked in a manner as to ensure the building will not be subjected to an appreciable amount of positive pressure. High-temperature and fan-failure alarms and damper position are provided to the main annunciator from the supply fan room.

The logic control devices for both Unit 1 and Unit 2 control system are solid-state units providing a full selection of logic functions designed for binary system operation. The control system is based on a programmable logic controller (PLC). The basis for qualification of the Triconex PLC and associated software follows the guidance of Branch Technical Positions 7-14 and 7-18 (refer to References 21 and 22). The logic control system has output to solenoids and dry contact relays for the control functions. Both the logic controls and relays are redundant and have power sources from Class 1E buses.

The ambient air temperatures in areas containing Class 1E electrical equipment will be monitored continuously where excessive temperatures could possibly occur.

Additional information about the temperature monitoring system is provided in Sections 3.11 and 9.4.2.3.14. Additional information about radiation monitoring is provided in Section 9.4.2.3.6.

There are three ABVS modes of operation: Building Only, Building and Safeguards, and Safeguards Only. These modes are described in Section 9.4.2.2.

9.4.2.3.6 General Design Criterion 17, 1967 – Monitoring Radioactivity Releases

The air flow from the auxiliary building is monitored for abnormal radiation levels of both particulate and gaseous nature at the plant vent monitors.

The plant vent is a large duct installed on the side of the containment structure discharging to the atmosphere at the 328.5 foot elevation. The discharges from the vent are monitored for radiation from both particulate and gaseous material by the plant vent air particulate and noble gas effluent monitors, RM-28 (or RM-28R) and RM-14 (or RM-14R), respectively. Additionally, the plant vent is equipped with iodine monitors RM-24 (or RM-24R) and an extended range noble gas effluent monitor (RM-87).

In addition, effluent from the RHR equipment compartments is monitored for abnormal radiation levels (RM-13). The sample for this monitor may be taken from either RHR compartment exhaust ducts so that an evaluation of any detected leakage may be made.

The radiological monitoring system is described in Section 11.4 and Table 11.4-1. Post-accident radiation monitoring is discussed in Section 9.4.2.3.19.

9.4.2.3.7 General Design Criterion 21, 1967 - Single Failure Definition

The ABVS has redundancy for the initiation circuitry and all non-static components, except for the electric heater (which is not required for filter operability). The fans are each full capacity, sized to handle the ESF pump motor cooling. Each ABVS train consists of two full capacity supply and exhaust fans, each powered from a separate Class 1E bus. In the event of the loss of an exhaust fan coincident with a safety injection signal, the second exhaust fan will start and the dampers will position themselves to route the air through the ESF ducts to the combined HEPA and charcoal filter banks. All dampers fail in the positions required for emergency conditions.

The ABVS is provided with a single, full capacity roughing, HEPA, and charcoal filter bank (including an electric heater) to limit the offsite exposures from a post-LOCA RHR pump seal failure. A single charcoal filter train is provided because the failure of the charcoal filter train in conjunction with a LOCA and RHR pump seal would constitute a second failure as discussed in Section 15.5.17.

The power for the fans and the initiating (logic) circuitry is taken from Class 1E buses with separation of redundant components. The dampers are positioned by pneumatic actuators supplied from the plant compressed air supply. The dampers are designed to assume the position required for emergency conditions on the failure of the air supply. If a damper’s fail position is open, two dampers are mounted in parallel. Conversely, if the damper’s fail position is closed, two dampers are mounted in series. The initiating (logic) circuitry is redundant, including relays and solenoids required to actuate the system. Each control train serves similar control functions, in addition to switching over circuits in the event of a failure to the other train. Separation has been maintained for the electrical circuits from each Class 1E bus.

The ventilation system is designed to meet single failure criteria by having the non-static elements installed in redundancy. All dampers that must fail in the open position are redundant. Failure in the open position maintains cooling air flow through the ESF pump motor compartments.

The radwaste area is primarily that area served by the system that is not included in the "safeguards only" mode of operation. Two conditions will interrupt the air flow to the radwaste area. The first condition involves a double failure, the loss of either an exhaust or a supply fan and a coincident safety injection signal or the start of an ESF pump motor. The second condition is the loss of control air supply to the building

exhaust duct dampers 4A and 4B (refer to Figure 9.4-3). Either case is an abnormal condition that is indicated to the control room operator who then takes action to minimize the leakage of radioactive material to the compartments and/or to the ventilation system.

HISTORICAL INFORMATION IN ITALICS BELOW NOT REQUIRED TO BE REVISED.

Experience at the Humboldt Bay reactor has shown that normal leakage or vents from the radwaste system are not a large contributor to airborne radioactivity.

9.4.2.3.8 General Design Criterion 37, 1967 – Engineered Safety Features Basis for Design

The PG&E Design Class I ABVS provides the ESF function to reduce the amount of volatile radioactive materials that could be released to the atmosphere in the event of leakage from the RHR circulation loop following a LOCA (refer to Sections 6.1.2, 6.3.3.5.3.2, and 15.5.17).

The ventilation system serves the auxiliary building (including the radwaste area, excluding the fuel handling area). The general flow pattern is from areas of lower potential contamination to areas of higher potential contamination. The building is under a slight negative pressure. This concept has been followed throughout. This flow pattern will be maintained under the first two modes of operation. However, when the system is operating under the "safeguards only" mode (refer to Section 9.4.2.2), the total air flow will be exhausted through the ESF motor compartments only.

The exhaust air from the auxiliary building is normally routed through roughing and HEPA filter banks for the purpose of removing particulates that may be in the ventilation air. When the system is in the "building and safeguards" or "safeguards only" modes of operation without safety injection signal, air that is exhausted from the ESF pump motor areas is routed through roughing and HEPA filter banks. In the presence of a safety injection signal in conjunction with the system in one of these two modes, the exhaust air from the ESF pump motor area passes through the combined roughing, HEPA, and charcoal filters. The specifications for the exhaust filters are given in Table 9.4-5. Refer to Section 15.5.17 for a discussion on dose consequences analyses.

9.4.2.3.9 General Design Criterion 38, 1967 – Reliability and Testability of Engineered Safety Features

The ESF portion of the ABVS is designed with provisions for periodic tests, inspections and surveillance to ensure that the systems will be dependable and effective when called upon to function.

The system is operationally tested in accordance with the Technical Specifications. These tests include checking the function of the dampers and controls under each mode of operation and determination of total air flow.

A functional test of the HEPA and/or charcoal filter banks is performed whenever a filter element is replaced. A charcoal sample is removed in accordance with the VFTP to determine the effectiveness of the charcoal bank (refer to Sections 9.4.2.3.16 and 9.4.2.3.17 and Table 9.4-2).

9.4.2.3.10 General Design Criterion 40, 1967 – Missile Protection

There are no credible missiles outside of containment resulting from plant equipment failures that would prevent the ESF portion of the ABVS from performing its design functions (refer to Section 3.5.1.2).

Dynamic effects as a result of plant equipment failure will not prevent the PG&E Design Class I portion of the ABVS from performing its design functions (refer to Section 3.6).

9.4.2.3.11 General Design Criterion 41, 1967 – Engineered Safety Features Performance Capability

Each full capacity fan of a redundant set receives power from a separate Class 1E bus. The dampers for the system are redundant, pneumatically operated, and designed to fail in the positions required for emergency conditions. Dampers are arranged in parallel if the fail position is open, and in series if the fail position is closed (refer to Section 9.4.2.3.7).

9.4.2.3.12 General Design Criterion 42, 1967 – Engineered Safety Features Components Capability

Following a loss-of-coolant accident (LOCA), the ABVS can tolerate a 50 gpm RHR system leak during the recirculation phase in the auxiliary building (refer to Sections 6.1.2, 6.3.3.5.3.2, and 15.5.17).

9.4.2.3.13 General Design Criterion 70, 1967 – Control of Releases of Radioactivity to the Environment

The normal building exhaust air is filtered through HEPA filters, and upon a safety injection signal, the emergency cooling exhausts air through both HEPA filters and charcoal filter banks.

The occurrence of complete failure of the auxiliary building ventilation flow would result in a slow rise in airborne activity in the building only if a significant amount of leakage existed from equipment carrying radioactive fluids prior to the failure of ventilation flow. If concentrations should rise to significant levels, personnel can be kept out of the area by administrative controls, or wear protective respiratory equipment during any required maintenance work. Specific limits on plant operation and requirements for shutdown under conditions of reduced or lost ventilation flow are contained in the Technical Specifications. The characteristics of the monitors and sampling procedures for auxiliary building areas are given in Section 11.4. There are no public safety

implications of failure of the auxiliary building ventilation during normal plant operation, since reduced exhaust flow would only result in increased holdup and decay of airborne activity before release from the plant. With regard to simultaneous coincident major failures in both the ventilation system and a major radwaste component, an analysis of the most severe consequences of such events is contained in Sections 15.5.24, 15.5.25, 15.5.26, and 15.5.27. Assessments of long-term exposures from small equipment leakages are included in Sections 11.3.8 and 12.2.6.

Radioactive iodines and particulates, for the removal of which the ABVS is potentially effective, are generally stored at low pressure in the auxiliary building. Failure of a low-pressure storage vessel would be extremely unlikely and would not generate a pressure pulse sufficient to damage the ABVS.

A larger pressure pulse would result from the rupture of a gas decay tank or the volume control tank. The failure probability for these tanks is very low. As an upper bound, the pressure resulting from the rupture of a gas decay tank pressurized to 100 psig has been assumed to equalize instantaneously within the four interconnected cells housing the four gas decay tanks. The resulting pressure would be 2.63 psig. A similar calculation for the volume control tank results in an equalized pressure of 1.5 psig for the tank compartment and the one adjacent to it.

These pressures are sufficient to cause local damage to the duct work and release of radioactive materials into other auxiliary building areas. As shown in Figure 9.4-2, such a pressure pulse can propagate and dissipate for a considerable distance down the main exhaust duct from the tanks before reaching normally occupied areas of the auxiliary building. While some momentary release of radioactivity to these areas could result from a pressure pulse, any damage to the ductwork is likely to be confined to either (a) the branch serving the gas decay tanks and waste gas compressors, or (b) the branch serving the volume control tank and the sample heat exchangers.

After the initial pulse of pressure and release of radioactive materials, any airborne activity in areas served by the auxiliary building ventilating system will be drawn toward the high efficiency filters of the system. Any local damage to the duct should affect only the ventilation in the immediate area.

In case of the spread of radioactive materials to other auxiliary building areas, the operating restrictions, described above and within Section 9.4.2.3.7, can be instituted if necessary. As described in Section 15.5.24, no credit is taken for radioactivity removal by the ABVS in calculating offsite doses resulting from postulated failure of a gas decay tank.

For environmental consequences of plant accidents associated with the plant vent, refer to Sections 15.5.24 through 15.5.26.

9.4.2.3.14 Auxiliary Building Ventilation System Safety Function Requirements

(1) Protection from Missiles and Dynamic Effects

There are no credible missiles outside of containment resulting from plant equipment failure that would prevent the non-ESF portion of the PG&E Design Class I ABVS from performing its design functions (refer to Section 3.5.1.2).

Dynamic effects as a result of plant equipment failures will not prevent the non-ESF portion of the PG&E Design Class I ABVS from performing its design functions (refer to Section 3.6).

(2) Cooling of PG&E Design Class I Equipment

The ventilation system has been designed to maintain a maximum design room temperature of 104°F in the auxiliary building with a design outdoor ambient air temperature of 76°F (refer to Section 9.4) with the following exceptions:

(1) The liquid holdup tank rooms shall have a maximum design room temperature of 130°F.

(2) The ambient temperature in the area of the boric acid transfer pumps may reach a maximum temperature of approximately 124°F after one hour following the postulated event of one train of the ABVS being inoperable post LOCA. The boric acid transfer pump may be required to operate within this period post LOCA. During any other operating conditions, the maximum design room temperature in this area shall be 104°F.

The airflow requirements have been based on the ESF motor cooling load. The allowable ambient air temperature for continuous operation of the ESF motors is 104°F.

Although not an ESF function, the ABVS supplies cooling air for the ESF pump motors. Motors are designed for continuous operation at an ambient air temperature of 104°F. The supply fans and their associated dampers need to be in operation under both normal and accident conditions to maintain the environmental qualification of the ESF pump motors because the cooling function of the system is important for their long-term operation.

9.4.2.3.15 10 CFR 50.49 – Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants

The ABVS components required to function in harsh environments under accident conditions are qualified to the applicable environmental conditions to ensure that they will continue to perform their safety functions. Section 3.11 describes the DCPP EQ program and the requirements for the environmental design of the electrical and related

mechanical equipment. The affected components are listed on the EQ Master List (refer to Section 3.11.1).

9.4.2.3.16 Regulatory Guide 1.52, June 1973 – Design, Testing, and Maintenance Criteria for Atmosphere Cleanup Systems Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants

The ABVS provides the capability to control the volatile radioactive material that could exit to the atmosphere. The system is analyzed to the positions in NRC Regulatory Guide 1.52, June 1973 (Reference 11) as shown in Table 9.4-2 with exceptions noted for specific items. Requirements for the performance of ventilation filter testing are stated in the DCPP VFTP.

9.4.2.3.17 Regulatory Guide 1.52, Revision 2, March 1978 – Design, Testing, and Maintenance Criteria for Post-Accident Engineered Safety Feature Atmosphere Cleanup Systems Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants

The VFTP provides the requirements for the testing of charcoal samples from the ABVS charcoal adsorbers in accordance with ASTM D 3803-1989, which complies with Regulatory Guide 1.52, Revision 2, and Generic Letter 83-13, March 1983 for laboratory testing of charcoal samples and in-place penetration and bypass leakage testing in accordance with ANSI N510-1980. The VFTP complies with Regulatory Positions C.5.a, C.5.c, C.5.d, and C.6.a requirements as described in Table 9.4-2, with exceptions noted.

9.4.2.3.18 Regulatory Guide 1.97, Revision 3, May 1983 – Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident

Damper position indication in the control room provides status of the Unit 1 and Unit 2 ABVS fan suction and discharge motorized dampers in response to an ESF actuation (refer to Table 7.5-6 for a summary of compliance to Regulatory Guide 1.97, Revision 3).

9.4.2.3.19 NUREG-0737 (Item II.F.1), November 1980 – Clarification of TMI Action Plan Requirements

Item II.F.1 – Additional Accident Monitoring Instrumentation:

Position (1) – Extended range noble gas effluent monitoring is installed in the plant vent and is designed to function during accident conditions (refer to Sections 7.5.2.3 and 11.4.2.2.1).

Position (2) – Installed capability is provided in the plant to obtain samples of the particulate and iodine radioactivity concentrations which may be present in the gaseous

effluent being discharged to the environment from the plant under accident and post-accident conditions. The technical support center laboratory is available for onsite testing of the containment air samples.

9.4.2.4 Tests and Inspections

HISTORICAL INFORMATION IN ITALICS BELOW NOT REQUIRED TO BE REVISED.

An initial checkout of the motors, dampers, fans, controls, etc., was made at the time of installation. A system air balance test and adjustment to design conditions was conducted. The final tests performed prior to actual operation of the ventilation system were the functional tests of the HEPA and charcoal filter banks. These tests determined the overall effectiveness of the filter banks.

Refer to Section 9.4.2.3.9 for additional information on testing requirements.

9.4.2.5 Instrumentation Applications

Refer to Sections 9.4.2.3.4 and 9.4.2.3.5 for a complete discussion of the instrumentation requirements and controls for the ABVS.

9.4.3 TURBINE BUILDING

The turbine building ventilation system provides for personnel comfort and is a PG&E Design Class II system (refer to the DCPP Q-List, Reference 8 of Section 3.2).

Although the onsite TSC is adjacent to the turbine building, the TSC is provided with its own ventilation system (refer to Section 9.4.11). Separate PG&E Design Class I ventilation systems in the turbine building are provided for the diesel generator rooms (refer to Section 9.4.7), and the 4.16-kV switchgear and 4.16-kV cable spreading rooms, (refer to Section 9.4.8).

9.4.3.1 Design Bases

9.4.3.1.1 General Design Criterion 3, 1971 – Fire Protection

The turbine building ventilation system is designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

9.4.3.2 System Description

The turbine building ventilation system has been designed for the purpose of providing personnel comfort in the operation of the turbine-generator equipment. This system is generally not necessary for airborne radioactivity control because of the low potential for contamination in the steam cycle. The overall design objectives of the ventilation

systems regarding control of airborne radioactive materials are discussed in Section 12.2.1.

Because significant airborne activity is not expected on a continuous basis in the turbine building, continuous monitoring equipment is not provided. If significant activity levels are observed in the air ejector offgas, however, periodic sampling will be initiated to determine turbine building airborne activity. If sampling indicates the need for continuous sampling, it will be provided.

The turbine building ventilation system is a PG&E Design Class II system, and its complete failure has no safety implication. Because of the many fans in the system, failure of any fan or group of fans will not cause excessive temperatures in building compartments. Furthermore, if ventilation flow were not available, doors can be opened to provide natural flow. In the event that airborne activity exists in the building at a time when ventilation flow is not available, some increase in concentrations could occur. Because of the low level of this activity, however, it is not expected that concentrations above 10 CFR 20.1-20.601 (pre-1994) maximum permissible concentration (MPC) levels could exist with the building doors open. In any event, sampling or monitoring will be in effect under these conditions.

Regarding the requirements for the treatment of exhaust air from the turbine building, a detailed analysis of potential doses to the public from various sources of gaseous release is provided in Chapter 11. As a result of this analysis, it can be concluded that, at the DCPP site, treatment of turbine building exhaust air is not required to meet the exposure limits listed in Appendix I to Part 10 CFR 50.

Air is drawn into the system, through roughing filters, by the system's fifteen (15) supply fans. The supply fans direct air into the turbine building through the east wall both above and below the elevation 140 foot operating deck. An exhaust fan for the lube oil reservoir room draws air through the room from the 104 foot elevation of the turbine building, which is supplied by the turbine building ventilation system. The turbine building ventilation system provides supply air as well as a discharge path to atmosphere for the non-Class 1E battery rooms.

The four exhaust fans and their related duct systems, located on the west side of the building, ensure air flow across the building below the operating deck. The exhaust fans discharge the air vertically up above the operating deck inside the turbine building. The turbine building ventilation system provides a discharge path to atmosphere for the exhaust air from the Class 1E 4.16-kV switchgear rooms and associated cable spreading rooms (refer to Section 9.4.8), the non-Class 1E 480-V switchgear room, and the non-Class 1E battery rooms. A vent located on the top of the turbine building provides the exhaust path to atmosphere for turbine building supply air that is not discharged from the building via other paths.

Each fan can be operated independently through a manual motor starter with power from a non-Class 1E bus. Should there be single or double fan failure, the net effect on

the turbine building would be negligible. Should all non-Class 1E power to fans be de-energized, all doors on the east and west walls (elevation 85 foot) could be opened, allowing the building to function on gravity ventilation.

The locations of all fans, vents, and compartments are shown in the following: Figures 1.2-13, 1.2-14, 1.2-15, 1.2-16, 1.2-17, 1.2-18, 1.2-19, 1.2-20, 1.2-24, 1.2-25, 1.2-26, 1.2-27, 1.2-30, 1.2-31, and 1.2-32. The major equipment for the Turbine Building (General Area) Ventilation system is listed in Table 9.4-7.

The requirements for system temperature design are described in Section 9.4.

9.4.3.3 Safety Evaluation

9.4.3.3.1 General Design Criterion 3, 1971 – Fire Protection

The turbine building ventilation system is designed to the fire protection guidelines of NRC Branch Technical Position APCSB 9.5-1 (refer to Appendix 9.5B Table B-1). Specifically, fire dampers are provided for the lube oil reservoir room to maintain carbon dioxide (CO_2) gas concentration upon actuation of the CO_2 flooding gas extinguishing system provided for that room.

9.4.3.4 Tests and Inspections

HISTORICAL INFORMATION IN ITALICS BELOW NOT REQUIRED TO BE REVISED.

Initial checks of the fan housings, bearings, motors, bolts, controls, etc., were made at the time of installation. A system air balance test and adjustment to design conditions was conducted.

9.4.3.5 Instrumentation Applications

Each of the 15 supply fans and 4 exhaust fans can be operated independently through manual motor starters.

9.4.4 FUEL HANDLING BUILDING VENTILATION SYSTEM

The non-ESF portion of the fuel handling building ventilation system (FHBVS) serves the fuel handling building (FHB) and rooms containing the motor-driven and turbine-driven auxiliary feedwater (AFW) pumps, spent fuel pool pumps, spent fuel pool heat exchanger, makeup water transfer pumps, and fire pumps.

The ESF function of the FHBVS is to sweep radiolytic gases from the surface of the spent fuel pool and to treat the exhaust air in order to remove radioactive iodine (refer to Section 6.1). The purpose of the treatment of the exhaust air is to reduce the offsite dose to acceptable levels in the event of a fuel handling accident (FHA). The sweeping

effect of the ventilation air over the surface of the pool will also reduce personnel exposures in the event of a FHA.

9.4.4.1 Design Bases

9.4.4.1.1 General Design Criterion 2, 1967 – Performance Standards

The PG&E Design Class I portion of the FHBVS is designed to withstand the effects of, or is protected against, natural phenomena such as earthquakes, winds and tornadoes, floods and tsunamis, and other local site effects.

9.4.4.1.2 General Design Criterion 3, 1971 – Fire Protection

The PG&E Design Class I portion of the FHBVS is designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

9.4.4.1.3 General Design Criterion 11, 1967 – Control Room

The PG&E Design Class I portion of the FHBVS is designed to support actions to maintain and control the safe operational status of the plant from the control room or from an alternate location if control room access is lost due to fire or other causes.

9.4.4.1.4 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Instrumentation and controls are provided as required to monitor and maintain the PG&E Design Class I portion of the FHBVS variables within prescribed operating ranges.

9.4.4.1.5 General Design Criterion 17, 1967 – Monitoring Radioactive Releases

The FHBVS is provided with means for monitoring the FHB atmosphere and the FHB effluent discharge path for radioactivity that could be released from normal operations or from a FHA.

9.4.4.1.6 General Design Criterion 21, 1967 – Single Failure Definition

The PG&E Design Class I portion of the FHBVS is designed to remain operable after sustaining a single failure. Multiple failures resulting from a single event are treated as a single failure.

9.4.4.1.7 General Design Criterion 37, 1967 – Engineered Safety Features Basis for Design

The ESF portion of the FHBVS provides a significant reduction in the amounts of volatile radioactive materials that could be released to the atmosphere in the event of a FHA.

9.4.4.1.8 General Design Criterion 38, 1967 – Reliability and Testability of Engineered Safety Features

The ESF portion of the FHBVS is designed to provide high functional reliability and ready testability.

9.4.4.1.9 General Design Criterion 40, 1967 – Missile Protection

The ESF portion of the FHBVS is designed to be protected against dynamic effects and missiles that might result from plant equipment failures.

9.4.4.1.10 General Design Criterion 41, 1967 – Engineered Safety Features Performance Capability

The ESF portion of the FHBVS is designed to provide sufficient performance capability to accommodate a partial loss of installed capacity, such as a single failure of an active component, and still perform its required safety function.

9.4.4.1.11 General Design Criterion 69, 1967 – Protection Against Radioactivity Release from Spent Fuel and Waste Storage

The ESF portion of the FHBVS provides a significant reduction in the amounts of volatile radioactive materials that could be released to the atmosphere in the event of a FHA.

9.4.4.1.12 General Design Criterion 70, 1967 – Control of Releases of Radioactivity to the Environment

The ESF portion of the FHBVS is designed with provisions for maintaining control over the plant's radioactive gaseous effluents.

9.4.4.1.13 Fuel Handling Building Ventilation System Safety Function Requirements

(1) Protection from Missiles and Dynamic Effects

The PG&E Design Class I, non-ESF portion of the FHBVS is designed to be protected against internal missiles generated outside containment and dynamic effects that might result from plant equipment failure.

(2) Cooling of PG&E Design Class I Equipment

The PG&E Design Class I, non-ESF portion of the FHBVS is designed to provide cooling to PG&E Design Class I pumps.

9.4.4.1.14 Safety Guide 13, March 1971 – Fuel Storage Facility Design Basis

Regulatory Position 4:

The PG&E Design Class I, ESF portion of the FHBVS is designed to limit the potential release of radioactive iodine and other radioactive materials in the event of a significant release of radioactivity from the fuel following a FHA.

9.4.4.1.15 Regulatory Guide 1.52, June 1973 – Design, Testing, and Maintenance Criteria for Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants

The ESF portion of the FHBVS design and maintenance conforms with the guidance provided in Regulatory Guide 1.52, June 1973 with exceptions noted in Table 9.4-2.

9.4.4.1.16 Regulatory Guide 1.52, Revision 2, March 1978 – Design, Testing, and Maintenance Criteria for Post-Accident Engineered Safety Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants

The ventilation filter testing program (VFTP) conforms with the guidance provided in Regulatory Guide 1.52, Revision 2, March 1978 Regulatory Positions C.5.a, C.5.c, C.5.d, and C.6.a as described in Table 9.4-2. The VFTP also conforms with the guidance provided in Generic Letter 83-13, March 1983.

9.4.4.1.17 Regulatory Guide 1.97, Revision 3, May 1983 – Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident

Instrumentation is provided in the control room to monitor the FHBVS ventilation damper position status for post-accident indication.

9.4.4.1.18 NUREG-0737 (Item II.F.1), November 1980 – Clarification of TMI Action Plan Requirements

Item II.F.1 – Additional Accident Monitoring Instrumentation:

Position (1) – The FHBVS is designed with noble gas effluent monitors that are installed with an extended range designed to function during accident conditions.

Position (2) – The FHBVS is designed with provisions for sampling of plant effluents for post-accident releases of radioactive iodines and particulates and onsite laboratory capabilities.

9.4.4.2 System Description

Design values for the FHBVS are listed in Table 9.4-10. The requirements for the system design are as follows:

(1) Provide an air flow pattern sweeping the spent fuel pool surface

(2) Meet the single failure criteria (refer to Section 9.4.4.3.6)

(3) Remove more air than is supplied so that all potential air leakages will be inward

(4) Automatically function in the event of a FHA involving recently irradiated fuel

(5) Provide pretreatment of supply air

  (a) Roughing filters

  (b) Heating provisions

(6) Provide post-treatment of exhaust air

  (a) Particulate

  (b) Gaseous

(7) Provide ventilation to the FHB, including the equipment rooms containing the AFW pumps, spent fuel pool pumps, spent fuel pool heat exchanger, makeup water transfer pumps, and fire pumps.

(8) Design, build, and install equipment according to design classifications given in the DCPP Q-List (refer to Reference 8 of Section 3.2)

The evaluation of the fission product removal performance of the system is contained in Sections 15.4 and 15.5, in connection with the description of the FHAs.

The FHBVS has the capability to provide ventilation air for the FHB separately from the auxiliary building. The FHB for each unit is physically isolated from the auxiliary building. The system as shown in Figure 9.4-3 consists of redundant supply and exhaust fans, and redundant HEPA and charcoal filter banks. A third full capacity exhaust fan and HEPA filter bank train is provided for normal operation. Each HEPA

filter bank is preceded by a roughing filter bank. The major equipment for the system is listed in Table 9.4-6. The supply airflow, was selected on the basis of the heat dissipated by the equipment. The exhaust air flow (35,750 cfm) consists of approximately 81 percent exhausted from the spent fuel pool area by drawing the air flow over the pool. The balance of the flow is ducted and exhausted by the exhaust fan from other areas in the FHB.

The heating coil is used to temper the air that is supplied to the area. The supply air is ducted to corridors and equipment compartments on the floor levels below the operating level. The air flow pattern is from these compartments through the spent fuel shipping cask decontamination area up to the spent fuel pool. Exhaust grilles over and along one side of the spent fuel pool draw the air in a sweep across the pool surface. The exhaust air is then filtered and discharged to the plant vent.

The FHB is separated from the rest of the auxiliary building by partitions and doors on all floors. The separating doors, partitions, and outside walls are of standard construction with no particular leaktight consideration. The exhaust fans remove more air than is supplied. This extra air is made up by infiltration from the outside and adjoining areas of the auxiliary building.

The system is provided with three modes of operation that affect the filtering of the exhaust air.

Normal Mode: The first mode is for normal use. The mode may be selected manually from pool side or from the control room. Under this mode all of the exhaust air passes through roughing and HEPA filter banks only. The exhaust fan for this mode is powered from a non-Class 1E 480-V bus.

Iodine Removal Mode: The second mode of operation is for the removal of potential radioactive particulates and/or radioactive gases in the exhaust air. This mode of operation is automatically initiated by an exhaust fan failure while in Normal Mode, or it may be selected manually from the pool side or from the control room. This mode routes all the exhaust air through roughing, HEPA, and charcoal filters. The fans and filter banks for this mode of operation are redundant. The fans are powered from separate Class 1E 480-V buses.

Automatic Iodine Removal Mode: The third mode of operation (emergency mode) is also for the removal of radioactive particulate and/or radioactive gases in the exhaust air. This mode is physically the same as Iodine Removal Mode except for automatic initiation by a radiation detector. The radiation detectors located near the fuel storage areas will automatically initiate this mode when radiation levels exceed the setpoint level in Table 11.4-1.

9.4.4.3 Safety Evaluation

9.4.4.3.1 General Design Criterion 2, 1967 – Performance Standards

The FHBVS is designed to perform its safety functions under the effects of earthquakes (refer to Section 3.10.2.30), winds and tornadoes (refer to Section 3.3.2.3.2.3), and external missiles (refer to Section 3.5.1.2). The metal siding and roofing of the FHB do not provide significant missile protection for the FHBVS due to a tornado event. However, the capability of the FHBVS to maintain a negative pressure in the FHB is not required after a tornado. The FHBVS exhaust ducts and FHB radiation monitors have limited tornado resisting capabilities. Failures of these components do not affect the safe operational status of the plant and do not result in significant radiation releases since damage to the spent fuel does not occur as a result of a tornado.

The FHBVS is located within the FHB; a PG&E Design Class I structure (refer to Section 3.8.2). The FHB is designed to withstand the effects of winds and tornadoes (refer to Section 3.3), floods and tsunamis (refer to Section 3.4), external missiles (refer to Section 3.5), and earthquakes (refer to Section 3.7). This design protects the FHBVS, ensuring its design functions can be performed during these events.

9.4.4.3.2 General Design Criterion 3, 1971 – Fire Protection

The FHBVS is designed to the fire protection guidelines of Branch Technical Position APCSB 9.5-1 (refer to Appendix 9.5B, Table B-1, Sections D and F).

9.4.4.3.3 General Design Criterion 11, 1967 – Control Room

The FHBVS is normally controlled from the control room. Controls are provided on the main control board which allow for system startup and shutdown, fan selection, and for the selection of system operating configuration and modes (refer to Section 9.4.4.2).

Indication is provided on the main control board to indicate fan failure or damper out of position. Annunciators in the control room alert operators to abnormal conditions and system or equipment failures (refer to Section 9.4.4.3.4).

9.4.4.3.4 General Design Criterion 12, 1967 – Instrumentation and Control Systems

The control logic devices for both DCPP Unit 1 and Unit 2 FHB are solid-state units providing a full selection of logic functions, designed for binary system operation. The control system is based on a programmable logic controller (PLC). The basis for qualification of the Triconex PLC and associated software follows the guidance of Branch Technical Position 7-14 and 7-18 (References 21 and 22). The logic control system has output to solenoids and dry contact relays for the control functions. Both the logic controls and relays are redundant and have power sources from Class 1E buses.

The FHBVS has manual selection for Normal Mode and Iodine Removal Mode operations. It also has an automatic initiation of the Iodine Removal Mode. The automatic initiation is from radiation monitors mounted near the fuel storage areas. Radiation levels greater than the setpoint level will change the operation of the system from Normal Mode to Automatic Iodine Removal Mode operation. For setpoint radiation level, see Table 11.4-1.

High temperature alarms are provided to the main annunciator for the FHB supply fan room.

9.4.4.3.5 General Design Criterion 17, 1967 – Monitoring Radioactive Releases

Radiation detection instruments are located in the spent fuel pool area and the new fuel storage area. These instruments continuously detect operating radiation levels. If the radiation levels should rise above the setpoints listed for each channel (refer to Table 11.4-1), an alarm is initiated in the control room. Local annunciation is also provided at the detectors to indicate high radiation levels to personnel in the area.

The air flow from the FHB is monitored for abnormal radiation levels of both particulate and gaseous nature at the plant vent monitor.

9.4.4.3.6 General Design Criterion 21, 1967 – Single Failure Definition

The FHBVS has redundancy for all non-static (active) components. The fans are each full capacity. The exhaust fan (E-4) and corresponding filter bank used for Normal Mode are not necessary for emergency operation and are not redundant. If the exhaust fan or its associated mode damper used in the Normal Mode were to fail, Iodine Removal Mode (fans E-5 and E-6) would be automatically initiated.

If a supply fan or its associated mode damper should fail, or if the exhaust fan or exhaust mode damper used in Iodine Removal Mode should fail, the redundant fan and damper system for that mode would be automatically started. Off-delay timers, set for a nominal time delay of 2 seconds, keep supply fans running during a change of ventilation mode to prevent the loss of supply fan air flow and the subsequent shutting down of the supply fan.

The power sources for the redundant fans are taken from Class 1E 480-V buses with separation of redundant components.

The initiating (logic) circuitry, including the relays and solenoids required to actuate the system, is redundant. Each control train serves similar control functions and switches circuits in the event of a failure to the other train. Separation has been maintained for the electrical circuits from each Class 1E bus.

All ductwork has been designed to withstand any internal pressure that may be generated by any fan in the system, and braced according to PG&E Design Class I criteria to prevent earthquake damage to the ducts (refer to Section 9.4.4.3.1). All static (passive) ventilation components (i.e., volume dampers, air diffusers) have locking devices to prevent accidental closing. No duct liner or other insulating substance that might sag or fall down, thereby blocking the duct, has been installed in any ductwork.

9.4.4.3.7 General Design Criterion 37, 1967 – Engineered Safety Features Basis for Design

9.4.4.3.7.1 Air Flow Pattern

The ventilating air is discharged from duct work into the corridors and equipment compartments below the spent fuel pool floor. The air exhausts from the FHB after passing over the pool surface. Two exhaust air headers remove the air from above and from one side of the pool to achieve a sweeping movement of gases above the pool surface.

The FHB is separated from the rest of the auxiliary building by partitions and doors on all floors. The separating doors, partitions, and outside walls are of standard construction with no particular leaktight consideration. The exhaust fans remove more air than is supplied. This extra air is made up by infiltration from the outside and adjoining areas of the auxiliary building.

The dampers are positioned with pneumatic actuators with air supplied from the plant compressed air system. The dampers are designed to assume the position required for emergency conditions on the failure of the control air supply.

9.4.4.3.7.2 Effects of Ventilation System Failure

The administrative controls specified in the Equipment Control Guidelines preclude the handling of recently irradiated fuel in the event of ventilation system inoperability or failure. Although it is conceivable that a FHA might occur coincident with a failure in the FHBVS, this combination of events is not regarded to be of sufficient likelihood to warrant system design changes. In any event, personnel will be leaving the FHB immediately following any indication of a FHA. Personnel exposure is not expected to be significant in any of these events because of the presence of the area monitor and continuous air monitor functioning during any operations involving irradiated fuel. These provisions are further described in Section 12.1.4 and the Technical Specifications.

9.4.4.3.7.3 Treatment of Air

The supply air for the FHB passes through roughing filters to remove dust and lint that may be in the atmosphere. The supply filters have a minimum dust spot efficiency of 30 percent for atmospheric dust (National Bureau of Standards (NBS) or Air Filter Institute (AFI) method).

The exhaust air from the FHB is filtered through roughing filters and HEPA filters during normal operation. Iodine Removal Mode operation has, in addition, charcoal filters (refer to Section 9.4.4.2). The charcoal filter banks have been sized to take the full air flow of the ventilation system without exceeding the manufacturer's recommendations for flow through each individual module of the bank. Thirty-six modules with three filter trays per module are provided for each full capacity filter bank. The total amount of activated impregnated charcoal in each filter bank is a function of the charcoal-containing capacity and the density of the charcoal. The amount of charcoal contained in each filter bank is adequate to adsorb radioactive gases from any projected design FHA without overloading with iodine or overheating from decay heat. The exhaust air for the system is routed to the plant vent. All air flow through the plant vent is monitored for radioactivity.

9.4.4.3.8 General Design Criterion 38, 1967 – Reliability and Testability of Engineered Safety Features

The ESF portion of the FHBVS is designed with provisions for periodic tests, inspections, and surveillance to ensure that the systems will be dependable and effective when called upon to function.

Testing of the FHBVS is in accordance with the requirements of the Technical Specifications, including the VFTP as described in Sections 9.4.4.3.15 and 9.4.4.3.16.

9.4.4.3.9 General Design Criterion 40, 1967 – Missile Protection

There are no credible missiles outside of containment resulting from plant equipment failure that would prevent the ESF portion of the FHBVS from performing its design functions (refer to Section 3.5.1.2).

Dynamic effects as a result of plant equipment failure will not prevent the PG&E Design Class I FHBVS from performing its design function of supporting ESFs (refer to Section 3.6).

9.4.4.3.10 General Design Criterion 41, 1967 – Engineered Safety Features Performance Capability

The ESF portion of the FHBVS has redundancy for all non-static (active) components. The power sources for the redundant fans are taken from Class 1E 480-V buses with separation of redundant components (refer to Section 9.4.4.3.6). Therefore, the FHBVS provides sufficient performance capability to accommodate partial loss of installed capacity and still fulfill the required functions of sweeping radiolytic gases from the surface of the spent fuel pool and treating the exhaust air in order to remove radioactive iodine.

9.4.4.3.11 General Design Criterion 69, 1967 – Protection Against Radioactivity Release from Spent Fuel and Waste Storage

The FHBVS consists of redundant supply and exhaust fans, redundant HEPA and charcoal filter banks, and redundant controls and Class 1E 480-V power (refer to Section 9.4.4.3.6).

In the event of a FHA, radiation detectors located near the fuel storage areas will automatically initiate the iodine removal mode when radiation levels exceed the setpoint level in Table 11.4-1. This mode routes all the exhaust air through roughing, HEPA, and charcoal filters. Refer to Section 9.4.4.2.

The charcoal filters are designed to adsorb radioactive gases from any projected design FHA without overloading with iodine or overheating from decay heat. The exhaust air for the system is routed to the plant vent. All air flow through the plant vent is monitored for radioactivity (refer to Section 9.4.2.3.6).

The assumptions used in the FHA analyses are presented in Table 15.5-45.

9.4.4.3.12 General Design Criterion 70, 1967 – Control of Releases of Radioactivity to the Environment

The ESF portion of the FHBVS has been designed to pass exhaust air from the FHB through HEPA filters and charcoal filter banks before reaching the plant vent

9.4.4.3.13 Fuel Handling Building Ventilation System Safety Function Requirements

(1) <u>Protection from Missiles and Dynamic Effects</u>

There are no credible missiles outside of containment resulting from plant equipment failure that would prevent the non-ESF portion of the PG&E Design Class I FHBVS from performing its design functions (refer to Section 3.5.1.2).

Dynamic effects as a result of plant equipment failure will not prevent the non-ESF portion of the PG&E Design Class I FHBVS from performing its design functions (refer to Section 3.6).

(2) <u>Cooling of PG&E Design Class I Equipment</u>

Although not an ESF function, the FHBVS supplies cooling air to the ESF AFW pump rooms.

The FHBVS provides ventilation at ambient design air temperature, as described in the introduction of Section 9.4, to the FHB operating floor and the equipment described in Section 9.4.4.2(7). The ambient indoor air temperature in the FHB will be maintained

below 104°F except the Unit 1 spent fuel pool pump room has a design room temperature of 109°F and the Unit 2 spent fuel pool pump room has a design room temperature of 112°F.

9.4.4.3.14 Safety Guide 13, March 1971 – Fuel Storage Facility Design Basis

Regulatory Position 4:

The PG&E Design Class I, ESF portion of the FHBVS is designed with appropriate containment, confinement, and filtering systems to limit the potential release of radioactive iodine and other radioactive materials in the event of a FHA in which the cladding of all of the fuel rods in one fuel bundle are breached. Refer to Section 15.5.22 for the radiological consequences of a FHA.

The FHB is separated from the rest of the auxiliary building by partitions and doors on all floors. The separating doors, partitions, and outside walls are of standard construction with no particular leaktight consideration. The exhaust fans remove more air than is supplied. This extra air is made up by infiltration from the outside and adjoining areas of the auxiliary building.

The exhaust air for the FHB is filtered through roughing filters and HEPA filters during normal operation. Iodine Removal Mode operation has, in addition, charcoal filters. The charcoal filter banks have been sized to take the full air flow of the FHBVS without exceeding the manufacturer's recommendations for flow through each individual module of the bank.

The radiation detectors located near the fuel storage areas will automatically initiate this mode when radiation levels exceed the setpoint level in Table 11.4-1 (refer to Sections 9.1.2.3.5 and 11.4.2).

In the event of spent fuel pool cooling system failure, exhaust filters of the FHBVS are tested after the period of emergency conditions occurs. The filter efficiency tests are conducted in accordance with the FHBVS testing requirements discussed in Section 9.4.4.4.2. These tests are performed in addition to the periodic testing described in the Plant Surveillance Test Procedure.

9.4.4.3.15 Regulatory Guide 1.52, June 1973 – Design, Testing, and Maintenance Criteria for Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants

The ESF portion of the FHBVS provides the capability to control the volatile radioactive material that could exist to the atmosphere. The system is analyzed to the positions in NRC Regulatory Guide 1.52, June 1973 (Reference 11) as shown in Table 9.4-2 with exceptions noted for specific items. Requirements for the performance of ventilation filter testing are stated in the DCPP VFTP.

9.4.4.3.16 Regulatory Guide 1.52, Revision 2, March 1978 – Design, Testing, and Maintenance Criteria for Post-Accident Engineered Safety Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants

The VFTP provides the requirements for the testing of charcoal samples from the FHBVS charcoal adsorbers in accordance with ASTM D 3803-1989, which complies with Regulatory Guide 1.52, Revision 2, March 1978 and Generic Letter 83-13, March 1983, for laboratory testing of charcoal samples, and in-place penetration and bypass leakage testing in accordance with ANSI N510-1980. The VFTP complies with the intent of Regulatory Positions C.5.a, C.5.c, C.5.d, and C.6.a requirements as described in Table 9.4-2, with exceptions noted.

9.4.4.3.17 Regulatory Guide 1.97, Revision 3, May 1983 – Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident

Damper position indication in the control room provides status of the FHBVS supply and exhaust fan damper positions (refer to Table 7.5-6 for a summary of compliance to Regulatory Guide 1.97, Revision 3, May 1983).

9.4.4.3.18 NUREG-0737 (Item II.F.1), November 1980 – Clarification of TMI Action Plan Requirements

Item II.F.1 – Additional Accident Monitoring Instrumentation:

Position (1) – Extended range noble gas effluent monitoring is installed in the plant vent and is designed to function during accident conditions (refer to Sections 7.5.2.3 and 11.4.2.2.1).

Position (2) – Installed capability is provided in the plant to obtain samples of the particulate and iodine radioactivity concentrations which may be present in the gaseous effluent being discharged to the environment from the plant under accident and post-accident conditions. The technical support center laboratory is available for onsite testing of the containment air samples.

9.4.4.4 Tests and Inspections

9.4.4.4.1 Initial System Tests and Inspections

HISTORICAL INFORMATION IN ITALICS BELOW NOT REQUIRED TO BE REVISED

The system was installed under field inspection by PG&E General Construction and Quality Assurance personnel. An initial checkout of the motors, dampers, controls, etc., was made at that time. A system air balance test and adjustment to design conditions were conducted. The final tests performed prior to actual operation of the FHBVS were

the functional tests of the HEPA and charcoal filter banks. These tests determined the overall efficiency of the filter banks.

9.4.4.4.2 Routine System Tests

Refer to Section 9.4.4.3.8 for information on routine system testing requirements.

9.4.4.5 Instrumentation Applications

Refer to Sections 9.4.4.3.3 and 9.4.4.3.4 for discussions of the instrumentation requirements and controls for the FHBVS.

9.4.5 CONTAINMENT

The containment heating, ventilation, and air conditioning (HVAC) system is designed to maintain temperature and pressure within the containment at acceptable levels for equipment operation and personnel access at power for inspection, maintenance, and testing. The ESF function of the containment fan coolers is to reduce the containment atmosphere temperature and pressure following a loss-of-coolant accident (LOCA) or main steam line break (MSLB) and is addressed in Section 6.2.2.

The containment HVAC system includes the following:

(1) Containment fan cooler system (CFCS)

(2) Control rod drive mechanism (CRDM) exhaust system

(3) Iodine removal system

(4) Incore instrument room cooling system (abandoned in place)

(5) Containment purge system

(6) Pressure relief line

(7) Vacuum relief line

The CFCS is also designed to operate during accident conditions as a part of the containment heat removal system (CHRS) and is described in Section 6.2.2. Codes and standards applicable to the containment HVAC system are listed in Table 9.4-8.

9.4.5.1 Design Bases

9.4.5.1.1 General Design Criterion 2, 1967 - Performance Standards

The PG&E Design Class I portions of the containment HVAC system are designed to withstand the effects of, or are protected against natural phenomena, such as earthquakes, tornadoes, flooding, winds, tsunamis, and other local site effects.

9.4.5.1.2 General Design Criterion 3, 1971 - Fire Protection

The containment HVAC system is designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

9.4.5.1.3 General Design Criterion 11, 1967 - Control Room

The PG&E Design Class I portion of the containment HVAC system is designed to support actions to maintain and control the safe operational status of the plant from the control room or from an alternate location if control room access is lost due to fire or other causes.

9.4.5.1.4 General Design Criterion 12, 1967 - Instrumentation and Control Systems

Instrumentation and controls are provided as required to monitor and maintain the containment HVAC variables within prescribed operating ranges.

9.4.5.1.5 General Design Criterion 17, 1967 - Monitoring Radioactive Releases

Means are provided for monitoring the containment atmosphere, effluent discharge paths, and the facility environs of the containment HVAC system for radioactivity that could be released from normal operations, anticipated transients, and accident conditions.

9.4.5.1.6 General Design Criteria 54, 1971 - Piping Systems Penetrating Containment

The PG&E Design Class I containment purge system isolation valves and the containment pressure/vacuum relief systems penetrating primary reactor containment are provided with leak detection, isolation and containment capabilities having redundancy, reliability and performance capabilities which reflect the importance to safety of isolating these piping systems. These systems are designed with a capability to test periodically the operability of the isolation valves and associated apparatus and to determine if the valve leakage is within acceptable limits.

9.4.5.1.7 General Design Criteria 56, 1971 - Primary Containment Isolation

The supply and exhaust lines connect directly to the containment atmosphere and penetrate primary containment. The supply and exhaust lines are provided with one automatic isolation valve inside and one automatic isolation valve outside containment. The purge system isolation valves outside containment are located as close to the containment as practical and upon loss of actuating power, the automatic isolation valves are designed to take the closed position.

9.4.5.1.8 Containment HVAC System Safety Function Requirements

(1) Cooling of PG&E Design Class I Equipment

The containment HVAC system is designed to provide cooling to the containment atmosphere to maintain the temperature environment within design conditions during normal operation.

9.4.5.1.9 10 CFR 50.49 - Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants

The containment HVAC components that require EQ are qualified to the requirements of 10 CFR 50.49.

9.4.5.1.10 10 CFR 50.55a(f) - Inservice Testing Requirements

ASME code components of the containment purge system and the containment pressure/vacuum relief system containment isolation valves are tested to the requirements of 10 CFR 50.55a(f)(4) and 10 CFR 50.55a(f)(5) to the extent practical.

9.4.5.1.11 10 CFR 50.55a(g) - Inservice Inspection Requirements

ASME code components of the containment purge system and the containment pressure/vacuum relief system piping and valves, and their supports are inspected to the requirements of 10 CFR 50.55a(g)(4) and 10 CFR 50.55a(g)(5) to the extent practical.

9.4.5.1.12 10 CFR 50.63 - Loss of All Alternating Current Power

The CFCS is capable of removing containment heat loads to maintain the containment temperature environment within design conditions, and to support systems that assure core cooling and containment integrity is maintained following a SBO event.

9.4.5.1.13 Regulatory Guide 1.97, Revision 3, May 1983 - Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident

The containment HVAC system provides instrumentation to monitor system variables during and following an accident.

9.4.5.1.14 NUREG-0737 (Item II.F.1), November 1980 - Clarification of TMI Action Plan Requirements

Item II.F.1 - Additional Accident Monitoring Instrumentation:

Position (1) – The containment HVAC system is designed with noble gas effluent monitors with an extended range designed to function during accident conditions.

Position (2) – The containment HVAC system is designed with provisions for sampling of plant effluents for post-accident releases of radioactive iodines and particulates and onsite laboratory capabilities.

9.4.5.2 System Description

The containment HVAC system is designed to perform as follows:

(1) Maintain the containment ambient temperature between 50 and 120°F during normal plant operation

(2) Maintain temperatures of 150°F or below in the CRDM shroud area and 135°F or below inside the primary concrete shield during normal plant operation

(3) Maintain a pressure between –1.0 psig and +1.2 psig in the containment during normal operation

(4) Provide the proper atmosphere and adequate ventilation for personnel before and during periods of personnel access for refueling operations and maintenance when the plant is shut down

(5) CFCS works in conjunction with the containment spray system to reduce the containment ambient temperature and pressure during accident conditions (refer to Section 6.2.2)

(6) Accept a single active failure and still provide adequate cooling to the components inside the containment (refer to Section 6.2.2)

The containment HVAC system shares some of these design bases with the CCS, which is described in detail in Section 6.2.3.

The containment HVAC system is designed, built, and installed according to the design classification given in the DCPP Q-List (refer to Reference 8 of Section 3.2).

The containment HVAC system is shown schematically in Figures 9.4-3 and 9.4-3A.

The fan coolers and their fan/motor couplings that limit reverse rotation (ARRD/coupling) are PG&E Design Class I. The connected system ductwork is PG&E Design Class II and the supports are seismically qualified.

9.4.5.2.1 Containment Fan Cooler System

The design bases for the sizing of the HVAC equipment are the normal operational heat sources in the containment as given in Table 9.4-11.

The CFCS is located inside the containment but outside the missile shield and consists of five coolers, ductwork and supports as shown in Figure 9.4-4. The fan coolers are designed to cool the containment air. The air flow for normal operation is 110,000 cfm per unit with a total system static pressure of 8 inches w.g. at 0.075-lb/ft^3 air density. This system is a total recirculation system. The cooling coils are each sized to remove 3.14 x 10^6 Btu/hr from 120°F entering air when supplied with 90°F cooling water. The normal operational design requires that up to four out of the five fan coolers remain in operation. Normally up to four out of five fan coolers operate to recirculate and cool the air within the containment during normal plant operation by drawing the air through their inlet dampers, cooling coils, fans, and ductwork, which allows for the estimated heat removal capacity given in Table 9.4-12. The total heat load for the nuclear steam supply system is given in Table 9.4-11.

The CFCS is designed to operate during accident conditions as a part of the CHRS and is described in Section 6.2.2. The fan coolers will reduce the motor speed from nominal 1200 to 600 rpm, draw the high density steam through cooling coils, and provide 81 x 10^6 Btu/hr cooling capacity per cooler during accident conditions. The safety evaluation is described in Section 6.2.2.

The fan cooler units are powered from the Class 1E 480-V system.

9.4.5.2.1.1 Evaluation of Cooling Water Supply

The normal cooling water requirements for all five fan coolers can be supplied by any two of the three component cooling water (CCW) pumps. In addition, one of the two auxiliary saltwater (ASW) pumps is required to provide ASW cooling water to the CCW heat exchanger.

Water flow through each fan cooler is balanced to the design flow by a manual valve on the discharge header from the cooling units.

Fouling of the waterside of the heat transfer area is minimized with the use of buffered condensate in the component cooling system. If a complete severance of a fan cooler water tube is postulated, double-ended flow must be assumed. This flow can be accommodated by the trough under the fan coolers and is piped to the containment sump.

The fan coolers are supplied by individual lines from the CCW headers. Each unit inlet and discharge line is provided with a manual shutoff valve and drain valve. This permits isolation of each cooler for testing purposes.

The evaluation of cooling water supply following accident conditions is discussed in Section 6.2.2.

9.4.5.2.2 Control Rod Drive Mechanism Exhaust System

The CRDM ventilation system consists of three exhaust fans mounted on the air plenum of the integrated head assembly. Two out of three fans operate at 73,500 cfm total, exhaust air from the area surrounding the CRDMs, and discharge to the containment atmosphere to remove heat from the CRDM area during normal plant operation. This system is not designed to operate during accident conditions.

Evaluation of the ventilation provisions for the primary shield, neutron detectors and cables, and CRDMs indicates that the present designs are adequate to ensure plant safety during normal plant operating conditions. Loss of air cooling during normal plant operation would be indicated by temperature instrumentation provided for this purpose. In general, the effects of elevated temperature on the above equipment take place gradually over a period of hours, so that sufficient time would be available to take appropriate corrective action, including an orderly plant shutdown, to avert any possible safety problem. With respect to accident conditions, none of this equipment is required to function during the post-accident recovery period.

9.4.5.2.3 Iodine Removal System

The iodine removal system consists of two one-half capacity iodine removal units that have roughing filters, high-efficiency particulate air (HEPA) filters, and charcoal filter banks. These units are provided for pre-entry cleanup of the containment atmosphere. The iodine removal system is not designed to be operated during accident conditions.

The iodine removal system is used to reduce the concentration of fission product particulate activities in the containment atmosphere prior to routine personnel access at power or in advance of a scheduled reactor shutdown. With sufficient reduction of these activities, particularly iodine and cesium, the personnel dose is due mainly to whole body and inhalation exposures from the unfilterable noble gases. Total capacity is based on the I-131 activity required to limit the airborne concentration of this isotope to approximately seven times occupational 10 CFR 20.1-20.601 (the original design of the iodine removal system was to the pre-1994 regulation) maximum permissible concentration (MPC) (I-131 occupational 10 CFR 20.1-20.601, MPC 40 = 9 x 10^{-9}

μCi/cc, refer to Section 9.4.5.2.8). This is consistent with the total exposure limitation of 100 mR received during a 2-hour access period. On this basis, two 12,000 cfm capacity units are provided. This capacity is based on assumptions of 1 percent defective fuel cladding and a 50 pound/day leakage from the RCS. The I-131 activity is reduced to the design equilibrium value by operating the two units for 15 hours.

9.4.5.2.4 Containment Purge System

Prior to entry of personnel into the containment shortly before or after shutdown from normal power operation, the airborne radioactive concentration in the containment atmosphere can be reduced as necessary by employing the iodine cleanup and containment purge systems. After the cleanup process, the containment purge system provides the supply air to and exhaust air from the containment for purge and ventilation.

The section of duct between the containment purge exhaust isolation valve and its debris screen, including the flexible connection, is classified as PG&E Design Class I. The remaining ductwork is PG&E Design Class II and the supports are seismically qualified.

The isolation valves are air-operated valves and are designed to require air pressure to stay open, and fail closed on a loss of air or loss of power to the solenoid valves on their air supply valves. Refer to Section 9.4.5.3.7 for a discussion of GDC 56, 1971, Primary Containment Isolation.

9.4.5.2.5 Pressure Relief Line

The containment pressure relief line connects to the suction side of the containment purge fan, E-3, which then discharges into the plant vent. The pressure relief flow is driven by the pressure differential between the containment and the outside atmosphere, and does not require operation of fan E-3.

9.4.5.2.6 Vacuum Relief Line

The vacuum relief line uses suction air from the containment purge air supply fan plenum to release the vacuum inside the containment. The vacuum relief line takes air from the containment purge system supply fan plenum so that the suction air can be filtered and heated before it goes into the containment. The function is independent of the purge system operation and manually operated.

9.4.5.2.7 Incore Instrument Room Cooling System

The incore instrument room cooling system is abandoned in place and is no longer in use.

9.4.5.2.8 Performance Objectives

The performance objectives of the containment HVAC system design are as follows:

(1) Normal Operation

(a)	Flowrates (4 of 5 fan coolers operating)	440,000 cfm
(b)	Heat transfer (4 of 5 fan coolers operating)	12.56×10^6 Btu/hr
(c)	Temperature range	50 to 120°F max
(d)	Humidity	no requirement
(e)	Flowrate iodine removal units (2 units operating)	24,000 cfm
(f)	Time to achieve equilibrium value I-131 - 1 percent defective cladding - 50 lb/day RCS leakage	15 hours
(g)	Flowrate CRDM ventilation (2 out of 3 fans operating)	73,500 cfm
(h)	Temperature in the cavity area above the CRDM shroud	127°F max
(i)	Heat removal for CRDM	2.26×10^6 Btu/hr
(j)	Containment purge flow inlet outlet	 50,000 cfm 55,000 cfm
(k)	Pressure relief flow average instantaneous, max.	 700 cfm 6000 cfm
(l)	Incore instrument room fan coil unit (Abandoned in place)	

(2) Emergency Operation

(a)	Flowrates, fan coolers (2 out of 5 units operating)	94,000 cfm

(b)	Pressure in containment	47 psig at saturated steam-air mixture
(c)	Heat transfer - fan cooler units (2 out of 5 operating)	81 x 10^6 Btu/hr (each cooler)
(d)	Iodine removal units	shut down
(e)	CRDM ventilation	shut down
(f)	Containment purge system	shut down
(g)	Incore instrument room fan coil unit(Abandoned in place)	

9.4.5.2.9 Single Failure Criteria

The containment HVAC system is designed to meet single failure criteria. The fan cooler units are powered from Class 1E buses and have a standby unit. The iodine removal units are not necessary for cleanup during accident conditions, so they are neither redundant nor powered from Class 1E buses. The CRDM exhaust fans are powered from a non-Class 1E bus. The iodine cleanup system is not considered an engineered safety feature (ESF) and is not designed to the requirements of Regulatory Guide 1.52. Because of its very sporadic use, it is unlikely to be operating at the time of a LOCA. If operating, the units will be manually shut off (refer to Section 6.2.2).

9.4.5.3 Safety Evaluation

9.4.5.3.1 General Design Criterion 2, 1967 - Performance Standards

The containment building and the auxiliary building are PG&E Design Class I (refer to Section 3.8). These buildings or portions thereof are designed to withstand the effects of winds and tornadoes (refer to Section 3.3), floods and tsunamis (refer to Section 3.4), external missiles (refer to Section 3.5), and earthquakes (refer to Section 3.7), and to protect SSCs from damage that may result from these events.

The PG&E Design Class II CFCS ductwork and duct supports are seismically qualified to protect other equipment important to safety during a seismic event.

The containment purge and vacuum/pressure relief line containment penetration piping and isolation valves are PG&E Design Class I. The remainder of the purge system is PG&E Design Class II. The PG&E Design Class II duct and duct supports of the purge system are seismically qualified where required for systems interaction concerns or to assure that the containment effluent flowpath is monitored by radiation monitors.

The CRDM exhaust system is PG&E Design Class II. Equipment supports are seismically qualified.

9.4.5.3.2 General Design Criterion 3, 1971 - Fire Protection

The containment HVAC system is designed to the fire protection guidelines of BTP APCSB 9.5.1 (refer to Appendix 9.5B Table B-1, Sections D and F).

9.4.5.3.3 General Design Criterion 11, 1967 - Control Room

The CFCS is initiated for normal operation by manual switches in the control room. The hot shutdown panel (HSP) also provides for remote control of the CFCS. The design details and logic of the instrumentation are discussed in Chapter 7.

Instrumentation is provided for indication and monitoring of containment air temperature in the control room.

9.4.5.3.4 General Design Criterion 12, 1967 - Instrumentation and Control Systems

The CFCS is initiated for normal operation by manual switches in the control room. The design details and logic of the instrumentation are discussed in Chapter 7.

The iodine removal units and the CRDM fans are operated by manual switches in the control room and the 480-V switchgear room area, respectively. Indication is provided to the operator as to the operation of these fans.

Evaluation of the ventilation provisions for the primary shield, neutron detectors and cables, and CRDMs indicates that the present designs are adequate to ensure plant safety during normal plant operating conditions. Loss of air cooling during normal plant operation would be indicated by temperature instrumentation provided for this purpose. In general, the effects of elevated temperature on the above equipment take place gradually over a period of hours, so that sufficient time would be available to take appropriate corrective action, including an orderly plant shutdown, to avert any possible safety problem.

9.4.5.3.5 General Design Criterion 17, 1967 - Monitoring Radioactive Releases

The purge exhaust fan takes suction from the containment ventilation distribution duct system via a branch duct off the annular ring connecting to the containment purge exhaust isolation valve. The containment purge flow, also used for ventilation during extended outages, is routed to the plant vent for monitored exhaust. The containment atmosphere is monitored for radioactivity by the containment and plant vent air particulate and/or gas effluent monitors.

The radiological monitoring systems are further described in Section 11.4. The offsite radiological monitoring program is described in Section 11.6.

9.4.5.3.6 General Design Criterion 54, 1971 - Piping Systems Penetrating Containment

The containment HVAC system isolation valves required for containment closure are periodically tested for operability. Testing of the components required for the CIS is discussed in Section 6.2.4.

9.4.5.3.7 General Design Criterion 56, 1971 - Primary Containment Isolation

The containment HVAC system containment penetrations comply with the requirements of GDC 56, 1971, as described in Section 6.2.4 and Table 6.2-39.

9.4.5.3.8 Containment HVAC System Safety Function Requirements

(1) Cooling of PG&E Design Class I Equipment

The CFCS is designed to cool the containment air during normal operation (refer to Section 9.4.5.2.1).

9.4.5.3.9 10 CFR 50.49 - Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants

Containment HVAC system SSCs required to function in harsh environments under accident conditions are qualified to the applicable environmental conditions to ensure that they will continue to perform their safety functions. Section 3.11 describes the DCPP EQ Program and the requirements for the environmental design of electrical and related mechanical equipment. The affected equipment are listed on the EQ Master List.

9.4.5.3.10 10 CFR 50.55a(f) - Inservice Testing Requirements

The DCPP IST Program applies to the PG&E Design Class I containment isolation valves. The IST requirements for these components are contained in the IST Program Plan.

9.4.5.3.11 10 CFR 50.55a(g) - Inservice Inspection Requirements

The ISI boundary for the containment HVAC system is defined on the DCPP ISI/IST drawings. The ISI Program Plan identifies applicable inspections for the containment HVAC system.

9.4.5.3.12 10 CFR 50.63 - Loss of All Alternating Current Power

During SBO there is adequate thermal margin without cooling by the CFCS. However, the containment fan coolers do automatically load on the emergency diesel generator (EDG) at low fan speed. Since operator action is not credited to strip the CFCS from the EDG, the CFCS is included as a load in the SBO analysis.

9.4.5.3.13 Regulatory Guide 1.97, Revision 3, May 1983 - Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident

Containment isolation valve position, containment temperature, and containment cooler operation indication is provided in the control room for Regulatory Guide 1.97, Revision 3, May 1983 monitoring (refer to Table 7.5-6).

9.4.5.3.14 NUREG-0737 (Item II.F.1), November 1980 - Clarification of TMI Action Plan Requirements

Item II.F.1 - Additional Accident Monitoring Instrumentation:

Position (1) – The containment purge vents to the plant vent. Instrumentation to monitor noble gas effluents is provided in the plant vent. Refer to Section 9.4.2 for discussion of the plant vent, and Section 11.4 for discussion of the plant vent radiation monitors.

Position (2) – Installed capability is provided to obtain samples of the particulate and iodine radioactivity concentrations which may be present in the gaseous effluent discharged from the containment purge system via the plant vent. The technical support center laboratory is available for onsite testing of the containment air samples.

9.4.5.4 Tests and Inspections

HISTORICAL INFORMATION IN ITALICS BELOW NOT REQUIRED TO BE REVISED

9.4.5.4.1 Initial System Tests and Inspections

An initial checkout of the motors, dampers, and controls was made at the time of installation. A system air balance test and adjustment to design conditions were conducted.

9.4.5.4.2 Routine System Tests

The containment HVAC system is tested in accordance with the requirements of the Technical Specifications.

9.4.5.5 Instrumentation Applications

Instrumentation requirements are described in Chapter 7 and Sections 9.4.5.3.3 and 9.4.5.3.4.

Instrumentation is also provided in the drain line from each fan cooler unit to indicate abnormally large flow.

9.4.6 AUXILIARY SALTWATER VENTILATION SYSTEM

The ASW ventilation system has the function of maintaining the temperature of the ASW pump motors within acceptable limits during their operation. The ASW ventilation system is the only PG&E Design Class I ventilation system located within the Intake Structure and must be in operation while the ASW pumps are operating. The fans and ductwork of the ASW ventilation system are PG&E Design Class I, while the Intake Structure itself is PG&E Design Class II. The ventilation shaft (or “snorkel”) is discussed in the ASW section, refer to Section 9.2.7.3.

9.4.6.1 Design Bases

9.4.6.1.1 General Design Criterion 2, 1967 – Performance Standards

The ASW ventilation system is designed to withstand the effects of, or is protected against, natural phenomena such as earthquakes, floods, tornadoes, winds, and other local site effects.

9.4.6.1.2 General Design Criterion 3, 1971 – Fire Protection

The ASW ventilation system is designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

9.4.6.1.3 General Design Criterion 11, 1967 – Control Room

The ASW ventilation system is designed to support actions to maintain and control the safe operational status of the plant from the control room or from an alternate location if control room access is lost due to fire or other causes.

9.4.6.1.4 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Instrumentation and controls are provided as required to monitor and maintain the ASW ventilation system variables within prescribed operating ranges.

9.4.6.1.5 General Design Criterion 21, 1967 – Single Failure Definition

The ASW ventilation system is designed to remain operable after sustaining a single failure. Multiple failures resulting from a single event shall be treated as a single failure.

9.4.6.1.6 ASW Ventilation System Safety Function Requirements

(1) Cooling of PG&E Design Class I Equipment

The ASW ventilation system is designed to provide heat removal to ASW pumps, ASW motor-operated valves, and ASW piping to maintain the environment within design conditions.

(2) Protection from Missiles and Dynamic Effects

The ASW ventilation system is designed to be protected against dynamic effects and missiles that might result from plant equipment failure.

9.4.6.1.7 10 CFR Part 50 Appendix R (Sections III.G, III.J, and III.L) – Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979

Section III.G – Fire Protection of Safe Shutdown Capability: Fire protection of the ASW ventilation system is provided by a combination of physical separation, fire rated barriers, and/or automatic suppression and detection.

Section III.J – Emergency Lighting: Emergency lighting or BOLs are provided in areas where operation of the ASW ventilation system that may be required for safe shutdown the unit following a fire.

Section III.L – Alternative and Dedicated Shutdown Capability: Safe shutdown capabilities are provided in the control room and at an alternate location via the HSP as required for the safe shutdown of the ASW ventilation system following a fire event.

9.4.6.2 System Description

The ASW ventilation system must be in operation when an ASW pump is operating. The requirements for the system temperature design are discussed in Section 9.4 and 9.4.6.3.6.

Outside air is drawn into an ASW pump room through ducting, passes through the motor area, and is exhausted to the atmosphere through the exhaust fan and related duct system.

The system is designed, built, and installed according to the design classification given in the DCPP Q-List (refer to Reference 8 of Section 3.2).

As described in Section 9.2.7, each unit is provided with two 100 percent redundant ASW pumps, each of which is installed in a separate watertight compartment to ensure continued operation during combined tsunami and storm wave runup conditions. Proper ventilation of these compartments is ensured by providing each compartment

with a separate ventilation system. Each system consists of a PG&E Design Class I coaxial supply and exhaust duct and an exhaust fan. The outside air is drawn into the compartment through the outer space of the coaxial ducts. The air passes through the ASW pump motor area and is exhausted to the atmosphere by the in-line exhaust fan through the inner space of the coaxial exhaust duct as shown in Figure 9.4-5. The intake and exhaust duct discharge points are located above the highest water level resulting from the combined effects of tsunami and storm wave runup (refer to Section 2.4.6.6).

Each exhaust fan starts automatically whenever its associated ASW pump is started. One pump and its associated ventilation system normally operate, with the second set providing system redundancy.

9.4.6.3 Safety Evaluation

9.4.6.3.1 General Design Criterion 2, 1967 – Performance Standards

The ASW ventilation system is located in the Intake Structure (refer to Figure 9.4-5), which is a PG&E Design Class II structure. The Intake Structure is designed to withstand the effects of winds and tornadoes (refer to Section 3.3), floods and tsunamis (refer to Section 2.4.5.7, 3.4 and 9.2.7.3.1), external missiles (Section 3.3.2.3.2.10), and earthquakes (refer to Section 3.7 and 3.8.5.2) to protect the PG&E Design Class I ASW ventilation system allowing it to perform its design function.

The ASW ventilation system is seismically designed to perform its safety functions under the effects of earthquakes (refer to Section 3.10.2.30).

9.4.6.3.2 General Design Criterion 3, 1971 – Fire Protection

The ASW ventilation system is designed to the fire protection guidelines of NRC BTP APCSB 9.5.1 (refer to Appendix 9.5B Table B-1).

9.4.6.3.3 General Design Criterion 11, 1967 – Control Room

The ASW ventilation system is activated whenever the pumps are activated. A start and stop switch is located in the control room for the ASW pumps, which also activates the ASW ventilation. The HSP also provides for remote control of the ASW pumps, and acts as a start and stop switch for the ASW ventilation system.

Indication is provided on the main control board to indicate fan failure while the pump is operating. Annunciators in the control room alert operators to high temperature conditions for the ASW ventilation.

9.4.6.3.4 General Design Criterion 12, 1967 – Instrumentation and Control Systems

In each pump room there is a temperature switch provided to monitor temperature within the ASW pump room.

High temperatures exceeding system set points are monitored and alarmed in the control room.

9.4.6.3.5 General Design Criterion 21, 1967 – Single Failure Definition

Redundant components, along with separated Class 1E power sources, give the system the capability of meeting single failure criteria. The redundant ASW pumps are located in separate vaults, are provided with a completely independent ventilation system, and therefore share no common components between trains. Each fan in the system receives power from the same Class 1E bus as its respective ASW pump. Separation has been maintained for the electrical circuits from each Class 1E bus.

9.4.6.3.6 ASW Ventilation System Safety Function Requirements

(1) Cooling of PG&E Design Class I Equipment

The system has been designed to maintain the inside air temperature below 104°F with an outdoor ambient design temperature described in Section 9.4. The 1 hp vane axial fans have been sized to provide a minimum air flow of 4000 cfm. The air flow requirements have been based on the ASW pump motor cooling load and the heat transfer through the coaxial duct. No credit is taken for wind cooling the intake structure. The maximum solar load on the ventilating system is negated by the heat losses through the slab floor.

(2) Protection from Missiles and Dynamic Effects

The PG&E Design Class I equipment was reviewed to determine those that could possibly be affected by potential missiles. For postulation missile sources, it was determined that release of a missile would not endanger the ASW ventilation system (refer to Section 3.5.1.2).

The PG&E Design Class I ASW ventilation system is designed to be protected against dynamic effects which may result from equipment failures (refer to Section 3.6.5.3). Each ASW pump and its associated ASW ventilation system is housed in a watertight compartment. The ASW ventilation system is a moderate energy system that is physically separate from high energy fluid systems. Therefore, there are no dynamic effects.

9.4.6.3.7 10 CFR Part 50 Appendix R (Sections III.G, III.J, and III.L) – Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979

Section III.G – Fire Protection of Safe Shutdown Capability: The ASW ventilation system satisfies the applicable fire protection requirements of 10 CFR Part 50 Appendix R, Section III.G. Refer to Appendix 9.5G, Tables 9.5G-1 and 9.5G-2, for further details.

Section III.J – Emergency Lighting: Emergency lighting or BOLs capable of providing 8 hours of illumination when ac power to the BOL is lost, are provided in areas where operation of the ASW ventilation system may be required to safely shutdown the Unit following a fire as defined by 10 CFR Part 50, Appendix R, Section III.J. Refer to Appendix 9.5D for further discussion.

Section III.L – Alternative and Dedicated Shutdown Capability: - Safe shutdown capabilities are provided in the control room and at an alternate location via the HSP (refer to Section 7.4) as defined by 10 CFR Part 50 Appendix R, Section III.L. Refer to Section 7.4 for a discussion of the HSP for the ASW ventilation system. The ability to safely shut down the plant following a fire in any fire area is summarized in Section 4.0 of Appendix 9.5A.

9.4.6.4 Inspection and Testing Requirements

HISTORICAL INFORMATION IN ITALICS BELOW NOT REQUIRED TO BE REVISED.

Initial checks of the motors, controls, etc., were made at the time of installation. A verification of air flow and necessary adjustments to design conditions was made.

9.4.6.5 Instrumentation Requirements

Refer to Section 9.4.6.3.3 and 9.4.6.3.4.

9.4.7 DIESEL GENERATOR COMPARTMENTS VENTILATION SYSTEM

Ventilation of diesel generator compartments is accomplished through the use of the same engine-driven fans that provide cooling air to the diesel generator radiators. The diesel generator cooling air system is described in Section 9.5.5.

The following sections provide information on (a) design bases, (b) system description, (c) safety evaluation, and (d) inspection and testing requirements for diesel generator compartment ventilation systems.

9.4.7.1 Design Bases

9.4.7.1.1 General Design Criterion 2, 1967 - Performance Standards

The EDG compartment ventilation system is designed to withstand the effects of, or is protected against natural phenomena such as earthquakes, flooding, tornados, winds, and other local site effects.

9.4.7.1.2 General Design Criterion 3, 1971 - Fire Protection

The EDG compartment ventilation system is designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

9.4.7.1.3 General Design Criterion 11, 1967 - Control Room

The EDG compartment ventilation system is designed to support safe shutdown and to maintain safe shutdown from the control room or from an alternate location if control room access is lost due to fire or other causes.

9.4.7.1.4 General Design Criterion 12, 1967 - Instrumentation and Control Systems

Instrumentation and controls are provided as required to monitor and maintain EDG compartment ventilation system variables within prescribed operating ranges.

9.4.7.1.5 General Design Criterion 21, 1967 - Single Failure Definition

The EDG compartment ventilation system is designed to remain operable after sustaining a single failure. Multiple failures resulting from a single event are treated as a single failure.

9.4.7.1.6 Protection from High and Moderate Energy Systems and Internal Missiles

The EDG compartment ventilation system is designed to be protected against dynamic effects and missiles that might result from plant equipment failure.

9.4.7.1.7 10 CFR Part 50 Appendix R (Sections III.G, III.J, and III.L) – Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979

Section III.G – Fire protection of Safe Shutdown Capability: Fire protection of the EDG compartment ventilation system is provided by a combination of physical separation, fire-rated barriers, and/or automatic suppression and detection.

Section III.J – Emergency Lighting: Emergency lighting or Battery Operated Lights (BOLs) are provided in areas where operation of the EDG compartment ventilation system may be required to safely shutdown the Unit following a fire.

Section III.L – Alternative and Dedicated Shutdown Capability: Safe shutdown capabilities are provided in the control room and at an alternate location via the hot shutdown panel or locally at the EDG, for equipment powered by the EDGs and required for the safe shutdown of the plant following a fire event.

9.4.7.2 System Description

The ventilation system for each diesel generator compartment has the function of maintaining compartment air temperature within acceptable limits during operation of the diesel generator. The system satisfies the requirements for system temperature design as described in Section 9.4 and satisfies the following design bases:

(1)	Design compartment temperature at diesel engine	120°F
(2)	Heat removal from generator	6,830 Btu/min
(3)	Heat loss from engine surfaces	12,000 Btu/min

The above design bases are for continuous operation at rated diesel generator load. No special provision for heating diesel generator compartments is required since diesel engine generator jacket water and lubricating oil are kept warm by thermostatically controlled heaters during periods when diesel generators are not operating.

Because no significant potential for airborne radioactivity exists in the vicinity of the diesel generator compartments, no filtration or treatment of ventilating air is required.

The ventilation system for each diesel generator compartment is designed, built, and installed according to the design classification given in the DCPP Q-List (refer to Reference 8 of Section 3.2).

As described in Section 8.3.1.1.6.3.1, each diesel generator is located in a separate compartment in the turbine building. Diesel engine cooling is provided by a closed-loop jacket water system with a radiator and a direct engine-driven fan. Approximately 70 percent of the required radiator cooling air is outside ambient air drawn by the fan from outside the compartment. The remaining 30 percent (approximately 36,000 cfm) of outside ambient air is drawn through duct work, providing ventilation for the diesel generator compartment. The ventilation air flow passes through the compartment, cooling the generator and absorbing surface heat losses from the diesel engine. Other heat loads in the compartment are negligible. In passing through the compartment, the design temperature of the ventilation air is raised by approximately 30°F when the diesel generators are operating continuously at rated load. The ventilation air then passes through the radiator and is exhausted outside the compartment by the direct

engine-driven fan. The ventilation system for the diesel generator compartments is shown in Figure 9.4-6.

No credit is taken for wind cooling of the turbine building containing the diesel generator compartments. The maximum solar load was determined by the method in Reference 8 for the exposed outside west wall of the radiator compartment. It was found to add less than 0.1°F to the temperature of the air drawn through the radiator compartment with the ventilation system in operation. Although the air flow through the diesel generator compartment is less, the effect of the maximum solar load on that compartment will also be negligible since it has no outside walls.

The design value for outdoor ambient air temperature for the HVAC systems is 76°F as described in Section 9.4.

The design condition for the diesel generator compartment ventilation is for the long-term recirculation period when the diesel generators are required for continuous emergency power following a LOCA. It is considered highly unlikely that a LOCA and a loss of offsite power would occur simultaneously with an ambient outside air temperature in excess of the design value. It is considered incredible that the two events would occur simultaneously with the maximum recorded outside air temperature at DCPP (refer to Section 2.3.3.2.2).

However, if the outside air temperature is postulated at a peak above the maximum recorded outside air temperature when the diesel generator units are required for emergency power immediately following a LOCA, the thermal capacity and overload capability of the diesel generator units ensure satisfactory performance during the short period until the outside air temperature drops. The temperatures at only a few locations in the diesel generator compartments would rise above 120°F under these conditions, but the units are capable of operating satisfactorily for at least 4 hours, which is longer than any peak is expected to last. The diesel engine itself is not a concern since engines of this type are operated continuously at similar temperatures in hot weather environments. For example, this particular type of engine is employed in locomotive and shipboard duty where continuous operation at temperatures over 120°F is common, e.g., the Great Pacific Southwest Desert and the eastern Atlantic Ocean off the coast of Africa.

9.4.7.3 Safety Evaluation

9.4.7.3.1 General Design Criterion 2, 1967 - Performance Standards

The EDGs are located in the turbine building, which is a PG&E Design Class II structure (refer to Figure 1.2-16 and 1.2-20). This building or applicable portions have been designed not to impact PG&E Design Class I components and associated safety functions (refer to Section 3.7.2.1.7.2). The turbine building is designed to withstand the effects of winds and tornados (refer to Section 3.3.1.2 and 3.3.2.3.2.8), floods and tsunamis (refer to Section 3.4), external missiles (refer to Section 3.5), and earthquakes

(refer to Section 3.7.2.1.7.2) to protect the EDGs, ensuring their design function will be performed.

The EDG units and their associated auxiliary systems, as shown for Unit 1 in Figures 9.5-8, 9.5-9, and 9.5-10, and similarly for Unit 2, are installed in separate compartments that are protected from fires, flooding, and external missiles.

An engineering review of the turbine building has shown that during a seismic event, the building may deform, but will not collapse. This analysis is discussed in Section 3.7.2. The design classification for the walls around each engine generator compartment and for the walls isolating the engine generator compartments from other parts of the turbine building are given in the DCPP Q-List (refer to Reference 8 of Section 3.2).

The EDG compartments are isolated from the turbine building with normally closed fire doors. In the event of a high-energy line break in the turbine building, it is not possible that steam could flow from the turbine building into the engine generator compartments.

9.4.7.3.2 General Design Criterion 3, 1971 - Fire Protection

The EDG areas are designed to the fire protection guidelines of Branch Technical Position APCSB 9.5-1 (refer to Appendix 9.5B, Table B-1).

9.4.7.3.3 General Design Criterion 11, 1967 - Control Room

The DCPP Equipment Control Guidelines identify rooms/areas monitored by the area temperature monitoring system, along with their corresponding temperature limits. The ambient air temperatures in these areas are monitored continuously. Air temperatures exceeding the established setpoints are recorded along with the times. An alarm for high temperature is also transmitted to the control room. The cause and effects of high temperature are investigated and corrected in accordance with the DCPP Equipment Control Guidelines.

Refer to Section 8.3.1.1.6.3.4 for additional discussion related to compliance to GDC 11, 1967.

9.4.7.3.4 General Design Criterion 12, 1967 - Instrumentation and Control Systems

The EDG compartment ventilation system instrumentation and controls are discussed in Sections 8.3.1.1.6.3.5 and 8.3.1.1.6.5.

9.4.7.3.5 General Design Criterion 21, 1967 - Single Failure Definition

Ventilation of a diesel generator compartment is required only when the diesel generator is operating. This is assumed because ventilation for each compartment is provided by the same direct engine-driven fan that provides cooling air to the radiator.

There are no active components in the ventilation system other than the diesel generator itself and the direct engine-driven fan. Refer to Section 8.3.1.1.6.3.8 for addition discussion regarding single failure.

9.4.7.3.6 Protection from High and Moderate Energy Systems and Internal Missiles

The EDG units and their associated auxiliary systems, as shown for Unit 1 in Figures 9.5-8, 9.5-9, and 9.5-10, and similarly for Unit 2, are installed in separate compartments that are protected from internal missiles.
Because engine generator units are separated from each other by the concrete walls of the compartments, the units are protected from postulated internal missiles. Any missile created by an explosion within a compartment would remain in that compartment.

The possibility of flooding in the turbine building and in the diesel generator compartments is discussed in Section 8.3.1.1.6.3.9.

9.4.7.3.7 10 CFR Part 50 Appendix R (Sections III.G, III.J, and III.L) – Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979

Fresh air intakes to areas containing safety-related equipment are located remote from exhaust air outlets to the extent practicable. The possibility of contaminating the intake air with products of combustion is extremely unlikely.

The approximate distance between air supply intakes and the nearest exhaust air outlets for the EDG area is 40 feet.

Refer to Section 8.3.1.1.6.3.12 for additional discussion on compliance to 10 CFR Part 50 Appendix R.

9.4.7.4 Tests and Inspections

No separate tests or inspections of the ventilation system are required because tests and inspections associated with the diesel generators will also serve the ventilation system. Initial testing of EDGs has verified the adequacy of the ventilating system.

9.4.7.5 Instrumentation Application

The criterion for monitoring air temperature in an EDG compartment is as follows:

Where only one Class 1E redundant train or division is in a given room or area and the ventilation is Class 1E, but is not redundant within the area, one temperature monitor will be used to monitor the area ambient temperature. The temperature monitor will meet Class 1E requirements for supply and separation or have two reliable and redundant non-Class 1E supplies.

Refer to Section 8.3.1.1.6.5 for additional discussion on EDG compartment ventilation system instrumentation.

9.4.8 4.16 kV SWITCHGEAR ROOM

The 4.16-kV switchgear room ventilation system provides cooling to the Class 1E 4.16-kV switchgear rooms and associated cable spreading rooms.

9.4.8.1 Design Bases

9.4.8.1.1 General Design Criterion 2, 1967 – Performance Standards

The PG&E Design Class I 4.16-kV switchgear room ventilation system is designed to withstand the effects of, or is protected against, natural phenomena, such as earthquakes, flooding, wind, and other local site effects. The effects of a tornado on the 4.16-kV switchgear room ventilation system are addressed to ensure that plant safe shutdown can be achieved.

9.4.8.1.2 General Design Criterion 3, 1971 – Fire Protection

The PG&E Design Class I 4.16-kV switchgear room ventilation system is designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

9.4.8.1.3 General Design Criterion 11, 1967 – Control Room

The PG&E Design Class I 4.16-kV switchgear room ventilation system is designed to support actions to maintain and control the safe operational status of the plant from the control room or from an alternate location if control room access is lost due to fire or other causes.

9.4.8.1.4 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Instrumentation and controls are provided as required to monitor and maintain the PG&E Design Class I 4.16-kV switchgear room ventilation system variables within prescribed operating ranges.

9.4.8.1.5 General Design Criterion 21, 1967 – Single Failure Definition

The PG&E Design Class I 4.16-kV switchgear room ventilation system is designed to remain operable after sustaining a single failure. Multiple failures resulting from a single event shall be treated as a single failure.

9.4.8.1.6 4.16-kV Switchgear Room Ventilation System Safety Function Requirements

(1) Cooling of PG&E Design Class I Equipment

The PG&E Design Class I 4.16-kV switchgear room ventilation system is designed to provide cooling to the Class 1E 4.16-kV switchgear and associated cable spreading room areas to maintain the temperature within acceptable limits.

(2) Protection from Missiles and Dynamic Effects

The PG&E Design Class I 4.16-kV switchgear room ventilation system is designed to be protected against missiles and dynamic effects that might result from plant equipment failure.

9.4.8.2 System Description

The 4.16-kV switchgear room ventilation system is designed to be in operation at all times to provide adequate ventilation for the 4.16-kV switchgear and cabling. This will also provide for the safety and comfort of operating personnel during normal conditions. Other atmospheric conditions, including humidity, atmospheric chemicals, smoke, radiation, and other contaminants are not considered to have significant effect on the switchgear and are not controlled. However, these abnormal conditions may limit operator access to these areas.

The areas served are the switchgear and associated cable spreading rooms for the three trains of Class 1E 4.16-kV switchgear. Each ventilation train consists of a supply fan, supply duct, and a vent stack to the turbine building operating floor, as shown in Figure 9.4-7.

Outside air enters the ventilation equipment room through louvers on the north/south wall of the turbine building. Each fan draws air through a roughing filter integral with the fan and supplies the air through the supply duct to the associated 4.16-kV cable spreading and switchgear rooms. The rooms exhaust to the turbine building operating floor without the use of exhaust fans. The trains operate completely independently and are powered independently, receiving power from the same electrical train as the switchgear that they each serve.

The system is designed, built, and installed according to the design classification given in the DCPP Q-List (refer to Reference 8 of Section 3.2). Applicable codes and standards are listed in Table 9.4-8.

9.4.8.3 Safety Evaluation

9.4.8.3.1 General Design Criterion 2, 1967 – Performance Standards

The PG&E Design Class I 4.16-kV switchgear room ventilation system equipment is located within the turbine building, as depicted in Figure 9.4-7. The turbine building is a PG&E Design Class II structure and is designed to withstand the effects of floods and tsunamis (refer to Section 3.4), external missiles (refer to Section 3.5), and earthquakes (refer to Section 3.7), ensuring the 4.16-kV switchgear room ventilation system design function will be performed. The area of the turbine building that contains the 4.16-kV switchgear room ventilation system fans and motors is not designed to protect the ventilation system from tornado missiles; however, loss of the 4.16-kV switchgear room ventilation system due to tornado missiles will not impair the ability of the plant to achieve safe shutdown (refer to Section 3.3.2.3.1(4)(j)).

The PG&E Design Class I 4.16-kV switchgear room ventilation system is seismically designed to perform safety functions under the effects of earthquakes (refer to Section 3.10.2.30).

9.4.8.3.2 General Design Criterion 3, 1971 – Fire Protection

The PG&E Design Class I 4.16-kV switchgear room ventilation system is designed to the fire protection guidelines of NRC Branch Technical Position APCSB 9.5-1 (refer to Appendix 9.5B Table B-1).

9.4.8.3.3 General Design Criterion 11, 1967 – Control Room

An annunciator alarm is provided at the control room indicating when the temperature within one of the monitored switchgear rooms has exceeded its setpoint or a selected exhaust duct fire damper has closed.

9.4.8.3.4 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Each fan is turned on and off by a one-stage thermostat located in the associated switchgear room. A switch is provided on each local motor starter panel for manual starting and stopping of the fans and for selecting automatic operation of the fans.

9.4.8.3.5 General Design Criterion 21, 1967 – Single Failure Definition

Functional and electrical independence and physical separation and protection ensure that no single failure of any active component can affect more than one ventilation train.

Each Class 1E 4.16-kV switchgear room and associated cable spreading room is provided with an independent ventilation train. There are no common components. Each ventilation train receives power from the same electrical train as the switchgear

that it serves. This provides separate Class 1E electrical supplies to power redundant equipment.

9.4.8.3.6 4.16-kV Switchgear Room Ventilation System Safety Function Requirements

(1) Cooling of PG&E Design Class I Equipment

The 4.16-kV switchgear room ventilation system is designed to be in operation at all times to provide adequate ventilation for the 4.16-kV switchgear and cabling. Each ventilation train provides adequate air flow to maintain the temperature of its associated switchgear and 4.16-kV cable spreading rooms within acceptable limits. The requirements for the system temperature design are as described in Section 9.4.

The design basis of the system is to minimize temperature excursions above the temperature assumed in the environmental qualification aging analysis (refer to Section 3.11). The ventilation flow consists of 100 percent outside air. The heat load of the switchgear is such that no tempering of the outside air supply is required. Wind cooling and solar effects are negligible.

(2) Protection from Missiles and Dynamic Effects

Adequate physical separation between the trains has been provided. The system design is such that no unacceptable component failures can occur and adequate physical protection is provided against physical hazards in the areas through which the system is routed.

Main turbine failure is not considered a credible event and failure of the main feedwater pump turbines would not result in missiles that could prevent fulfilment of 4.16-kV switchgear room ventilation system functions. Refer to Section 3.5.1.2.

Refer to Section 9.4.8.3.1 for a discussion on tornado missiles.

9.4.8.4 Tests and Inspections

HISTORICAL INFORMATION IN ITALICS BELOW NOT REQUIRED TO BE REVISED

Initial checks of the motors, controls, system balance, etc. were made at the time of installation. This included a verification of the adequacy of the calculated flowrates.

The system will be periodically inspected to ensure that all equipment is functioning properly.

9.4.8.5 Instrumentation Applications

Refer to Sections 9.4.8.3.3 and 9.4.8.3.4 for a discussion on the application of instrumentation and controls used for the 4.16-kV switchgear room ventilation system.

9.4.9 125-VDC AND 480-V SWITCHGEAR AREA

The 125-Vdc and 480-V switchgear area ventilation system serves the following electrical areas:

(1) 125-Vdc switchgear, inverters and battery chargers

(2) 480-V switchgear

(3) Hot shutdown panel (HSP)

(4) Process Control System (PCS) and Plant Protection System (PPS) rack area in the cable spreading room (CSR). To provide partial backup cooling whenever the PG&E Design Class II cable spreading room air conditioning system is not functional

9.4.9.1 Design Bases

9.4.9.1.1 General Design Criterion 2, 1967 - Performance Standards

The PG&E Design Class I portion of the 125-Vdc and 480-V switchgear area ventilation system is designed to withstand the effects of, or is protected against natural phenomena such as earthquakes, flooding, winds and other local site effects. The effects of a tornado on the 125-Vdc and 480-V switchgear area ventilation system are addressed to ensure plant shutdown can be achieved.

9.4.9.1.2 General Design Criterion 3, 1971 - Fire Protection

The 125-Vdc and 480-V switchgear area ventilation system and cable spreading room air conditioning (CSR/AC) systems are designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

9.4.9.1.3 General Design Criterion 11, 1967 – Control Room

The PG&E Design Class I portion of the 125-Vdc and 480-V switchgear area ventilation system is designed to support actions to maintain and control the safe operational status of the plant from the control room or from an alternate location if control room access is lost due to fire or other causes.

9.4.9.1.4 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Instrumentation and controls related to the PG&E Design Class I portion of the 125-Vdc and 480-V switchgear area ventilation system are provided as required to monitor and maintain applicable variables within prescribed operating ranges.

9.4.9.1.5 General Design Criterion 21, 1967 - Single Failure Definition

The PG&E Design Class I portion of the 125-Vdc and 480-V switchgear area ventilation system is designed to remain operable after sustaining a single failure. Multiple failures resulting from a single event are treated as a single failure.

9.4.9.1.6 125-Vdc and 480-V Switchgear Area Ventilation System Safety Function Requirements

(1) Cooling of PG&E Design Class I Equipment

The PG&E Design Class I portion of the 125-Vdc and 480-V switchgear area ventilation system is designed to provide cooling to the 480-V switchgear, the 125-Vdc switchgear and inverters, the battery chargers and the HSP areas to maintain the environment within design conditions.

(2) Protection from Missiles and Dynamic Effects

The PG&E Design Class I portion of the 125-Vdc and 480-V switchgear area ventilation system is designed to be protected against missiles and dynamic effects that might result from plant equipment failure.

9.4.9.1.7 10 CFR 50.63 - Loss of All Alternating Current Power

The PG&E Design Class I portion of the 125-Vdc and 480-V switchgear area ventilation system is designed to continue to support switchgear area temperature limits in the event of a SBO.

9.4.9.1.8 10 CFR Part 50, Appendix R (Section III.G, III.J, and III.L) – Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979

Section III.G – Fire protection of Safe Shutdown Capability: Fire protection of the PG&E Design Class I portion of the 125-Vdc and 480-V switchgear area ventilation system is provided by a combination of physical separation, fire-rated barriers, and/or automatic suppression and detection.

Section III.J – Emergency Lighting: Emergency lighting or BOLs are provided in areas where operation of the 125-Vdc and 480-V switchgear area ventilation system may be required to safely shut down the Unit following a fire.

Section III.L – Alternative and Dedicated Shutdown Capability: Safe shutdown capabilities are provided in the control room and at an alternate location via the HSP or locally at the 125-Vdc and 480-V switchgear, for equipment powered by the 125-Vdc and 480-V switchgear ventilation system required for the safe shutdown of the plant following a fire event.

9.4.9.2 System Description

The 125-Vdc and 480-V switchgear area ventilation system provides adequate ventilation for the switchgear. This also provides for the safety and comfort of operating personnel during normal conditions. Other atmospheric conditions, including humidity, atmospheric chemicals, smoke, radiation, and other contaminants are not considered to have significant effects on the switchgear and are not controlled. However, these abnormal conditions may limit operator access to these areas.

The areas served by the PG&E Design Class I 125-Vdc and 480-V switchgear ventilation system are the compartments housing the three redundant trains of 480-V switchgear and dc switchgear, the four redundant trains of inverters, battery chargers, and HSP areas. The system consists of two sets of redundant 100 percent capacity supply and exhaust fans, a common supply and exhaust duct, dampers, air outlets and inlets, and fire dampers as shown in Figure 9.4-8.

The ventilation system is a once-through type with 100 percent outside air supply. In Unit 1 outside air is drawn by one of the two redundant supply fans, discharging through a common supply ductwork and roughing filter and introduced to each area by supply registers. The Unit 2 configuration is the same except that the filter is located at the inlet side of the fans.

Exhaust air from each area is drawn by one of the two redundant exhaust fans and discharged to the atmosphere. The 125-Vdc and 480-V switchgear area ventilation system supply and exhaust fans are powered from the 480-V Class 1E buses (refer to Figures 8.3-6 and 8.3-8).

The system intake louver is located in the intake plenum and the exhaust air is discharged away from the supply air intake.

The system also provides partial backup ventilation for the cable spreading room, which is normally served by PG&E Design Class II ventilation air conditioning systems as shown in Figure 9.4-8. Normally, the cable spreading room is cooled by a PG&E Design Class II air conditioning system (CSR/AC). The backup service in the cable spreading room requires manual alignment of dampers in the interconnecting ductwork.

The PG&E Design Class II CSR/AC system consists of an air conditioning unit with chilled water coil that recirculates air from the cable spreading room. One of two, redundant, 100 percent capacity, PG&E Design Class II air-cooled water chillers servicing Unit 1 and Unit 2 provides chilled water to the air conditioning units (ACU), one ACU per cable spreading room, and to a condensing coil (one per unit) The CSR/AC system is interconnected with the 125-Vdc and 480-V switchgear area ventilation (PG&E Design Class I) system to provide partial back up cooling whenever the CSR/AC system is not functional.

The cable spreading room temperature is controlled, when the CSR/AC system is in operation, by modulating the amount of chilled water flowing through the cooling coil in the ACU in response to a room thermostat. The cable spreading room humidity is stabilized by use of a condensing cooling coil in the supply air duct bringing outside air into the room.

Sufficient design provisions are provided (e.g., door curbs, hatch curbs) to limit any flooding to the Elevation 115 foot area due to a chilled water line break of the CSR ACU. Cable penetrations are sealed to prevent carryover of water to other areas. The chilled water system does not have automatic makeup. Therefore, the total water volume of the chilled water system, less than 390 gallons, would cause the water to rise to a level of no more than 0.8 inches within the curbed area. The minimum height of the curbs is 2 inches.

The chillers, circulating chilled water pumps, and ACUs are manually started through local control stations.

The system is designed, built, and installed according to the design classification given in the DCPP Q-List (refer to Reference 8 of Section 3.2). Applicable codes and standards are listed in Table 9.4-8.

9.4.9.3 Safety Evaluation

9.4.9.3.1 General Design Criterion 2, 1967 - Performance Standards

The PG&E Design Class I 125-Vdc and 480-V switchgear area ventilation system equipment is located on or within the auxiliary building, a PG&E Design Class I structure (refer to Figure 1.2-6). Both redundant supply and exhaust fans are located on the roof of the auxiliary building. The supply duct is routed from the supply fans at the roof of the auxiliary building, penetrating the turbine building (a PG&E Design Class II structure) siding, then down along the wall outside the auxiliary building where it then enters the auxiliary building in the dc switchgear area. The exhaust duct is routed alongside the supply duct up to their respective penetrations in the wall of the auxiliary building and the turbine building siding.

The auxiliary building is designed to withstand the effects of winds and tornadoes (refer to Section 3.3), floods and tsunamis (refer to Section 3.4), and earthquakes (refer to

Sections 3.7 and 3.8.2) to protect the 125-Vdc and 480-V switchgear area ventilation system, ensuring its design function will be performed.

The turbine building, which contains portions of the125-Vdc and 480-V switchgear area ventilation system duct work and support is designed to withstand the effects of floods and tsunamis (refer to Section 3.4), the effects of winds (refer to Section 3.3), and the effects of earthquakes (refer to Sections 3.7 and 3.8.5.1) to protect the 125-Vdc and 480-V switchgear area ventilation system, ensuring its design function will be performed.

Loss of the125-Vdc and 480-V switchgear area ventilation system following a tornado does not compromise the capability to safely shutdown the plant (refer to Section 3.3.2.3.1(4)(h)).

The 125-Vdc and 480-V switchgear area ventilation system is seismically designed to perform its safety functions under the effects of earthquakes (refer to Section 3.10.2.30).

The interconnection between the PG&E Design Class II CSR/AC system and the 125-Vdc and 480-V switchgear area ventilation system (PG&E Design Class I) is made through normally closed manually operated dampers which are part of the PG&E Design Class I system. To avoid transfer of seismic loads between the systems, the intertie is made via a flexible connection.

9.4.9.3.2 General Design Criterion 3, 1971 - Fire Protection

The 125-Vdc and 480-V switchgear area ventilation system and CSR/AC systems are designed to the fire protection guidelines of NRC BTP APCSB 9.5.1 (refer to Appendix 9.5B, Table B-1). Ventilation of the dc battery rooms also prevents the accumulation of hydrogen (refer to Section 8.3.2.3.2).

9.4.9.3.3 General Design Criterion 11, 1967 – Control Room

Annunciation is provided in the control room to alarm temperatures in both the 125-Vdc and 480-V switchgear areas and the cable spreading room area.

In the event the control room is lost due to fire or other causes, the switchgear area ventilation system provides ventilation for the HSP.

9.4.9.3.4 General Design Criterion 12, 1967 – Instrumentation and Control Systems

Instrumentation is provided to monitor the 125-Vdc and 480-V switchgear ventilation system components.

A switch in a local control station is used to select either automatic operation or to start each fan manually. Automatic operation is for "operational convenience" and is not a design function credited in any safety analysis.

When the switch is in the automatic mode, the exhaust fan starts after its corresponding supply fan is started. The redundant set of supply and exhaust fans automatically starts if the normally operating set fails.

9.4.9.3.5 General Design Criterion 21, 1967 - Single Failure Definition

The redundant trains of supply and exhaust fans of the 125-Vdc and 480-V switchgear ventilation system are physically separated and powered from separate Class 1E electrical power supplies to ensure that any single failure of an active component will not prevent the ventilation system from supplying the required air flow.

The system design is such that no unacceptable passive component failures can occur and such that physical protection is adequately provided against physical hazards in the areas through which the system is routed.

9.4.9.3.6 125-Vdc and 480-V Switchgear Area Ventilation System Safety Function Requirements

(1) Cooling of PG&E Design Class I Equipment

The requirements for the system temperature design are described in Section 9.4. In addition, the system design indoor temperature is 104°F (refer to Section 3.11) for the 125-Vdc switchgear and battery chargers, the 480-V switchgear, and the HSP. The ventilation system with only one set of supply and exhaust fans operating was designed to provide adequate air flow in all the areas served by the system to maintain ambient temperature below 104°F with outside ambient temperature as described in Section 9.4, except for the cable spreading room which is also served by a PG&E Design Class II system. The system is designed to provide a relatively constant temperature and humidity within the room to enhance the service life of electronic devices installed in the room.

Indoor design temperature for the PCS and PPS rack area in the cable spreading room is 72 ±5°F during normal operation of PG&E Design Class II air conditioning system and 108°F when the backup PG&E Design Class I 480-V switchgear area ventilation system serves that area.

The heat load of all electrical equipment inside the areas served by the system requires no tempering of the air supply. Wind cooling and solar effects are negligible.

(2) Protection from Missiles and Dynamic Effects

The system design is such that physical protection is adequately provided against physical hazards in the areas through which the system is routed.

The PG&E Design Class I equipment was reviewed to determine those that could possibly be affected by potential missiles. For postulated missile sources, it was determined that release of a missile would not endanger the 125-Vdc and 480-V switchgear ventilation system (refer to Section 3.5.1.2).

The PG&E Design Class I 125-Vdc and 480-V switchgear ventilation system is designed to be protected against dynamic effects which may result from equipment failures (refer to Section 3.6.5.3). Protection against missiles and dynamic effects resulting from the rupture of HELB piping is provided for the 125-Vdc and 480-V switchgear ventilation system and such that physical protection is adequately provided against physical hazards in the areas through which the system is routed.

9.4.9.3.7 10 CFR 50.63 - Loss of All Alternating Current Power

The 125-Vdc and 480-V switchgear area ventilation system is designed to continue to maintain 125-Vdc and 480-V switchgear area temperature requirements in the event of a SBO (refer to Section 8.3.1.6). The 125-Vdc and 480-V switchgear area ventilation system supply and exhaust fans are powered from the 480-V Class 1E buses (refer to Figures 8.3-6 and 8.3-8).

9.4.9.3.8 10 CFR Part 50, Appendix R (Section III.G, III.J, and III.L) – Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979

Section III.G – Fire Protection of Safe Shutdown Capability: The 125-Vdc and 480-V switchgear area ventilation system satisfies the applicable fire protection requirements of 10 CFR Part 50 Appendix R, Section III.G. Refer to Appendix 9.5G, Tables 9.5G-1 and 9.5G-2 for further details.

Section III.J – Emergency Lighting: Emergency lighting or BOLs capable of providing 8 hours of illumination when ac power to the BOL is lost, are provided in areas where operation of the 125-Vdc and 480-V switchgear area ventilation system may be required to safely shut down the Unit following a fire as defined by 10 CFR Part 50, Appendix R, Section III.J. Refer to Appendix 9.5D for further discussion.

Section III.L – Alternative and Dedicated Shutdown Capability: Safe shutdown capabilities are provided at a local control station as defined by 10 CFR Part 50, Appendix R, Section III.L. The ability to safely shut down the plant following a fire in any

fire area is summarized in Section 4.0 of Appendix 9.5A and Appendix 9.5E. The 125-Vdc and 480-V switchgear area ventilation system provides cooling to the HSP area.

9.4.9.4 Test and Inspections

HISTORICAL INFORMATION IN ITALICS BELOW NOT REQUIRED TO BE REVISED.

Initial checks of the motors, controls, system balance, etc., were made at the time of installation. This included a verification of the adequacy of the calculated flow rates. The system is periodically inspected to ensure that all normally operating equipment is functioning properly. Redundant components are periodically tested to ensure system availability.

9.4.9.5 Instrumentation Applications

Instrumentation used to control and operate the ventilation system is discussed in Sections 9.4.9.3.3 and 9.4.9.3.4.

9.4.10 POST-ACCIDENT SAMPLE ROOM

The post-accident sample room complex is located in the auxiliary building; however, it is provided with its own HVAC system. The system may also be referred to as the post-LOCA sample room HVAC system in other plant documentation.

9.4.10.1 Design Bases

9.4.10.1.1 General Design Criterion 2, 1967 – Performance Standards

The PG&E Design Class II post-accident sample room HVAC system is designed to withstand the effects of earthquakes.

9.4.10.1.2 General Design Criterion 3, 1971 – Fire Protection

The PG&E Design Class II post-accident sample room HVAC system is designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

9.4.10.1.3 General Design Criterion 70, 1967 – Control of Releases of Radioactivity to the Environment

The PG&E Design Class II post-accident sample room HVAC system has been designed based on 10 CFR Part 20 requirements for maintaining control over the plant's radioactive gaseous effluents. Appropriate holdup capacity is provided for retention of gaseous effluents, particularly where unfavorable environmental conditions can be expected to require operational limitations upon the release of radioactive effluents to the environment.

9.4.10.1.4 NUREG-0737 (Items II.B.3.9.b and II.B.3.11.b), November 1980 – Clarification of TMI Action Plan Requirements

Item II.B.3.9.b – Post Accident Sampling Capability: The PG&E Design Class II post-accident sample room HVAC system is designed to restrict background levels of radiation in the radiological and chemical analysis facility from sources such that the sample analysis will provide results with an acceptably small error (approximately a factor of 2). This is supported through the use of the system design, which will control the presence of airborne radioactivity.

Item II.B.3.11.b – Post Accident Sampling Capability: The exhaust air from the panels and hoods is filtered with charcoal adsorbers and HEPA filters.

9.4.10.2 System Description

The post-accident sample room HVAC system is an independent system as shown in Figure 9.4-10.

The post-accident sample room HVAC system is designed to provide ventilation, heating, and cooling to the sample room for plant personnel comfort during normal plant operation.

During normal plant operation, a ventilation fan will deliver 300 cfm of outside air to the sample room complex.

Following an accident, the system provides protection for plant personnel from radiological contaminants.

The post-accident sample room HVAC system is a PG&E Design Class II system. The design classification of the post-accident sample room HVAC system is given in the DCPP Q-List (refer to Reference 8 of Section 3.2).

Redundant supply and exhaust fans and filters, the seismic design of the system, and the shielding provided for in the sample room complex will provide the required personnel protection and equipment ventilation following an accident.

The air conditioning portion of the HVAC system will maintain the sample room at a temperature ranging between 65 and 90°F during normal plant operation.

The fans are manually initiated from the post-accident sampling system ventilation control panel.

9.4.10.3 Safety Evaluation

9.4.10.3.1 General Design Criterion 2, 1967 – Performance Standards

The PG&E Design Class II post-accident sample room HVAC system equipment is located within the auxiliary building, a PG&E Design Class I structure (refer to Figure 1.2-6 and Section 3.7.2.1.7).

The design class requirements for the system, except the air conditioner, are supplemented with more stringent seismic criteria than those required for a PG&E Design Class II system; the system has been evaluated for the Hosgri earthquake. The calculated stresses are within the allowables for PG&E Design Class I systems.

The air conditioner is so supported that it will remain in place after a Hosgri earthquake.

9.4.10.3.2 General Design Criterion 3, 1971 – Fire Protection

The PG&E Design Class II post-accident sample room HVAC system is designed to the fire protection guidelines of Branch Technical Position APCSB 9.5.1 (refer to Appendix 9.5B Table B-1, Section F, Item 18).

9.4.10.3.3 General Design Criterion 70, 1967 – Control of Releases of Radioactivity to the Environment

The PG&E Design Class II post-accident sample room HVAC system has been designed with appropriate holdup capacity for the retention of radioactive gaseous effluents. Exhaust air is charcoal- and HEPA-filtered before being discharged to the atmosphere.

9.4.10.3.4 NUREG-0737 (Items II.B.3.9.b and II.B.3.11.b), November 1980 – Clarification of TMI Action Plan Requirements

Item II.B.3.9.b – Post Accident Sampling Capability: Following an accident, one of two 100 percent capacity redundant pressurization fans will deliver 1000 cfm of charcoal-filtered outside air to the complex and maintain it at a positive pressure with respect to surrounding plant areas.

The sample panel and the sample station hood located in the complex are maintained at a negative pressure when an exhaust fan is in operation. One of the two 100 percent capacity, redundant, manually initiated, ventilation exhaust fans will discharge 700 cfm exhaust air to atmosphere.

The post-accident sample room HVAC system supports DCPP sampling contingency plan requirements (refer to Reference 23), and continues to meet the above original design basis requirements.

Item II.B.3.11.b – Post Accident Sampling Capability: The exhaust air from the panels and hoods is manifolded together, charcoal-filtered, HEPA-filtered, and discharged by the exhaust fan to the atmosphere.

The post-accident sample room HVAC system supports DCPP sampling contingency plan requirements (refer to Reference 23), and continues to meet the above original design basis requirements.

9.4.10.4 Tests and Inspections

HISTORICAL INFORMATION IN ITALICS BELOW NOT REQUIRED TO BE REVISED

The initial checks of the motors, controls, system balance, etc. were made at the time of installation. The verification of the calculated flowrates was also accomplished at this time.

The system is periodically inspected and tested to ensure that all equipment is functioning properly.

9.4.10.5 Instrumentation Applications

Instrumentation provides local indication of the system's operating parameters; i.e., filter differential pressure (indicating usage and cleanliness), and subsystem temperatures and pressures. An interlock is also provided to prevent climate control unit heater operation under a low supply air flow condition.

In addition, an area radiation monitor with local annunciation is installed in the post-accident sample room to warn personnel of high or increasing radiation. High radiation will alarm at the main annunciator (refer to Section 11.4).

9.4.11 TECHNICAL SUPPORT CENTER

The basic function of the TSC HVAC system is to provide protection for personnel working in the center from radiological contaminants and to provide heating, ventilation, and air conditioning for working areas and equipment.

9.4.11.1 Design Bases

9.4.11.1.1 General Design Criterion 4, 1967 - Sharing of Systems

The TSC HVAC system or components are not shared by the DCPP Units unless safety is shown not to be impaired by the sharing.

9.4.11.1.2 10 CFR 50.47 - Emergency Plans

The TSC HVAC system is adequate to support the use of the TSC for emergency response.

9.4.11.1.3 NUREG-0737 (Items II.B.2 and III.A.1.2), November 1980 - Clarification of TMI Action Plan Requirements

II.B.2 – Design Review of Plant Shielding and Environmental Qualification of Equipment for Spaces/Systems Which May be Used in Post Accident Operations: Adequate access to the TSC is provided by design changes, increased permanent or temporary shielding, or post-accident procedural controls.

III.A.1.2 – Upgrade Emergency Support Facilities: NUREG-0737, Supplement 1 (January 1983) provides the requirements for III.A.1.2 as follows:

> Section 8.2.1.e - The TSC is environmentally controlled to provide room air temperature, humidity, and cleanliness appropriate for personnel and equipment.
>
> Section 8.2.1.f - The TSC is provided with radiological protection and monitoring equipment necessary to assure that radiation exposure to any person working in the TSC would not exceed 5 rem whole body, or its equivalent to any part of the body, for the duration of the accident.

9.4.11.2 System Description

The TSC is provided with its own PG&E Design Class II HVAC system that is schematically shown in Figure 9.4-10. The entire system is manually initiated and is designed to maintain the occupied areas of the TSC at a temperature below 85ºF. During normal operation, all the makeup air and recirculated air passes through a roughing filter and the air conditioning unit. Makeup air in the normal operation mode is supplied via the outside air intake by a single makeup air fan. The TSC HVAC system has the capability to manually isolate the area from outside air and to recirculate air via the air conditioning system.

In the radiological accident mode of operation, the TSC HVAC system makeup air is supplied by the control room pressurization system (CRPS) in order to maintain the TSC area at a minimum of +1/8 inch water gauge pressure. Penetrations into the TSC are equipped with penetration seals and floor drain traps with make-up water supplies to prevent exfiltration of the positive pressure from within the TSC through these paths. The pressurization air, and a portion of the recirculated air, is passed through HEPA and charcoal filters for cleanup purposes and supplied to the general area rooms along with the majority of the recirculated air. Exhaust air leaves the TSC by exfiltration.

The TSC HVAC System is fed from a non-Class 1E power source, although it has the capability to be supplied power from a Class 1E bus. The system is not seismically

qualified but the ducting, duct supports, and equipment supports are designed and analyzed to seismic requirements. The ducting and components associated with the TSC pressurization air supply are PG&E Design Class I up to and including the manual damper upstream of the redundant duct heaters associated with the TSC filter bank. (refer to Reference 8 of Section 3.2).

The duct heaters maintain the relative humidity of the pressurization air below 70 percent.

9.4.11.3 Safety Evaluation

9.4.11.3.1 General Design Criterion 4, 1967 - Sharing of Systems

The TSC HVAC system is common to Unit 1 and Unit 2 and therefore requires sharing of SSCs between Units. The TSC HVAC system serves no safety functions. The TSC HVAC system is designed to provide adequate heating, ventilation, and air conditioning for working areas and equipment within the TSC. In addition, the CRPS is shared between the control room and the TSC. Sharing of the CRPS by the control room and the TSC is addressed in Section 9.4.1.3.2.

9.4.11.3.2 10 CFR 50.47 - Emergency Plans

The TSC HVAC system meets applicable requirements and is maintained in support of emergency response (refer to Sections 9.4.11.1.3 and 9.4.11.3.3).

9.4.11.3.3 NUREG-0737 (Items II.B.2 and III.A.1.2), November 1980- Clarification of TMI Action Plan Requirements

Item II.B.2 - Design Review of Plant Shielding and Environmental Qualification of Equipment for Spaces/Systems Which May be Used in Post Accident Operations

Plant shielding has been evaluated with regard to radiation doses at equipment locations and requirements for vital area access/occupancy (including the TSC) for post-accident plant operations.

Item III.A.1.2 - Upgrade Emergency Support Facilities: NUREG-0737, Supplement 1 (January 1983)

Section 8.2.1.e - During normal operation, all the TSC HVAC makeup air and recirculated air passes through the climate control units (CCUs). The CCUs are designed to maintain the occupied areas of the TSC below 85°F, and provide for humidity and cleanliness appropriate for personnel and equipment.

The TSC HVAC system is a PG&E Design Class II system. The pressurization air for the system is supplied by the designated PG&E Design Class I control room pressurization system . The radiological accident mode of operation maintains the TSC area at a positive pressure. The relative humidity of the pressurization air is maintained below 70 percent. The air cleanup portion of the system is equipped with redundant fans and heaters and a power supply that may be manually switched over to a Class 1E bus source. Post-accident dose in the TSC is discussed in Section 6.4.2.

Section 8.2.1.f - TSC area radiation monitoring instruments provide continuous indication of the general area ambient radiation levels and provide local alarm annunciation in various areas and work spaces. TSC ventilation air monitoring instruments provide continuous sampling of the TSC HVAC return air ducts for detection of airborne radiation and provide for alarm annunciation in the TSC computation center.

9.4.11.4 Inspection and Testing Requirements

Initial checks of the motors, controls, system balance, etc. were made at the time of installation. The system is periodically inspected to ensure that all equipment is functioning properly.

9.4.11.5 Instrumentation Requirements

TSC area radiation monitoring instruments provide continuous indication of the general area ambient radiation levels and provide local alarm annunciation in various areas and work spaces.

TSC ventilation air monitoring instruments provide continuous sampling of the TSC HVAC return air ducts for detection of airborne radioactivity and provide for alarm annunciation in the TSC computation center.

Instrumentation related to post-accident operation includes indication and alarm on low pressurization flow and an alarm for high temperature in the charcoal filter section of the charcoal/HEPA filter bank.

9.4.12 CONTAINMENT PENETRATION AREA GE/GW

The containment penetration area GE/GW ventilation system has the function of maintaining the ambient temperature and pressure of the GE/GW area within acceptable limits during normal operations. The GE/GW area ventilation system is a PG&E Design Class II draw-through type ventilation system.

9.4.12.1 Design Bases

9.4.12.1.1 General Design Criterion 2, 1967 – Performance Standards

The containment penetration GE/GW area ventilation system interface with the plant vent is designed to seismic loads to ensure the structural integrity of the plant vent.

9.4.12.1.2 General Design Criterion 17, 1967 – Monitoring Radioactivity Releases

Radiation monitoring instrumentation is provided to monitor radioactive releases in the GE/GW ventilation exhaust via the plant vent.

9.4.12.2 System Description

The GE/GW area ventilation system was designed to:

(1) Provide means of monitoring GE/GW exhaust for airborne radioactivity during normal plant operation by exhausting into the plant vent

(2) Maintain the ambient temperature at maximum average temperature of 104°F during normal plant operation to support environmental requirements of PG&E Design Class I equipment (refer to Section 3.11)

(3) Maintain the GE/GW area at a slight negative pressure with respect to outdoors

(4) Maintain steam relief flow path during High Energy Line Break Accident (HELBA)

The design classification of the containment penetration area GE/GW ventilation system is given in the DCPP Q-List (refer to Reference 8 of Section 3.2). Applicable codes and standards are listed in Table 9.4-8.

One of the two full capacity exhaust fans runs to exhaust air from the GE/GW areas. This running fan maintains the GE/GW areas at a slight negative pressure relative to the outdoors.

The ventilation flow consists of 100 percent outside air drawn through the intake louvers located on the wall of GW area. Four (4) recirculation fans move the entering air to the areas farthest from the intake louver.

The system is shown in Figure 9.4-11.

The containment penetration area GE/GW ventilation system is not a safety-related system, and its complete failure has no safety implication. Two redundant 100 percent capacity fans are provided, so that failure of one fan will not result in loss of ventilation for these areas during the normal plant operation.

The enclosure over the annular space between containment wall and auxiliary building roof at Elevation 140 foot is provided with blow-out type bellows to provide steam relief flow path during HELBA.

9.4.12.3 Safety Evaluation

9.4.12.3.1 General Design Criterion 2, 1967 – Performance Standards

The GE/GW ventilation system ducting and supports from isolation dampers to the connection to the plant vent has been seismically qualified for the Hosgri and Double Design Earthquake to maintain structural integrity of the plant vent. All other components are PG&E Design Class II.

9.4.12.3.2 General Design Criterion 17, 1967 – Monitoring Radioactivity Releases

The ventilation air flows to the enclosed annular gap on Elevation 140 foot, into the duct connected to the exhaust fan and discharged into the plant vent, where it is monitored for radioactivity.

For a description of the radiological monitoring system refer to Section 11.4.2.2.

9.4.12.4 Tests and Inspections

HISTORICAL INFORMATION IN ITALICS BELOW NOT REQUIRED TO BE REVISED

Initial checks of the fan housings, bearings, motors, bolts, controls, etc., are made at the time of installation. A system air balance test and adjustment to design conditions are conducted.

The system will be periodically inspected to ensure that all equipment is functioning properly.

9.4.12.5 Instrumentation Applications

Each exhaust fan is manually turned on and off by a switch on the local control panel mounted near the exhaust fans. Switchover to standby unit is done manually. The recirculation fans are initiated by thermostat located in the area where recirculation fan is located. The isolation dampers are operated by their associated pressure differential switches. The shut-off dampers are interlocked to their corresponding exhaust fans "on-off" switches.

9.4.13 REFERENCES

1. Deleted in Revision 8.

2. Deleted in Revision 8.

3. Deleted in Revision 10.

4. Deleted in Revision 10.

5. Recommended Outdoor Design Temperatures, Southern California, Arizona, and Nevada, Third Edition, Southern California Chapter, American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc., March 1964.

6. Deleted in Revision 22.

7. Deleted in Revision 10.

8. Deleted in Revision 22.

9. R. R. Bellamy, Elemental Iodine and Methyl Iodine Adsorption on Activated Charcoal at Low Concentrations, 13th Air Cleaning Conference, 1974.

10. Technical Specifications, Diablo Canyon Power Plant Units 1 and 2, Appendix A to License Nos. DPR-80 and DPR-82, as amended.

11. Regulatory Guide 1.52, Design, Testing, and Maintenance Criteria for Atmosphere Cleanup System Air Filtration and Absorption Units of Light-Water-Cooled Nuclear Power Plants, USAEC, Revision 0, June 1973.

12. G. W. Kielholts, Filters, Sorbents, and Air Cleaning Systems as Engineered Safeguards in Nuclear Installations, ORNL-NSIC-13, October 1966.

13. NUREG-0570, "Toxic Vapor Concentrations in the Control Room Following a Postulated Accidental Release," James Wing, USNRC-ONRR, June 1979.

14. Deleted in Revision 10.

15. Deleted in Revision 10.

16. Regulatory Guide 1.78, Assumptions for Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release, USAEC, Revision 0, June 1974.

17. Deleted in Revision 8.

18. Deleted in Revision 10.

19. Deleted in Revision 10.

20. Deleted in Revision 10.

21. Branch Technical Position 7-14, Guidance on Software Reviews for Digital Computer-Based Instrumentation and Control Systems, Revision 5, March 2007.

22. Branch Technical Position 7-18, Guidance on the Use of Programmable Logic Controllers in Digital Computer-Based Instrumentation and Control Systems, Revision 5, March 2007.

23. License Amendment Nos. 149 (DPR-80) and 149 (DPR-82), "Issuance of Amendment Re: Elimination of Post Accident Sampling Requirements," USNRC, July 13, 2001.

24. Regulatory Guide 1.52, Revision 2 - Design, Testing, and Maintenance Criteria for Post Accident Engineered-Safety-Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants.

9.4.14 REFERENCE DRAWINGS

Figures representing controlled engineering drawings are incorporated by reference and are identified in Table 1.6-1. The contents of the drawings are controlled by DCPP procedures.

9.5 OTHER AUXILIARY SYSTEMS

This section provides information on plant auxiliary systems that do not otherwise apply to the preceding sections of this chapter.

9.5.1 FIRE PROTECTION SYSTEM

A Fire Protection Program for DCPP Units 1 and 2 has been established by PG&E. The program outlines the fire protection policy for the protection of structures, systems, and components important to safety as well as the procedures, equipment, and personnel required to implement the program.

This section summarizes the basic principles of the Fire Protection Program at DCPP Units 1 and 2 and contains the following information:

(1) A description of the design bases of the Fire Protection Program (Section 9.5.1.1)

(2) A system description of the fire protection features (Section 9.5.1.2)

(3) Evaluations of the fire protection systems and design features (Section 9.5.1.3)

(4) Inspection and testing requirements and program administration (Section 9.5.1.4)

(5) A description of the methods and assumptions used in evaluating the Fire Protection Program, and a detailed fire hazards analysis for all plant areas, including the safe shutdown analysis as required by 10 CFR 50, Appendix R, Section III.G (Appendix 9.5A)

(6) A comparison of the Fire Protection Program with the guidelines of the NRC Branch Technical Position (BTP) APCSB 9.5-1 and with Appendix R to 10 CFR 50, Sections III.J, III.L, and III.0 (Appendices 9.5B, C, D, E)

(7) Figures showing the various fire areas and zones (Appendix 9.5F), and tables defining the safe shutdown equipment required to satisfy the requirements of Appendix R to 10 CFR 50, Section III.G (Appendix 9.5G)

(8) Administrative procedures governing the program are described in Appendix 9.5H

9.5.1.1 Design Bases of the Fire Protection Program

9.5.1.1.1 Licensing Background

In response to letters from the director of the division of project management, dated May 3, 1976, and September 30, 1976, the NRC transmitted to PG&E copies of revised Standard Review Plan 9.5.1, "Fire Protection," and Appendix A to BTP APCSB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976." In addition to transmitting the above documents, the NRC requested that PG&E evaluate the fire protection provisions at DCPP Units 1 and 2. The fire hazards analysis was developed in response to this request.

On July 27, 1977, PG&E submitted Amendment 51 to its application for an operating license for Units 1 and 2. The amendment was titled "Fire Protection Review, Units 1 and 2 Diablo Canyon Site." The NRC Staff reviewed the document and issued 58 NRC fire protection review questions. PG&E responded to the questions in four letters dated February 6, July 7, August 3, and November 13, 1978. The NRC Staff documented its review and acceptance of the DCPP Fire Protection Program in Supplemental Safety Evaluation Reports (SSERs) 8, 9, and 13.

On October 1, 1981, PG&E submitted a letter documenting the Fire Protection Plan's compliance with Sections III.G, III.J, III.L, and III.0 of Appendix R to 10 CFR 50. This submittal was required by Section 2.C(6).b of Facility Operating License DPR-76. In reviewing the requirements of the noted sections of Appendix R, PG&E recognized that the approved Fire Protection Plan had deviated from Appendix R. Since these deviations had previously been accepted by the NRC in its review of Diablo Canyon to BTP APCSB 9.5-1 Appendix A, PG&E concluded that the deviations were approved exemptions from Appendix R. Subsequently, the NRC requested that the deviations from Appendix R and their justifications be re-documented.

Accordingly, on July 15, 1983, PG&E submitted its Report on 10 CFR 50 Appendix R Review for Unit 1 for NRC review and approval. PG&E responded to questions from the NRC review and further clarified the July 15 report in letters dated September 23 and 27, 1983; October 3, 6, 11, 14, and 21, 1983; November 4, 1983; April 17, 1984; and May 16, 1984. In June 1984 the NRC issued SSER 23 to document the approval of those areas for which PG&E requested exemptions. The NRC Staff stipulated that several modifications be completed prior to exceeding 5 percent of power. The NRC’s SSER 27 for DCPP, dated July 1984, documents the approval of the requested modifications and the removal of the condition on the license.

The Unit 2 Report on 10 CFR 50 Appendix R Review was issued for NRC review and approval on December 6, 1984. PG&E responded to questions from the NRC review and further clarified the December 6 report in letters dated January 29, February 4, and April 22, 1985. In April 1985, the NRC issued SSER 31 to document the approval of those areas for which PG&E had requested exemptions.

9.5.1.1.2 Design Goals of the Fire Protection System

The Fire Protection Program at DCPP has been established to provide reasonable assurance that a fire:

(1) Would not cause unacceptable risk to public health and safety

(2) Would not prevent the performance of necessary safe shutdown functions

(3) Would not significantly increase the risk of radioactive release to the environment

(4) Would have a limited probability of occurrence

(5) Would produce limited property loss

BTP APCSB 9.5-1, Appendix A, and 10 CFR 50, Appendix R, Sections III.G, III.J, III.L, and III.0 provide specific guidelines used to review the Fire Protection Program at DCPP. Whenever applicable, these guidelines have been addressed (see Appendices 9.5B, C, D, and E). To provide broader guidelines for evaluating Diablo Canyon's program, additional criteria were selected to serve as the basis for overall evaluation. These criteria are outlined below.

9.5.1.1.3 General Design Criterion 3 (10CFR 50, Appendix A) - Fire Protection

GDC 3 states:

> Structures, systems, and components important to safety shall be designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions. Noncombustible and heat-resistant materials shall be used wherever practical throughout the unit, particularly in locations such as the containment and control room. Fire detection and fighting systems of appropriate capacity and capability shall be provided and designed to minimize the adverse effects of fires on structures, systems and components important to safety. Fire fighting systems shall be designed to ensure that their rupture or inadvertent operation does not significantly impair the safety capability.

9.5.1.1.4 Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979 (10 CFR 50, Appendix R)

Appendix R to 10 CFR 50 establishes fire protection features for nuclear power plants licensed prior to January 1, 1979. These features are required to satisfy GDC 3 to Appendix A of 10 CFR 50. PG&E is committed to meet the provisions of 10 CFR 50, Appendix R, Sections III.G, III.J, III.L, and III.O. DCPP has been reviewed and documented according to the requirements of 10 CFR 50, Appendix R, Sections III.G, III.J, III.L, and III.0. Deviations are described in SSERs 23 and 31.

9.5.1.1.5 Defense in Depth

For each fire hazard, a suitable combination of prevention, detection and suppression capability, and ability to withstand the effects of a fire shall be provided. Both equipment and procedural aspects of each shall be considered.

9.5.1.1.6 Fire Suppression Capacity and Capability

Adequate fire suppression capability shall be provided. The fire suppression equipment will have enough capacity to extinguish any fire that could adversely affect equipment and components important to safety. For areas where fire hazards might affect redundant systems or components important to achieving safe shutdown, total reliance for fire protection shall not depend on any single fire suppression system. Fire-retardant coating for the redundant system and/or appropriate backup fire suppression capability shall be provided.

9.5.1.1.7 Single Failure Criterion

No single active failure shall result in complete loss of protection of both primary and backup fire suppression capability.

9.5.1.1.8 General Design Criterion 19 (10 CFR 50, Appendix A) - Control Room

GDC 19 states:

> A control room shall be provided from which actions can be taken to operate the nuclear power unit safely under normal conditions, and to maintain it in a safe condition under accident conditions, including loss-of-coolant accidents.
>
> Equipment at appropriate locations outside the control room shall be provided (a) with a design capability for prompt hot shutdown to maintain the unit in a safe condition during hot shutdown, and (b) with a potential capability for subsequent cold shutdown of the reactor through the use of suitable procedures.

9.5.1.1.9 Occurrence of Fire and Other Phenomena

In accordance with 10 CFR 50, Appendix R, fire is not considered to occur simultaneously with other accidents or phenomena, such as a design-basis accident with the exception of a loss of offsite power for areas that credit alternate shutdown (Section III.G.3 of 10 CFR 50, Appendix R). Capability is provided consistent with GDC 19 and 10 CFR 50, Appendix R, Section III.G, to safely shut down the plant in the event of any single fire that can credibly occur.

Systems and components required to achieve and maintain a safe shutdown condition in spite of postulated fires must be identified. The general functional safe shutdown requirements are:

(1) The fission product boundary integrity shall not be affected.

(2) The reactivity control function shall be capable of achieving and maintaining cold shutdown reactivity conditions.

(3) The reactor coolant makeup function shall be capable of maintaining and controlling primary system coolant inventory.

(4) The reactor heat removal function shall be capable of achieving and maintaining decay heat removal.

(5) The process monitoring function shall be capable of providing direct readings of the process variables necessary to perform and control the above functions.

(6) The supporting function shall be capable of providing the process cooling, lubrication, etc, necessary to permit the operation of the equipment used for safe shutdown.

(7) The equipment and systems used to achieve and maintain hot standby conditions and cold shutdown conditions shall be capable of being powered by onsite emergency power.

The systems and equipment required to fulfill these functions are identified in Appendix 9.5G of this report. An explanation of the ability to safely shut down the plant during a postulated fire in any fire area or zone can be found in Appendix 9.5A of this report.

9.5.1.2 Fire Protection System Description

9.5.1.2.1 Water Supply

Two sources provide firewater supply for the Fire Protection System.

(1) One source for the site is a 5.0 million gallon raw water storage reservoir. The reservoir is elevated above the plant and provides approximately 93 psi static pressure by gravity feed into the yard loop at plant grade. The reservoir supplies the firewater system via an epoxy-lined asbestos cement pipeline, 12 inches in diameter.

(2) Another water supply is provided by two 1500 gpm electric-motor-driven fire pumps, which are installed in parallel and draw suction from a 300,000-gallon firewater storage tank. Both pumps start automatically and sequentially upon low system pressure and are located within the power block.

The system's static pressure is maintained by the reservoir. This water system is designed to supply the largest water suppression system identified in the Equipment Control Guidelines (see Chapter 16), plus 500 gpm for hose streams for 2 hours.

9.5.1.2.2 Firewater Distribution System

The plant has two fire distribution systems, interconnected as follows:

(1) The power block underground loop, shown in Figure 9.5-1, is fed by the raw water reservoir with gravity feed pressure, and by the south site firewater distribution system, which is normally isolated from the underground yard loop by manual valves. When aligned with the south site firewater system, the power block loop is normally prevented from backfeeding the south site loop by check valves.

(2) A seismically qualified firewater system, within the turbine building, auxiliary building, and containment structure, is designed to provide an uninterrupted water supply to hose stations servicing safety-related areas of the plant following a Hosgri earthquake. The seismically qualified firewater system is shown in Figure 9.5-2. The qualified system consists of:

  (a) The 300,000 gallon firewater storage tank (Tank 0-1)

  (b) Two 1500 gpm electric-motor-driven fire pumps (pumps 01 and 02), powered from separate vital buses (refer to Table 9.5-1 for pump design data)

  (c) Feed mains and piping required to provide firewater to hose reel stations in safety-related areas of the plant

  (d) Valves to isolate the seismically qualified system from the nonqualified system

This system is supplemented by the yard loop and is isolated by check valves. These valves isolate the qualified system from the nonqualified system by preventing water loss through the nonqualified yard loop.

Nonqualified sprinkler piping in the turbine building can be isolated from the qualified system by closing two valves per unit. The sprinkler system piping protecting the reactor coolant pumps is seismically qualified but can be isolated by closing the air-operated containment firewater isolation valve, or by closing the manual isolation valves on the containment firewater line inside or outside of containment. All nonqualified sprinkler piping protecting the auxiliary building can be isolated from the qualified system by closing the sprinkler isolation valves. The auxiliary building sprinkler

piping in safe shutdown areas has been seismically qualified to ensure that a piping failure would not endanger safe shutdown components.

Plant procedures require walkdowns following an earthquake because failure of nonqualified system piping following a seismic event must be postulated. Failed portions of the system can be isolated by sectionalizing valves. As previously discussed, the water supply from the two 1500 gpm fire pumps is normally isolated from the yard loop by check valves because of seismic considerations. These check valves isolate the yard loop and direct the system water flow to the turbine building, auxiliary building, and containment structure to provide a seismically qualified water supply to hose stations. Normally closed bypass valves around each check valve may be opened to supply the yard loop if additional water supply or pressure is required.

The 300,000 gallon seismically qualified firewater tank that provides suction for the two 1500 gpm pumps is located inside the makeup water storage tank as a separate container. A flow path is available from the makeup water storage tank, but a check valve prevents reverse flow.

The plant yard firewater distribution system can be sectionalized to isolate any section without disrupting service to other fire protection systems or to the remainder of the plant.

9.5.1.2.3 Firewater Hose Reel and Hydrant System

Outdoor fire hose stations and hydrants are supplied from the underground yard loop. Fire hydrants are spaced a maximum of 250 feet apart. Hose stations and hydrants are spaced so that outside areas may be reached by at least two hose streams. The hose reel stations are equipped with a minimum of 100 feet of 1-1/2 inch rubber-lined fire hose, a combination nozzle, and a spanner wrench. The hose stations and fire hydrants are threaded compatible with the local fire department's equipment.

The supply piping for the plant interior firewater hose reel system is a seismically qualified system, which can be isolated by sectionalizing within the plant. Hose stations are provided within the plant areas and zones so that all areas and zones may be reached by a minimum of one hose stream. These hose stations are supplied by 4 inch and 2 inch diameter risers, which are located throughout the plant. Hose reels are provided with 1-1/2 inch diameter, woven-jacketed, rubber-lined fire hose in 50 foot, 75 foot, and 100 foot lengths with listed or approved adjustable nozzles.

Three portable, trailer-mounted, diesel-driven, 250 gpm pumps provide the capability to refill the firewater storage tank(s) and pressurize the firewater hose reel system from an alternative water source. Connections on the condenser hotwell (condensate) and the component cooling water heat exchanger shell (seawater) can be utilized to supply water to the firewater system. Cross-connection from these alternative water sources is provided by a 4 inch suction hose.

9.5.1.2.4 Water Spray Systems

Automatic water spray deluge systems are provided in the power block for the following:

(1) Main transformers

(2) Auxiliary transformers

(3) Standby/startup transformers

(4) Hydrogen seal oil units

(5) Feedwater pump turbines

(6) Lube oil piping at the turbine generator bearings

Automatic actuation of these systems is provided by pilot lines. Manual actuation is provided locally at system valves, or remotely by the control room. Each deluge system is provided with a flow alarm that annunicates both locally and in the control room.

9.5.1.2.5 Wet Pipe Sprinkler Systems

Automatic wet pipe sprinkler systems are provided for the following plant areas:

(1) Turbine building, elevation 85 feet

(2) Turbine building, elevation 104 feet

(3) Turbine building, elevation 119 feet

(4) Turbine building cold machine shop

(5) Technical support center

(6) Work planning center

(7) Corridor outside diesel generator rooms

(8) 4.16 kV switchgear ventilation fan rooms

(9) Auxiliary boilers

(10) Solid radwaste storage area

(11) Design Class II and III document storage rooms

(12) Component cooling water heat exchange rooms

(13) Component cooling water pump rooms

(14) Charging pump rooms

(15) Access Control and laboratory area

(16) Auxiliary feedwater pump room

(17) Boric acid transfer pump area

(18) Security diesel generator room

(19) Reactor coolant pumps

(20) Auxiliary building ventilation supply fan room

(21) Control room ventilation equipment room

(22) Penetration area outside containment, elevation 100 feet

(23) Penetration area outside containment, elevation 115 feet

(24) Fuel handling building corridor, elevation 100 feet

(25) Miscellaneous areas: electric repair shop, operations ready room

(26) Radioactive waste storage and laundry buildings

(27) Calibration Lab

The sprinkler systems are provided with zone flow alarms, which provide remote annunciation in the control room.

Sprinkler piping in safe shutdown areas has been seismically qualified to ensure that the leakage from damaged piping or the piping itself will not endanger equipment required for safe shutdown. Interfaces between qualified and nonqualified portions of the firewater system are capable of being isolated by sectionalizing valves.

Pendent fire sprinklers in the plant are installed without return bends as required by NFPA 13 (1969 edition). This condition has been evaluated and will not adversely impact the ability to achieve and maintain safe shutdown in the event of a fire (Reference 8).

9.5.1.2.6 Carbon Dioxide (CO_2) Suppression system

9.5.1.2.6.1 Low Pressure CO_2

A 7-1/2 ton capacity refrigerated tank stores the low-pressure carbon dioxide for the fire suppression systems. Design details are presented in Table 9.5-1.
The sizing of this system is based on a dual function of generator purge (two complete purges assumed) and fire suppression (two complete flooding discharges to the single largest hazard plus a reserve to operate local hose reels).

Automatic low-pressure, total flooding CO_2 systems, shown in Figure 9.5-3, are provided in the following areas:

(1) Diesel generator rooms

(2) Turbine lube oil reservoir rooms

(3) Turbine generator No. 10 bearing (local application)

(4) Cable spreading rooms

(5) Design Class I document storage rooms

Manually initiated low-pressure CO_2 hose reels of 100 foot lengths are provided for the following areas:

(1) 12 kV switchgear rooms

(2) 4.16 kV switchgear rooms

(3) 4.16 kV cable spreading rooms

(4) 25 kV potential transformer area

(5) 480 V switchgear rooms

(6) 125 Vdc battery and inverter rooms

(7) Electric load center rooms

Heat detectors installed for coverage of the hazard areas initiate automatic actuation for the total flooding CO_2 systems. Upon detection, a predischarge alarm of approximately 45 seconds (30 seconds for the lube oil storage room) is begun. During the predischarge alarm, the master select valve (located at the 7-1/2 ton tank) is opened and the carbon dioxide fills the piping to the hazard select valve. Once the predischarge alarm has expired, the hazard select valve is opened, discharging the

carbon dioxide into the hazard. The vents, dampers, and doors in the hazard area are also closed when the hazard select valve is opened. Remote annunciation of system discharge is sent to the control room via a pressure switch.

Manual actuation of the total flooding carbon dioxide systems is available both locally and from the control room. Local manual discharge can also be accomplished by mechanical means if power is lost. The diesel generator (DG) room carbon dioxide systems have a different operating sequence. The heat detection system for the DG rooms is designed to close the west roll-up doors in addition to operating as discussed above. Upon alarm of these detectors, the roll-up doors are closed and the CO_2 is discharged into the hazard. A remote manual switch for each DG room is provided to parallel the heat detection system for remote activation of the CO_2 and the closure of the west roll-up doors. The design sequence for CO_2 actuation precludes a single spurious alarm from simultaneously disabling all DGs in one unit.

Mechanical disable switches are provided for each area that is protected by carbon dioxide. The disable switches are supplied for personnel safety during maintenance in the area. Their operation annunciates in the control room and locally by rotating amber beacons, within the hazard area.

The CO_2 hose reels are designed to pressurize when the play pipe (nozzle) is removed from its mount. The hose reel system may also be pressurized by manual operation of the selector valve. Pressurization of this pipe system is annunciated in the control room.

The CO_2 systems are not seismically qualified. However, the low-pressure CO_2 in areas containing equipment required for safe shutdown has been reviewed to ensure that the piping will not endanger the equipment that is being protected.

9.5.1.2.6.2 High Pressure Carbon Dioxide

A high-pressure automatic CO_2 total flooding system is furnished in the circulating water pump motors for Units 1 and 2. The discharge includes an initial high flow rate to provide design concentration and a 20 minute extended discharge at reduced flow to maintain CO_2 concentration during motor coastdown.

High-pressure system discharge is initiated automatically by heat detection. The system may also be actuated manually by operating a high-pressure actuation cylinder or by manually operating the pilot outlet valve on the system supply cylinders.

A pressure switch trips on pressurization of hazard piping to indicate actual system release. Like the low-pressure systems, this system can be released by remote pushbutton from the control room. Unlike the low-pressure system with its mechanical disables, the high-pressure system is equipped with an electrical disable on the access door. The high-pressure system is also provided with a predischarge alarm to allow safe exit from the hazard area.

9.5.1.2.7 Portable Fire Extinguishers

Portable fire extinguishers are provided throughout the plant area and switchyards. Extinguishers are selected for the potential hazards in the area and located to limit travel distance required for the proper unit. The fire extinguishers are mounted in a manner to facilitate easy identification. Types of extinguishers provided are:

(1) Pressurized water

(2) Carbon dioxide

(3) Multipurpose dry chemical

(4) Halon 1211

9.5.1.2.8 Smoke and Heat Control

The plant ventilation supply and exhaust systems provide manual smoke and heat venting capability in the event of a fire. The ventilation systems either supply fresh outside air to rooms or exhaust air from rooms into a closed duct system (or both for some areas). Ventilation capability exists in all plant areas.

Plant ventilation systems are isolated by dampers upon activation of total flooding gaseous fire protection systems.

Plant ventilation systems or portable fans may be used after the fire by the fire brigade to clear the area of smoke. Consideration has been given to the loss of offsite power to ensure availability of those systems.

Fire dampers are provided with 1-1/2 or 3-hour UL-listed fusible link, electrical thermal link (ETL), or pneumatic release type. Situations where rated fire dampers have been provided include:

(1) Rooms that have total flooding CO2 protection

(2) Where heat or smoke transmission through a fire barrier might result in a fire propagating to an adjacent fire area

The fractional horsepower electric fans can be readily plugged into the receptacles for the normal or emergency ac lighting.

These fans can be arranged to exhaust to the outside or nearby operating ventilation exhaust ducts. If the normal ventilation systems are used for heat and smoke removal, system design is such that heat and smoke would be discharged outside, and not to other compartments. Gas-powered fans are provided in the event that ac power is lost. Control room ventilation isolation capability is discussed in Section 9.4.

9.5.1.2.9 Fire Doors

Fire barriers separating safe shutdown equipment are provided with doors with rating commensurate with that of the barrier. Otherwise, an engineering evaluation is provided to justify the adequacy of the door assembly. This evaluation is performed to the guidelines of Generic Letter 86-10.

9.5.1.2.10 Breathing Apparatus

Self-contained breathing apparatuses of the nominal 1/2-hour type are located within the plant area. Locations are based on accessibility prior to entering hazard areas. Additional breathing apparatuses are located in the vicinity of the control room. Spare cylinders and recharging facilities are provided for this equipment.

9.5.1.2.11 Communications Systems

The communications systems include internal (inplant) and external communication designed to provide convenient and effective operational communication among various plant locations and between the plant and locations external to the plant.

9.5.1.2.11.1 Intra-Plant System

A direct-dial company telephone is the primary communication facility within the plant. It has conference call features and consists of an emergency conference circuit that will handle a sufficient number of parties, including the control room operator.

Fire alarms may be dialed from any telephone, and a feature is provided that sounds a horn to identify an emergency. Response to this alarm is covered by procedures. Where background noise is high, telephones designed especially for use in high noise level areas are provided.

A manually initiated emergency signal is operated from the control console. The emergency signal is utilized for site evacuation. A public address system is installed in the plant and is accessible through the phone system via access numbers. This system is available as a plant notification system.

A multichannel intercommunication system is the secondary communication facility within the plant. It operates between the control room master station, fuel handling building, and the containment building.

The in-plant radio system provides dedicated frequencies for operations and security. The system consists of base radios, portable radios, and control consoles and is a half duplex repeater system.

9.5.1.2.11.2 Plant-to-Offsite System

The primary system of notification for offsite fire response agencies is by public telephone. Additionally, radio/intercom capability in the control room and technical support center provides a direct communications link to the county fire department emergency command center.

9.5.1.3 System Evaluation

The adequacy of the plant fire protection systems and plant design features that ensure the capability to achieve safe shutdown is discussed in Section 9.5.1.2 and Appendix 9.5A.

9.5.1.4 Inspection and Testing Requirements and Program Administration

The inspection and testing requirements for the fire equipment as well as the fire protection organization and administrative responsibilities are described in Inspection and Testing Requirements and Program Administration (Appendix 9.5H of this report).

9.5.2 COMMUNICATION SYSTEMS

The communications systems include internal inplant and external communication designed to provide convenient and effective operational communications among various plant locations and between the plant and locations external to the plant.

9.5.2.1 Design Bases

The communications systems are designed to ensure continuous intraplant and plant-to-offsite operation by the use of primary, secondary, and tertiary routings.

The design classification of the communication systems is given in the DCPP Q-List (see Reference 8 of Section 3.2).

9.5.2.2 Description

9.5.2.2.1 Intra-Plant System

A direct dial company telephone system is the primary communication facility within the plant. It has conference call features consisting of emergency conference and regular conference circuits. The emergency conference circuit and regular conference circuits will handle a sufficient number of parties. Each of the four regular "Meet Me" conference circuits will handle a total of nine parties. There is a radio paging system for paging plant personnel within the plant and in surrounding communities. Fire alarms may be dialed from any telephone in the plant, and the caller verbally identifies the location of the fire to the control room operator. Response to this alarm is covered by

procedures. Where background noise is high, telephones designed especially for use in high noise level areas are provided.

A multichannel intercommunication system is the secondary communication facility within the plant and operates between the control room master station, fuel handling building, and containment building areas.

A manually initiated emergency signal is the tertiary communication facility. It is operated from the control console.

A public address system (PAS) provides audio announcements over a majority of the plant complex. The PAS divides the plant into zones and is capable of selectively reaching single zones, groups of zones, or all zones simultaneously.

Response to any of the signals mentioned will be governed by procedures.

Control room operators have access to breathing masks with integral microphones/amplifiers for communication in hazardous environments.

9.5.2.2.2 Plant-to-offsite System

Two communication links are utilized between DCPP and the PG&E Energy Control Center in San Francisco. Each communication link carries approximately one-half of the voice/data traffic.

The primary communication link between the plant and the PG&E Energy Control Center in San Francisco is the PG&E West Valley Microwave System. This system transmits administrative and control voice communication, system load dispatch teletype data links, and 500 kV protective relaying tone channels. The system is based on digital equipment and is provided with battery power for emergency operation. The system has dual transmitters/receivers in the event one does not operate. See Figure 9.5-5 for system routing.

The secondary communications link between the plant and the PG&E Energy Control Center in San Francisco is on common carrier facilities. This system transmits simultaneously with the West Valley system all information except 500 kV protective relaying. It is an all-fiber-optic network. See Figure 9.5-6 for system routing.

The tertiary communications link between the plant and the PG&E Telecommunication Control Center are the Public Switched Telephone Network lines that carry voice and the protective relaying circuit tones.

9.5.2.2.3 Communications Systems Evaluation

All intraplant systems, except the public address system, and all plant-to-offsite communications utilize tertiary backup and multiple power sources, therefore preventing the failure of individual components from causing a discontinuity of communications. The public address system does not have multiple power sources for its many distributed amplifier centers.

9.5.2.3 Inspection and Testing Requirements

Every critical component of the communications systems, such as the microwave radio system, the 48 V batteries, and the associated equipment, has major functions alarmed locally and at the PG&E Telecommunication Control Center (TCC). Routine maintenance procedures require testing and lineup of microwave radio multiplex and battery equipment to take place on a regularly scheduled basis. Tests were conducted to ensure that the plant radios do not affect the instrumentation systems for the Reactor Protection and Engineered Safety Features for Unit 1. Those plant areas that were determined to be affected were made radio exclusion zones. Since plant similarity exists for both units, plant modifications identified by these tests for Unit 1 were also implemented in Unit 2. All communications equipment serving the power plant will be continuously operating and this will provide operational quality checks.

9.5.3 LIGHTING SYSTEMS

Normal lighting is operated at 208Y/120 V, three-phase on a four-wire solidly grounded system, supplied from the 480-V system through dry type, delta-wye connected three-phase transformers.

The dc emergency lighting is supplied at 125 V from the nonvital station batteries. The dc emergency lighting fixtures are located principally in electrical equipment rooms, stairways, exits and entrances, corridors, passageways, and at lower levels in all other areas.

The ac emergency lighting is supplied from two of the three vital 480-V buses through dry type, single-phase transformers, and is sized to provide a maximum load of 112 kW for Unit 1 and 100 kW for Unit 2. The ac emergency lighting fixtures are located throughout the plant to provide minimum lighting.

The ac emergency lighting in the pipe rack area is powered by an uninterruptible power supply (UPS). This UPS is powered by non-Class 1E power and has an eight hour rated battery.

The ac emergency lighting circuits are routed in separate conduits from the normal ac lighting on the secondary transformer sides to panels and fixtures. On the primary side, the ac power from the vital 480-V buses is run in separate conduits or in respective vital

routes. The 208Y/120-V circuits are routed in normal power conduits. The dc circuits are in separate conduits in vital operating areas of the plant.

After the diesels start and the single-phase ac emergency transformers receive power, the dc emergency lights are automatically turned off. The average period of operation of the dc lights is 18 seconds, (approximately 13 seconds for diesel generator loading and 5 seconds for time delay of contactor pick-up in the emergency dc lighting panel). DC lights in the fuel handling building at all elevations will be on for 10 minutes. Engineered safety feature (ESF) equipment areas and various access routes thereto are provided with battery-operated lights (BOLs) or UPS-powered lights capable of providing 8 hours of illumination if ac power to the BOLs or UPS is lost. The batteries are continuously charged with a built-in charger.

Lighting in the containment structure and radiation areas of the spent fuel area and part of Area K of the auxiliary building has incandescent light fixtures. In the fuel handling building on the 140-foot elevation in the spent fuel and machine shop areas, the light fixtures are HID pulse start metal halide lights.

BOLs for areas containing safety-related equipment or to enable operator action to meet Appendix R safe shutdown requirements are seismically qualified.

Also see Appendix 9.5D, "Emergency Lighting Capability and Evaluation to Appendix R, Section III.J," for additional discussion.

9.5.4 DIESEL GENERATOR FUEL OIL STORAGE AND TRANSFER SYSTEM

The diesel generator fuel oil system, shown in Figures 3.2-21, 9.5-8 and 9.5-9, maintains adequate storage of diesel fuel oil and supplies it to the six emergency diesel generators. The following subsections provide information on (a) design bases, (b) system description, and (c) safety evaluation for the system.

9.5.4.1 Design Bases

9.5.4.1.1 General Design Criterion 2, 1967 - Performance Standards

The EDG fuel oil storage and transfer system is designed to withstand the effects of or is protected against natural phenomena, such as earthquakes, flooding, tornados, winds, and other local site effects.

9.5.4.1.2 General Design Criterion 3, 1971 - Fire Protection

The EDG fuel oil storage and transfer system is designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

9.5.4.1.3 General Design Criterion 4, 1967 - Sharing of Systems

The EDG fuel oil storage and transfer system or components are not shared by the DCPP Units unless safety is shown not to be impaired by the sharing.

9.5.4.1.4 General Design Criterion 11, 1967 - Control Room

The EDG fuel oil storage and transfer system is designed to support actions to maintain and control the safe operational status of the plant from the control room or from an alternate location if control room access is lost due to fire or other causes.

9.5.4.1.5 General Design Criterion 12, 1967 - Instrumentation and Control Systems

Instrumentation and controls are provided as required to monitor and maintain EDG fuel oil storage and transfer system variables within prescribed operating ranges.

9.5.4.1.6 General Design Criterion 17, 1971 - Electric Power Systems

The EDG fuel oil storage and transfer system is designed with sufficient capacity, capability, independence, redundancy, and testability to perform its safety function assuming a single failure.

9.5.4.1.7 General Design Criterion 21, 1967 - Single Failure Definition

The EDG fuel oil storage and transfer system is designed to remain operable after sustaining a single failure. Multiple failures resulting from a single event shall be treated as a single failure.

9.5.4.1.8 Protection from High and Moderate Energy Systems and Internal Missiles

The EDG fuel oil storage and transfer system is protected from the internal dynamic effects due to a postulated pipe failure or pipe crack and internally generated missiles.

9.5.4.1.9 10 CFR Part 50 Appendix R (Sections III.G, III.J, and III.L) - Fire Protection Program for Nuclear Power Facilities Operating Before January 1, 1979

Section III.G – Fire protection of Safe Shutdown Capability: Fire protection of the EDG fuel oil storage and transfer system is provided by a combination of physical separation, fire-rated barriers, and/or automatic suppression and detection.

Section III.J – Emergency Lighting: Emergency lighting or Battery Operated Lights (BOLs) are provided in areas where operation of the EDG fuel oil storage and transfer system may be required to safely shutdown the Unit following a fire.

Section III.L – Alternative and Dedicated Shutdown Capability: Safe shutdown capabilities are provided in the control room and at an alternate location via the hot shutdown panel or locally at the EDG, for the EDG fuel oil storage and transfer system, for the safe shutdown of the plant following a fire event.

9.5.4.1.10 Regulatory Guide 1.137, Revision 1, October 1979 – Fuel-Oil Systems for Standby Diesel Generators

For proper operation of the EDGs, it is necessary to ensure the proper quality of the fuel oil. It is also necessary to adhere to recommended fuel oil practices of checking and removing accumulated water from the day tank and main storage tank, respectively, as well as draining the fuel stored in the fuel storage tanks to remove accumulated sediments and to clean the tanks.

9.5.4.2 System Description

The diesel generator fuel oil system diagram is shown in Figure 3.2-21. The physical arrangement of the engine generator units is shown in Figures 9.5-10 and 9.5-11 for Unit 1; the arrangement is similar for Unit 2. Figure 9.5-12 shows the outline of the Unit 1 engine generators; the arrangement is similar for the Unit 2 generators with the exception of EDG 2-3, which is slightly different. The design data is given in Table 9.5-2. The system consists of the following major components and features:

(1) Two underground diesel fuel oil storage tanks, each with a storage capacity of 50,000 gallons.

(2) Two diesel fuel oil transfer pumps located below ground level, each adjacent to a storage tank but in separate compartments. Each transfer pump delivers more than 55 gpm at a discharge pressure of approximately 50 psig. Pumps are of the positive displacement rotary screw type with 5-hp motors. One pump is more than adequate to supply the six diesel generators of Units 1 and 2 running at rated load. A duplex-type strainer is installed upstream of each fuel oil transfer pump to protect the pump from particles that could damage it. A cartridge-type fuel oil filter is located at the discharge of the fuel oil transfer pumps to prevent any fuel oil contamination from reaching the engine-base-mounted diesel fuel oil tanks. The diagram of the engine fuel oil transfer system is shown in Figure 3.2-21. The physical arrangement of the fuel oil transfer system is shown in Figures 9.5-8 and 9.5-9.

(3) Two diesel fuel oil supply headers to each unit routed in separate trenches.

The motor controllers for the two transfer pumps are located inside the auxiliary building. Manual pump control stations and manual controls for the valves are located near each diesel generator set.

The other engine generator auxiliary systems and accessories are essentially as provided on all engine generator units of this size. Each engine generator unit is equipped with a skid-mounted fuel oil tank that has a capacity of 550 gallons, which provides about 2-1/2 hours of full load operation before fuel oil must be transferred from the underground storage tanks. Fuel is transferred to each diesel generator skid-mounted fuel oil tank via two level control valves (and two associated upstream isolation valves) per diesel generator. Each of the two level control valves and associated upstream isolation valves on each diesel generator is associated with a separate diesel fuel oil transfer system train; however, the level control valves, the isolation valves immediately upstream from the level control valves, and the skid-mounted fuel oil tank are part of the associated diesel generator rather than the diesel fuel oil transfer system. The fuel oil transfer pumps start automatically on low level in the engine generator unit tanks. The two 50,000-gallon storage tanks provide a 7-day supply of fuel.

Each emergency diesel generator day tank has the capacity for approximately 2.5 hours of continuous full-load operation. The fuel oil transfer system is designed to replenish the day tanks from the underground fuel oil storage tanks to ensure onsite power is available following a design-basis accident. Each day tank has two associated redundant fuel oil transfer system level control valves (LCVs) that automatically open to replenish the tank. The LCVs are air-operated by the associated diesel starting air receiver tanks. To ensure the starting air system is capable of supporting the required automatic LCV operation, the leakage of each diesel starting air system is verified periodically (Reference 6).

Experience with the PG&E transmission system indicates that in the event of complete loss of offsite power, restoration of normal power sources could be accomplished within a few hours. However, 7 days of onsite power generation has been used as a conservative upper limit for design and safety evaluations of fuel storage capacity for the tanks, even though it is highly improbable that the diesel generators would be required to furnish plant auxiliary power for this long a period.

9.5.4.3 Safety Evaluation

9.5.4.3.1 General Design Criterion 2, 1967 - Performance Standards

The EDG units and their associated auxiliary systems, as shown for Unit 1 in Figures 9.5-8, 9.5-9, and 9.5-10, and similarly for Unit 2, are installed in separate compartments that are protected from fires, flooding, and external missiles.

The system valves, fittings, and piping are fabricated and inspected to ANSI Code for Pressure Piping B31.1 and B31.7 where applicable. The diesel fuel oil storage tanks

are designed and fabricated to UL Standard 58. Seismic effects on the buried tanks are determined by a soil structure interaction analysis. Seismic effects are combined with gravity effects, including those resulting from the weight of the tanks and their contents, and the weight of the soil overburden.

Protection against corrosion problems is provided for underground portions of the system. Tank supports have firm foundations to minimize uneven settling and prevent seismic damage.

The exterior surfaces of the tanks have a corrosion-resistant fiberglass reinforced plastic (FRP) wrap. Cathodic protection was provided to protect the tanks and underground piping from corrosion in case of damage to the coating. This cathodic protection system provided minimal protection, is no longer functioning, and has been abandoned in place (Reference 7). Most jurisdictions (including San Luis Obispo County) do not require cathodic protection for fiberglass reinforced plastic clad double wall tanks. California Code of Regulations 23 CCR 2635 does not require cathodic protection for this type of tank construction. ANSI/ANS-59.51-1997 states the use of a double wall tank design is an adequate means of meeting corrosion requirements.

Underground steel piping is provided protection from the effects of long term corrosion by coating or wrapping, in accordance with NACE Standard Practice SP0169. The transfer and vent piping is electrically isolated from the tanks in accordance with NACE Standard Practice SP0169. Magnesium anodes are utilized to protect the tank hold down straps.

The design considerations to prevent water from flooding or groundwater from entering the fuel oil storage tanks, concrete vaults, and pipe trenches were:

(1) As discussed in Section 2.4, the risk of surface water flooding at this site is essentially zero. No groundwater has been encountered at or below the buried tanks, pump vaults, or pipe trenches. Therefore, the source potential for water flooding the fuel oil system is negligible. In addition, the below-ground system is completely sealed with the vent line extending approximately 2 feet above ground.

(2) Fuel oil tank vent lines running above ground are protected by concrete boxes and are surrounded by warning posts to alert any vehicular traffic. The concrete boxes will protect redundant vent lines from any credible common-mode failure.

(3) The two transfer pumps are in separate, underground, reinforced concrete vaults with solid covers protected from surface runoff due to their location inside the west buttress and condensate polishing system structure. The vault's manway hatch covers are made of steel and are provided with concrete curbing to prevent water intrusion into the vaults. These vaults are drained to the building sump and are protected with backwater valves.

Flooding of the transfer pump vaults is alarmed at the turbine building sump local annunciator and on the Unit 1 main annunciator.

(4) The two redundant fuel oil supply headers are in separate, below-ground reinforced concrete pipe trenches with solid steel or concrete covers that are generally flush with the adjacent ground level, except as noted below. Since the trenches collect water from surface runoff, drainage is provided through floor drains to manholes, which are pumped to the turbine building sumps or standpipes that can be connected to portable pumps. Portions of the fuel oil supply header trenches routed in the rooms housing the EDGs are provided with metal grating. The grating provides physical protection of the headers, allows for visual inspection, and provides access for manual control of the fuel oil level control valves using a wrench. Because the grating is located indoors, the potential for flooding is extremely small. The trenches, with the exception of that in the room housing EDG 2-3, drain back to the Turbine Building sump. The trench in the room housing EDG 2-3 main header does not drain to a sump and must be pumped out manually.

(5) The design classification for the diesel fuel oil piping within the trenches is given in the DCPP Q-List (refer to Reference 8 of Section 3.2).

A calculation was performed to determine the maximum ambient temperature inside the pump vaults due to heat output of fuel oil transfer pump motor (Reference 5). The motor is rated to withstand this maximum temperature. The design outdoor design temperature is based on 9 years of onsite hourly data, and the minimum recorded onsite outdoor temperature during this 9-year period is 39°F (refer to Section 9.4). Based on the results of the calculations, and the fact that the extreme low temperature recorded at the DCPP site was above freezing point, it is concluded that neither heating nor cooling is required to perform safe operation of the fuel oil pumps. However, for personnel protection, temporary portable ventilation equipment will be used as required to restore the confined space for habitability inside the vaults during periodic inspection and maintenance, in accordance with the plant administrative procedures.

9.5.4.3.2 General Design Criterion 3, 1971 - Fire Protection

The EDG areas are designed to the fire protection guidelines of Branch Technical Position APCSB 9.5-1 (refer to Appendix 9.5B, Table B-1).

Refer to Section 8.3.1.4.9 for further discussion on fire barriers and separation. To ensure good fire protection practice, the diesel engine generator installation was designed in accordance with NFPA Standard No. 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines. This standard permits a maximum capacity of 660 gallons (550 imperial gallons) for an integral fuel oil day tank. It also provides sufficient time for all necessary operator actions to ensure that diesel

generator operation is not interrupted in the event of any malfunctions in the system that transfers fuel oil from the underground storage tanks to the day tanks.

The two diesel fuel oil storage tanks are buried, and are designed to the criteria of Part 2, Bulk Underground Storage, of NFPA Standard No. 30, Standard for the Storage, Handling and Use of Flammable Liquids. The National Fire code does not require any specific fire protection system for this type of underground storage tank. Physical separation of the two tanks precludes the possibility of a fire in one storage tank from spreading to another tank. Fire risk is further minimized by the fact that the only source of oxygen to support a fire is through the 4 inch tank vent. If sufficient heat were generated to damage and collapse the storage tank, dirt would cave in and help smother the fire. Two yard hose reel stations are available for fighting any above ground fires at the tank location.

9.5.4.3.3 General Design Criterion 4, 1967 - Sharing of Systems

The diesel generator fuel oil system is provided to supply diesel oil to the emergency diesel engine generators for Units 1 and 2. The design classification of this system is given in the DCPP Q-List (refer to Reference 8 of Section 3.2). The fuel storage capacity provides 7 days of onsite power generation in order to operate (a) the minimum required ESF equipment following a loss-of-coolant accident (LOCA) for one unit, and the equipment for the second unit in either the hot or cold shutdown condition, or (b) the equipment for both units in either the hot or cold shutdown condition. The supply of fuel beyond the 7 day period is ensured by the availability of offsite sources and a reliable delivery method.

Safety of the reactor facilities is not impaired by the sharing of the fuel oil systems as any combination of one storage tank and one pump is capable of serving all six-day tanks. Each unit normally supplies power to one transfer pump from one Class 1E 480-V bus (refer to Section 8.3.1.1.4.3.3). Provisions are made to manually switch both pumps to the Class 1E buses of either unit, in case one unit should be placed in a prolonged cold shutdown condition.

9.5.4.3.4 General Design Criterion 11, 1967 - Control Room

System instrumentation and control is provided on the tanks and pumps as follows:

(1) The base-mounted day tanks have two separate redundant transfer pump start-stop level switches. Each level switch starts a transfer pump and opens the supply header solenoid valve corresponding to the respective transfer pump, A or B. The start setting for the header A level switches is slightly different from those for header B, allowing one to be a backup.

(2) The start of transfer pump A or B is indicated both locally and in the control room.

(3) Local controls at each diesel generator and manual crosstie valving between headers allow manual starting of either transfer pump and filling of the base-mounted day tanks from either header system A or B.

(4) High- and low-level alarm switches are installed on all base-mounted day tanks that activate alarms both locally and in the control room to alert the operators.

(5) High- and low-level alarm switches are installed on both fuel oil storage tanks that will activate alarms in the control room. Additionally, dipstick-type indicators and a local level indicator are provided for each storage tank.

Additionally, a monitoring system to detect the leakage of oil from the fuel oil transfer system piping in the fuel oil transfer trenches is provided to comply with California Underground Storage Tank regulations.

9.5.4.3.5 General Design Criterion 12, 1967 - Instrumentation and Control Systems

Refer to Section 9.5.4.3.4 for discussion related to instrumentation and control.

9.5.4.3.6 General Design Criterion 17, 1971 - Electric Power Systems

The EDG system has sufficient capacity, capability, independence, redundancy, and testability to perform its safety function assuming a single failure. Refer to Sections 9.5.4.2 and 9.5.4.3.7 for details on the system.

9.5.4.3.7 General Design Criterion 21, 1967 - Single Failure Definition

The diesel generator fuel oil system is designed to remain operable after sustaining a single failure of either an active or a passive component. The capability to meet the single failure criterion is met by providing redundancy in tanks, pumps, valves, piping, and power supplies. The system arrangement provides sufficient separation of the tanks and their associated transfer pumps so that the possibility of damage to both simultaneously as a result of a single event is considered highly unlikely. The fuel oil transfer piping, transfer pumps, and tank manifolding are arranged so a single failure of any pipe, valve, tank, or pump will not disable the system.

The design incorporates sufficient redundancy so that a malfunction or failure of either an active or a passive component will not impair the ability of the system to supply fuel oil.

As discussed in the preceding paragraph, the diesel fuel oil system transfer components and power sources are redundant up to and including fill valves and connections on the engine day tanks, so that a single malfunction will not prevent the transfer of oil. In the

unlikely event of malfunctions in both redundant fuel oil headers, such as a pump failure in one and piping blockage in the other, low level will be alarmed when sufficient fuel oil remains in the base-mounted day tank for a nominal one hour period of operation of the engine at full load. This nominal one hour period is adequate for an operator (a) to correct a malfunction on one of the two redundant transfer headers, or (b) to line up manually the valves of the two headers into one path that will transfer oil. All the valves necessary for this action are readily accessible in the compartments for the diesel fuel oil transfer pumps.

Each diesel generator has a dedicated shaft driven fuel pump, priming tank and day tank along with instrumentation, and fuel injectors such that failure of this engine mounted fuel equipment affects its associated diesel generator only.

9.5.4.3.8 Protection from High and Moderate Energy Systems and Internal Missiles

The EDG units and their associated auxiliary systems, as shown for Unit 1 in Figures 9.5-8, 9.5-9, and 9.5-10, and similarly for Unit 2, are installed in separate compartments that are protected from internal missiles.

The possibility of flooding in the turbine building and in the diesel generator compartments is discussed in Section 8.3.1.1.6.3.9.

9.5.4.3.9 10 CFR Part 50 Appendix R (Sections III.G, III.J, and III.L) - Fire Protection Program for Nuclear Power Facilities Operating Before January 1, 1979

Refer to Section 8.3.1.1.6.3.12 for discussion regarding compliance to the requirements of 10 CFR Part 50 Appendix R.

9.5.4.3.10 Regulatory Guide 1.137, Revision 1, October 1979 – Fuel-Oil Systems for Standby Diesel Generators

There is no specific DCPP commitment to use Regulatory Guide 1.137 guidance to establish fuel oil quantity requirements for 7 day EDG operation.

The Technical Specification required fuel oil quantity for 7 day EDG operation is based on the calculated fuel oil consumption necessary to support the operation of the EDGs to power the minimum ESF systems required to mitigate a design basis loss of coolant accident (LOCA) in one unit and those minimum required systems for a concurrent non-LOCA safe shutdown in the other unit (both units initially in Mode 1 operation).

Proper operation of the EDGs requires following recommended fuel oil practices to ensure proper quality. These practices include checking and removing accumulated water from the day tanks and main storage tanks and draining the main fuel storage tanks, removing accumulated sediment, and cleaning the tanks. Regulatory Guide

1.137 recommends surveillance frequencies for these practices as well as assurance of fuel oil quality in accordance with applicable industry standards.

9.5.4.4 Tests and Inspections

The diesel fuel supply headers are hydrostatically or pneumatically tested during construction and all active system components, pumps, valves, and controls are functionally tested during startup and periodically thereafter. The diesel fuel oil in storage will be periodically tested for any possible contamination or deterioration. The underground Diesel Fuel Oil and Transfer System is demonstrated operable as required by the Technical Specifications and at least once per ten years by:

(1) Draining each fuel oil storage tank, removing the accumulated sediment, and cleaning the tank using a sodium hypochlorite or equivalent solution, and

(2) Performing a visual examination of accessible piping during an operating pressure leak test.

9.5.4.5 Instrumentation Application

Refer to Section 9.5.4.3.4 for discussion related to instrumentation application.

9.5.5 DIESEL GENERATOR COOLING WATER SYSTEM

The diesel generator cooling water system is shown schematically in Figure 3.2-21. The physical arrangement of the EDG units is shown in Figures 9.5-10 and 9.5-11 for Unit 1; the arrangement is similar for Unit 2. Figure 9.5-12 shows the outline of the Unit 1 EDGs. The arrangement is similar for the Unit 2 EDGs with the exception of EDG 2-3, which is slightly different.

9.5.5.1 Design Bases

9.5.5.1.1 General Design Criterion 2, 1967 - Performance Standards

The EDG cooling water system is designed to withstand the effects of, or is protected against natural phenomena such as earthquakes, flooding, tornados, winds, and other local site effects.

9.5.5.1.2 General Design Criterion 3, 1971 - Fire Protection

The EDG cooling water system is designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

9.5.5.1.3 General Design Criterion 11, 1967 - Control Room

The EDG cooling water system is designed to support actions to maintain and control the safe operational status of the plant from the control room or from an alternate location if control room access is lost due to fire or other causes.

9.5.5.1.4 General Design Criterion 12, 1967 - Instrumentation and Control Systems

Instrumentation and controls are provided as required to monitor and maintain EDG cooling water system variables within prescribed operating ranges.

9.5.5.1.5 General Design Criterion 21, 1967 - Single Failure Definition

The EDG cooling water system is designed to remain operable after sustaining a single failure. Multiple failures resulting from a single event shall be treated as a single failure.

9.5.5.1.6 Protection from High and Moderate Energy Systems and Internal Missiles

The EDG cooling water system is protected from the internal dynamic effects due to a postulated pipe failure or pipe crack and internally generated missiles.

9.5.5.1.7 10 CFR 50.55a(g) - Inservice Inspection Requirements

Applicable EDG cooling water system components must meet the requirements of 10 CFR 50.55a(g). The EDG jacket water cooling system is the only EDG component included in the DCPP Inservice Inspection (ISI) Program.

9.5.5.1.8 10 CFR Part 50 Appendix R (Sections III.G, J, & L) - Fire Protection Program for Nuclear Power Facilities Operating Before January 1, 1979

Section III.G – Fire protection of Safe Shutdown Capability: Fire protection of the EDG cooling water system is provided by a combination of physical separation, fire-rated barriers, and/or automatic suppression and detection.

Section III.J – Emergency Lighting: Emergency lighting or BOL are provided in areas where operation of the EDG cooling water system may be required to safely shutdown the Unit following a fire.

Section III.L – Alternative and Dedicated Shutdown Capability: Safe shutdown capabilities are provided in the control room and at an alternate location via the hot shutdown panel or locally at the EDG, for the EDG cooling water system, for the safe shutdown of the plant following a fire event.

9.5.5.2 System Description

A closed loop jacket water-cooling system is provided for each of the six diesel engines. The engine generator skid has an integrally mounted radiator with a direct engine-driven fan for cooling the engine jacket water. Cooling air is largely outside ambient air, drawn by the fan from outside the building through the tornado missile shield into the radiator-fan portion of the engine generator compartment, and then through the radiator core. The diesel generator ventilation system is described in Section 9.4.7. This closed system allows the diesel generator unit to function in a self-contained manner, independent of outside cooling water systems and electric motor-driven fans.

The radiator is a jacket water-to-air heat exchanger of all copper and brass construction. Makeup to the jacket water cooling system can be added through a fill line after removing the radiator cap, labeled RV-71 in Figure 3.2-21 (Sheets 13 and 14, 14A, 14B). A low jacket water level alarm notifies the operator that makeup is required.

Engine jacket water is circulated by a jacket water pump directly driven by the engine. A three-way temperature regulating valve bypasses a portion of engine jacket cooling water around the radiator to maintain proper system temperature. Lubricating oil is cooled by a shell and tube heat exchanger using the jacket water as the coolant. Thermostatically controlled immersion heaters keep the jacket water warm for fast starting while the engine is in a shutdown condition.

The generators on these units are air-cooled by a shaft-mounted blower. The cooling system is shown schematically in Figure 9.4-6.

9.5.5.3 Safety Evaluation

9.5.5.3.1 General Design Criterion 2, 1967 - Performance Standards

Refer to Section 8.3.1.1.6.3.1 for discussion regarding the protection of the EDGs, and their associated auxiliary systems from flooding and external missiles.

9.5.5.3.2 General Design Criterion 3, 1971 - Fire Protection

Refer to Section 8.3.1.1.6.3.2 for discussion regarding the design of the fire protection system for the EDGs and their associated auxiliary systems.

9.5.5.3.3 General Design Criterion 11, 1967 - Control Room

Refer to Section 8.3.1.1.6.3.4 for discussion regarding the design of the EDGs and their associated auxiliary systems to support safe shutdown and to maintain safe shutdown from the control room or from an alternate location if the control room access is lost due to fire or other causes.

9.5.5.3.4 General Design Criterion 12, 1967 - Instrumentation and Control Systems

Refer to Sections 8.3.1.1.6.3.5 and 8.3.1.1.6.5 for discussions regarding the instrumentation and control for the EDGs and their associated auxiliary systems provided as required to monitor and maintain their variables within prescribed operating ranges.

9.5.5.3.5 General Design Criterion 21, 1967 - Single Failure Definition

Each diesel generator has a dedicated radiator/fan set, water pump and expansion tank such that failure of the cooling equipment affects its associated diesel generator only.

Refer to Section 8.3.1.1.6.3.8 for discussion regarding single failure criterion.

9.5.5.3.6 Protection from High and Moderate Energy Systems and Internal Missiles

The EDG units and their associated auxiliary systems, as shown for Unit 1 in Figures 9.5-8, 9.5-9, and 9.5-10, and similarly for Unit 2, are installed in separate compartments that are protected from internal missiles. Because EDG units are separated from each other by the concrete walls of the compartments, the units are protected from postulated internal missiles. Any missile created by an explosion within a compartment would remain in that compartment.

The possibility of flooding in the turbine building and in the diesel generator compartments is discussed in Section 8.3.1.1.6.3.9.

9.5.5.3.7 10 CFR 50.55a(g) - Inservice Inspection Requirements

Refer to Section 8.3.1.1.6.3.10 for discussion regarding compliance to the requirement of 10 CFR 50.55a(g).

9.5.5.3.8 10 CFR Part 50 Appendix R (Sections III.G, III.J, and III.L) - Fire Protection Program for Nuclear Power Facilities Operating Before January 1, 1979

Refer to Section 8.3.1.1.6.3.12 for discussion regarding compliance to the requirements of 10 CFR Part 50 Appendix R.

9.5.5.4 Tests and Inspections

Refer to Section 8.3.1.1.6.4 for discussion regarding the inspection and testing associated with the EDGs and their associated auxiliary systems.

9.5.5.5 Instrumentation Applications

Instrumentation application for this system is discussed in Section 8.3.1.1.6.5.

9.5.6 DIESEL GENERATOR STARTING SYSTEM

The diesel generator starting system is is shown schematically in Figure 3.2-21. The physical arrangement of the engine generator units is shown in Figures 9.5-10 and 9.5-11 for Unit 1; the arrangement is similar for Unit 2. Figure 9.5-12 shows the outline of the Unit 1 engine generators. The arrangement is similar for the Unit 2 generators with the exception of EDG 2-3, which is slightly different.

Each diesel generator is designed with two starting control circuits, one field flashing circuit, and one sensing circuit. These circuits receive Class 1E dc control power through a manual transfer switch. Normal Class 1E dc power is from the same train as the diesel generator. In the event of failure of dc power to these control circuits, an alarm appears on the main annunciator. The manual transfer switch, located near the control panel at the diesel generator can be used to transfer to backup Class 1E dc power.

9.5.6.1 Design Bases

9.5.6.1.1 General Design Criterion 2, 1967 - Performance Standards

The EDG starting system is designed to withstand the effects of, or is protected against natural phenomena such as earthquakes, flooding, tornados, winds, and other local site effects.

9.5.6.1.2 General Design Criterion 3, 1971 - Fire Protection

The EDG starting system is designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

9.5.6.1.3 General Design Criterion 11, 1967 - Control Room

The EDG starting system is designed to support actions to maintain and control the safe operational status of the plant from the control room or from an alternate location if control room access is lost due to fire or other causes.

9.5.6.1.4 General Design Criterion 12, 1967 - Instrumentation and Control Systems

Instrumentation and controls are provided as required to monitor and maintain EDG starting system variables within prescribed operating ranges.

9.5.6.1.5 General Design Criterion 21, 1967 - Single Failure Definition

The EDG starting system is designed to remain operable after sustaining a single failure. Multiple failures resulting from a single event are treated as a single failure.

9.5.6.1.6 Protection from High and Moderate Energy Systems and Internal Missiles

The EDG starting system is protected from the internal dynamic effects due to a postulated pipe failure or pipe crack and internally generated missiles.

9.5.6.1.7 10 CFR Part 50 Appendix R (Sections III.G, IIIJ, and III.L) - Fire Protection Program for Nuclear Power Facilities Operating Before January 1, 1979

Section III.G – Fire protection of Safe Shutdown Capability: Fire protection of the EDG starting system is provided by a combination of physical separation, fire-rated barriers, and/or automatic suppression and detection.

Section III.J – Emergency Lighting: Emergency lighting or BOL are provided in areas where operation of the EDG starting system may be required to safely shutdown the Unit following a fire.

Section III.L – Alternative and Dedicated Shutdown Capability: Safe shutdown capabilities are provided in the control room and at an alternate location via the hot shutdown panel or locally at the EDG, for the EDG starting system, for the safe shutdown of the plant following a fire event.

9.5.6.2 System Description

Each diesel engine of the six engine generator sets is provided with two separate and redundant air-start systems. Normally two trains, four starting air motors, operate together in combination with the turbo-charger air assist system to ensure that the engine generator set starts and accelerates to rated speed and to minimum bus voltage in less than 10 seconds. In the event that one of the air start systems fails or is unavailable, the remaining air-start system with turbo assist is capable of starting and accelerating the engine to rated speed and to minimum bus voltage in 10 seconds. Each of the two air-starting systems consists of an air receiver; a non-Class 1E electric motor-driven air compressor to charge the receiver; two air-starting motors that engage and turn the engine flywheel; and all piping, valves, and controls necessary to provide a complete system. Each of the two redundant PG&E Design Class II air compressors for each engine generator unit is fed from different Class 1E buses so that the possibility of simultaneous loss of both air compressors is minimized. The diesel engine vendor sizing criteria for each air start receiver is to provide sufficient capacity for three consecutive 15-second cranking cycles. Additional cranking cycles can be made as the PG&E Design Class II air compressors replenish their air receivers.

In addition to the above described two air-start systems, each diesel engine is equipped with an engine turbocharger boost system. The turbocharger boost system serves two functions: it aids in acceleration of the large rotating mass of the turbocharger, and it provides extra air to the engine to improve combustion during acceleration. The additional air is necessary since the turbocharger is inefficient at low speeds. The turbocharger boost system consists of one PG&E Design Class II air compressor, one air receiver, and all piping, valves, and controls necessary to provide a complete system. The turbocharger boost system with two air-starting motors is capable of starting and accelerating the engine generator set to rated speed and to minimum bus voltage in 10 seconds. The starting air system and the turbocharger boost systems are shown schematically in Figure 3.2-21 (Sheets 3 through 6B). The physical arrangement of those systems is shown in Figures 9.5-10 and 9.5-11.

9.5.6.3 Safety Evaluation

9.5.6.3.1 General Design Criterion 2, 1967 - Performance Standards

Refer to Section 8.3.1.1.6.3.1 for discussion regarding the protection of the EDGs and their associated auxiliary systems from flooding and external missiles.

9.5.6.3.2 General Design Criterion 3, 1971 - Fire Protection

Refer to Section 8.3.1.1.6.3.2 for discussion regarding the design of the fire protection system for the EDGs and their associated auxiliary systems.

9.5.6.3.3 General Design Criterion 11, 1967 - Control Room

Refer to Section 8.3.1.1.6.3.4 for discussion regarding the design of the EDGs and their associated auxiliary systems to support safe shutdown and to maintain safe shutdown from the control room or from an alternate location if the control room access is lost due to fire or other causes.

9.5.6.3.4 General Design Criterion 12, 1967 - Instrumentation and Control

Refer to Sections 8.3.1.1.6.3.5 and 8.3.1.1.6.5 for discussions regarding the instrumentation and control for the EDGs and their associated auxiliary systems provided as required to monitor and maintain their variables within prescribed operating ranges.

9.5.6.3.5 General Design Criterion 21, 1967 - Single Failure Definition

Each diesel engine of the six engine generator sets is provided with two separate and redundant air-start systems. Normally two trains, four starting air motors, operate together in combination with the turbo-charger air assist system to ensure that the engine generator set starts and accelerates to rated speed and to minimum bus voltage

in less than 10 seconds. In the event that one of the air start systems fails or is unavailable, the remaining air-start system with turbo assist is capable of starting and accelerating the engine to rated speed and to minimum bus voltage in 10 seconds.

Each diesel generator has dedicated air start receiver tanks (redundant), and a turbocharger receiver tank along with solenoid valves such that failure of this air start equipment affects its associated diesel only.

Refer to Section 8.3.1.1.6.3.8 for discussion regarding single failure criterion.

9.5.6.3.6 Protection from High and Moderate Energy Systems and Internal Missiles

The EDG units and their associated auxiliary systems, as shown for Unit 1 in Figures 9.5-8, 9.5-9, and 9.5-10, and similarly for Unit 2, are installed in separate compartments that are protected from internal missiles. Because EDG units are separated from each other by the concrete walls of the compartments, the units are protected from postulated internal missiles. Any missile created by an explosion within a compartment would remain in that compartment.

The possibility of flooding in the turbine building and in the diesel generator compartments is discussed in Section 8.3.1.1.6.3.9.

9.5.6.3.7 10 CFR Part 50 Appendix R (Sections III.G, III.J, and III.L) - Fire Protection Program for Nuclear Power Facilities Operating Before January 1, 1979

Refer to Section 8.3.1.1.6.3.12 for discussion regarding compliance to the requirements of 10 CFR Part 50 Appendix R.

9.5.6.4 Tests and Inspections

Refer to Section 8.3.1.1.6.4 for discussion regarding the inspection and testing associated with the EDGs and their associated auxiliary systems.

9.5.6.5 Instrumentation Applications

Instrumentation application for this system is discussed in Section 8.3.1.1.6.5.

9.5.7 DIESEL GENERATOR LUBRICATION SYSTEM

The diesel generator lubrication system is shown schematically in Figure 3.2-21. The physical arrangement of the engine generator units is shown in Figures 9.5-10 and 9.5-11 for Unit 1; the arrangement is similar for Unit 2. Figure 9.5-12 shows the outline of the Unit 1 engine generators. The arrangement is similar for the Unit 2 generators with the exception of EDG 2-3, which is slightly different.

9.5.7.1 Design Bases

9.5.7.1.1 General Design Criterion 2, 1967 - Performance Standards

The EDG lubrication system is designed to withstand the effects of, or is protected against natural phenomena such as earthquakes, flooding, tornados, winds, and other local site effects.

9.5.7.1.2 General Design Criterion 3, 1971 - Fire Protection

The EDG lubrication system is designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.

9.5.7.1.3 General Design Criterion 11, 1967 - Control Room

The EDG lubrication system is designed to support actions to maintain and control the safe operational status of the plant from the control room or from an alternate location if control room access is lost due to fire or other causes.

9.5.7.1.4 General Design Criterion 12, 1967 - Instrumentation and Control Systems

Instrumentation and controls are provided as required to monitor and maintain EDG lubrication system variables within prescribed operating ranges.

9.5.7.1.5 General Design Criterion 21, 1967 - Single Failure Definition

The EDG lubrication system is designed to remain operable after sustaining a single failure. Multiple failures resulting from a single event are treated as a single failure.

9.5.7.1.6 Protection from High and Moderate Energy Systems and Internal Missiles

The EDG lubrication system is protected from the internal dynamic effects due to a postulated pipe failure or pipe crack and internally generated missiles.

9.5.7.1.7 10 CFR Part 50 Appendix R (Sections III.G, III.J, III.L) - Fire Protection Program for Nuclear Power Facilities Operating Before January 1, 1979

Section III.G – Fire protection of Safe Shutdown Capability: Fire protection of the EDG lubrication system is provided by a combination of physical separation, fire-rated barriers, and/or automatic suppression and detection.

Section III.J – Emergency Lighting: Emergency lighting or BOL are provided in areas where operation of the EDG lubrication system may be required to safely shutdown the Unit following a fire.

Section III.L – Alternative and Dedicated Shutdown Capability: Safe shutdown capabilities are provided in the control room and at an alternate location via the hot shutdown panel or locally at the EDG, for the EDG lubrication system, for the safe shutdown of the plant following a fire event.

9.5.7.2 System Description

The lubricating oil system for each engine is entirely contained on that engine's baseplate. The system is schematically shown in Figure 3.2-21 (Sheets 11, 11A, 11B and 12, 12A, 12B). During engine operation, all required lubricating oil is drawn from the engine crankcase through a shaft-mounted oil pump to a lubricating oil filter with a built-in pressure relief device to bypass lubricating oil flow in the event that the filter becomes excessively dirty. The oil is then cooled in the jacket water-cooled heat exchanger and returned to the engine bearings through a duplex strainer. During normal operation, engine cooling water will not leak into the lubricating oil due to a leak in the lubricating oil heat exchanger since the operating pressure of the lubricating oil system is above 75 psig, and the operating pressure of the cooling water system is about 35 psig. Instrumentation provided in the lubricating oil circuit is described in Section 8.3.1.1.6.5.

While the engine is idle, oil is continually circulated by means of a small precirculating pump. A thermostatically controlled immersion heater on the outlet of the precirculating pump maintains a 90-110°F oil temperature to ensure rapid and safe startup of the engine at any time.

9.5.7.3 Safety Evaluation

9.5.7.3.1 General Design Criterion 2, 1967 - Performance Standards

Refer to Section 8.3.1.1.6.3.1 for discussion regarding the protection of the EDGs and their associated auxiliary systems from flooding, and external missiles.

9.5.7.3.2 General Design Criterion 3, 1971 - Fire Protection

Refer to Section 8.3.1.1.6.3.2 for discussion regarding the design of the fire protection system for the EDGs and their associated auxiliary systems.

9.5.7.3.3 General Design Criterion 11, 1967 - Control Room

Refer to Section 8.3.1.1.6.3.4 for discussion regarding the design of the EDGs and their associated auxiliary systems to support safe shutdown and to maintain safe shutdown from the control room or from an alternate location if the control room access is lost due to fire or other causes.

9.5.7.3.4 General Design Criterion 12, 1967 - Instrumentation and Control Systems

Refer to Sections 8.3.1.1.6.3.5 and 8.3.1.1.6.5 for discussions regarding the instrumentation and control for the EDGs and their associated auxiliary systems provided as required to monitor and maintain their variables within prescribed operating ranges.

9.5.7.3.5 General Design Criterion 21, 1967 - Single Failure Definition

Each diesel generator has a dedicated lubrication oil tank, cooler, recirculation pump, and pre-circulation pump such that failure of this equipment affects the associated diesel generator only.

Refer to Section 8.3.1.1.6.3.8 for discussion regarding single failure criterion.

9.5.7.3.6 Protection from High and Moderate Energy Systems and Internal Missiles

The EDG units and their associated auxiliary systems, as shown for Unit 1 in Figures 9.5-8, 9.5-9, and 9.5-10, and similarly for Unit 2, are installed in separate compartments that are protected from internal missiles. Because EDG units are separated from each other by the concrete walls of the compartments, the units are protected from postulated internal missiles. Any missile created by an explosion within a compartment would remain in that compartment.

The possibility of flooding in the turbine building and in the diesel generator compartments is discussed in Sections 8.3.1.1.6.3.9.

9.5.7.3.7 10 CFR Part 50 Appendix R (Sections III.G, III.J, and III.L) - Fire Protection Program for Nuclear Power Facilities Operating Before January 1, 1979

Refer to Section 8.3.1.1.6.3.12 for discussion regarding compliance to the requirements of 10 CFR Part 50 Appendix R.

9.5.7.4 Tests and Inspections

Refer to Section 8.3.1.1.6.4 for discussion regarding the inspection and testing associated with the EDGs and their associated auxiliary systems.

9.5.7.5 Instrumentation Applications

Instrumentation application for this system is discussed in Section 8.3.1.1.6.5.

9.5.8 REFERENCES

1. Pacific Gas and Electric Company, Fire Protection Review, Units 1 and 2 (Diablo Canyon Power Plant), Facility Operating License No. DPR-76, Amendment No. 51; July 27, 1977.

2. Pacific Gas and Electric Company, Report on 10 CFR 50 Appendix R Review (Diablo Canyon Power Plant, Unit 1), July 15, 1983.

3. Technical Specifications, Diablo Canyon Power Plant Units 1 and 2, Appendix A to License Nos. DPR-80 and DPR-82, as amended.

4. Report on 10 CFR 50, Appendix R Review (Diablo Canyon Power Plant, Unit 2), Pacific Gas and Electric Company, December 6, 1984.

5. Diablo Canyon Engineering Calculation HVAC 83-11, Pacific Gas and Electric Company, Nuclear Power Generation files.

6. Pacific Gas and Electric Company Probabilistic Risk Assessment Calculation File No. PRA04-11, Potential Loss of DFO Day Tank LCVs Following a Seismically Induced LOOP, July 5, 2005.

7. Pacific Gas and Electric Company Design Change Package DDP: 1000000205, Diesel Fuel Oil Storage Tank Cathodic Protection System Abandonment, April 2009

8. NECS File: 131.95, FHARE 160, Lack of Return Bends in Fire Sprinkler Piping.

9.5.9 REFERENCE DRAWINGS

Figures representing controlled engineering drawings are incorporated by reference and are identified in Table 1.6-1. The contents of the drawings are controlled by DCPP procedures.

TABLE 9.1-1

SPENT FUEL POOL COOLING AND CLEANUP SYSTEM ANALYSIS DATA[(a)]

Spent Fuel Pool Permanent Storage Capacity	1,324 assemblies[(b)]
Spent Fuel Pool Water Volume, cubic feet	47,215
Minimum Boron Concentration of the Spent Fuel Pool Water, ppm	2,000 (Up to 2600 during MPC Loading)*
Partial core off-load (Case 1): 96 fuel assemblies from current refueling assumed to have 52,000 MWD/MTU burnup. Conservative assumptions have been used to minimize decay time and maximize base decay hear load.	
Spent fuel pool HX CCW inlet temp, °F	75
Decay heat production, Btu/hr	22.92×10^6
Spent fuel pool water temperature, °F	≤ 127
Full core off-load (Case 2): 193 fuel assemblies from current refueling separated into two burnup groups: 101 assemblies at 52,000 MWD/MTU and 92 assemblies at 25,000 MWD/MTU. Conservative assumptions have been used to minimize decay time and maximize base decay heat load.	
Spent fuel pool HX CCW inlet temp, °F	75
Decay heat production, Btu/hr	36.67×10^6
Spent fuel pool water temperature, °F	≤ 157
Emergency full core off-load (Case 3): 193 assemblies from current refueling after 36 days of operation at full power. Fuel assemblies are separated into two burnup groups: 113 assemblies at 40,000 MWD/MTU and 80 assemblies at 3,000 MWD/MTU. Conservative assumptions have been used to minimize decay time and maximize base decay heat load.	
Spent fuel pool HX CCW inlet temp, °F	75
Decay heat production, Btu/hr	38.71×10^6
Spent fuel pool water temperature, °F	≤ 162
Spent Fuel Pool Water Heat Inertia	
Time to heat from 127 to 212°F for partial offload Case 1 above and no heat loss, hr	11.27
Time to heat from 157 to 212°F for full offload Case 2	4.35

above, hr	
Time to heat from 162 to 212°F for emergency offload Case 3 above, hr	3.76

* Refer to Diablo Canyon ISFSI Technical Specifications

(a) DCPP thermal-hydraulic analyses have been changed per LAR 04-07, Enclosure 1, Section 4.3 as part of the temporary cask pit spent fuel storage rack project

(b) The maximum number of irradiated fuel assemblies stored in the SFP during normal plant operations is limited to 1433 fuel assemblies per DCPP TS LCO 3.7.17.C.

TABLE 9.1-2 Sheet 1 of 3

SPENT FUEL POOL COOLING AND CLEANUP SYSTEM DESIGN AND OPERATING PARAMETERS

	Pumps 1-1/2-1	Pumps 1-2/2-2
Spent Fuel Pool Pump		
Number, per unit	1	1
Design pressure, psig	150	100
Design temperature, °F	225	225
Design flow, gpm	2,300	3,000
Material	Stainless steel	Stainless steel
Spent Fuel Pool Skimmer Pump		
Number, per unit	1	
Design pressure, psig	50	
Design temperature, °F	200	
Design flow, gpm	100	
Material	Stainless steel	
Refueling Water Purification Pump		
Number, per unit	1	
Design pressure, psig	150	
Design temperature, °F	200	
Design flow, gpm	400	
Material	Stainless steel	
Spent Fuel Pool Heat Exchanger		
Number, per unit	1	
Design heat transfer, Btu/hr	11.95×10^6	

	Shell	Tube
Design pressure, psig	150	150
Design temperature, °F	250	250
Design flow, lb/hr	1.49×10^6	1.14×10^6
Inlet temperature, °F	95	120
Outlet temperature, °F	103	109.5
Fluid circulated	Component cooling water	Spent fuel pool water
Material	Carbon steel	Stainless steel

Spent Fuel Pool Demineralizer	
Number, per unit	1
Design pressure, psig	200
Design temperature, °F	250
Design flow, (min. to max.), gpm	27 to 109
Resin volume, ft^3	39
Material	Stainless steel
Spent Fuel Pool Filter	
Number, per unit	1
Design pressure, psig	200
Design temperature, °F	250
Design flow, gpm	150
Filtration requirement	98% retention of particles above 5 microns
Material, vessel	Stainless steel
Spent Fuel Pool Resin Trap Filter	
Number, per unit	1
Design pressure, psig	200
Design temperature, °F	250
Design flow, gpm	150
Filtration requirement	98 percent retention of particles above 5 microns
Material, vessel	Stainless steel
Spent Fuel Pool Skimmer Filter	
Number, per unit	1
Design pressure, psig	200
Design temperature, °F	250
Rated flow, gpm	150
Filtration requirement	98% retention of particles above 5 microns
Material, vessel	Stainless steel
Refueling Water Purification Filter	
Number, per unit	1
Design pressure, psig	200
Design temperature, °F	250
Design flow, gpm	400
Filtration requirement	98% retention of particles above 5 microns
Demineralizer Resin Trap	
Number, per unit	1
Slot opening, inches	0.010
Material	Stainless steel

TABLE 9.1-2

Spent Fuel Pool Strainer	
Number, per unit	1
Rated flow, gpm	2300
Perforation, inches	Approximately 0.2
Material	Stainless steel
Spent Fuel Pool Skimmer Strainer	
Number, per unit	1
Rated flow, gpm	100
Design pressure, psig	50
Design temperature, °F	200
Perforation, inches	1/8
Material	Stainless steel
Spent Fuel Pool Skimmers	
Number, per unit	2
Design flow, gpm	50
Piping and Valves	
Design pressure, psig	150
Design temperature, °F	200
Material	Stainless steel

TABLE 9.2-1

AUXILIARY SALTWATER SYSTEM
COMPONENT DESIGN DATA

Auxiliary Saltwater Pumps

Number, per unit	2
Type	Vertical, wet pit, single stage
Rated capacity, gpm	11,000
Rated head, feet of sea water	125
Efficiency, %	83
Motor horsepower	465[(a)]
Speed, rpm	900
Column and discharge head material exposed to salt water	316L stainless steel
Design temperature, °F	120
Casing rated pressure, psig	100
Submergence required, ft	3
Minimum flow to prevent overheating, gpm	1,400

(a) Nameplate rating is 400 HP; analyzed to be capable of operating at 465 brake HP

TABLE 9.2-2

AUXILIARY SALTWATER SYSTEM MALFUNCTION ANALYSIS

Component	Malfunction	Consequences and Comments
1. Auxiliary saltwater pump	Pump casing rupture	The casing is designed for 100 psig, which exceeds maximum operating conditions. Pump is inspectable. Standby pump provides redundancy.
2. Auxiliary saltwater pump	Pump fails to start	One operating pump supplies either normal or minimum postaccident flow. Second pump provides full redundancy. Indication in control room shows pump status.
3. Auxiliary saltwater pump	Manual valve at discharge closed or check valve sticks closed	This will be prevented by prestartup and operational checks. Indication in control room shows position of remotely operated valves and whether flow is established.
4. Component cooling water heat exchanger	Tube or channel rupture	Rupture is considered highly unlikely because of low operating pressures and use of corrosion resistant materials. However, the leaking heat exchanger can be identified by sequential isolation or visual inspection. If the leak is in the on-line heat exchanger, the standby heat exchanger would be placed in service and the leaking exchanger isolated.
5. Piping and general	Any leakage from system via open vent or drain valve, ruptured heat exchanger tube, or other malfunction of equipment served by the system	The leaking component can be identified by sequential isolation or visual inspection. Rupture in a main cooling header would be indicated in the control room as low differential pressure across the heat exchanger and high component cooling water temperature. The operator can remotely or manually transfer flow to the redundant supply header restoring the system's cooling function before there is a significant temperature rise in the component cooling water system.
6. Motor	Pipe rupture at pump-motor enclosure	Rupture is considered highly unlikely because of low operating pressures and use of corrosion-resistant materials in contact with the saltwater. However, each pump is located in an isolated enclosure. Rupture could flood one compartment but the other motor would be protected. Level transmitters in pump enclosures alarm to the control room when flooding is detected.
7. Traveling Screen	Screen clogging	Clogging of the ASW common traveling screen with debris is discussed in Section 9.2.7.2.3, "Intake Structure and Equipment."

TABLE 9.2-3

COMPONENT COOLING WATER SYSTEM COMPONENT DESIGN DATA

Component Cooling Water Pumps

Number, per unit	3
Type	Horizontal centrifugal
Rated capacity, gpm	9200
Rated head, ft	145
Motor horsepower	400
Casing material	ASTM A-216 Gr. WCB carbon steel
Design pressure, psig	150
Design temperature, °F	300

Component Cooling Water Heat Exchangers

Number, per unit	2
Type	Shell and tube
Heat transferred, Btu/hr	258.8×10^6
Shell-side	
Component cooling water outlet temperature, °F	125.0
Component cooling water inlet temperature, °F	171.7
Component cooling water flow rate, gpm	11,210
Design pressure, psig	150
Design temperature, °F	300
Tube side	
Auxiliary saltwater inlet temperature, °F	70
Auxiliary saltwater outlet temperature, °F	120
Auxiliary saltwater flow rate, gpm	10,580
Design pressure, psig	100
Design temperature, °F	200
Tube material	ASME SB-111 and/or ASME SB-543, 90-10 CuNi
Shell material	ASME SA 515 Gr. 70

Component Cooling Water Surge Tank

Number, per unit	1
Type	Horizontal cylindrical with elliptical head: approximately 8 ft diameter x 30 ft long, internally baffled
Volume	
Total, gal	10,750
Normal operating, gal	Greater than 4,000
Design pressure, psig	150
Design temperature, °F	300
Material	ASME SA-285 Gr C

TABLE 9.2-4

COMPONENTS COOLED BY THE COMPONENT COOLING WATER SYSTEM

	Loop A	Loop B	Loop C
Containment fan coolers	2	3	
Residual heat removal heat exchangers	1	1	
Residual heat removal pump seal water coolers	1	1	
Centrifugal charging pumps CCP1 and CCP2 oil coolers	1	1	
Safety injection pump oil and seal water coolers	1	1	
Component cooling water pump oil coolers and stuffing boxes	2	1	
Post-LOCA sampling cooler	1		
Spent fuel pool heat exchanger			1
Seal water heat exchanger			1
Letdown heat exchanger			1
Excess letdown heat exchanger			1
NSSS sample heat exchangers – Unit 1			5
NSSS sample heat exchangers – Unit 2			4
Steam generator blowdown sample heat exchangers			5
Reactor coolant pump thermal barriers and motor oil coolers			4
Boric acid evaporator condenser, distillate cooler, vent condenser, and sample cooler (abandoned in place)			
Auxiliary steam drain receiver vent condenser (abandoned in place)			1
Waste gas compressors			2
Reactor vessel support coolers			4
Sample panel coolers			1

TABLE 9.2-5 Sheet 1 of 2

COMPONENT COOLING WATER SYSTEM NOMINAL FLOWS[(a)]
(in gpm)

	Normal	LOCA[(b)]	Cooldown[(c)]
Containment fan coolers and motors	10,250	4,560	10,250
RHR heat exchangers	-	5,000	10,000
RHR pumps[(f)]	20	10	20
Centrifugal charging pumps CCP1 and CCP2[(f)]	30	15	30
Safety injection pumps[(d)(f)]	48	24	48
Component cooling water pumps[(e)(f)]	30	10	30
Spent fuel pool heat exchanger[(i)]	3,400	-	3,400
Seal water heat exchanger	210	-	210
Letdown heat exchanger	1,000	-	300
Excess letdown heat exchanger	-	-	-
NSSS sample heat exchanger	50	-	50
CCW sample line	10	-	10
Steam generator blowdown HX	40	-	40
Reactor coolant pumps	780	-	780
Boric acid evaporator package[(h)]	-	-	-
Waste concentrator package[(h)]	-	-	-
Auxiliary steam vent condenser[(h)]	-	-	-
Waste gas compressors	100	-	100
Reactor vessel support coolers	100	-	100
Sample panel coolers	40	-	40
Post-LOCA sample cooler	-	-	-
No. of pumps required	2	2	3[(g)]
No. of pumps normally in service	2	2 (one for each vital loop	3
No. of pumps installed	3	3	3

(a) Unless noted otherwise, the data contained in this table are nominal flows. For the purpose of design basis analyses, lower assumed flows may be used to evaluate equipment, containment heat removal capability, or different alignments (such as Section XI testing or RHR heat exchanger operation); higher assumed flows may be used to evaluate maximum CCW temperatures.

(b) Recirculation phase (flows are for vital header "B" which is greater than those of vital header "A"). The minimum required post-LOCA flow rates are shown. The flow rate for the CFCUs represents a minimum flow of 1490 gpm to the cooling coils and 30 gpm to the motor coolers. Note that during the injection phase the total minimum CFCU flow rate is 1650 gpm.

(c) 20 hours after initiation of reactor cooldown.

(d) For safety injection pumps, the minimum required cooling flow following a LOCA is 24 gpm per pump.

(e) For component cooling water pumps, a minimum flow of 10 gpm per pump is required for stuffing box cooling flushing. Additional flow is required for lube oil cooling and is controlled by throttling to maintain lube oil temperature.

(f) Flow rates are minimum required following a LOCA. Flow rates during normal operation are higher, depending on system alignment.

(g) Three pumps are desirable. Loss of one extends cooldown time but does not create an unsafe condition.

(h) The waste concentrator package, boric acid evaporator package, and auxiliary steam vent condenser have been abandoned in place and are currently isolated from the CCW system.

(i) During core offload

TABLE 9.2-6

COMPONENTS WITH A SINGLE BARRIER BETWEEN COMPONENT COOLING WATER AND REACTOR COOLANT WATER

	Barrier Design Temperature, °F	Barrier Design Pressure, psig	Temperature Range of Reactor Coolant Water, °F	Pressure Range of Reactor Coolant Water, psig
RHR heat exchangers	400	630	≤ 350	≤ 600
RHR pumps (seal coolers)	800	5140	≤ 350	≤ 600
Reactor coolant pumps(thermal barrier cooling coils)	650	2485	≤ 600	≤ 2485
Letdown heat exchanger	400	600	≤ 380	≤ 600
Excess letdown heat exchanger	650	2485	≤ 600	≤ 2485
Seal water heat exchanger	250	150	≤ 200	≤ 150
Sample heat exchangers	680	2485	≤ 652.7	≤ 2485

TABLE 9.2-7

COMPONENT COOLING WATER SYSTEM MALFUNCTION ANALYSIS

Component	Malfunction	Consequences and Comments
1. Component cooling water pumps	Pump casing rupture	The casing is designed for 150 psig and 300°F which exceeds maximum operating conditions. Pump is inspectable and protected against credible missiles. Rupture is not considered credible. Standby pump provides redundancy.
2. Component cooling water pumps	Pump fails to start	Two operating pumps supply normal flow. Third standby provides redundancy.
3. Component cooling water pumps	Manual valve at pump suction or discharge closed or check valve sticks closed	This will be prevented by prestartup and operational checks. Further, periodic checks during normal operation would show that a valve was closed.
4. Component cooling water heat exchanger	Tube or shell rupture	Because of low operating pressures, rupture is considered incredible in normal or postaccident injection phase service; however, a leaking exchanger could be ascertained by sequential isolation or visual inspection. If a leak is in the on-line component cooling water heat exchanger, the standby exchanger would be put on stream and the leaking exchanger isolated and repaired. The leaking exchanger could be left in service with leakage up to the capacity of the makeup line to the system from the condensate storage tank, which is 250 gpm. During long-term postaccident recirculation the component cooling water system (CCWS) may be operated as two separate loops, either of which could sustain this failure with the other providing the minimum required engineered safety features.

TABLE 9.2-7

Component	Malfunction	Consequences and Comments
5. General	Any leakage from system via open or drain valve severed loop piping, ruptured heat exchanger tube or other malfunction of equipment served by the system	Leakage from the CCWS can be detected by a falling level in the component cooling water surge tank. Observation of the time for the water level to fall a given amount and the area of the water surface in the tank will permit a determination of the leakage rate. The leaking component can be ascertained by sequential isolation or visual inspection of equipment in the system or complete isolation of a header. The 4000 gallons remaining in the surge tank after a makeup valve open alarm and the makeup flow will provide time for the closure of valves external to the containment for the isolation of all but the largest leaks. A 200 gpm maximum leak or rupture is postulated, so the operator has at least 20 minutes to isolate the leak before the surge tank is empty. The period is extended if the automatically operated, Design Class II, normal makeup path functions as designed and adds makeup water to the system. If the operator observes a rapidly falling surge tank level, he can elect to align/start a backup makeup water flow to the system before trying to isolate the leak (a backup source of water to the CCWS is provided from the condensate storage tank). The 250 gpm, Design Class I, makeup water flowpath, described in Section 9.2.3.3, can be started within 10 minutes. Because the makeup rate is greater than the postulated leak, the sequential isolation of components to stop the leak can proceed in an orderly manner. The 200 gpm leak is within the capacity of the auxiliary building drainage system. The complete rupture of large pipes or equipment with rapid loss of water is considered highly unlikely in normal operation or postaccident injection phase operation since all vital system piping and heat exchangers are located in the missile protected area of the containment. However, any of the three headers can be isolated. The two vital headers may be separated in accordance with EOP E-1.4 based on plant conditions during long-term postaccident operation and a passive failure in either would not impair the minimum engineered safety features supported by the other. Leaks into the CCW system can result from heat exchanger tube failure. For the RCP thermal barrier, the system design is to contain the in-leakage to the CCW system within the containment structure. The outboard containment isolation valve returning CCW from all reactor coolant pump thermal barriers closes on a high flow signal indicating in-leakage from the higher pressure RCS. All piping and valves

required to contain this in-leakage are designed for an RCS design pressure of 2485 psig. Should a coolant leak develop from the postulated failure mode that does not result in automatic flow isolation, the corresponding increase in CCW volume is accommodated by the relief valve on the CCW surge tank. The four relief valves on the CCW returns from thermal barriers are sized to relieve volumetric expansion and are set to relieve at RCS design pressure.

Tube failure in components with design pressures / temperatures less than RCS design condition can also initiate a leak into the CCW system. The radioactivity associated with the reactor coolant would actuate the CCW system radiation monitor (see Section 9.2.2.2.12). The monitor in turn would annunciate in the control room and close the vent valve located just upstream of the CCW surge tank back-pressure regulator to prevent the regulator from venting after sensing high radiation. The operator would also receive high level and high-pressure alarms from the surge tank as it filled. Continued in-leakage would increase the pressure in the surge tank until the high surge tank pressure alarm is actuated and the relief valve setpoint is reached. The relief valve on the surge tank protects the system from overpressurization. The maximum postulated in-leakage into the CCW system is based on an RHR heat exchanger tube rupture. The relief valve can accommodate this flow. Relief valve discharge from the CCW system surge tank is routed to the skirted area under the surge tank where it enters a floor drain routed to the auxiliary building sump.

TABLE 9.2-9

MAKEUP WATER SYSTEM
EQUIPMENT DESIGN AND OPERATING PARAMETERS

Lime Tank[(a)]

Number, shared	1 (35 gal.)
Chemical	Lime
Lining	Thermo-setting resin
Size, in.	48 x 48
Material	Carbon steel
Tank mixer, hp	1/4

Coagulant Tank[(a)]

Number, shared	1 (100 gal.)
Chemical	Ferrous sulfate
Lining	Thermo-setting resin
Size, in.	48 x 48
Material	Carbon steel
Tank mixer, hp	1/4

Chemical Feed[(a)]

Pumps	Diaphragm and metering pump - 2 pumps, 2 drive motors

Mixed Bed Demineralizers Regeneration System

Caustic day tank

Number, total	1
Lining	Thermo-setting resin
Size, in.	42 (dia) x 48 (straight side)
Material	Carbon steel

Caustic storage tank[(a)]

Number, total	1
Design pressure, psia	65
Design temperature, °F	400
Operating pressure, psia	35
Operating temperature, °F	90
Size, gal.	6710
Type	Horizontal with saddle steam heater
Material	ASME SA-36

TABLE 9.2-9

Acid storage tank[a]

Number, total	1
Design pressure, psia	65
Design temperature, °F	400
Operating pressure, psia	35
Operating temperature, °F	70
Size, gal.	6710
Type	Horizontal
Material	ASME SA-36

Miscellaneous equipment

Caustic dilution water heater	Electric, 125 kW @ 460 V
Caustic Feed pump	Diaphragm, 98 gph @ l30 psig

Reverse Osmosis (RO) System[a]

Flowrate (influent), gpm	200
Permeate flow rate, gpm	150
Reject flow rate, gpm	50
Operating pressure, psig	432
Total dissolved solid removal capacity, % minimum	90
RO pressure vessels	
First stage	6
Second stage	3
RO elements, per vessel	6
RO element type	ROGA (spiral wound)

RO Auxiliary Equipment[a]

RO booster pumps (total)	2
Flow rate, gpm	200
Operating Head, psig	432
Motor, hp	100

RO prefilters

Cartridge filters, total	2
Filters rating, microns	5
Cartridge material	Polypropylene
Flow rate, gpm	100
Operating pressure, psig	150
Filter casing construction material	304 stainless steel

Hypochlorite feed	
Day tank size, in.	28 (dia) x 48 (straight side)
Tank volume, gal.	100
Mixer volume, gal.	1/4
Hypochlorite feed pumps	2 each, positive displacements, 1/6 hp
Acid feed	
Acid day tank size, in.	60 (dia) x 48 (straight side)
Tank volume, gal.	400
Lining	Lithcote lined with cover
Acid feed pump	2 each, positive displacement 1/6 hp
Hexametaphosphate feed	
Hexametaphosphate day tank size, in.	28 (dia) x 42 (high)
Tank volume, gal.	100
Hexametaphosphate feed pumps	2 each, positive displacement 1/6 hp
Dechlorination system	
Sodium bisulfate day tank size, in.	28 (dia) x 42 (high)
Tank volume, gal.	100
Sodium bisulfate feed pumps	2 each, positive displacement, I/6 hp
Makeup Water Degassifier[a]	
Number, total	1
Design pressure	atmospheric
Design temperature, °F	90
Design flowrate, gal.	150
Air blower, scfm	440 @ 5 in H_2O
Blower motor, hp	1
Holding Tank size, in.	84 (dia) x 108 (high)
Tower size, in.	36 (dia) x 104 (high)
Construction material	Reinforced polyester fiberglass
Makeup Water Storage Tanks	
Primary water storage tank	
Number, per unit	1
Type	Vertical diaphragm sealed tank
Capacity, gal.	200,000
Size, ft	30 (dia) x 40 (straight side)
Material	304L stainless steel

Condensate storage tank

Number, per unit	1
Type	Vertical tank with floating roof
Capacity, gal.	425,000
Size, ft	40 (dia) x 47 (straight side)
Material	Carbon steel with reinforced concrete wall

Fire water and transfer storage tank - serves both units

Number	1
Type	Vertical dual compartment tank
Capacity - fire water, gal.	300,000
transfer, gal.	150,000
Size - fire water, ft	33 (dia) x 51 (straight side)
transfer, ft	40 (dia) x 51 (straight side)
Material	Carbon steel Inner tank - carbon steel Outer tank - carbon steel with reinforced concrete wall

Primary water makeup pumps

Number, per unit	2
Design pressure, psia	128
Design temperature, °F	70
Operating flow, gpm	150
Operating head, ft	222
Fluid	Water
Driver, hp	15
Material	316 stainless steel
Type	Vertical in-line

Makeup water transfer pumps

Number, shared	2
Design pressure, psia	205
Design temperature, °F	70
Operating flow, gpm	250
Operating head, ft	240
Fluid	Water
Driver, hp	30
Material	Class 30 cast iron
Type	Horizontal end suction

(a) These items are abandoned in place per administrative procedure. DCPP uses a rental seawater reverse osmosis system and a rental makeup water pretreatment system.

TABLE 9.3-1

COMPRESSED AIR SYSTEM EQUIPMENT

A. INSTRUMENT AIR SYSTEM

Compressors	
Number	4
Type	Oil-free, single-stage, double-acting, reciprocating
Capacity	334 scfm each
Pressure	100 psig
Number	2
Type	Oil-free, two stage, water cooled, rotary screw
Capacity	650 scfm each
Pressure	110 psig
Number	1
Type	Oil-free, two stage, air cooled, rotary screw
Capacity	650 scfm each
Pressure	110 psig
Air Dryers	
Number	2
Type	Adsorbent, heat-regenerative (1) and heatless (1)
Capacity	1500 scfm each
Inlet pressure	100 psig
Inlet temperature	100°F
Exit dew point	-40°F at 100 psig and inlet air 100°F sat.
Pre-Filters	
Number	2
Type	Positive-seal
Capacity	2800 scfm each
Filtration	0.6 microns
After Filters	
Number	2
Type	Positive-seal
Capacity	3600 scfm each
Filtration	1 micron
Receivers	
Number	2
Capacity	650 cu ft each
Pressure	120 psig
Material	ASME SA 515 Gr. 70

B. SERVICE AIR SYSTEM

Compressors	
Number	1
Type	Oil-free, two stage, air-cooled, rotary screw
Capacity	650 scfm
Pressure	125 psig
Number	1
Type	Oil-free, two stage, air-cooled, rotary screw
Capacity	1050 scfm each
Pressure	125 psig
Air Dryers	
Number	3
Type	Heatless (2) and heat of compression (1)
Capacity	1500 scfm
Inlet pressure	100 psig
Exit dew point	-40°F
Pre-Filters	
Number	2
Type	Positive-seal
Capacity	2100 scfm
Filtration	1 micron
After Filters	
Number	2
Type	Positive-seal
Capacity	2400 scfm
Filtration	1 micron
Receiver	
Number	1
Capacity	750 cu ft
Pressure	125 psig

TABLE 9.3-2

NUCLEAR STEAM SUPPLY SYSTEM
SAMPLING SYSTEM COMPONENT DESIGN DATA

Sample Heat Exchanger		
Number, per unit	3	
Design heat transfer rate (duty for 652.7°F sat. steam to 127°F liquid), each, Btu/hr	2.12×10^5	
	Shell	Tube
Design pressure, psig	150	2485
Design temperature, °F	350	680
Design flow, gpm	14.1	0.42
Temperature, in, °F	95	652.7 (max)
Temperature, out, °F	125	127 (max)
Fluid	Component cooling water	Sample
Material	Carbon steel	Austenitic stainless steel
Sample Pressure Vessel		
Number, per unit	4	
Volume, ml	150	
Design pressure, psig	2485	
Design temperature, °F	680	
Material	Austenitic stainless steel	

TABLE 9.3-5

CHEMICAL AND VOLUME CONTROL SYSTEM DESIGN DATA

General:	
Seal water supply flow rate, four pumps, nominal, gpm	32
Seal water return flow rate, four pumps, nominal, gpm	12
Letdown flow:	
Normal, gpm	75
Minimum, gpm	45
Maximum, gpm	120
Charging flow (excludes seal water):	
Normal, gpm	55
Minimum, gpm	25
Maximum, gpm	100
Temperature of letdown reactor coolant entering system, °F	545
Temperature of charging flow directed to reactor coolant system, °F	495
Centrifugal charging pump (CCP1 and 2) bypass flow (each), gpm	60
Centrifugal charging pump (CCP3) bypass flow (each), gpm	50
Amount of 4% boric acid solution required to meet design basis shutdown requirements, gal. (fuel cycle dependent)	14,042
Maximum pressurization required for hydrostatic testing of reactor coolant system, psig	3107

TABLE 9.3-6

CHEMICAL AND VOLUME CONTROL SYSTEM
PRINCIPAL COMPONENT DATA SUMMARY

Centrifugal Charging Pumps CCP1 and CCP2	
Number, per unit	2
Design pressure, psig	2800
Design temperature, °F	300
Design flow, gpm	150
Design head, ft	5800
Material	Austenitic stainless steel
Centrifugal Charging Pump CCP3	
Number, per unit	1
Design pressure, psig	3200
Design temperature, °F	300 [(a)]
Design flow, gpm	150
Design head, ft	5700
Material	Austenitic stainless steel
Boric Acid Transfer Pump	
Number, per unit	2
Design pressure, psig	150
Design temperature, °F	250
Design flow, gpm	75
Design head, ft	235
Material	Austenitic stainless steel
Gas Stripper Feed Pumps	
Number, per unit	2
Design pressure, psig	150
Design temperature, °F	200
Design flow, gpm	30
Design head, ft	320
Material	Austenitic stainless steel
Liquid Holdup Tank Recirculation Pump	
Number, per unit	1
Design pressure, psig	75
Design temperature, °F	200
Design flow, gpm	500
Design head, ft	100
Material	Austenitic stainless steel

Boric Acid Reserve Tank Pumps	
Number, shared	2
Design pressure, psig	150
Design temperature, °F	200
Design flow, gpm	150
Design head, ft	200
Material	Austenitic stainless steel
Boric Acid Reserve Tank Recirculation Pump	
Number, shared	2 per tank
Design pressure, psig	300
Design temperature, °F	400
Design flow, gpm	25
Design head, ft.	100
Material	Austenitic stainless steel
Concentrates Holding Tanks 0-1,0-2 Transfer Pumps (abandoned in place)	
Regenerative Heat Exchanger	
Number, per unit	1
Heat transfer rate at design conditions, Btu/hr	10.3×10^6
Shell side	
Design pressure, psig	2485
Design temperature, °F	650
Fluid	Borated reactor coolant
Material	Austenitic stainless steel
Tube side	
Design pressure, psig	2735
Design temperature, °F	650
Fluid	Borated reactor coolant
Material	Austenitic stainless steel
Shell side (Letdown)	
Flow, lb/hr	37,050
Inlet temperature, °F	545
Outlet temperature, °F	290
Tube Side (Charging)	
Flow, lb/hr	27,170
Inlet temperature, °F	130
Outlet temperature, °F	495

Letdown Heat Exchanger

Number, per unit	1	
Heat transfer rate at design conditions, Btu/hr	14.8×10^6	
Shell side		
Design pressure, psig	150	
Design temperature, °F	250	
Fluid	Component cooling water	
Material	Carbon steel	
Tube side		
Design pressure, psig	600	
Design temperature, °F	400	
Fluid	Borated reactor coolant	
Material	Austenitic stainless steel	
Shell side	Design	Normal
Flow, lb/hr	492,000	203,000
Inlet temperature, °F	95	95
Outlet temperature, °F	125	125
Tube Side (Letdown)		
Flow, lb/hr	59,280	37,050
Inlet temperature, °F	380	290
Outlet temperature, °F	127	127

Excess Letdown Heat Exchanger

Number, per unit	1	
Heat transfer rate at design conditions, Btu/hr	4.61×10^6	
	Shell Side	Tube Side
Design pressure, psig	150	2485
Design temperature, °F	250	650
Design flow, lb/hr	115,000	12,380
Inlet temperature, °F	95	545
Outlet temperature, °F	135	195
Fluid	Component cooling water	Borated reactor coolant
Material	Carbon steel	Austenitic stainless steel

Seal Water Heat Exchanger

Number, per unit	1	
Heat transfer rate at design conditions, Btu/hr	2.49×10^6	
	Shell side	Tube Side
Design pressure, psig	150	150
Design temperature, °F	250	250
Design flow, lb/hr	99,500	160,600
Inlet temperature, °F	95	143
Outlet temperature, °F	120	127
Fluid	Component cooling water	Borated reactor coolant
Material	Carbon steel	Austenitic stainless steel

Volume Control Tank

Number, per unit	1
Volume, ft^3	400
Design pressure, psig	75
Design temperature, °F	250
Spray nozzle flow (maximum), gpm	120
Material	Austenitic stainless steel

Boric Acid Tank

Number, per unit	2
Capacity, gal.	8,060
Design pressure	Atmospheric
Design temperature, °F	180
Material	Austenitic stainless steel

Boric Acid Batching Tank

Number, shared	1
Capacity, gal.	800
Design pressure	Atmospheric
Design temperature, °F	300
Material	Austenitic stainless steel

Chemical Mixing Tank

Number, per unit	1
Capacity, gal.	5
Design pressure, psig	150
Design temperature, °F	200
Material	Austenitic stainless steel

Liquid Holdup Tanks

Number, shared	5
Volume, gal.	83,220
Design pressure, psig	15
Design temperature, °F	200
Material	Austenitic stainless steel

Boric Acid Reserve Tanks

Number, shared	2
Capacity, gal.	24,610
Design pressure	Atmospheric
Design temperature, °F	150
Material	Austenitic stainless steel with membrane seal

Concentrates Holding Tank (abandoned in place)

Mixed Bed Demineralizers

Number, per unit	2
Design pressure	200
Design temperature, °F	250
Design flow, gpm	120
Normal resin volume, each, ft^3	30
Maximum resin volume, each, ft^3 (flush only)	39
Material	Austenitic stainless steel

Boric Acid Reserve Tank Recirculation Heater

Number, shared	1 per tank
Design pressure, psig	150
Design temperature, °F	500
Design flow, gpm	25
Material	Austenitic stainless steel

Cation Bed Demineralizer

Number, per unit	1
Design pressure, psig	200
Design temperature °F	250
Design flow, gpm	120
Resin volume, each, ft^3	27
Material	Austenitic stainless steel

Deborating Demineralizers

Number, per unit	2
Design pressure	200
Design temperature, °F	250
Design flow, gpm	120
Normal resin volume, each, ft^3	30
Maximum resin volume, each, ft^3 (flush only)	39
Material	Austenitic stainless steel

Evaporator Feed Ion Exchangers

Number, per unit	4
Design pressure, psig	200
Design temperature, °F	250
Design flow, gpm	30
Resin volume (maximum), ft^3	16
Material	Austenitic stainless steel

Evaporator Condensate Demineralizers (abandoned in place)

Reactor Coolant Letdown Filters

Number, per unit	2
Design pressure, psig	200 (1-1, 2-1), 300 (1-2, 2-2)
Design temperature, °F	250
Design flow, gpm	150 (1-1, 2-1), and 250 (1-2, 2-2)
Particle retention	98% of 25 micron size 100% of 50 micron size
Material, vessel	Austenitic stainless steel

Seal Water Injection Filters

Number, per unit	2
Design pressure, psig	2,735
Design temperature, °F	200
Design flow, gpm	80
Particle retention	98% of 5 micron size
Material, vessel	Austenitic stainless steel

Seal Water Return Filter

Number, per unit	1
Design pressure, psig	200
Design temperature, °F	250
Design flow, gpm	150
Particle retention	98% of 25 micron size
Material, vessel	Austenitic stainless steel

Boric Acid Filter

Number, per unit	1
Design pressure, psig	200
Design temperature, °F	250
Design flow, gpm	150
Particle retention	5 micron or less
Material, vessel	Austenitic stainless steel

Ion Exchanger Filter

Number, per unit	1
Design pressure, psig	200
Design temperature, °F	250
Design flow, gpm	35
Particle retention	98% of 25 micron size
Material, vessel	Austenitic stainless steel

Condensate Filter (abandoned in place)

Concentrates Filter (abandoned in place)

Boric Acid Blender

Number, per unit	1
Design pressure, psig	150
Design temperature, °F	250
Material	Austenitic stainless steel

Letdown Orifice	45 gpm	75 gpm
Number, per unit	1	2
Design flow, lb/hr	22,230	37,050
Differential pressure at design flow, psia	1,900	1,900
Design pressure, psig	2,500	2,500
Design temperature, °F	650	650
Material	Austenitic stainless steel	Austenitic stainless steel

Gas Stripper - Boric Acid Evaporator Package (abandoned in place)

(a) The design temperature of 300°F is for the structural integrity of the pump but not the limitation for operation.

TABLE 9.3-7

NITROGEN REQUIREMENTS

Equipment	Supply Pressure, psig	Supply Flow, scfm	Comments
Pressurizer relief tank	3	8.5	Initial gas cover
Unit 1 Reactor coolant drain tank	<15	20 (27 max.)	Gas cover/purge (refueling outage)
Unit 2 Reactor coolant drain tank	<15	20 (40 max.)	Gas cover/purge
Volume control tank	18	8.3	Initial gas cover (2950 scf total for all 3 tanks above, per refueling cycle)
Spray additive tank	5	5	
Gas decay tanks	5	15	
Waste concentrator condenser	2	10	(abandoned in place)
Boric acid concentrator	2	10	(abandoned in place)
Boric acid tanks	1	10	
Concentrates holding tank 0-1	1	6	(abandoned in place)
Concentrates holding tank 0-2	1	8	(abandoned in place)
Liquid holdup tank	3	4 (70 max.)	
Accumulators	650	22	103,000 scf initial fill, based on 700 psig and 40% gas space per refueling cycle
Boric acid reserve tanks	1.5	1	
Various replenishment requirements			Degasification purging during cold shutdown, 8400 scf per cold shutdown
Nitrogen layup system for steam generators			400 lb of nitrogen gas required to purge 4 main steam lines and provide initial charge of nitrogen on steam generators at 5 psig

Equipment	Supply Pressure, psig	Supply Flow, scfm	Comments
Nitrogen layup for 12 feedwater heaters			Same requirement as for steam generators except need 760 lb of nitrogen
CCW surge tank pressurization with N_2	20	25 (max)	Intermittent (to maintain surge tank pressure)
Condenser	30 (max)	20	Continuous
Zinc Tank	2” H_2O	<1	Intermittent (to maintain N_2 blanket in the zinc tank)

TABLE 9.3-8

HYDROGEN REQUIREMENTS

Equipment	Supply Pressure, psig	Supply Flow, scfm	Comments
Generator	75 (max.)	200 (makeup)	Initial fill of 34,390 scf
Volume control tank	15 to 26	8.3	960 scf required for purge and initial fill

TABLE 9.4-1

CONTROL ROOM VENTILATION SYSTEM (CRVS) COMPONENT DESIGN DATA

Filter Unit (per unit)

	No.	Size, in.	Efficiency, %[d]	Rated Air Flow Per Filter, cfm
Roughing filters	2	24 x 24 x 6	80-85[a]	1000 @ 0.30"SP
HEPA filters	2	24 x 24 x 11-1/2	99.97[b]	1150 @ 1.00"SP
Charcoal filters (cells or trays)	6	26 x 26 x 6	99/85[c]	333 @ 1.3"SP

Charcoal Filter Humidity Control Heater (per unit)

	No.	Capacity, kW	Voltage, V
Electric heater	2	5.0	480

Fans (per unit)

	No.	Static Pressure, in H_2O	Air Flow, cfm	Motor, hp
Main supply	2	1.75	7800	7.5
Filter booster	2	5.40	2100	3
Exhaust	1	1.00	1700	3/4
Pressurization[e]	2	5.00	2100	7.5

Air Conditioning Units (per unit)

Two full-capacity air conditioning units are provided, each consisting of a reciprocating compressor, cooling coil, and fan air-cooled condenser. The refrigeration capacity for each condenser is 31.0 tons using Freon 22 at 37°F suction temperature and 107°F condenser temperature. The cooling coils are each capable of handling 7800 cfm of air at 400 fpm face velocity. The air conditions for the cooling coil are:

Entering air: 84.0°F D.B./64.8°F W.B.
Leaving air: 54°F D.B./53°F W.B.
Friction drop through the coil: 0.41 in. H_2O

Airborne Contaminant Detectors (per unit)

	No.	Location	Sensitivity
Smoke	2	Return air duct	Trace amounts of combustion products
	2	Control room normal intake	Trace amounts of combustion products
Radioactivity	2	Control room normal intake	1 x 10^{-2} to 10^{+3} mR/hr
	2	Pressurization intakes	10^{-2} mR/hr (Sensitivity range is 10^{-2} to 10^{+4} mR/hr with setting point of 2 mR/hr)
Chlorine[(f)]	-	-	-

(a) Minimum efficiency requirements. Efficiency based on American Filter Institute (AFI) dust spot test

(b) Based on standard DOP test 0.3 micron particles

(c) Radioactive elemental iodine and radioactive iodide as methyl iodide, respectively (Efficiency rates are for filters as originally specified. Replacement filters shall comply with the requirements of the Ventilation Filter Test Program.

(d) Efficiency rates for HEPA and charcoal filters are for individual components (for filter efficiency rates during a DBA, refer to the respective accident analysis in Chapter 15)

(e) All four fans are common to both Unit 1 and Unit 2

(f) Chlorine monitors are abandoned in place or removed as there is no bulk chlorine onsite

TABLE 9.4-2

COMPLIANCE WITH REGULATORY GUIDE 1.52, JUNE 1973
DESIGN, TESTING, AND MAINTENANCE CRITERIA FOR ATMOSPHERE CLEANUP SYSTEM
AIR FILTRATION AND ADSORPTION UNITS OF LIGHT-WATER COOLED NUCLEAR POWER PLANTS

Regulatory Position	Compliance	Reasons or Comments
2. SYSTEM DESIGN CRITERIA		
a. Redundant systems and required components	Yes, except:	
	(1) No demisters.	(1) Demisters are not provided since they are not required for this filtration system design. In the control room, the outside air intake plenum is designed to present a tortuous path for flow in order to remove entrained water. At the time of operating the hydrogen vent system, several weeks after the DBA, no moisture will be entrained in the containment. Filters in the fuel handling building and the auxiliary building are not in direct contact with outside air.
	(2) No HEPA after-filters.	(2) Charcoal is thoroughly cleaned before insertion in filter trays. Formation of charcoal fines is not considered significant.
	(3) Auxiliary building ventilation system does not have redundant charcoal filters.	(3) As discussed in Section 15.5.17, failure of an RHR pump seal was already assumed as the single failure, an additional failure of the auxiliary building charcoal filter need not be postulated. Therefore, the charcoal filters need not be redundant.
	(4) Auxiliary building ventilation system does not have redundant electric heaters. Fuel handling building ventilation system does not have electric heaters (refer to 3.b below).	(4) Installation of one electric heater for the auxiliary building ventilation system is consistent with the commitments made as discussed in Section 15.5.17.

Regulatory Position	Compliance	Reasons or Comments
2. SYSTEM DESIGN CRITERIA		
b. Physical separation, including missile protection	Yes, except some ventilation systems in the plant are not specifically designed against tornadoes (refer to Section 3.3.2) or against local damage of ducting by missiles. However, the control room positive pressurization system is specifically designed for protection against tornado missiles (Refer to Section 9.4.1.3.1). The remainder of the control room ventilation system is enclosed within reinforced concrete structures.	No damage to components essential to safe plant shutdown or to protection of the public.
d. Protection against pressure surges	Not applicable.	Auxiliary building ventilation system not specifically designed for pressure surge due to failure of gas decay tank. Since insignificant amounts of radioiodine are contained in the tank, loss of this system will not affect offsite exposures.
f. Maximum air flow rate per train and preferred filter array	Air flow rate for the fuel handling building ventilation system is 35,750 cfm and auxiliary building ventilation system is 73,500 cfm versus recommended 30,000 cfm.	In either case, filters are easily replaced. Structural platforms and traveling hoists are permanently installed in filter rooms. In only one case are filters aligned more than three high above the floor or a platform.
g. Flow and ΔP signal, alarm and record in control room	No control room recorders or alarms.	Systems are tested at least once each 31 days when required to be operable per Technical Specifications. Fan status and damper position indicator lights are provided in the control room for the auxiliary and fuel handling buildings ventilation systems. The control room HVAC system is provided with a system trouble alarm in the control room.
j. Total enclosure and intact replacement	Not replaceable intact.	Each filter train consists of a totally enclosed unit, which cannot be replaced intact due to the as-built dimensions of the filter train room and access doors. Filter train components can be individually replaced.

TABLE 9.4-2

Regulatory Position	Compliance	Reasons or Comments
3. COMPONENT DESIGN CRITERIA & QUALIFICATION TESTING		
a. Demisters quality to MSAR 71-45 & UL Class I	Not applicable.	No demisters.
b. Heaters to reduce RH to 70% under DBA	The fuel handling building ventilation system does not have electric heaters. Heaters are installed for the control room and the auxiliary building ventilation systems.	Heaters not required for the fuel handling building, control room, and auxiliary building ventilation systems. Charcoal samples are tested to 95% RH. Relative humidity of the exhaust air of these systems is not expected to exceed the tested condition.
4. MAINTENANCE		
i. Entire standby atmosphere cleanup train should be operated at least 10 hours per month, with the heaters on (if so equipped), in order to reduce the buildup of moisture.	No.	Site climate should not lead to an excessive buildup of moisture on the filters; however, at least once per 31 days, when required by the Technical Specifications for operability, flow is initiated through the filters for at least 15 minutes to verify flow (refer to Section 9.4.1.4.2)
5. IN-PLACE TESTING CRITERIA		
b. In-place penetration of HEPA filters should conform to ANSI N101.1-1972.	No. Visual inspection, in-place penetration and bypass leakage testing of HEPA filter performed in accordance with ANSI N510-1980.	The in-place testing criteria are established in the Technical Specifications. The 1980 revision of ANSI N510 encompasses the testing criteria required by ANSI N101.1-1972.
HEPA filter sections should be tested in place initially and semiannually thereafter, to confirm a penetration of less than 0.05% at rated flow.	No. An in place test of the CRVS, ABVS and FHBVS HEPA filters shows a penetration and system bypass < 1.0% when tested at least once per 24 months.	The in-place testing criteria are established in the Technical Specifications.
c. Adsorber banks should be leak tested in accordance with USAEC Report DP-1082.	No. Visual inspection, in-place penetration and bypass leakage testing of adsorber banks for CRVS, ABVS and FHBVS is performed in accordance with ANSI N510-1980.	The in-place testing criteria are established in the Technical Specifications. The 1980 revision of ANSI N510 encompasses the testing criteria required by USAEC Report DP-1082.

Regulatory Position	Compliance	Reasons or Comments
Adsorber leak testing should be conducted whenever DOP testing is done.	No. An in place test of the CRVS, ABVS and FHBVS charcoal adsorbers shows a penetration and system bypass < 1.0% when tested at least once per 24 months.	The in-place testing criteria are established in the Technical Specifications.
6. LABORATORY TESTING CRITERIA FOR ACTIVATED CARBON		
a. Activated carbon adsorber section should be assigned the decontamination efficiencies given in Table 2.	No. The control room ventilation system decontamination efficiencies assumed in the accident analysis are 95% / 95% for elemental and organic iodine respectively. The control room HVAC system charcoal samples are tested at 30°C/95% RH per ASTM D3803-89 with a 2.5% acceptance criteria versus using RDT M16-1T (1972) at DBA conditions.	The laboratory test acceptance criteria are established in the Ventilation Filter Test Program, which is controlled by the Technical Specifications. Testing per RDT M16-1T (1972) has been superseded by the more conservative test requirements in ASTM D3803-1989.
	The auxiliary building ventilation system decontamination efficiencies assumed in the accident analysis are 90%/70% for elemental and organic iodine, respectively, versus 95%/95% as assigned by Regulatory Guide 1.52, June 1973 Table 2. Additionally, the charcoal samples are tested at 30°C/95% RH per ASTM D3803-89 with a 15% acceptance criterion versus using RDT M16-1T (1972) at DBA conditions.	The decontamination efficiencies used in the accident analysis are more conservative than the values stated in Regulatory Guide 1.52, June 1973. The laboratory test acceptance criteria are established in the Technical Specifications. Testing per RDT M16-1T (1972) has been superseded by the more conservative test requirements in ASTM D3803-1989.
	The fuel handling building ventilation system decontamination efficiencies are 95%/95% as assigned by Regulatory Guide 1.52, June 1973 Table 2. Refer to Table 15.5-45 for a discussion of	The decontamination efficiencies used in the accident analysis are more conservative than the values stated in Regulatory Guide 1.52, June 1973. The laboratory test acceptance criteria are established in the Technical Specifications. Testing per RDT M16-1T (1972) has been superseded by the more

TABLE 9.4-2

Regulatory Position	Compliance	Reasons or Comments
	assumed efficiencies in the accident analysis. Additionally, the charcoal samples are tested at 30°C/95% RH per ASTM D3803-89 with a 15% acceptance criterion versus using RDT M16-1T (1972) at DBA conditions.	Conservative test requirements in ASTM D3803-1989.

TABLE 9.4-5

AUXILIARY BUILDING VENTILATION SYSTEM COMPONENTS DESIGN DATA

Filters, per unit

	No.	Size, in	Efficiency, %[d]	Rated Air Flow Per Filter, cfm
Supply roughing[e]	70	24x24x26	30 (minimum)[e]	2,000 @ 0.17" SP
Exhaust roughing	172	24x24x12	80-85[a]	2,000 @ 0.55" SP
Exhaust HEPA	273	24x24x 11-1/2	99.97[b]	1,150 @ 1.00" SP
Exhaust charcoal (module composed of 3 cells or trays)	77	27-5/32 x 26-3/8 x 28-1/2	99/85[c]	1,000 @ 1.3" SP (Air enters from rear of tray)

Fans, per unit

	No.	Max. Static Pressure H_2O, in	Air Flow, cfm	Motor, hp
Supply (S31 & S32, Unit 1) (S33 & S34, Unit 2)	2	2.80	67,500	60
Exhaust (1E1 & 1E2,Unit 1) (2E1 & 2E2,Unit 2)	2	10.00	73,500	150

Electric Heaters, per unit

	No.	Rating
Exhaust (1EH-30, Unit 1) (2EH-30, Unit 2)	1	54 kW, 480 V, 3d

(a) Minimum efficiency requirements (Efficiency based on National Bureau of Standard (NBS) methods, dust spot test.)

(b) Based on standard DOP test 0.3 micron particles

(c) Radioactive elemental iodine and radioactive iodide as methyl iodide, respectively. Efficiency rates are for filters as originally specified. Replacement filters shall comply with the requirements of Regulatory Guide 1.52, June 1973 and ANSI N509.

(d) Efficiency rates for HEPA and charcoal filters are for individual components.

(e) Average dust spot efficiency requirement (Efficiency based on ASHRAE Standard 52.1 test)

(f) Supply filters are nominal values and may not reflect the as-built conditions.

TABLE 9.4-6

FUEL HANDLING BUILDING VENTILATION SYSTEM COMPONENTS DESIGN DATA

Filters, per unit

	No.	Size, in.	Efficiency, %	Rated Air Flow Per Filter, cfm
Supply roughing	21	24x24x13	30[a]	2,500 @ 0.35" SP
Exhaust roughing	120	24x24x12	80-85[a]	2,000 @ 0.55" SP
Exhaust HEPA	107	24x24x 11-1/2	99.97[b]	1,150 @ 1.00" SP
Exhaust charcoal (module composed of 3 cells or trays)	72	27-5/32 x 26-3/8 x 28-1/2	99/85[c]	1,000 @ 1.3" SP (Air enters from rear of tray)

Fans, per unit

	No.	Max. Static Pressure H_2O, in.	Air Flow, cfm	Motor, hp
Supply (S1 & S2)	2	2.90-3.30	23,300	25
Exhaust (E4)	1	6.75	35,750	75
(E5 & E6)	2	7.55	35,750	75

Heating Coils, per unit

Heating Capacity, Btu/hr	Area, sq ft	Air Flow, cfm	Entering Temp., °F	Leaving Temp., °F	Steam Press., psig
1,400,000	61.8	23,300	35	70	15

(a) Minimum efficiency requirements (Efficiency based on National Bureau of Standards (NBS) methods, dust spot test.)

(b) Based on standard DOP test 0.3 micron particles

(c) Radioactive elemental iodine and radioactive iodide as methyl iodide, respectively (Efficiency rates are for filters as originally specified. Replacement filters shall comply with the requirements of Regulatory Guide 1.52 and ANSI N509.)

TABLE 9.4-7

DESIGN VALUES FOR TURBINE BUILDING (GENERAL AREA) VENTILATION SYSTEM,

Turbine building volume, ft^3	5,125,000
15 Supply fans rating, cfm/fan	28,000
4 Exhaust fans rating, cfm/fan	40,000

TABLE 9.4-8

DESIGN CODES AND STANDARDS FOR VENTILATION SYSTEMS

Building or Area	Code
Control room	State of California, Industrial Safety Orders, Title 8, Sub-Chapter 7
	American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Guide
	Sheet Metal, Air Conditioning Contractors' National Association (SMACNA) Code
	Air Movement and Control Association (AMCA) - Standards for Air Moving Devices
Auxiliary building (excluding fuel handling area)	State of California, Industrial Safety Orders, Title 8, Sub-Chapter 7
	ASHRAE Guide
	SMACNA Code
	AMCA - Standards for Air Moving Devices
	American Conference of Governmental Industrial Hygienists - Industrial Ventilation Manual
Turbine building	State of California, Industrial Safety Orders, Title 8, Sub-Chapter 7
	ASHRAE Guide
	SMACNA Code
	AMCA - Standards for Air Moving Devices
Fuel handling area of the auxiliary building	State of California, Industrial Safety Orders, Title 8, Sub-Chapter 7
	ASHRAE Guide
	SMACNA Code
	AMCA - Standards for Air Moving Devices

Building or Area	Code
Containment	State of California, Industrial Safety Orders, Title 8, Sub-Chapter 7
	ASHRAE Guide
	SMACNA Code
	AMCA - Standards for Air Moving Devices
Auxiliary saltwater pump vaults	State of California, Industrial Safety Orders, Title 8, Sub-Chapter 7
	ASHRAE Guide
	SMACNA Code
	AMCA - Standards for Air Moving Devices
125-Vdc/480-V switchgear area	State of California, Industrial Safety Orders, Title 8, Sub-Chapter 7
	ASHRAE Guide
	SMACNA Code
	AMCA - Standards for Air Moving Devices
4.16-kV Switchgear room	State of California, Industrial Safety Orders, Title 8, Sub-Chapter 7
	ASHRAE Guide
	SMACNA Code
	AMCA - Standards for Air Moving Devices
Post-accident sample room	ASHRAE Guide
	SMACNA Code
	AMCA - Standards for Air Moving Devices

Building or Area	Code	
Technical support center	ASHRAE Guide	
	SMACNA Code	
	AMCA - Standards for Air Moving Devices	
Containment Penetration Area GE/GW	AMCA 99 (1972) -	Standards Handbook
	AMCA 210 (1974) -	Test Code For Air Moving Devices
	AMCA 500 (1975) -	Test Methods for Louvers, Dampers and Shutters
	ANSI N509-1980 -	Nuclear Power Plants Air Cleaning Units and Components
	SMACNA -	HVAC Duct Construction Standards 1985
	SMACNA -	Round Industrial Duct Construction Standard

TABLE 9.4-9

ESTIMATED CONTROL ROOM AREA HEAT LOADS[(a)]

(NORMAL OPERATING CONDITIONS - MODE 1)

Area	Btu/hr	
Control Room		
Floor and wall	14,990	
Occupants	3,200	
Lighting	35,495	
Annunciators, control boards, and nuclear instrumentation	109,365	
Computer Room		
Floor and wall	8,900	
Occupants	1,280	
Lighting	8,765	
Computers and analog control system	3,865	67,580[(b)]
Record Storage and Office		
Floor and wall	3,450	
Occupants	1,150	
Lighting	5,300	
Safeguard Room		
Floor and walls	2,545	
Occupants	640	
Lighting	3,030	
Solid state protection system	18,770	
Control Room Area Outside Air	2,835	
Total Heat Loads	223,580	
Total Tonnage - 19.0 Tons		

(a) All loads are given for Unit 1. Unit 2 heat loads are considered the same. The information contained in this table is "representative" of Units 1 and 2. Refer to the applicable design calculations for the current heat loads. This table will not be revised to reflect current design bases heat loads.

(b) Unit 1 computer room cooling load handled by supplemental computer room air conditioning units.

DESIGN VALUES FOR AUXILIARY BUILDING VENTILATION SYSTEM

Auxiliary Building Ventilation System (per unit)

Mode 1: Building Ventilation

1 Supply fan	Rating, cfm/fan	67,500
1 Exhaust fan	Rating, cfm/fan	73,500

Item	Heat Load, Btu/hr
Lighting	286,500
Equipment, piping, and cables	780,200
Electric motors	526,300
TOTAL	1,593,000

Mode 2: Building and Engineered Safety Ventilation

2 Supply fans	Rating, cfm/fan	67,500
2 Exhaust fans	Rating, cfm/fan	73,500

Item	Heat Load, Btu/hr
Lighting	286,500
Equipment, piping, and cables	1,194,000
Electric motors	1,271,200
TOTAL	2,751,700

Mode 3: Engineered Safety Ventilation

1 Supply fan	Rating, cfm/fan	67,500
1 Exhaust fan	Rating, cfm/fan	73,500

Item	Heat Load, Btu/hr
Lighting	286,500
Equipment, piping, and cables	1,194,000
Electric motors	1,103,400
TOTAL	2,583,900

Fuel Handling Building Ventilation System (per unit)

Normal and Iodine Removal Modes (not including auxiliary feed pumps)

1 Supply fan	Rating, cfm/fan	23,300
1 Exhaust fan	Rating, cfm/fan	35,750
Item		Heat Load, Btu/hr
Lighting		114,700
Equipment, piping, and cables		245,500
Electric motors		209,000
TOTAL		569,200

Normal and Iodine Removal Modes (including auxiliary feed pumps)

1 Supply fan	Rating, cfm/fan	23,300
1 Exhaust fan	Rating, cfm/fan	35,750
Item		Heat Load, Btu/hr
Lighting		114,700
Equipment, piping, and cables		245,500
Electric motors		352,900
TOTAL		713,100

TABLE 9.4-11

ESTIMATED NSSS HEAT LOSSES INSIDE CONTAINMENT

Piping	Btu/hr (x 10^6)
Reactor Coolant System	0.09
Other Piping	0.04
Equipment	
Reactor Vessel[(a)]	
Above seal	0.037
Below seal	0.125
Reactor Coolant Pumps[(b)]	3.600
Steam Generators	0.800
Pressurizer[(c)]	0.133
Control Rod Drive Mechanisms[(d)]	2.260
Pressurizer Relief Tank	0.022
Primary Concrete Shield	0.015
Regenerative Heat Exchanger	0.022
Excess Letdown Heat Exchanger	0.010
Total	7.154
Contingency	1.106
Total[(e)]	8.260

(a) Does not include supports

(b) Each pump: motor - 0.75 x 10^6 Btu/hr; uninsulated section - 0.15 x 10^6 Btu/hr

(c) Includes supports and heater terminal connections

(d) Includes heat losses from control rod drive mechanisms, and control rod penetration housings

(e) The following heat losses have not been included

Heat losses from piping and equipment not considered part of NSSS
Daily and seasonal ambient temperature changes
Solar heat load
Fan input power

TABLE 9.4-12

ESTIMATED TOTAL HEAT SOURCES INSIDE CONTAINMENT

Heat Sources	Btu/hr (x 10^6)
a. Steam and feedwater lines	0.30
b. Solar	0.10
c. Control rod drive fans	0.35
d. Ventilation fans (4 running)	2.94
e. NSSS[(a)]	8.26
f. Contingency for heat sources a, b, c, & d	0.37
Total	12.32

(a) The assumed NSSS sources of heat losses are shown in Table 9.4-11

TABLE 9.5-1

FIRE PROTECTION SYSTEM COMPONENT DESIGN DATA

Fire Pumps

Number, shared	2
Type	Horizontal centrifugal
Rated capacity, gpm	1,500
Rated head, ft	290
Motor horsepower	200
Design pressure (casing), psig	175
Casing material	Cast iron, Class 30

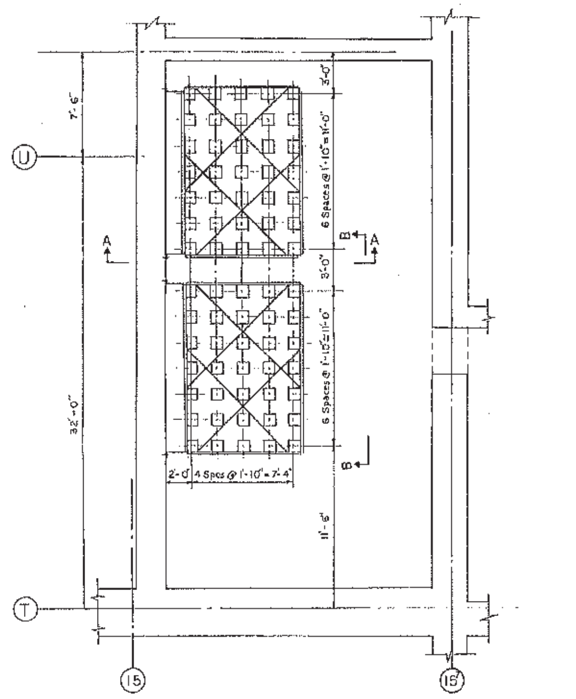
Carbon Dioxide System

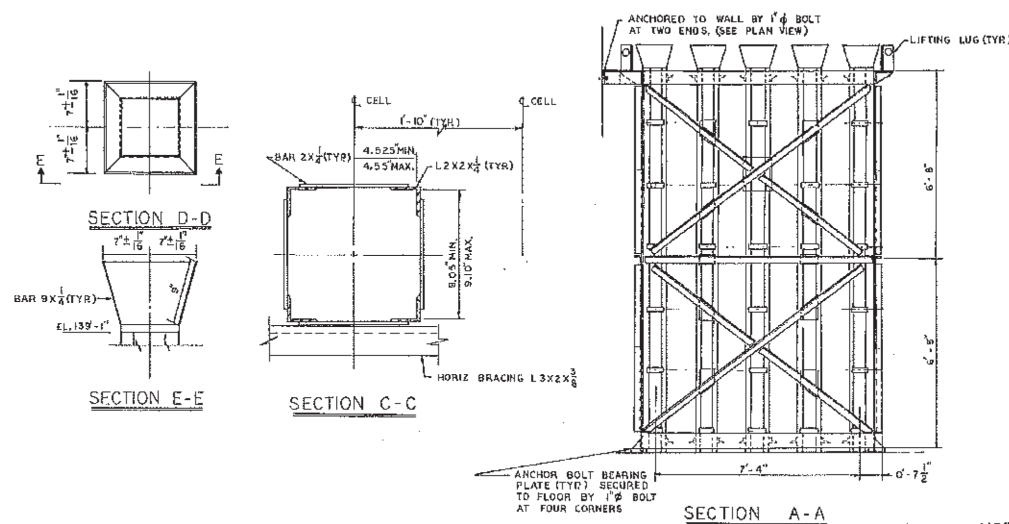
Number, shared	1
Type	Packaged unit, low pressure CO_2
Size, tons	7-1/2
Carbon dioxide	
Pressure, psig	300
Temperature, °F	0
Storage container	
Design pressure, psig	350
Operating pressure range, psig	295 - 305
Material	Carbon steel
Code	ASME Section VIII, Division I
Refrigeration unit	
Type	Compressor and coil
Motor horsepower	2
Vaporizer type	Steam

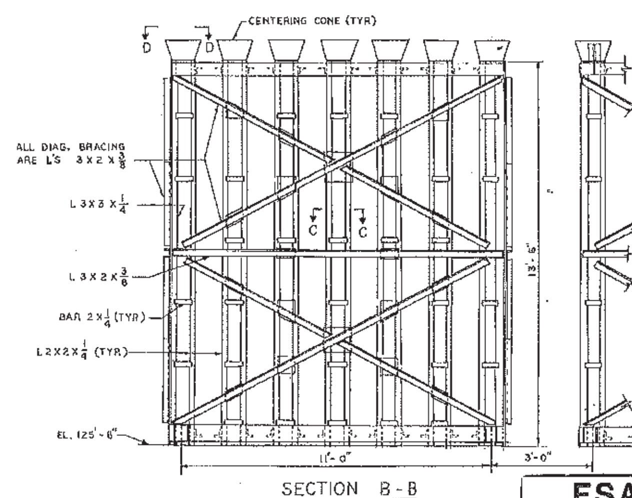
TABLE 9.5-2

DIESEL GENERATOR FUEL OIL SYSTEM COMPONENT DESIGN DATA

Storage Tanks	
Number, shared	2
Type	Horizontal, underground
Capacity, gal	50,000
Pressure	Atmospheric
Temperature	Ambient ground temperature
Material	Carbon steel/fiberglass
Transfer Pumps	
Number, shared	2
Type	Rotary, two-screw
Viscosity range, ssu	35 - 100
Rated capacity, gpm	58
Discharge pressure, psig	50
Suction pressure, in Hg	20
Casing material	Nodular iron
Motor horsepower	5







NOTES

1. THE 1'-10" CENTER TO CENTER SPACING BETWEEN ADJACENT FUEL CELLS IS CRITICAL AND MUST BE MAINTAINED TO $\pm\frac{1}{32}$ INCH.
2. VERTICAL ALIGNMENT & PLUMBNESS OF EACH STORAGE POSITION SHALL BE HELD TO 1/16" OVER FULL HEIGHT.
3. AFTER ASSEMBLY OF THE RACKS, A DUMMY FUEL ASSEMBLY 8.706" X 8.706" MUST BE ABLE TO PASS INTO EACH ASSEMBLY STORAGE POSITION WITHOUT BINDING.
4. PLACE FABREEKA BEARING PAD $8\frac{3}{4}$"X$8\frac{3}{4}$" X 1" THICK WITH 2" φ HOLE IN CENTER AT BOTTOM OF EACH CELL.
5. INTERIOR SURFACE WHICH MAY COME INTO CONTACT WITH FUEL ASSEMBLIES SHALL BE SMOOTH. INTERIOR EDGES SHALL BE FINISHED TO A MINIMUM RADIUS OF 1/8 INCH.
6. UNLESS OTHERWISE NOTED ALL FILLET WELDS ARE TO BE 3/16" FULL LENGTH WELDS.
7. MATERIAL SHALL BE STAINLESS STEEL TYPE 304.
8. BOTTOM SURFACE OF ALL BEARING PADS AND BEARING PLATES SHALL BE MAINTAINED IN THE SAME PLANE TO WITHIN ±1/16 INCH.

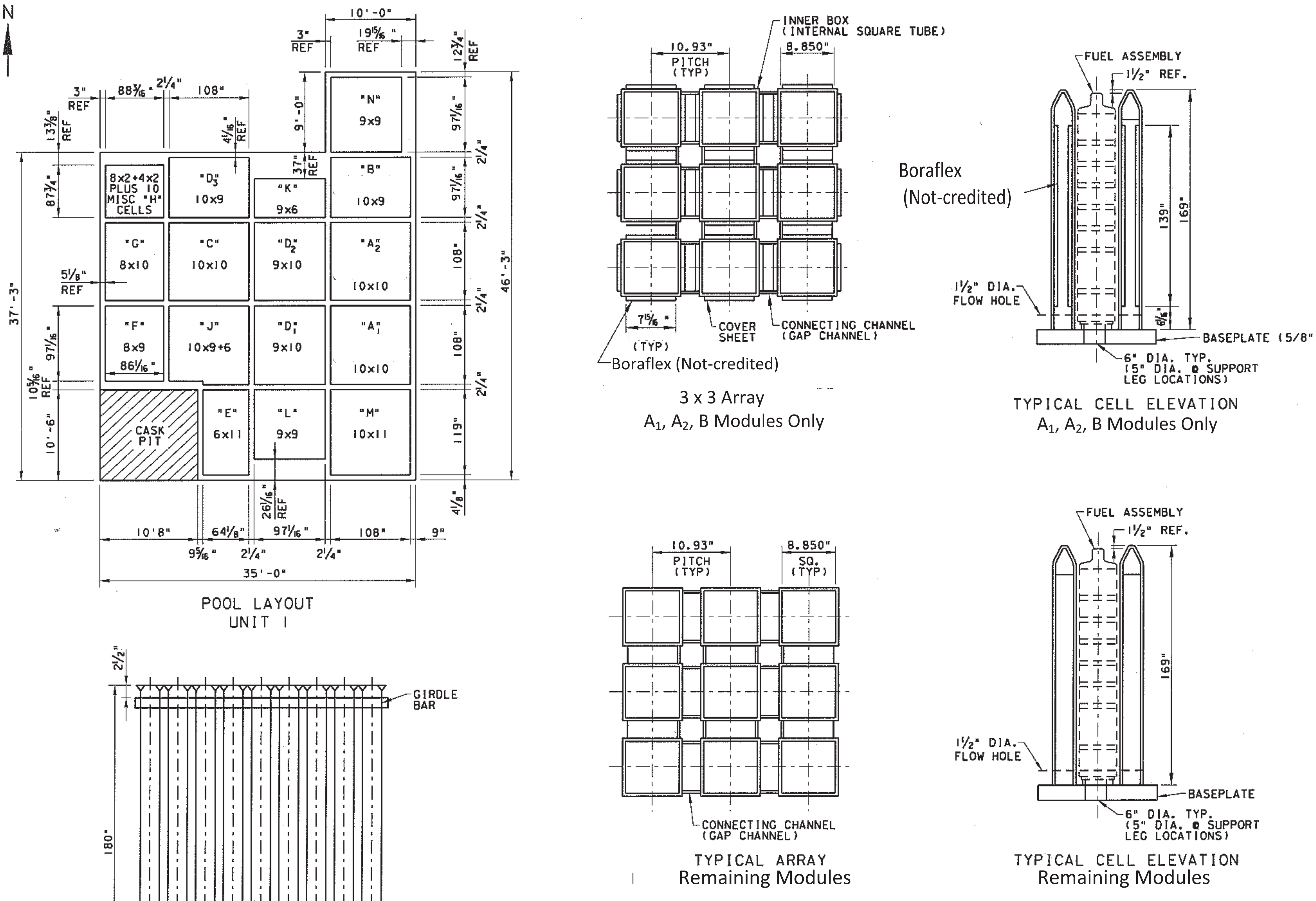
FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 9.1-1

NEW FUEL STORAGE

Revision 22 May 2015



POOL LAYOUT
UNIT I

TYPICAL RACK ELEVATION

3 x 3 Array
A_1, A_2, B Modules Only

TYPICAL CELL ELEVATION
A_1, A_2, B Modules Only

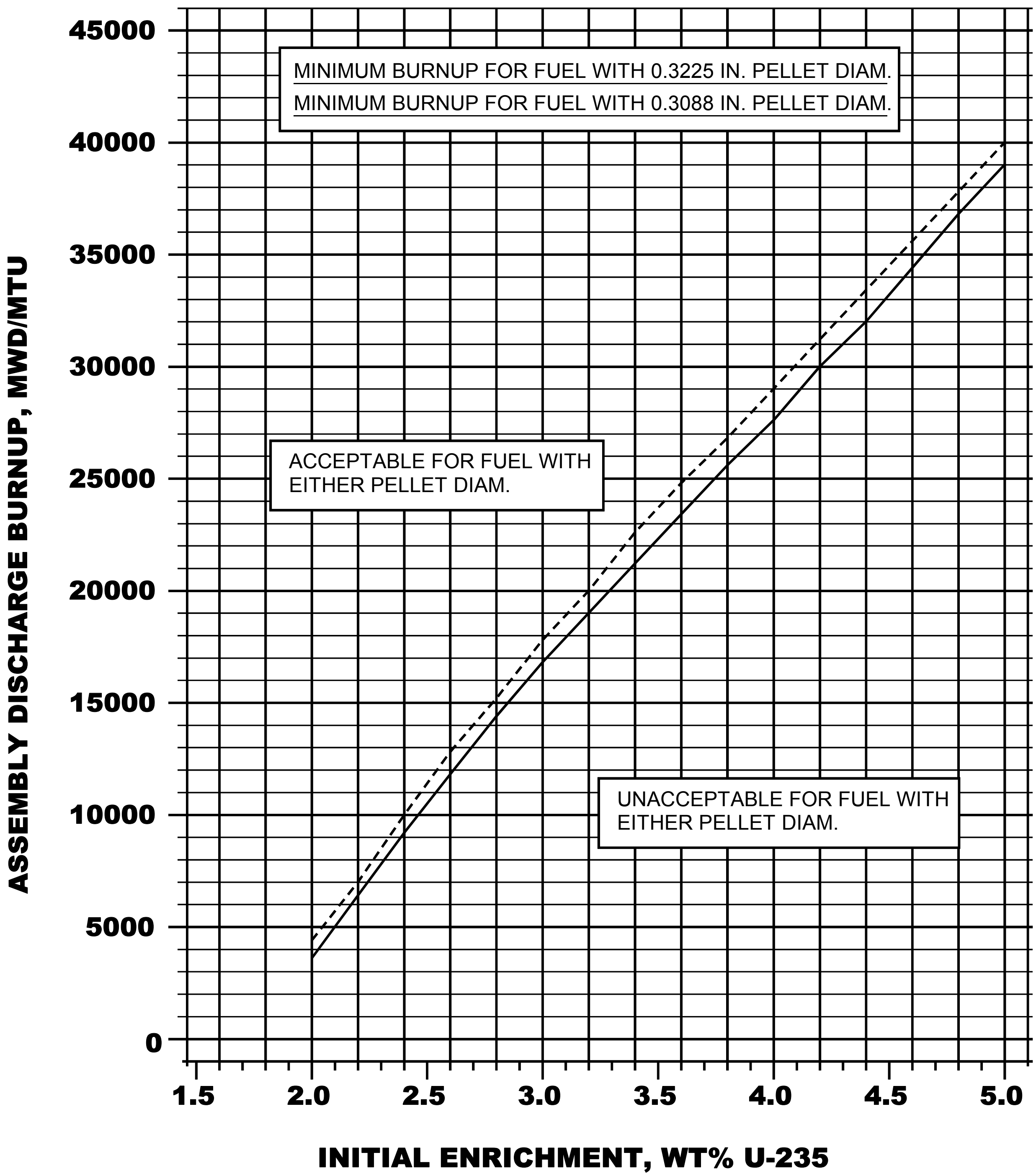
TYPICAL ARRAY
Remaining Modules

TYPICAL CELL ELEVATION
Remaining Modules

FSAR UPDATE
UNITS 1 AND 2
DIABLO CANYON SITE

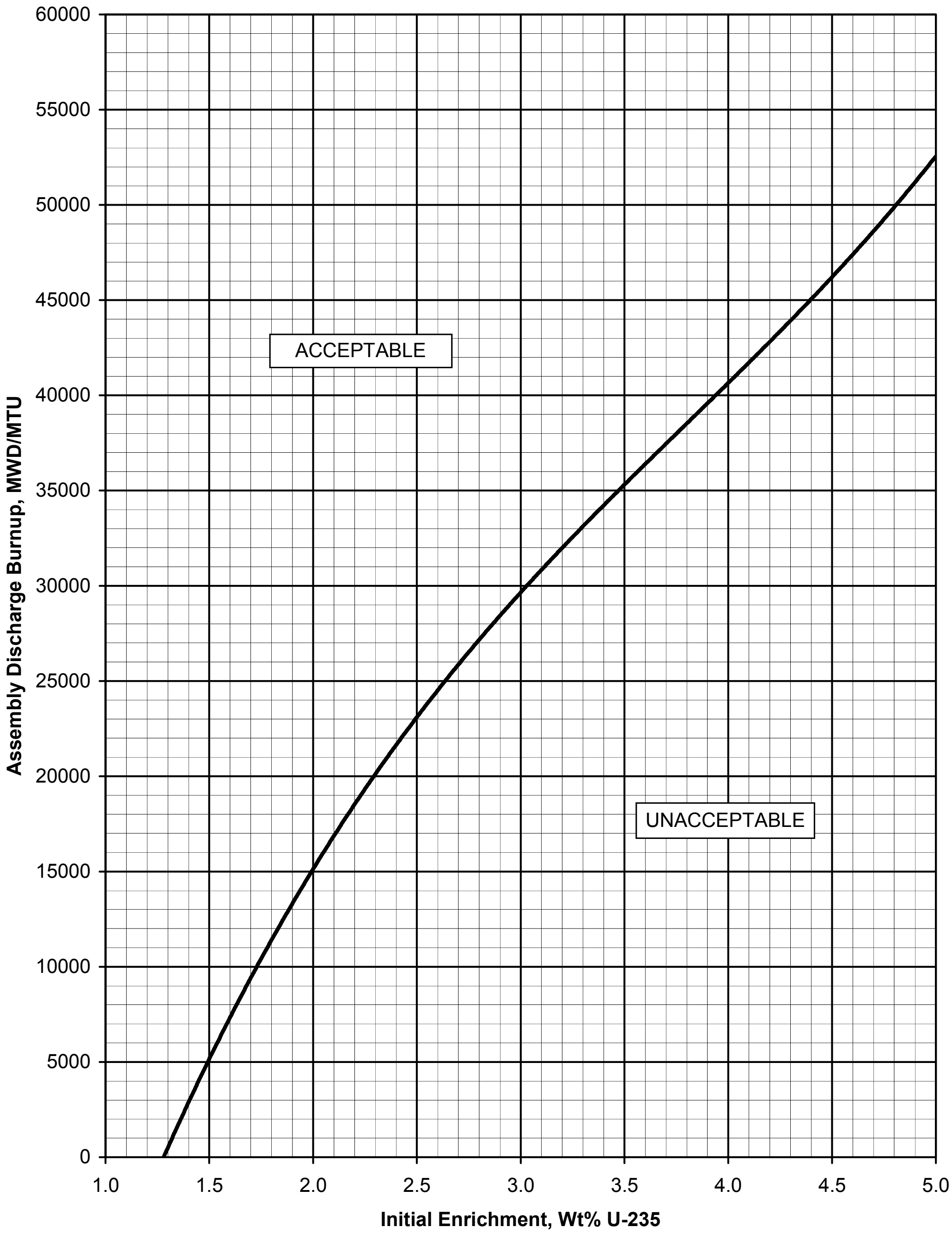
FIGURE 9.1-2
SPENT FUEL STORAGE

Revision 22 May 2015



MINIMUM REQUIRED ASSEMBLY DISCHARGE BURNUP AS A FUNCTION OF INITIAL ENRICHMENT AND FUEL PELLET DIAMETER FOR AN ALL CELL STORAGE CONFIGURATION.

FSAR UPDATE
UNITS 1 AND 2 DIABLO CANYON SITE
FIGURE 9.1-2A BURNUP VS. ENRICHMENT (ALL CELL)

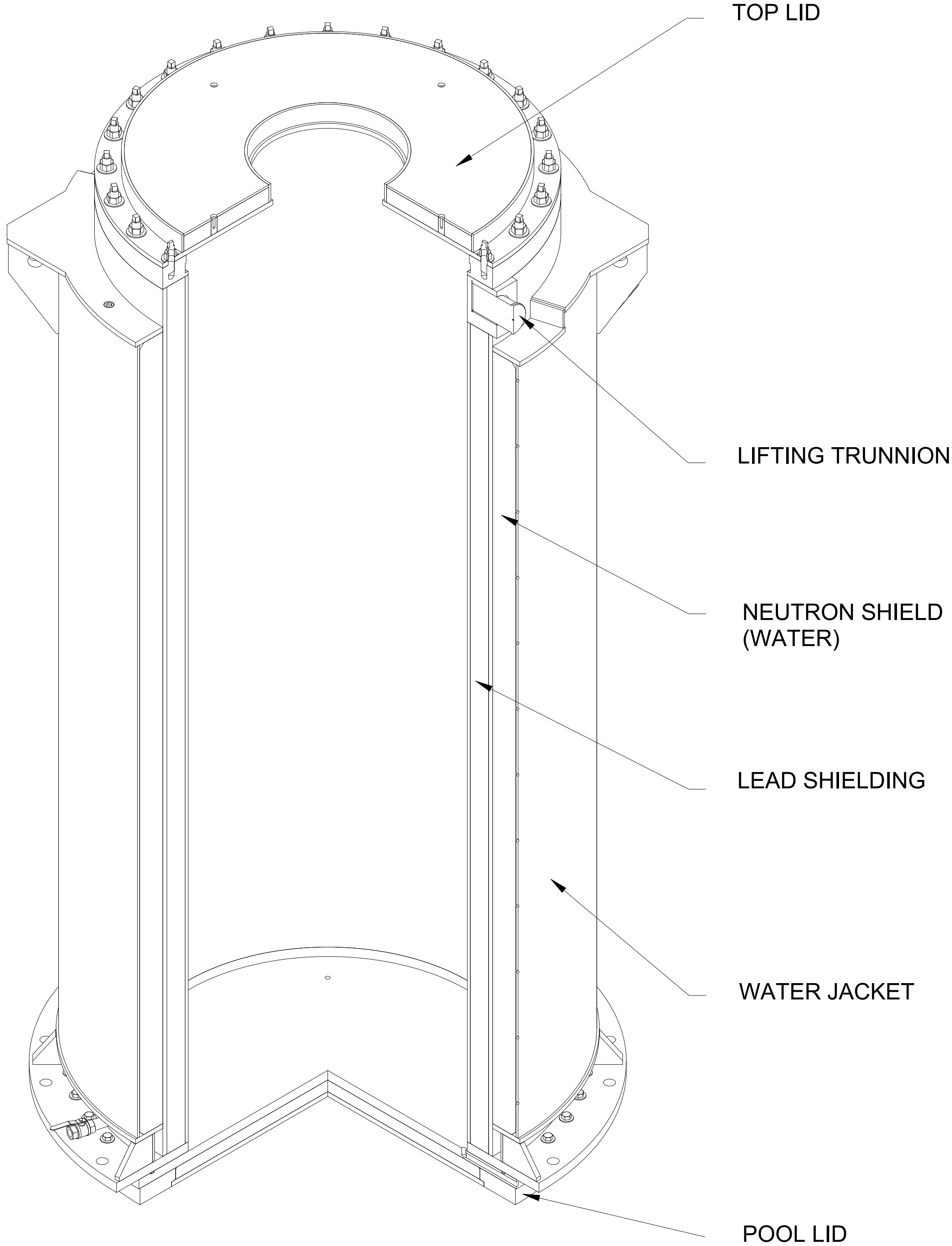


MINIMUM REQUIRED ASSEMBLY DISCHARGE BURNUP
AS A FUNCTION OF INITIAL ENRICHMENT
FOR A 2X2 ARRAY STORAGE CONFIGURATION

FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 9.1-2B
BURNUP VS. ENRICHMENT
(2 X 2 ARRAY)

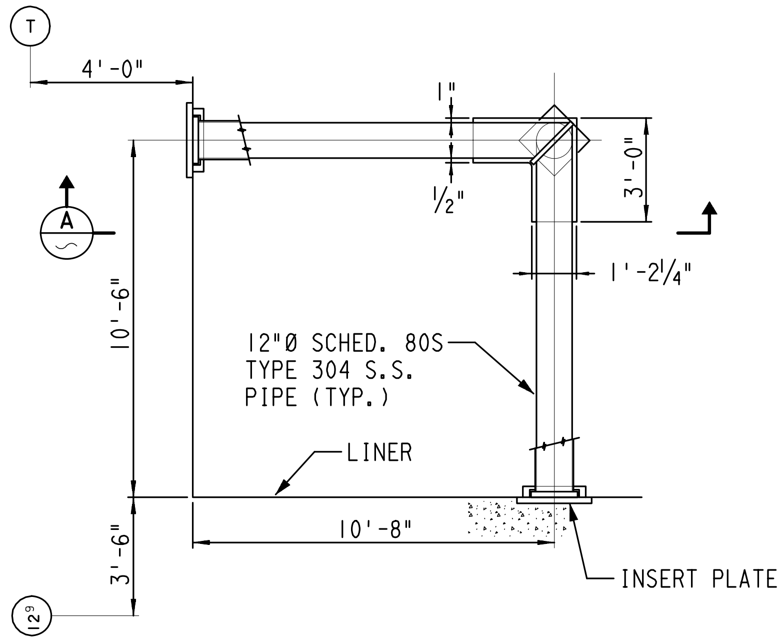


FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

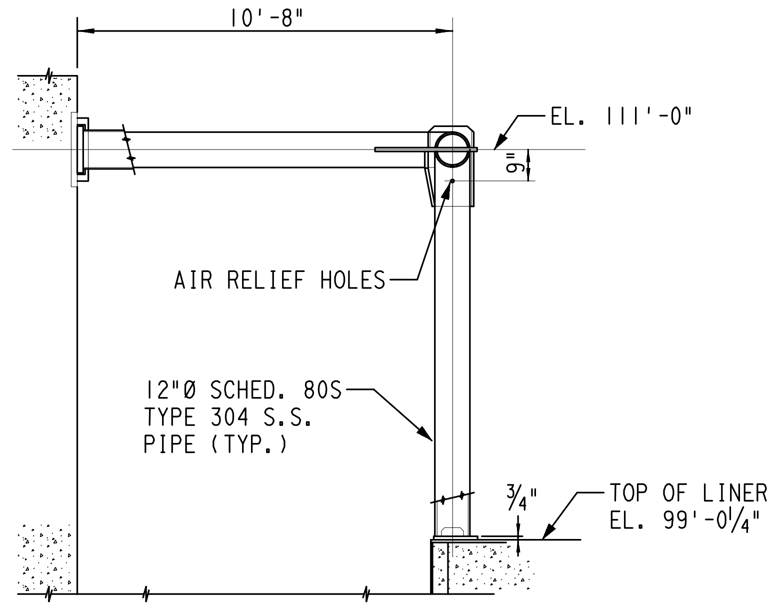
FIGURE 9.1-4
HI-TRAC 125D TRANSFER CASK

Revision 19 May 2010



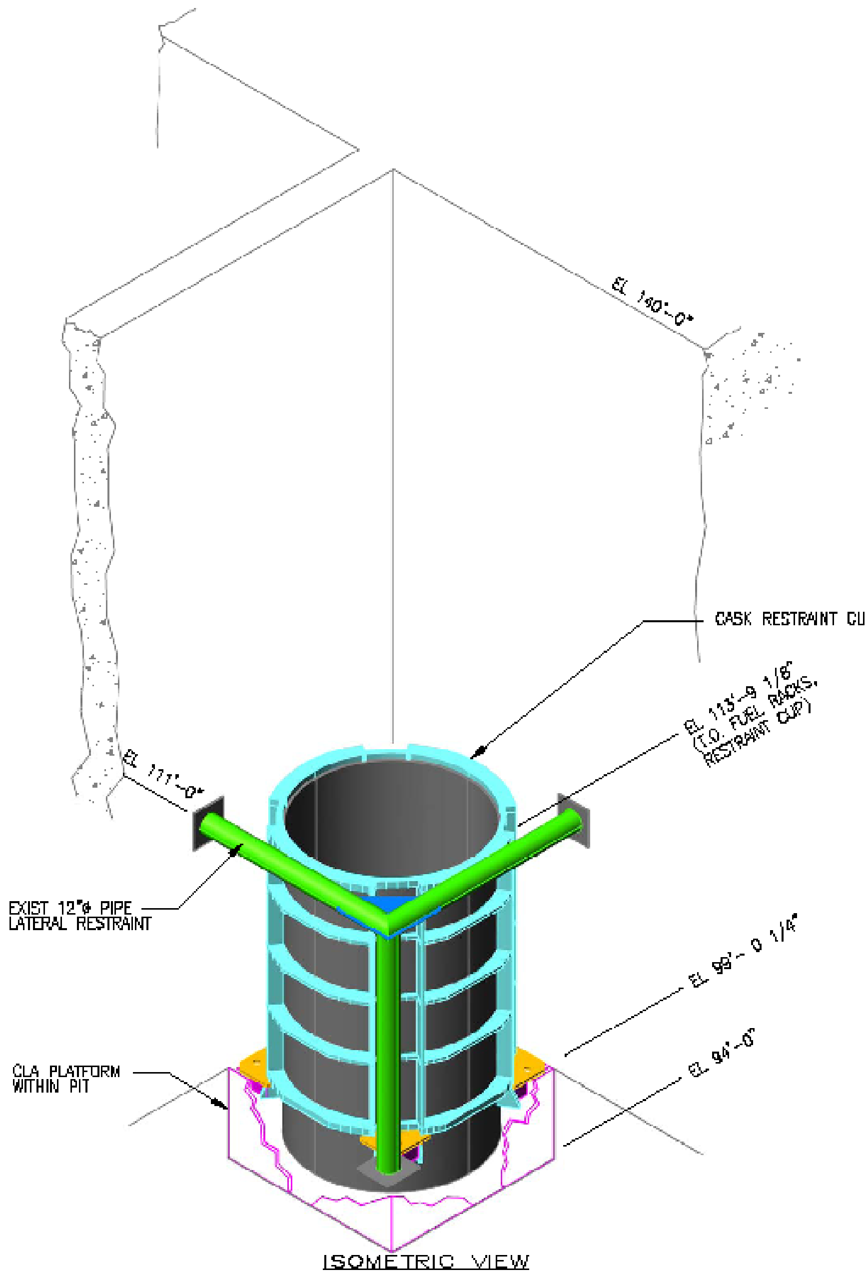
PLAN - SPENT FUEL CASK RESTRAINT

NOTE:
THIS FIGURE IS FOR UNIT 1
COLUMN LINES FOR UNIT 2 ARE DIFFERENT



SECTION A

FSAR UPDATE
UNITS 1 AND 2 DIABLO CANYON SITE
FIGURE 9.1-5 SPENT FUEL CASK RESTRAINT SPENT FUEL POOL



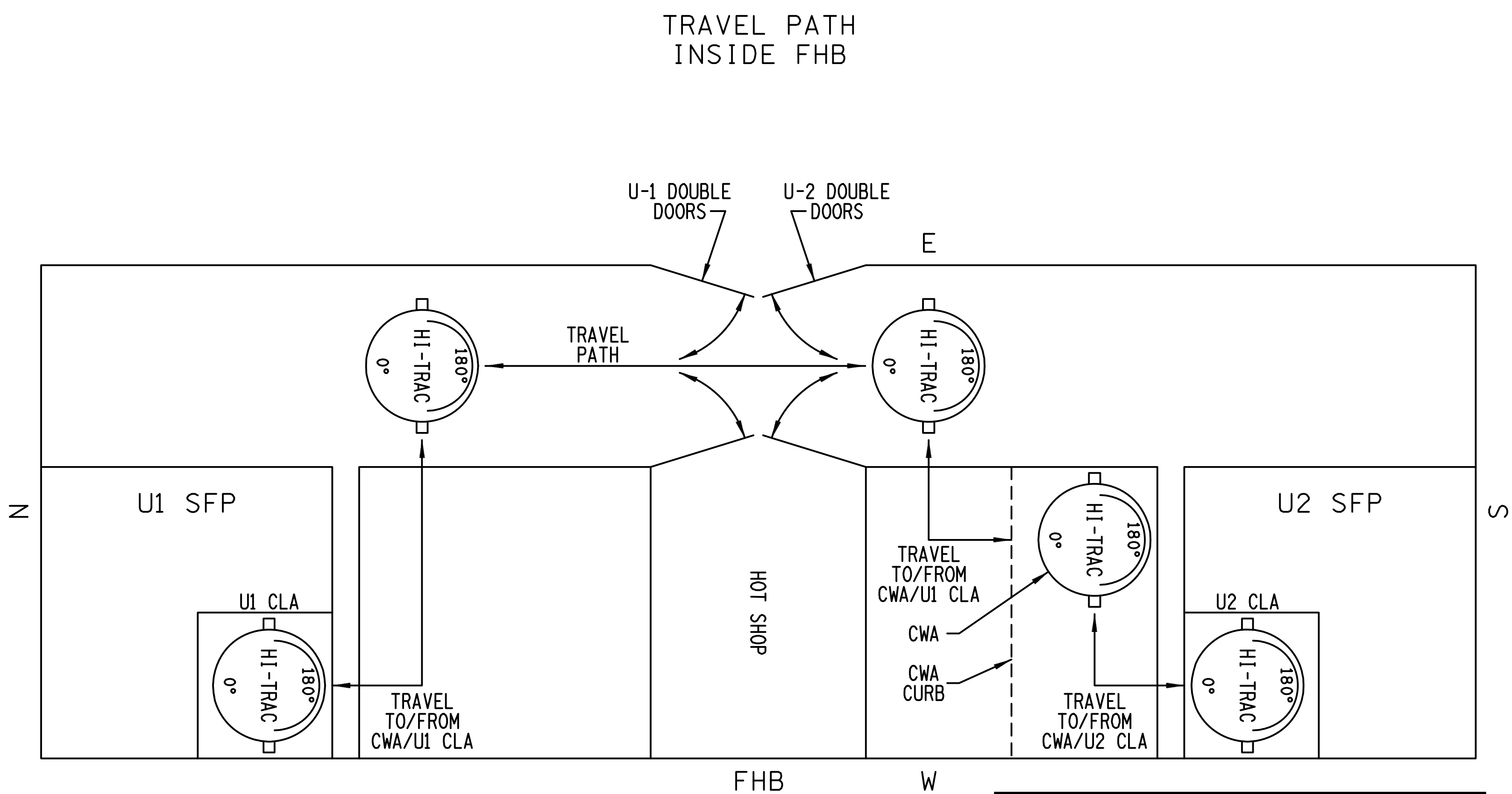
Dimensions and elevations are estimates

FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 9.1-6
SPENT FUEL POOL TRANSFER CASK RESTRAINT CUP

Revision 19 May 2010

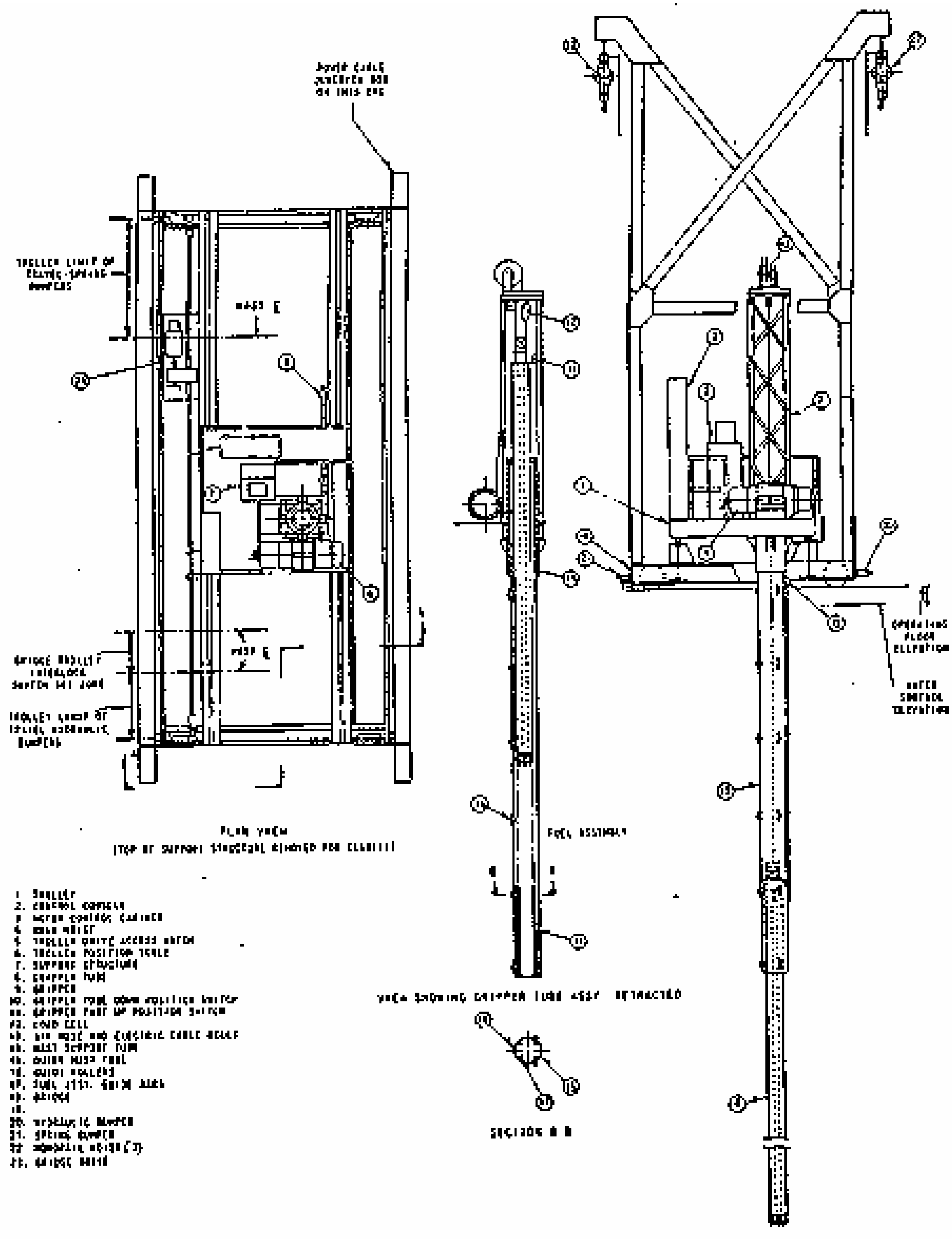


FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 9.1-7
HEAVY LOAD HANDLING PATHS
FOR THE TRANSFER CASK/MPC

Revision 19 May 2010

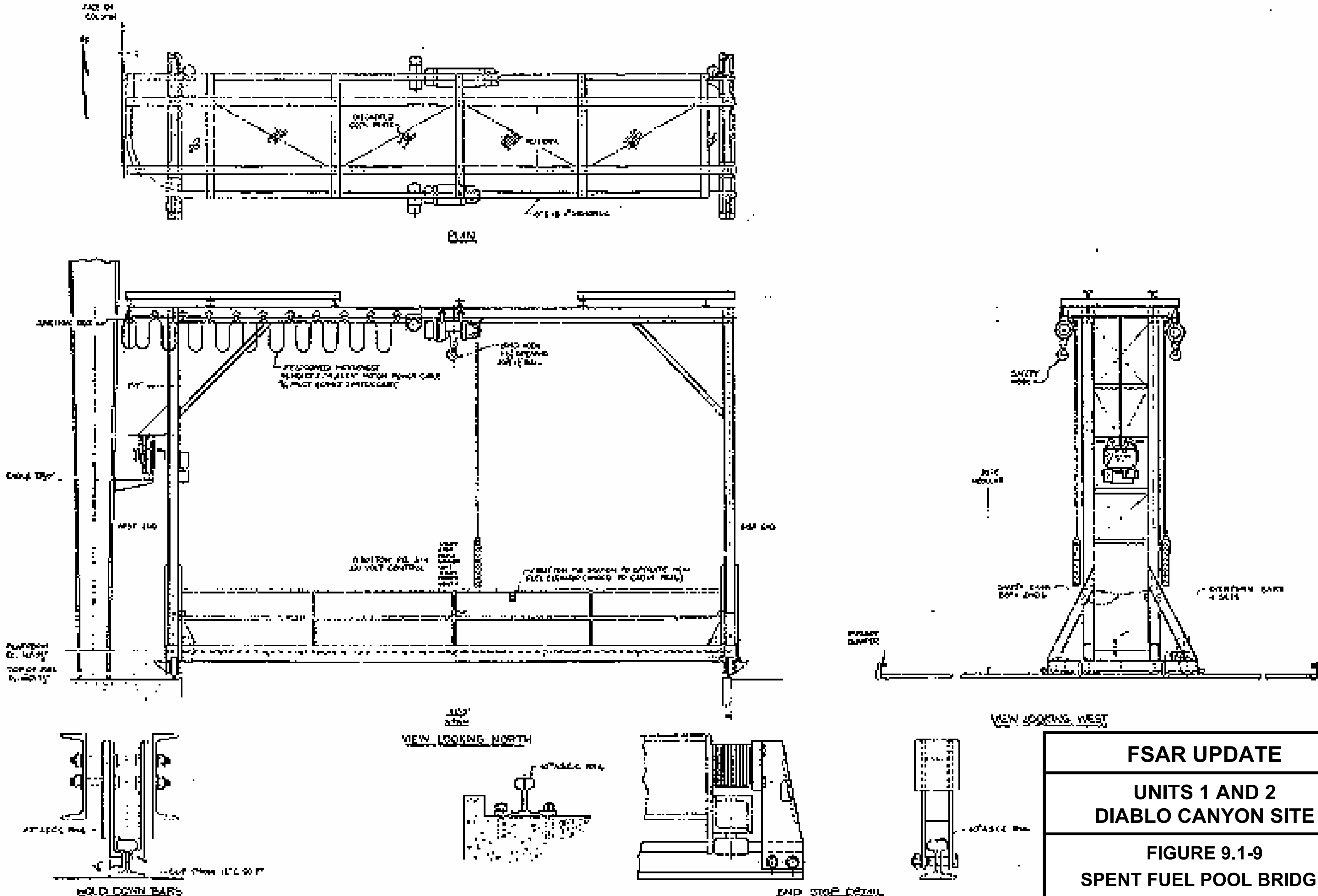


FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 9.1-8

MANIPULATOR CRANE

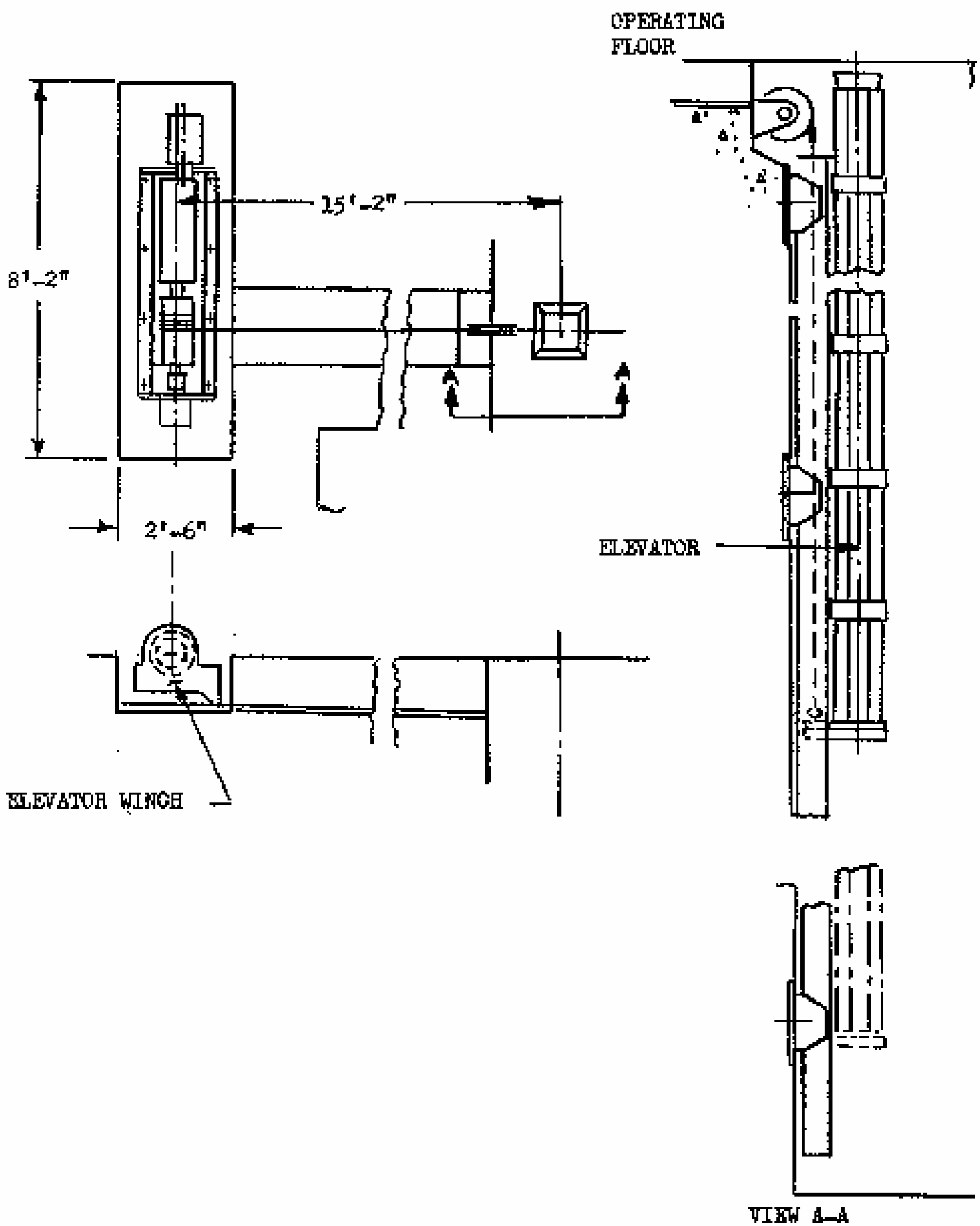


FSAR UPDATE

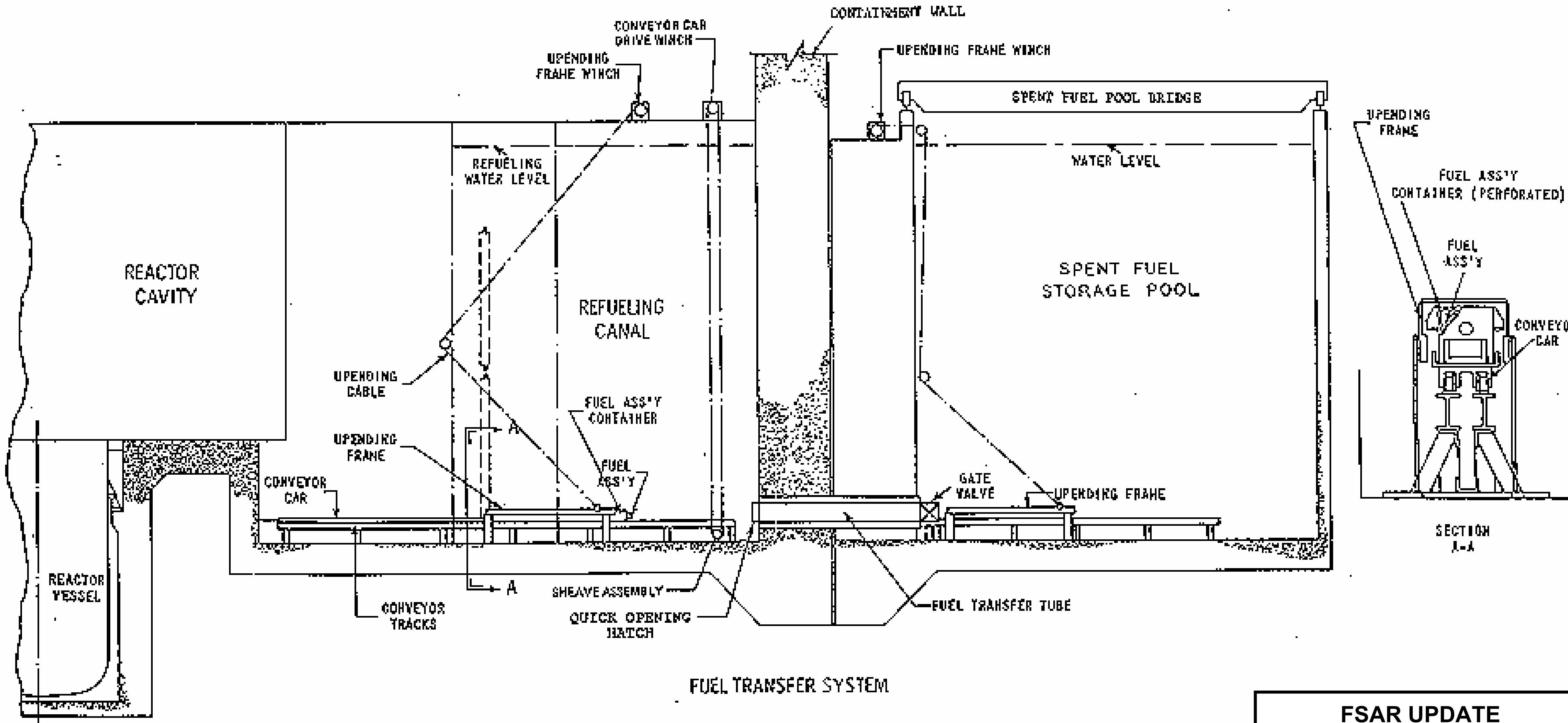
UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 9.1-9
SPENT FUEL POOL BRIDGE

Revision 11 November 1996



FSAR UPDATE
UNITS 1 AND 2 DIABLO CANYON SITE
FIGURE 9.1-10 NEW FUEL ELEVATOR

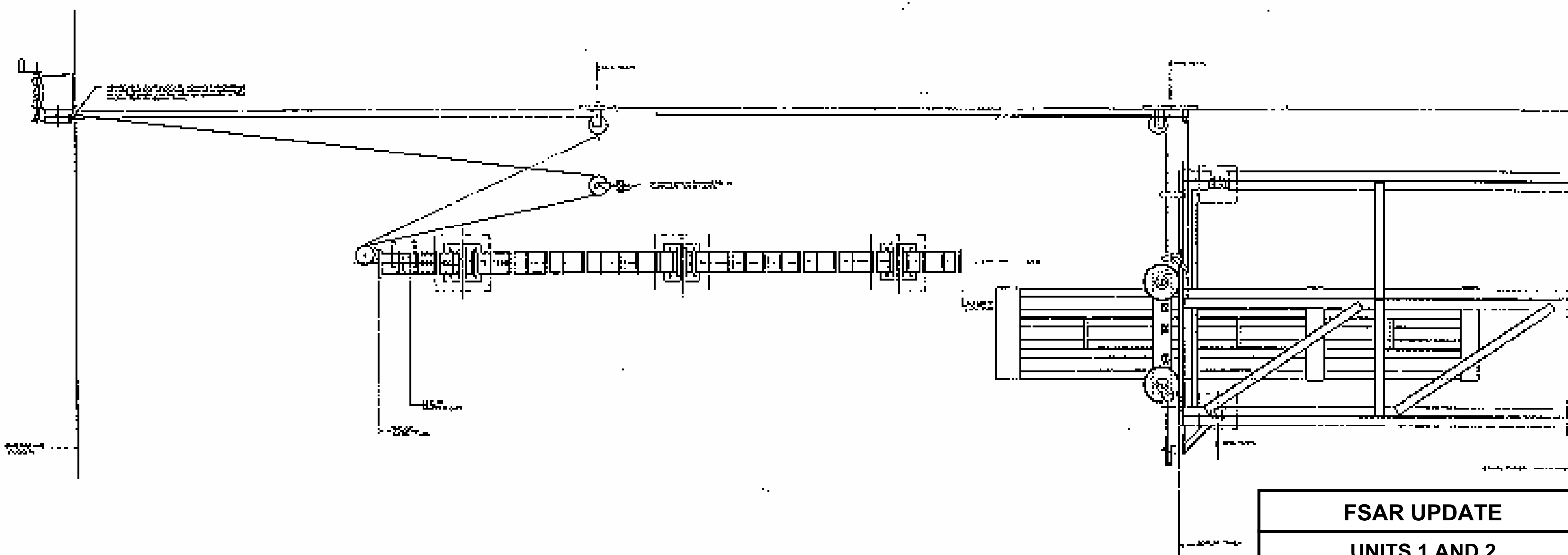


FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 9.1-11
FUEL TRANSFER SYSTEM

Revision 11 November 1996

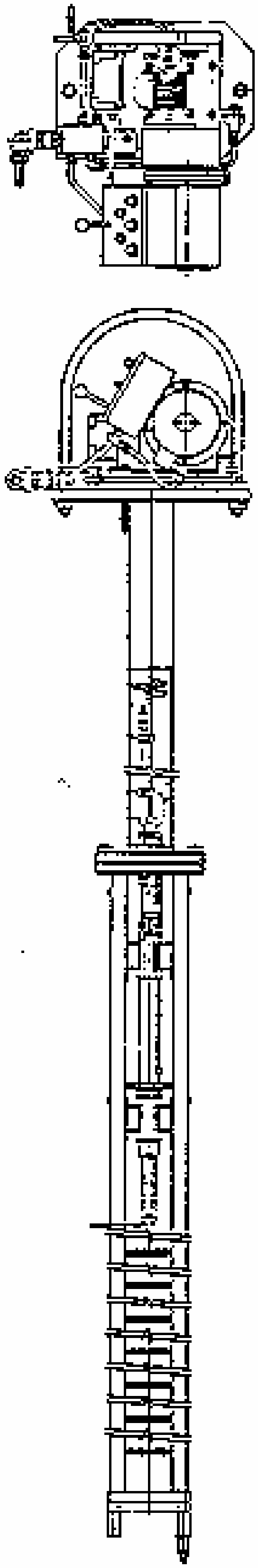


FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 9.1-12
ROD CLUSTER CONTROL
CHANGING FIXTURE

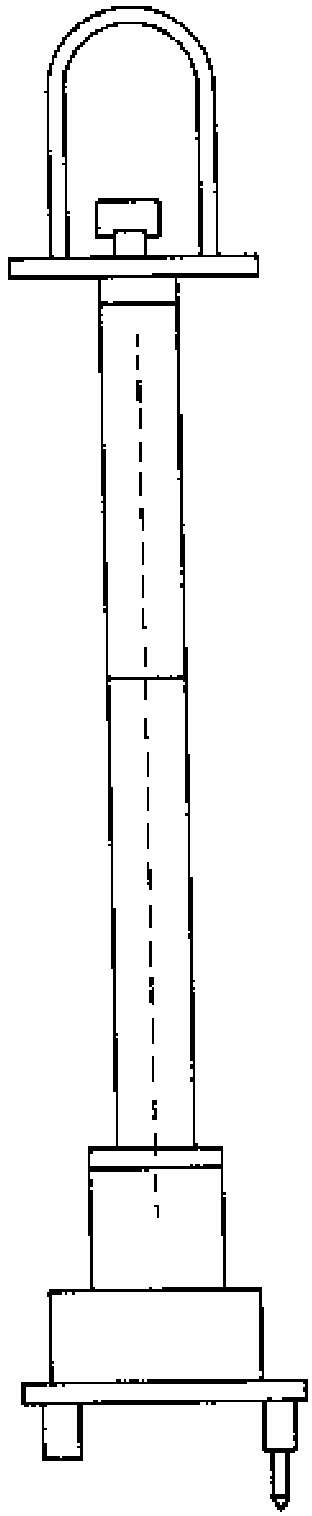
Revision 11 November 1996



FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

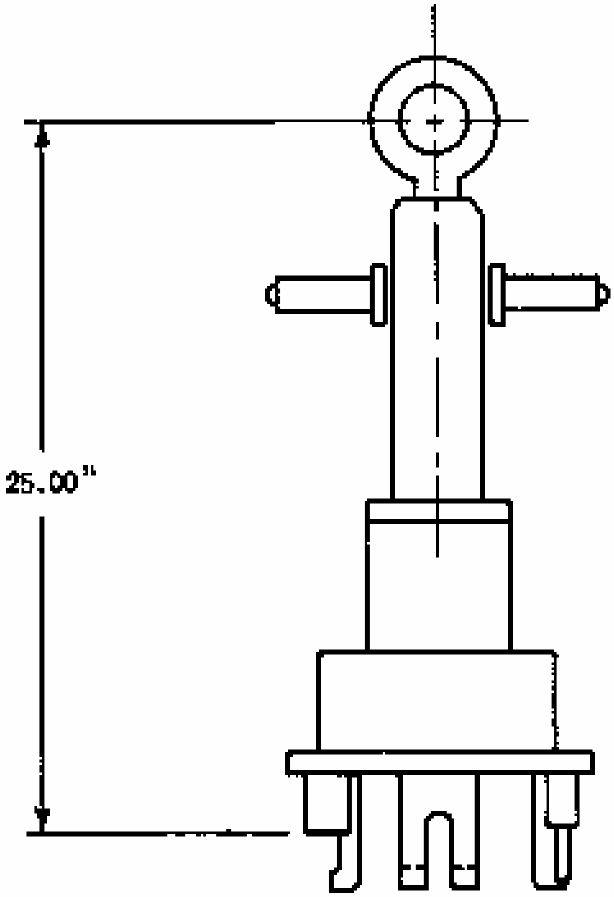
FIGURE 9.1-12a
ROD CLUSTER CONTROL
CHANGING TOOL



FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 9.1-13
SPENT FUEL HANDLING TOOL

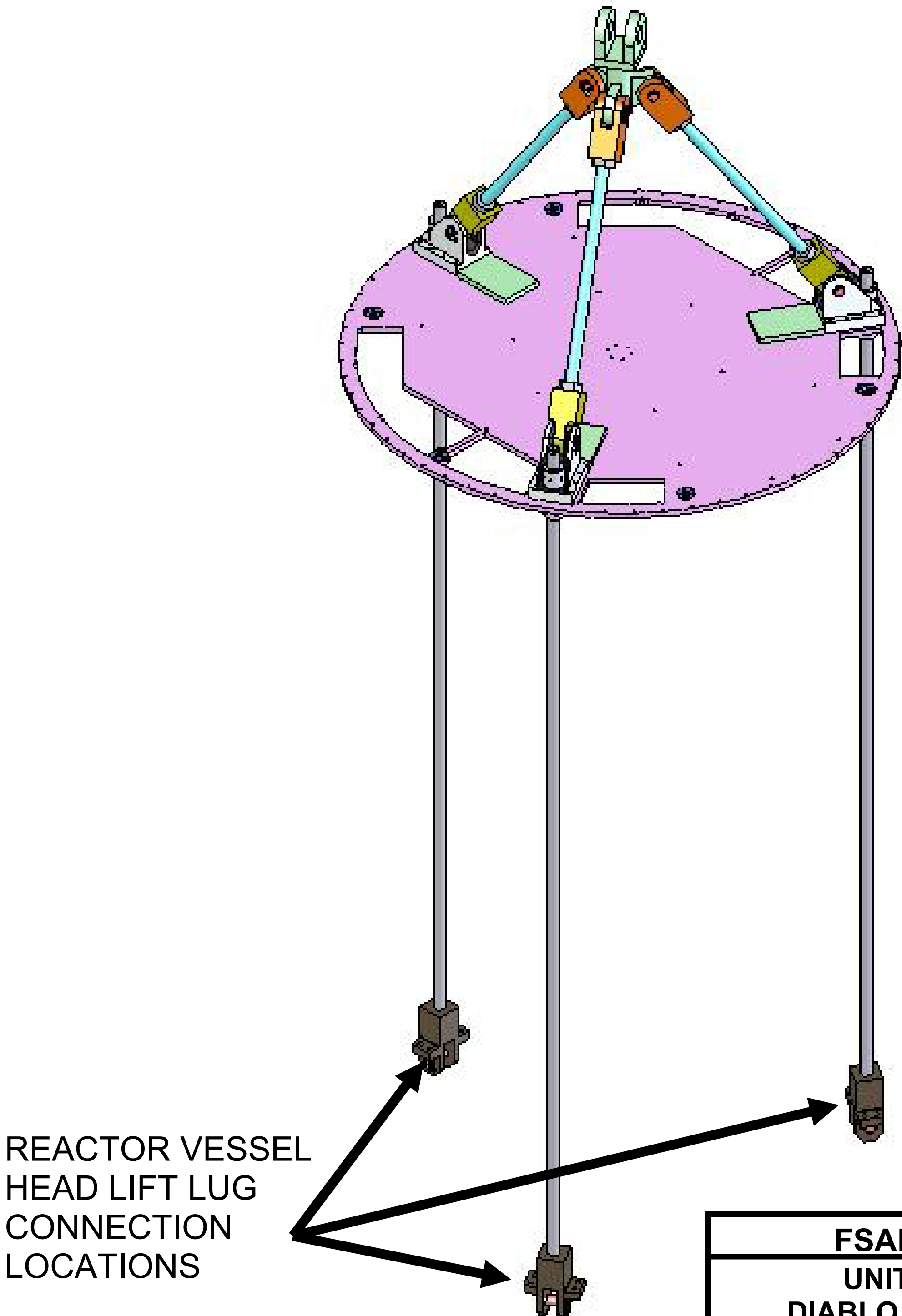


FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 9.1-14

NEW FUEL ASSEMBLY
HANDLING FIXTURE



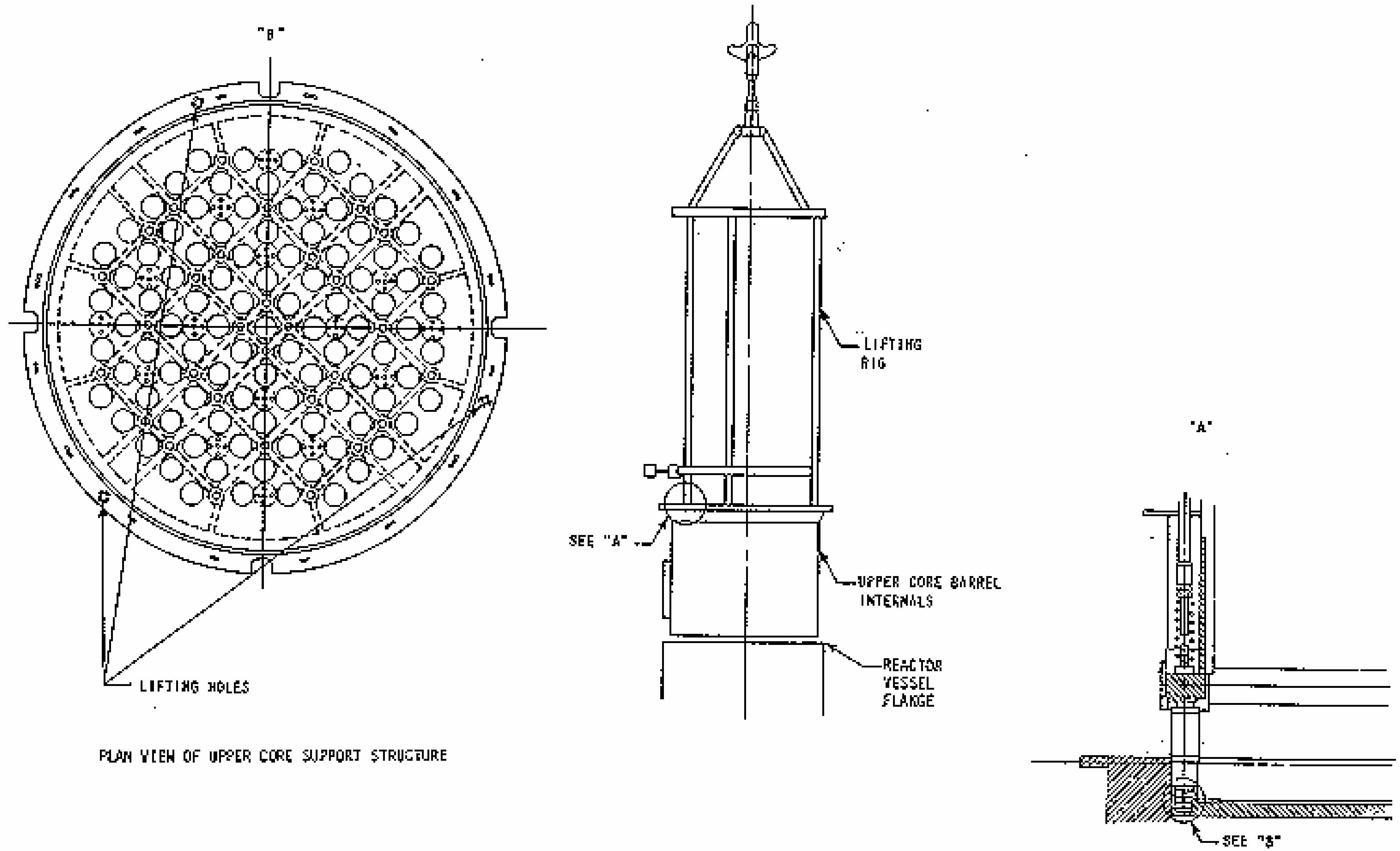
FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 9.1-15

REACTOR VESSEL HEAD
LIFT RIG ASSEMBLY

Revision 20 November 2011

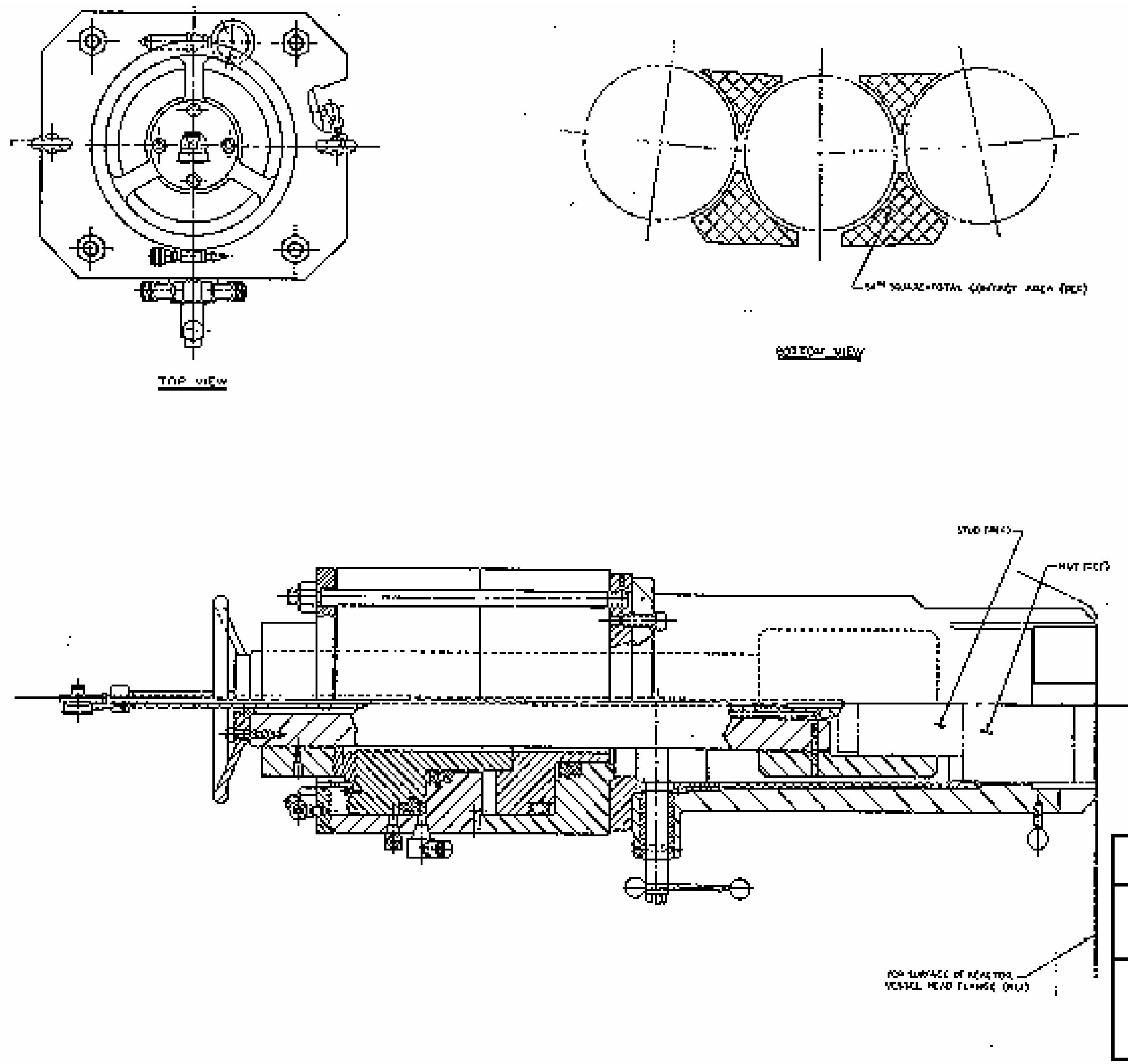


FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 9.1-16
REACTOR INTERNALS LIFTING DEVICE

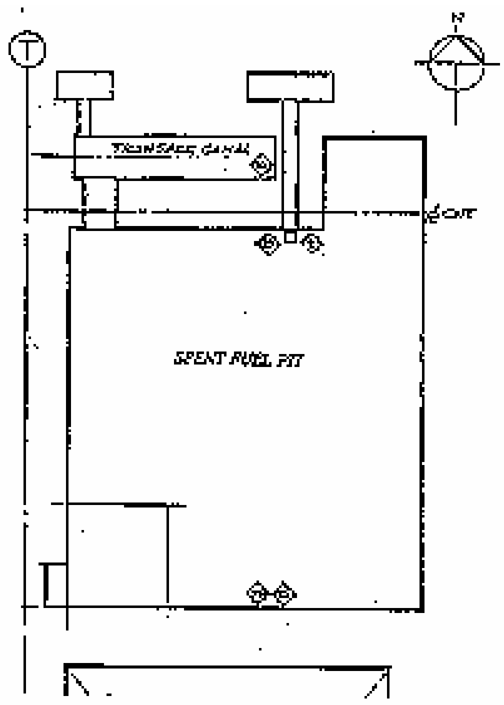
Revision 11 November 1996



FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

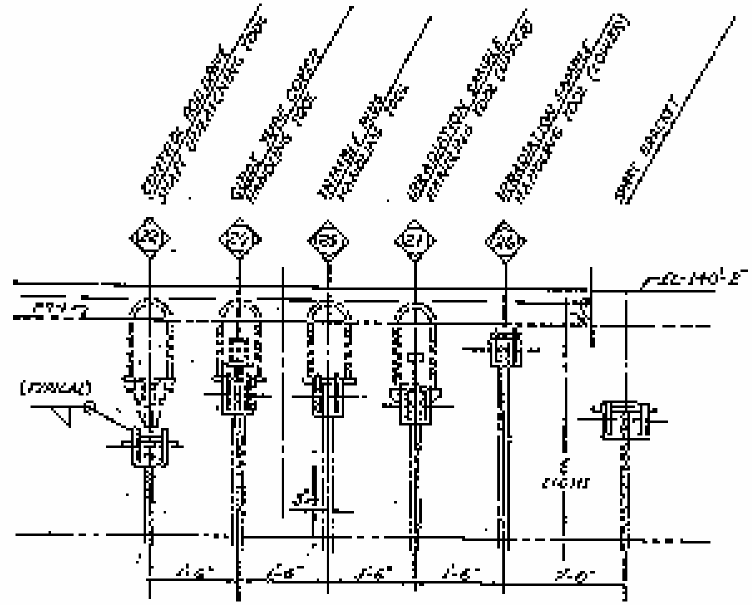
FIGURE 9.1-17
REACTOR VESSEL
STUD TENSIONER



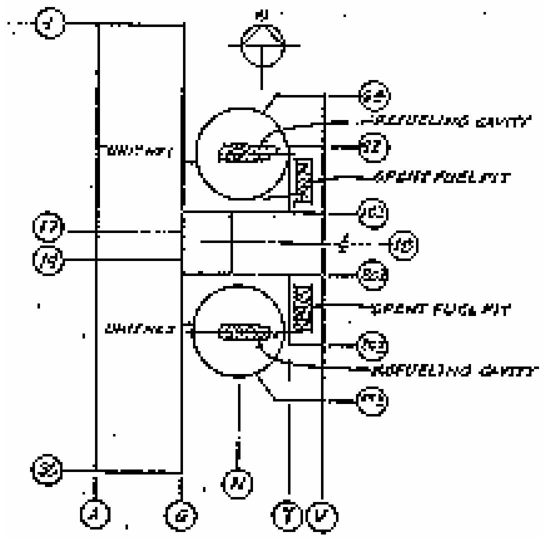
TOOL LOCATION PLAN
FUEL HANDLING BLDG.
UNIT No. 1 SHOWN / UNIT No. 2 OPPOSITE HAND

No.	NAME	LENGTH	WEIGHT
[illegible]	IRRADIATION SAMPLE/RIPPER	21'-10"±	110 LBS
[illegible]	CONT. ROD D.S. UNLATCHING	17'-5"±	280 LBS
	TOOL DELETED		
[illegible]	GUIDE TUBE COVER	28'-6"±	165 LBS
[illegible]	THIMBLE PLUG	30'-9 5/8"±	250 LBS
[illegible]	IRRADIATION SAMPLE/LOWER	21'-8"±	120 LBS
[illegible]	CROSS STORAGE RACK LATCHING	16'-6"	10 LBS
[illegible]	17x17 SPENT FUEL ASSEMBLY	50'-4"	388 LBS
[illegible]	BURNABLE POISON ROD	35'-5 3/4"	602 LBS.
[illegible]	CROSS STOR-RACK TOP		135 LBS
[illegible]	CROSS STOR-RACK BOTTOM		
[illegible]	GUIDE PIN SUPPORT TOP	19'-6"±	1800 LBS
[illegible]	GUIDE PIN SUPPORT BOTTOM		
[illegible]	NEW FUEL ASSEMBLY	2'-0"±	25 LBS
[illegible]	NEW ROD CLEANING FIXTURE	33'-1"±	1045 LBS
[illegible]	STUD HOLE PLUG	4'-0"±	
[illegible]	THIMBLE PLUG	52'-6"±	356 LBS.

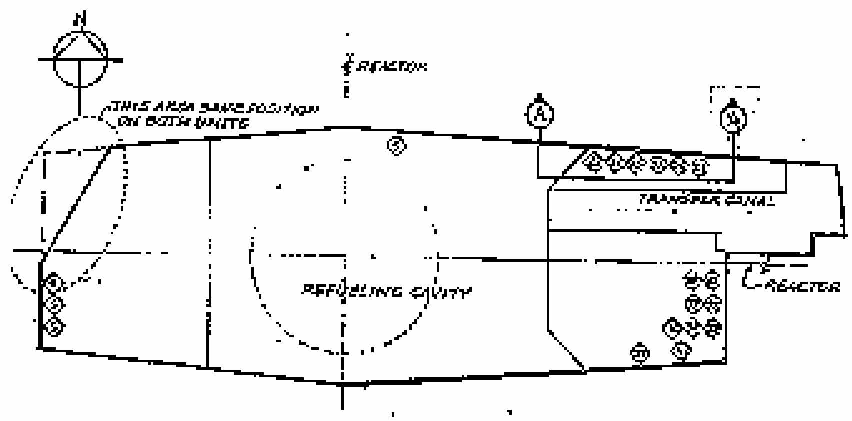
HANDLING TOOL RACK SCHEDULE



HANDLING TOOL - SUPPORT RACKS
SECTION A - A



KEY PLAN



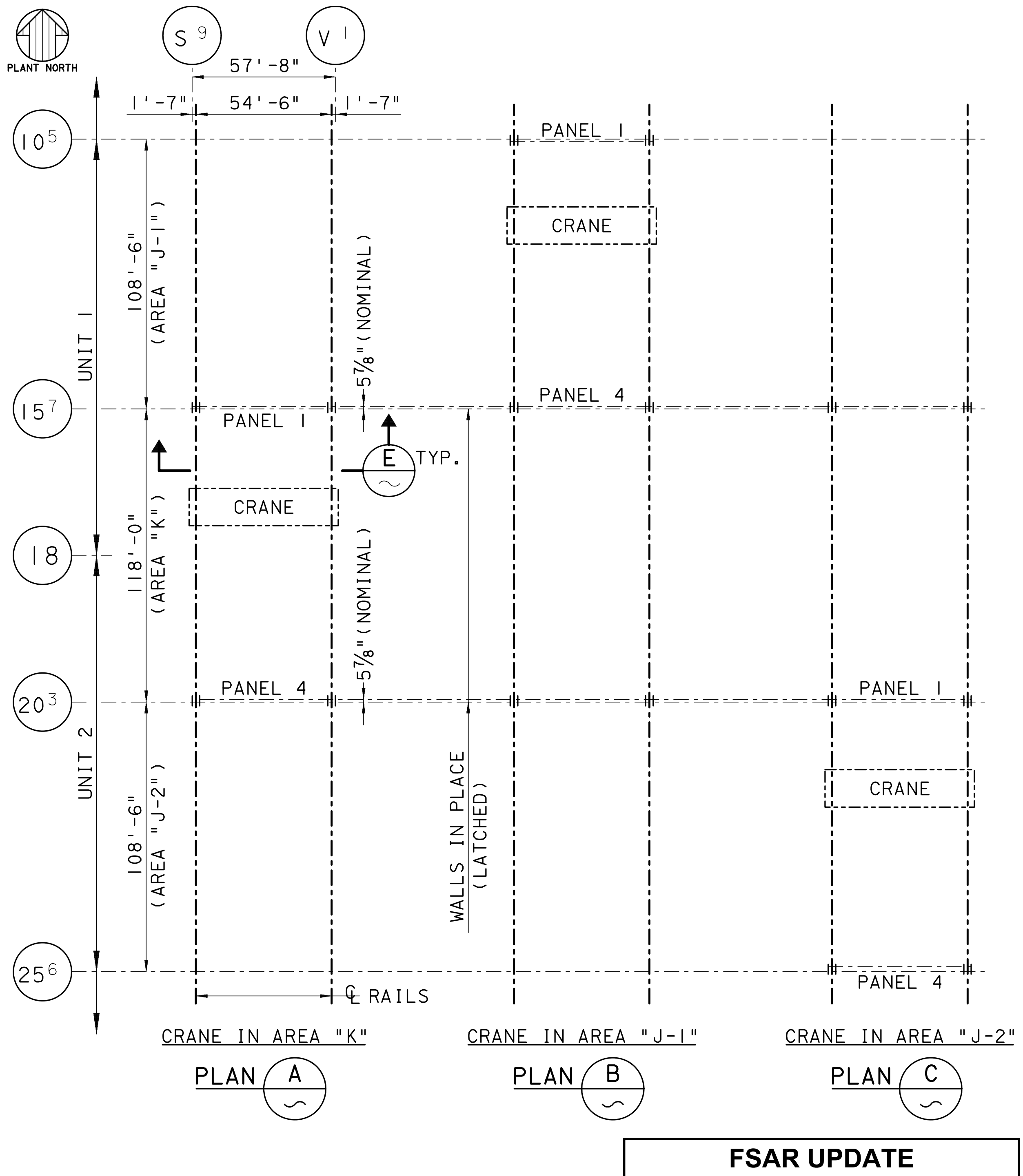
TOOL LOCATION PLAN - CONTAINMENT STRUCTURE
UNIT No. 1 SHOWN / UNIT No. 2 OPPOSITE HAND EXCEPT AS NOTED

FSAR UPDATE

**UNITS 1 AND 2
DIABLO CANYON SITE**

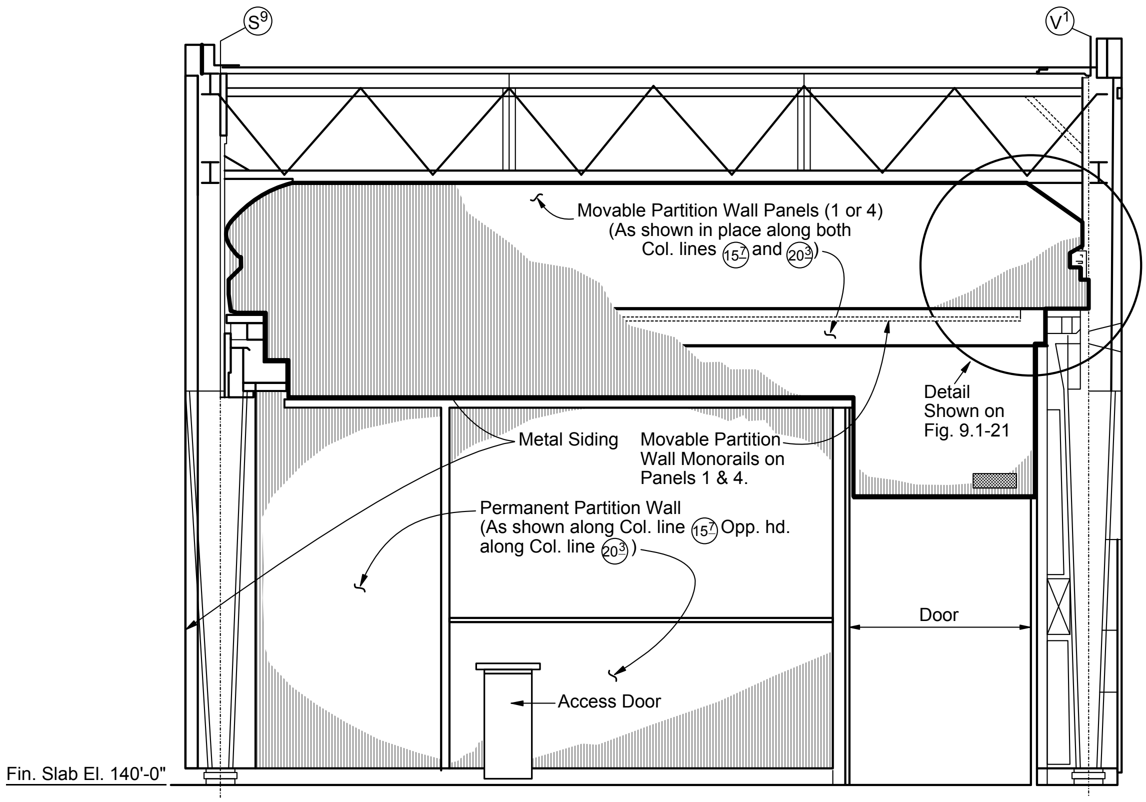
**FIGURE 9.1-18
FUEL HANDLING
TOOL LOCATIONS**

Revision 11 November 1996



FSAR UPDATE
UNITS 1 AND 2 DIABLO CANYON SITE
FIGURE 9.1-19 MOVEABLE PARTITION WALLS LOCATION PLANS

Revision 19 May 2010

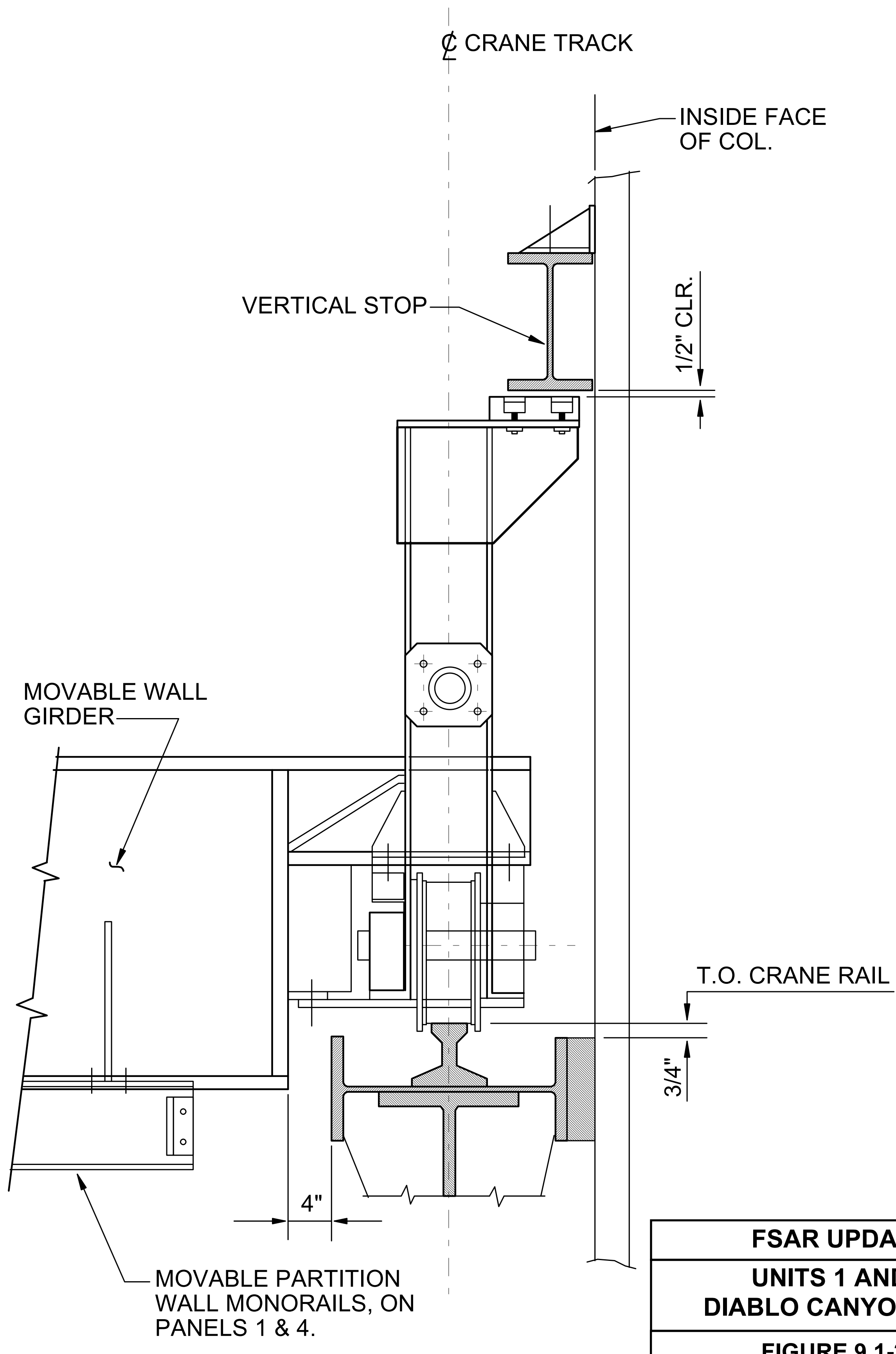


FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 9.1-20
MOVEABLE PARTITION WALLS
ELEVATION AT COLUMN
LINE 15-7 OR 20-3

Revision 19 May 2010

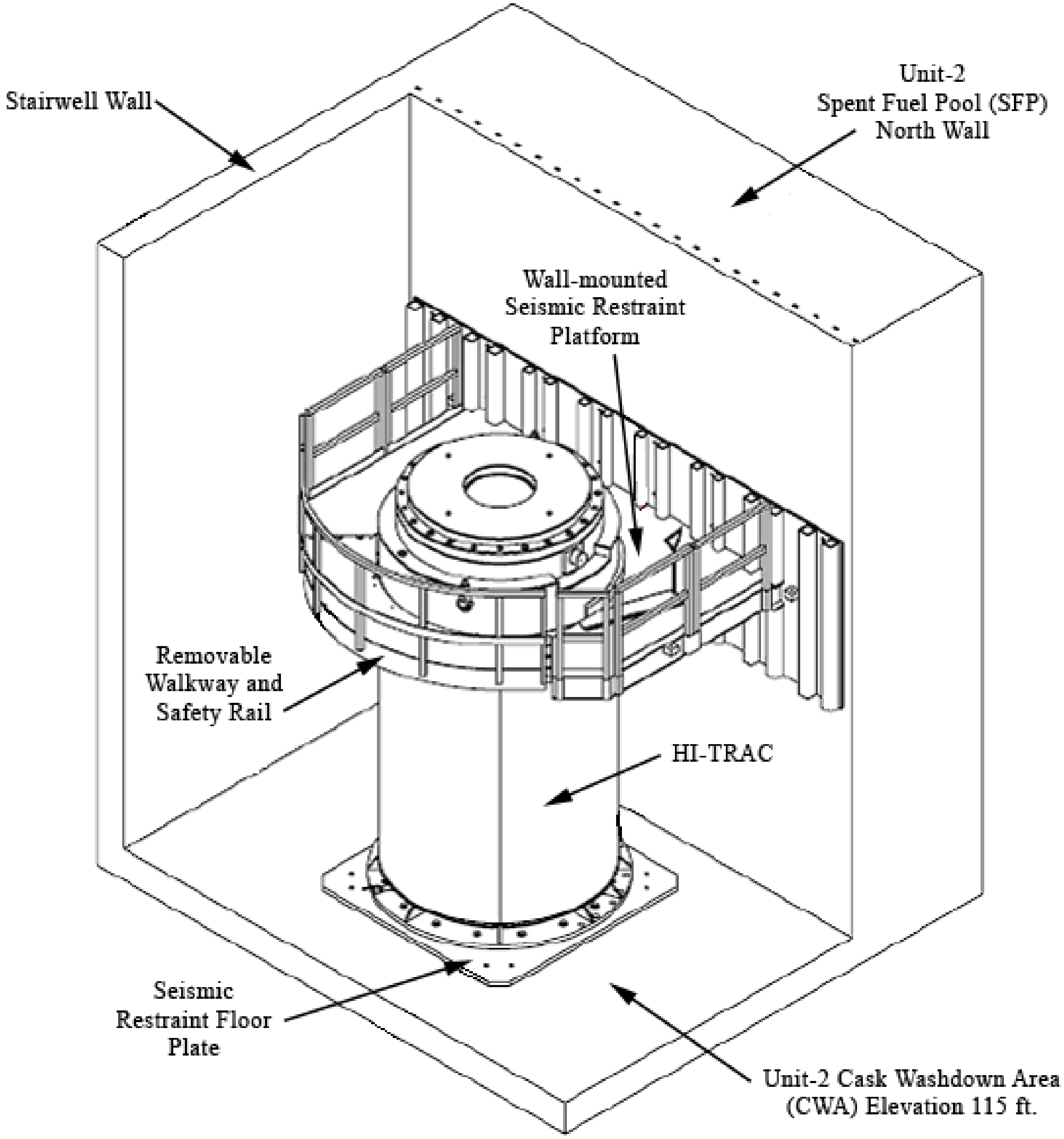


FSAR UPDATE

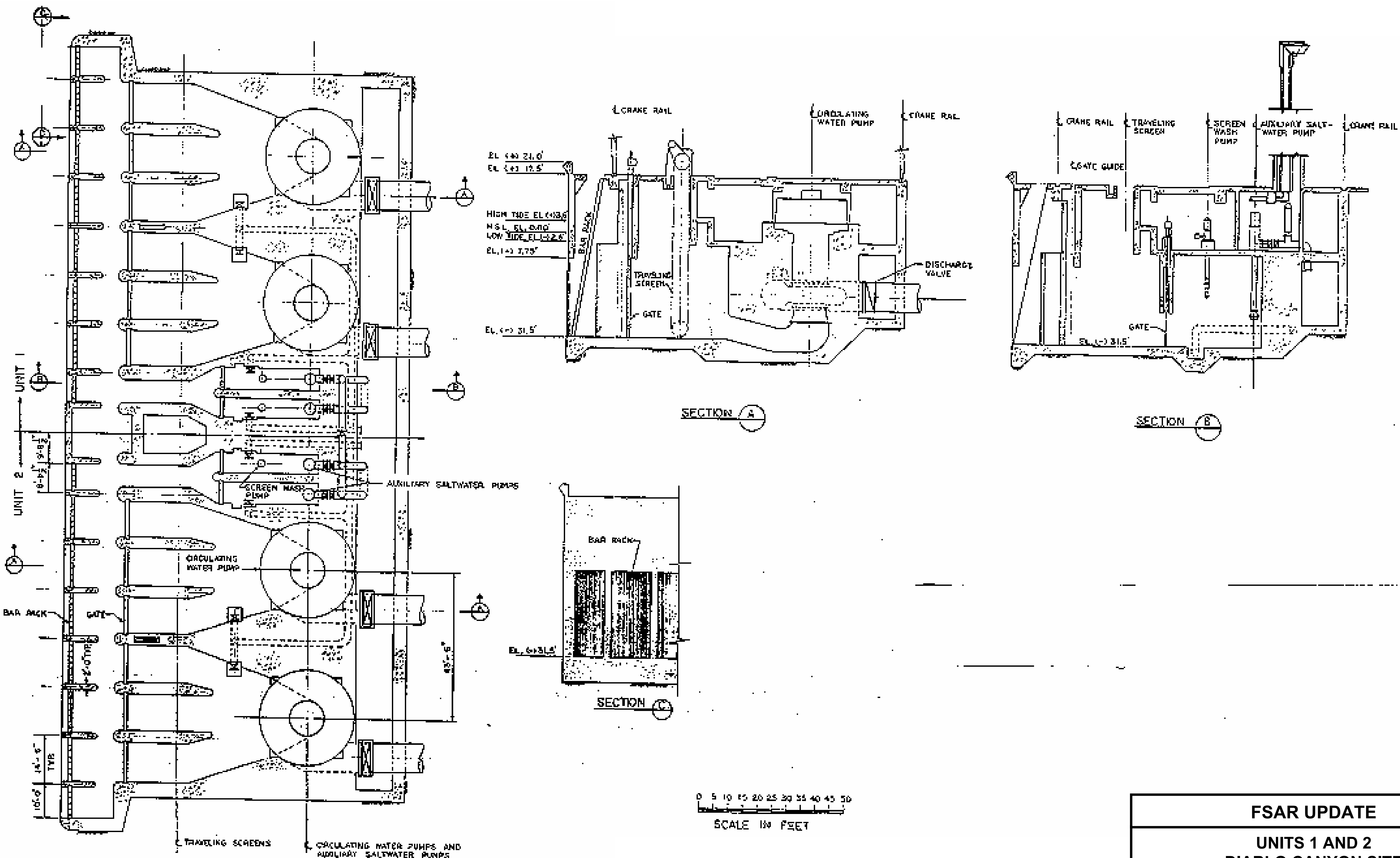
UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 9.1-21
MOVEABLE PARTITION WALLS
DETAILS SHOWING WALL,
TRACK, AND VERTICAL STOP

Revision 19 May 2010



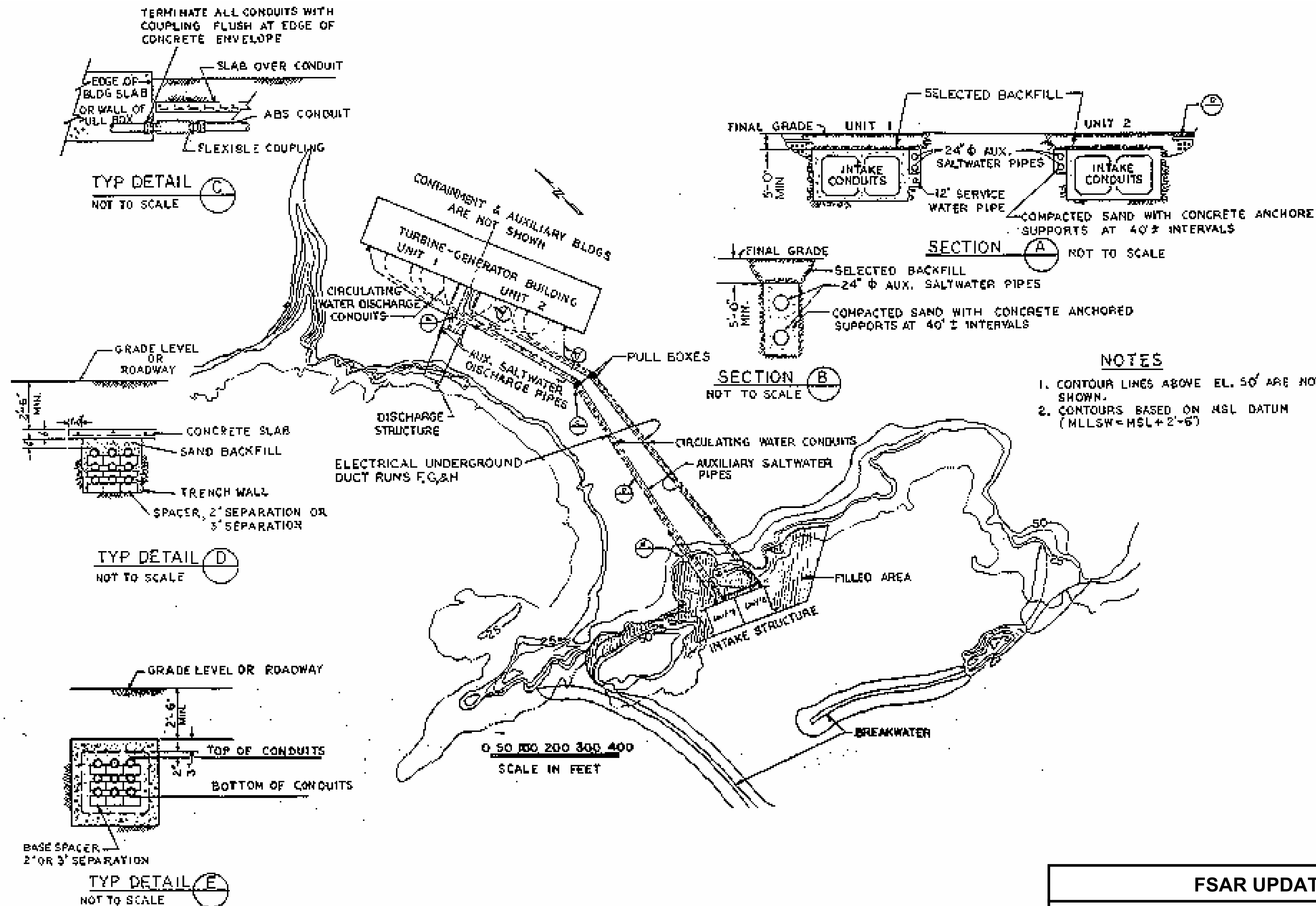
FSAR UPDATE
UNIT 2 DIABLO CANYON SITE
FIGURE 9.1-24 CASK WASHDOWN AREA RESTRAINT



PLAN AT ELEVATION (-) 31.5'

FSAR UPDATE
UNITS 1 AND 2 DIABLO CANYON SITE
FIGURE 9.2-2 ARRANGEMENT OF INTAKE STRUCTURE

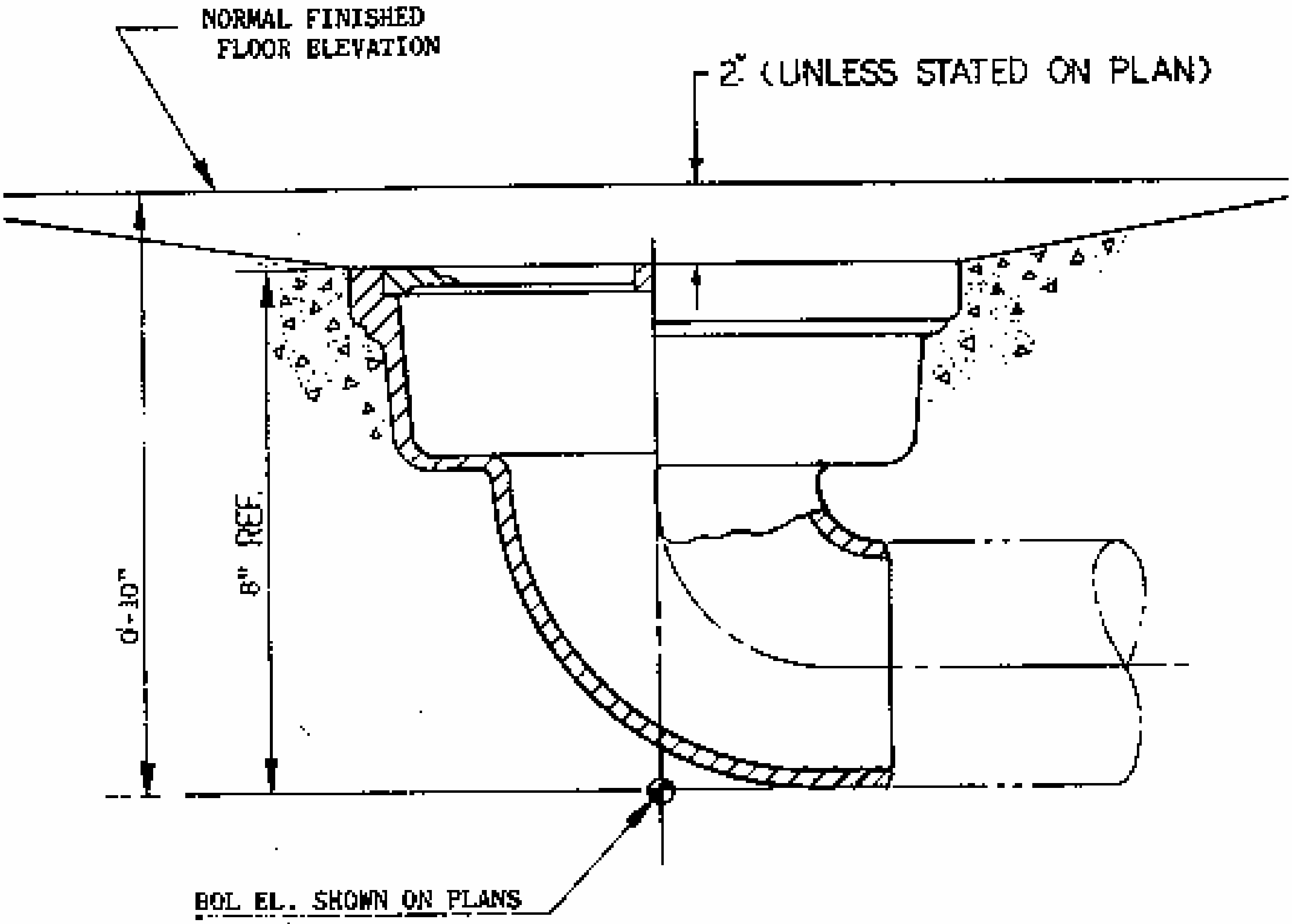
Revision 12 September 1998



FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 9.2-3
ARRANGEMENT OF AUXILIARY SALTWATER SYSTEM PIPING

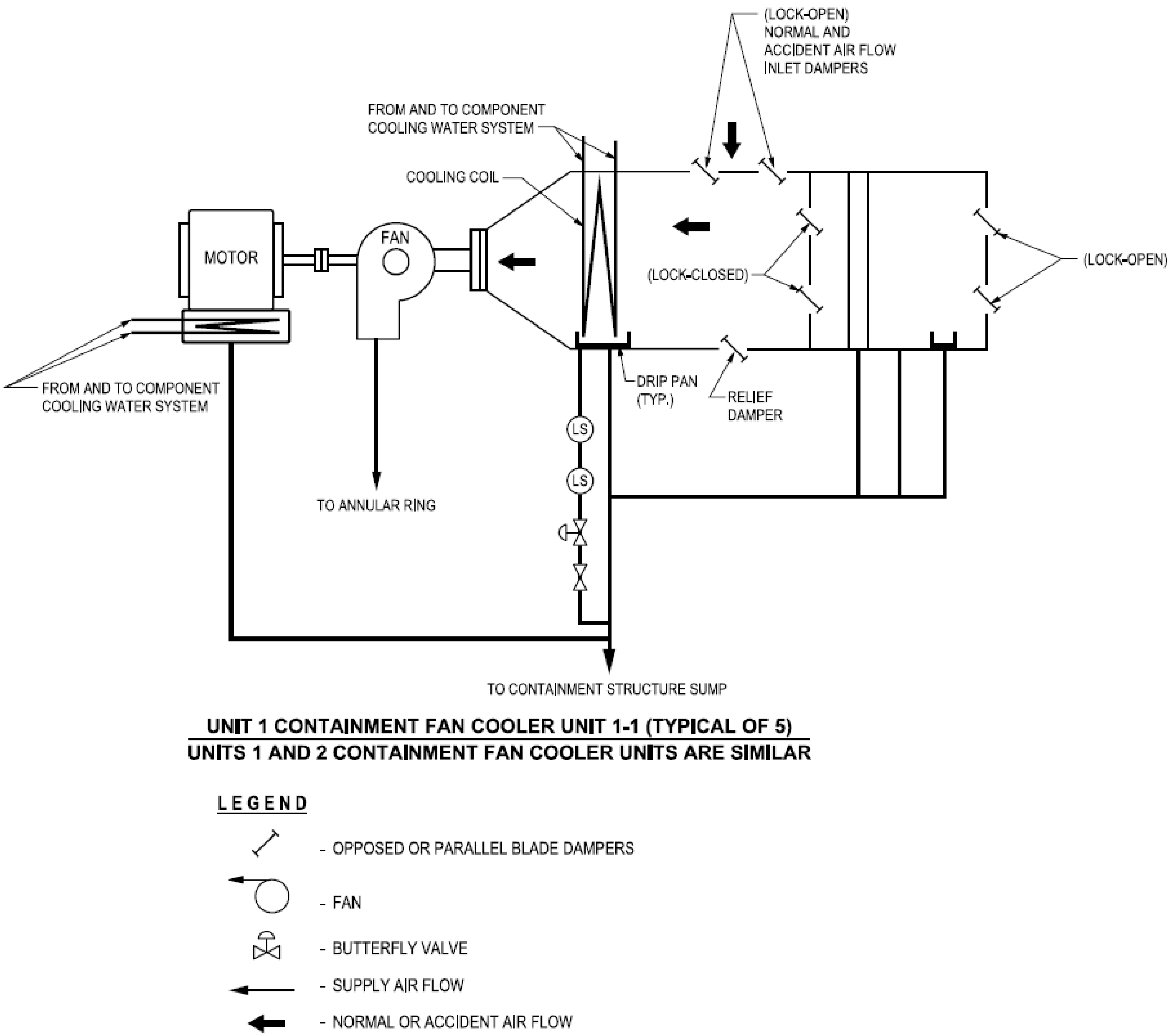


NOTES:

1. Represented by Symbol ⟨U⟩ on Drainage Piping Drawings.
2. It Shall be Furnished with Stainless Steel Grate.
3. Butt-Weld Connection to Match Schedule 10S
4. See Drainage Drawings for Pipe Size, Elevation, Etc.

FSAR UPDATE
UNITS 1 AND 2 DIABLO CANYON SITE
FIGURE 9.3-5 FLOOR DRAIN

Revision 11 November 1996

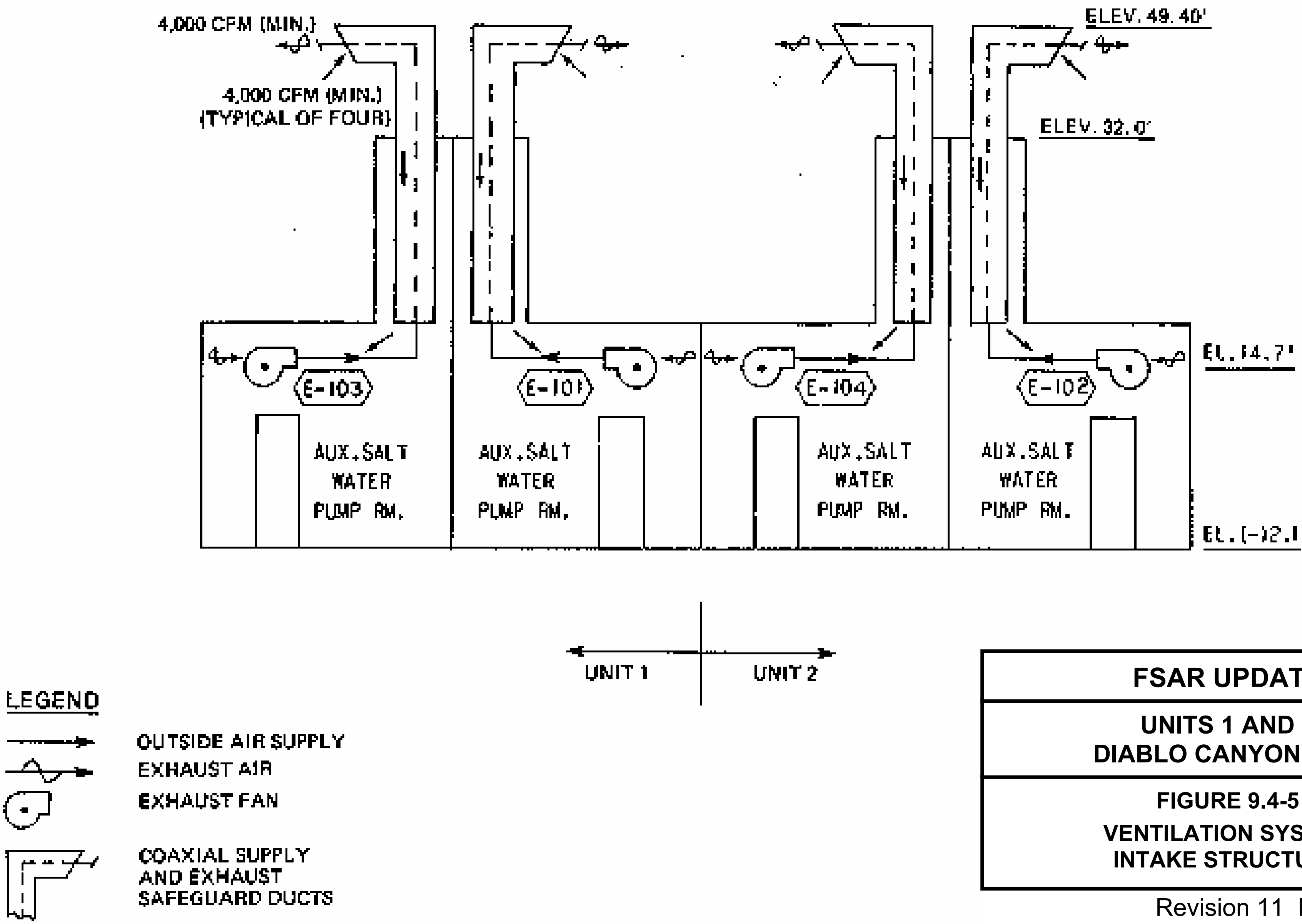


FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

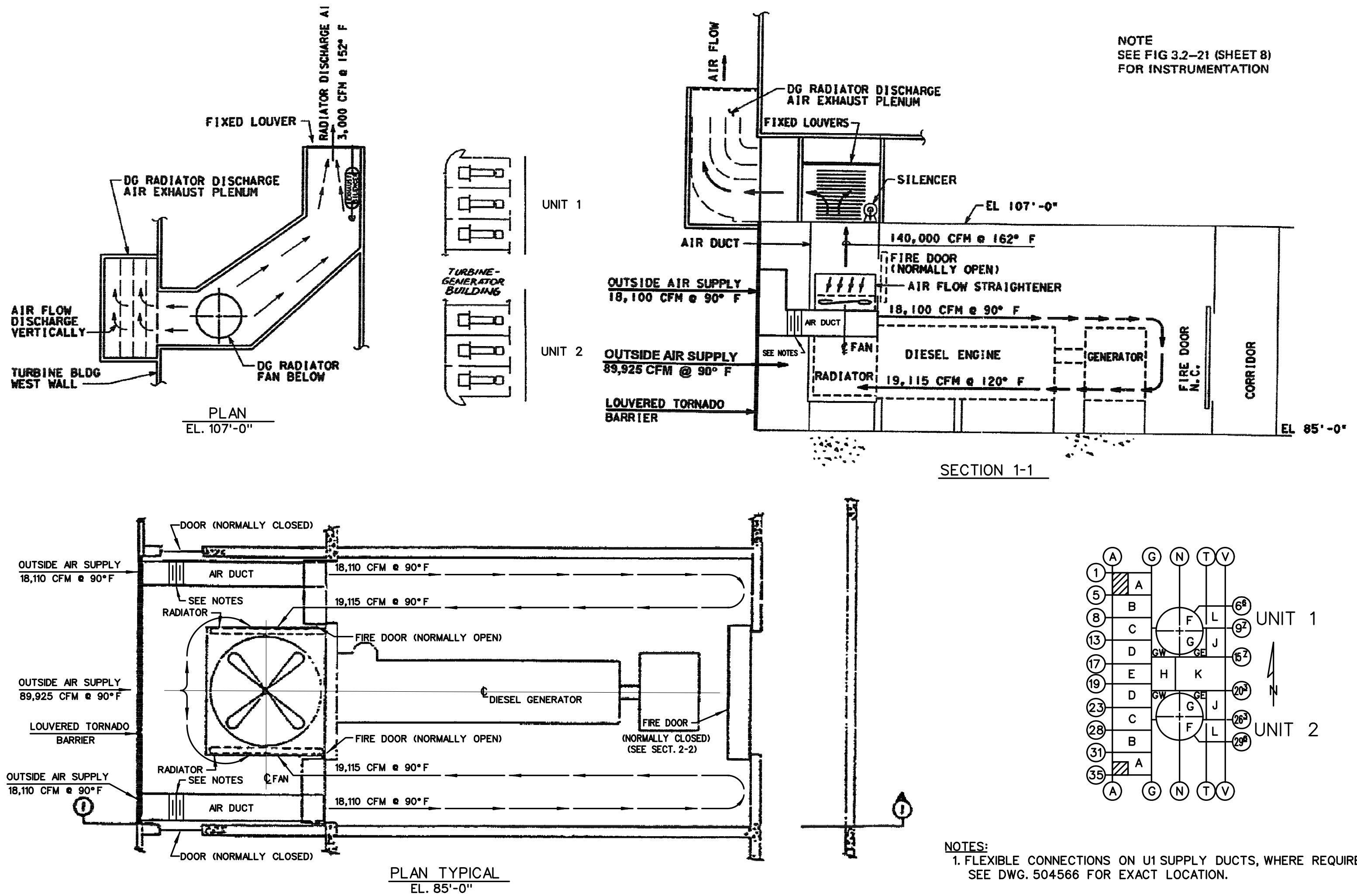
FIGURE 9.4-4

CONTAINMENT FAN COOLER UNIT
CONTAINMENT STRUCTURE



FSAR UPDATE
UNITS 1 AND 2 DIABLO CANYON SITE
FIGURE 9.4-5 VENTILATION SYSTEM INTAKE STRUCTURE

Revision 11 November 1996

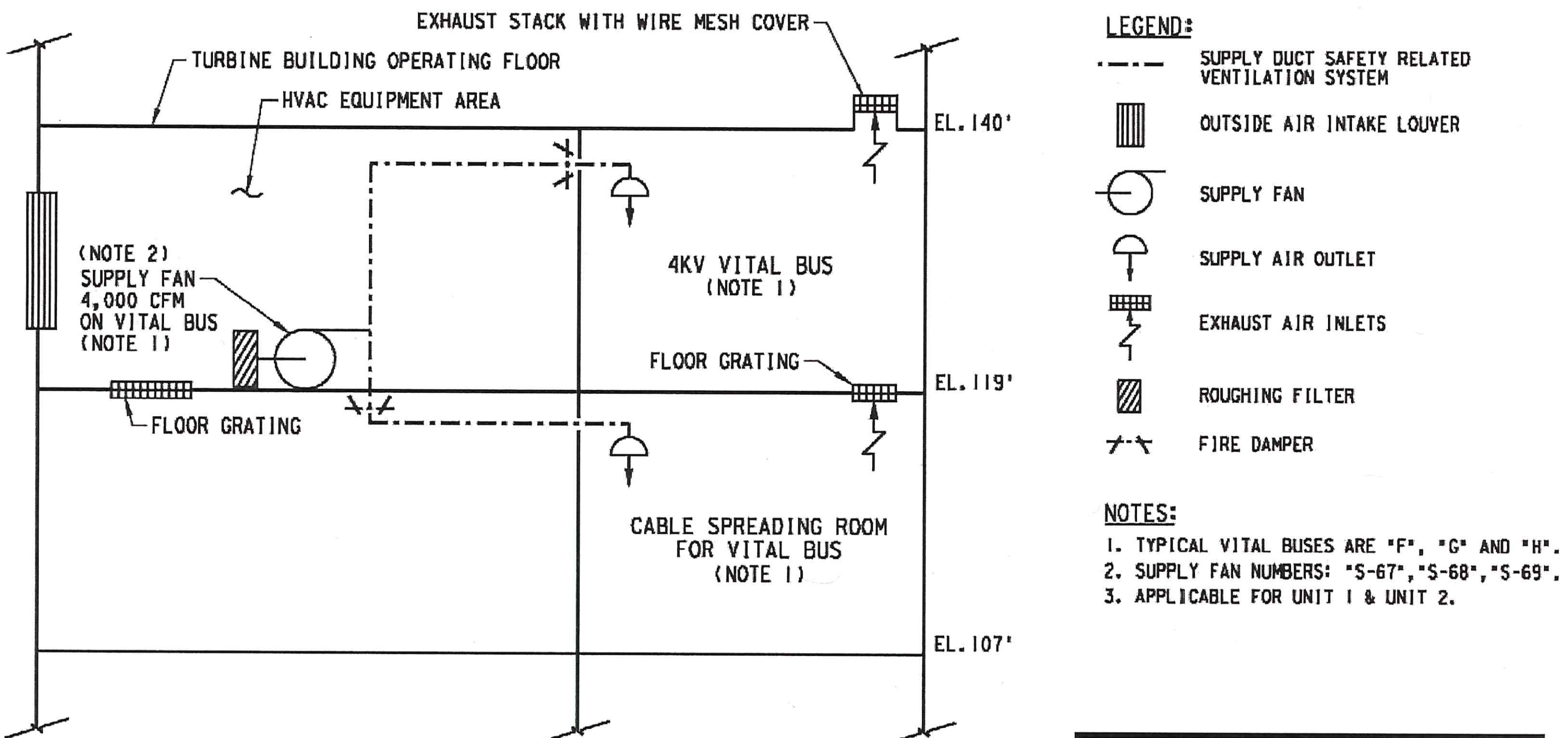


NOTES:

1. FLEXIBLE CONNECTIONS ON U1 SUPPLY DUCTS, WHERE REQUIRED. SEE DWG. 504566 FOR EXACT LOCATION.
2. FLEXIBLE CONNECTIONS ON U2 SUPPLY DUCT, WHERE REQUIRED. SEE DWG'S 521777 & 502591 FOR EXACT LOCATION.

FSAR UPDATE
UNITS 1 AND 2 DIABLO CANYON SITE
FIGURE 9.4-6 VENTILATION SYSTEM DIESEL GENERATION

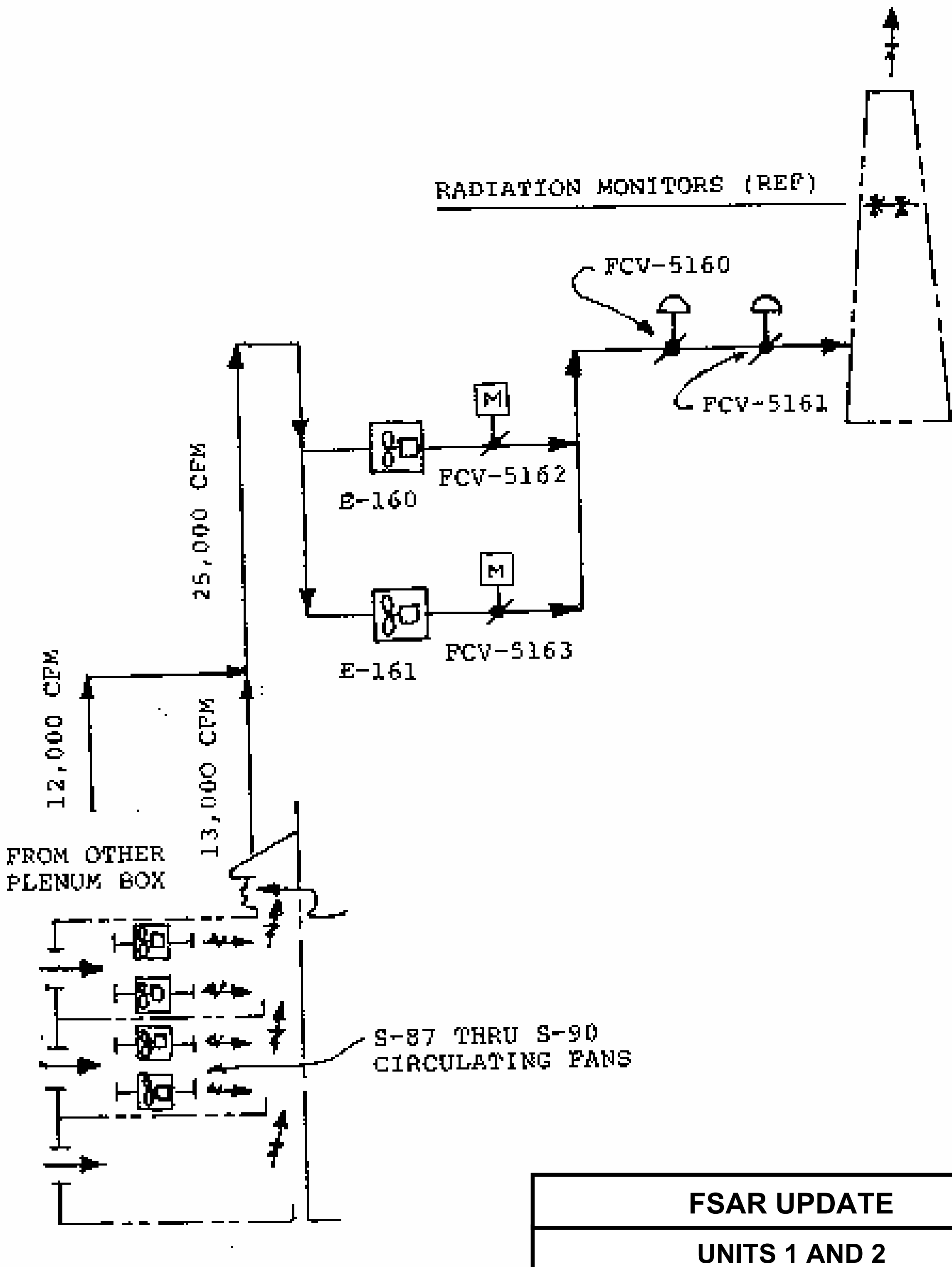
Revision 16 June 2005



NOTES:

1. TYPICAL VITAL BUSES ARE "F", "G" AND "H".
2. SUPPLY FAN NUMBERS: "S-67","S-68","S-69".
3. APPLICABLE FOR UNIT 1 & UNIT 2.

FSAR UPDATE
UNITS 1 AND 2 DIABLO CANYON SITE
FIGURE 9.4-7 VENTILATION SYSTEM 4KV SWITCHGEAR ROOMS



FSAR UPDATE

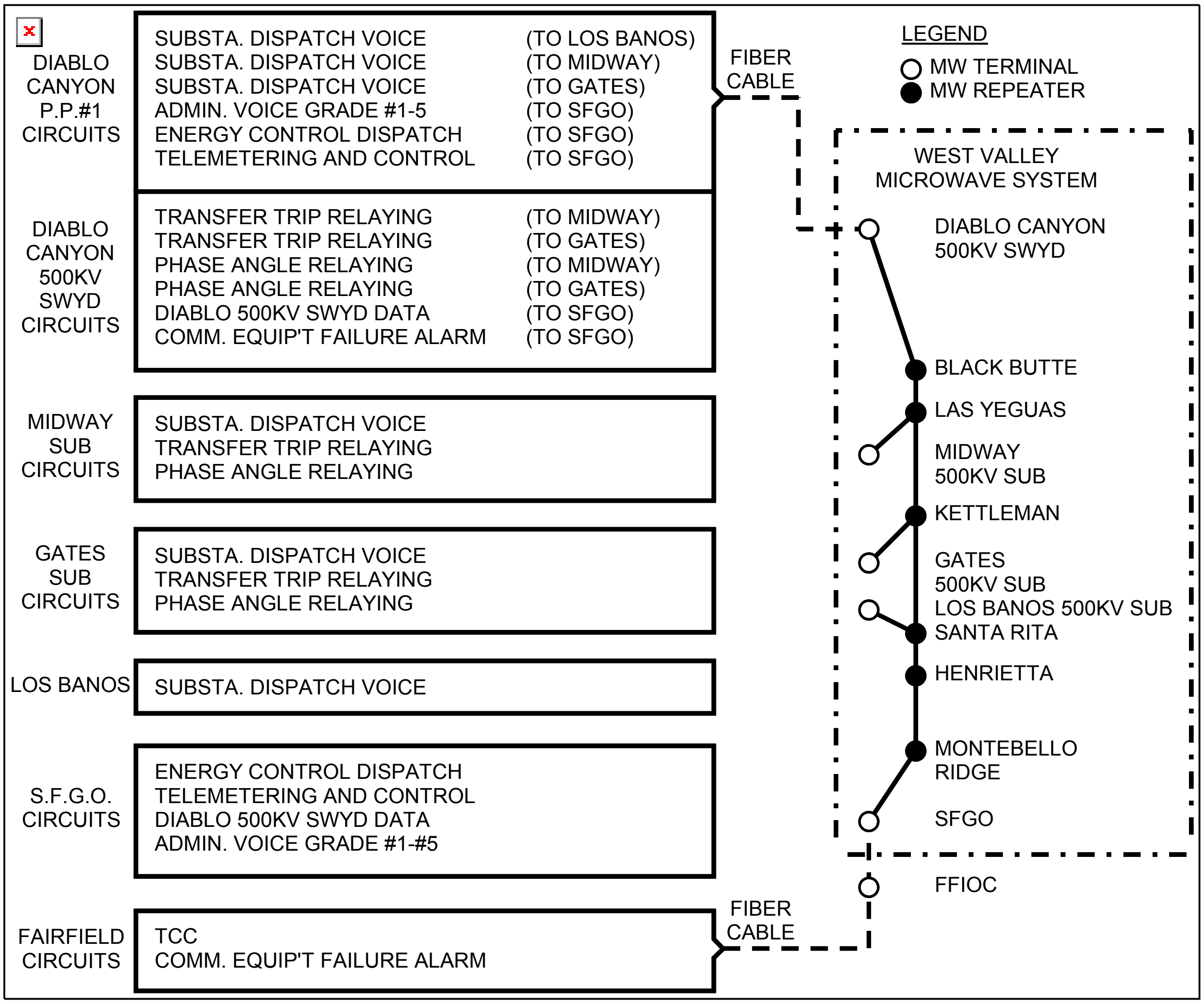
UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 9.4-11
VENTILATION SYSTEMS
CONTAINMENT PENETRATION
AREA GE/GW

FIGURE 9.5-1 TO BE WITHHELD FROM
PUBLIC PER 10 CFR 2.390 AND
SECY-04-0191.

FIGURE 9.5-2 TO BE WITHHELD FROM PUBLIC PER 10 CFR 2.390 AND SECY-04-0191.

FIGURE 9.5-3 TO BE WITHHELD FROM
PUBLIC PER 10 CFR 2.390 AND
SECY-04-0191.

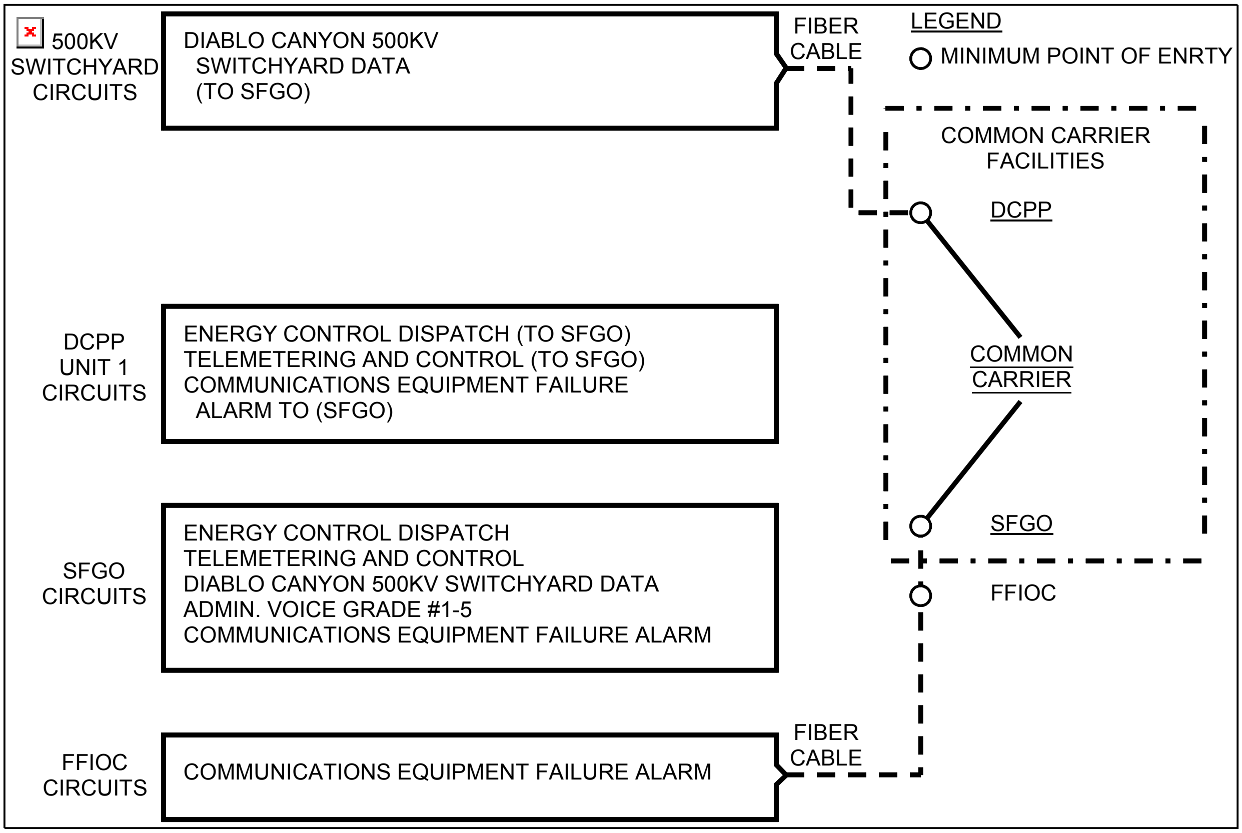


FSAR UPDATE

UNITS 1 AND 2
DIABLO CANYON SITE

FIGURE 9.5-5
PRIMARY COMMUNICATIONS SYSTEM

Revision 15 September 2003



FSAR UPDATE
UNITS 1 AND 2 DIABLO CANYON SITE
FIGURE 9.5-6 SECONDARY COMMUNICATIONS SYSTEM

Revision 15 September 2003

APPENDIX 9.5A

FIRE HAZARDS ANALYSIS

APPENDIX 9.5A

FIRE HAZARDS ANALYSIS

DISCUSSION

Engineering analyses/calculations are the bases for this appendix and the means of implementing a post-fire safe shutdown. Therefore, any changes, deletions, or additions to the analyses/calculations are reviewed for impact on plant implementing procedures. Any changes, deletions, or additions to the implementing procedures are reviewed to ensure that compliance is maintained with the analyses/calculations.

The Fire Hazards Analysis for each Appendix R fire area is comprised of six sections. A summary description for each section and an index to the analyses are provided below, followed by the analyses for the fire areas.

1.0 PHYSICAL CHARACTERISTICS

This section provides a detailed description of the fire area/zone and the location and boundaries of the fire area/zone. The fire ratings are given for the barriers that make up the fire area/zone on the north, south, east, and west walls, as well as the floors and ceilings. This section also describes any penetrations and barrier configurations approved in Fire Hazards Appendix R Evaluations (FHAREs).

2.0 COMBUSTIBLES

The combustible loading of the fire area/zone is described in this section. Both in situ and transient combustible materials present in the fire area/zone are documented in an itemized list. Each fire area/zone is categorized into an area of low, moderate, or high fire severity. These categories were derived from the fire duration that indicates the amount of time it would take for all of the combustible materials in the fire area/zone to completely burn assuming a fuel consumption rate of 80,000 Btu/hr-ft^2. The itemized list of combustible materials is administratively controlled in PG&E Engineering Calculation M-824. The use of transient combustible materials within the power plant fire area/zones is strictly controlled in accordance with Inter-Departmental Administrative Procedure OM8.ID4, “Control of Flammable and Combustible Materials.” Each fire area/zone is categorized by fire duration as follows:

- LOW: less than 60,000 Btu/ft^2 (less than 45 minute)
- MODERATE: 60,000 to 160,000 Btu/ft^2 (45 minutes to 2 hours)
- HIGH: over 160,000 Btu/ft^2 (over 2 hours)

These categories are more conservative than those referenced in the National Fire Protection Association (NFPA) Handbook, 14th edition, pages 6-79, British Fire Loading Studies. To be conservative, borderline cases are classified in the next higher category to allow for fluctuations.

3.0 FIRE PROTECTION

This section describes the type of detection and suppression systems available to protect the fire area/zone.

4.0 SAFE SHUTDOWN

This section identifies safe shutdown equipment that may be affected by a fire in each fire area/zone. 10 CFR 50, Appendix R, requires that fire damage be limited such that one train of safe shutdown equipment that is necessary to achieve and maintain hot shutdown is free from fire damage, and systems necessary to achieve and maintain cold shutdown are free from fire damage or can be repaired within 72 hours (10 CFR 50, Appendix R, Section III.G.1). Where cables or equipment of redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located within the same area, then one of the following methods is provided to ensure that one train of safe shutdown components is free from fire damage (10 CFR 50, Appendix R, Section III.G.2):

A. <u>Outside Containment</u>

1. Separation of redundant components by a 3-hour fire rated barrier

2. Separation of redundant components by a horizontal distance of more than 20 ft with no intervening combustible or fire hazards, in conjunction with the availability of fire detectors and an automatic fire suppression system in the fire area/zone

3. Enclosure of one train of redundant components in a 1-hour fire rated barrier, in conjunction with the availability of fire detectors and an automatic fire suppression system in the fire area/zone

B. Inside Containment - one of the fire protection means specified above (for outside containment), or

1. Separation of redundant trains by a horizontal distance greater than 20 ft with no intervening combustibles or fire hazards, or

2. Detection and automatic suppression, or

3. Separation of redundant trains by a radiant energy shield.

Alternative or dedicated shutdown capability (see Appendix 9.5E) is provided (10 CFR 50, Appendix R, Section III.G.3 and III.L) where the protection of systems whose function is required for hot shutdown does not satisfy the requirements of categories A and B listed above.

NRC approved deviations have been granted in cases where the requirements of 10 CFR 50, Appendix R, Section III.G have not been met. The NRC-approved deviations are described in SSERs 23 and 31. For some areas, a detailed evaluation is also documented in FHAREs.

In some cases, a manual action has been credited to mitigate fire damage to safe shutdown cables, to secure the non-credited train/system, or to align safe shutdown flowpaths for cooldown and transition to cold shutdown. The feasibility of performing the operator manual actions is documented in PG&E Engineering Calculations M-928 Appendix A, M-944, and M-1088. The use of manual actions is part of DCPP's original and current post-fire safe shutdown methodology for both III.G.2 and III.G.3 fire areas.[SAPN 50503925]

4.1 Spurious Automatic Actuation Signals

Components that are required for postfire safe shutdown may be impacted by a spurious plant protection system (PPS) actuation. For example, a safety injection signal (SIS) results in automatically starting emergency core cooling system (ECCS) pumps and positioning valves. The auto position of the postfire safe shutdown components may or may not be in the required position credited in the compliance analysis. Because the input signals to the PPS are not identified as safe shutdown circuits in PG&E Engineering Calculation 134-DC and because multiple input signals will be required to complete the logics for a safety function initiation, operator actions are identified in Section I, Attachment 4, of Calculation 134-DC to override or defeat the spurious protection system signal.

4.2 Multiple Fire-Induced Spurious Actuations

Because NRC guidelines on multiple fire-induced spurious operation are vague and have been interpreted differently throughout the industry, the compliance analysis has conservatively assumed multiple spurious actuations will occur for a given fire area. Operator actions have been identified to defeat each spurious actuation that could adversely affect safe shutdown.

The ability to safely shut down the plant in the event of a fire in any fire area is evaluated using the safe shutdown logic diagrams documented in PG&E Engineering Calculation M-680 and M-928, and the evaluations are summarized in Section 4.0 for each fire area.

5.0 CONCLUSION

The conclusion section summarizes the methods of compliance used to achieve safe shutdown, as well as the fire protection features available in the fire area/zone to meet the requirements of 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

Throughout each fire area/zone discussion, there are references to calculations, FHAREs, approved Appendix R deviations, letters to the NRC, etc. This section gives the information that is necessary to retrieve these documents.

INDEX TO FIRE HAZARD ANALYSES (UNIT 1)

Fire Area	Fire Zone	Description	Appendix R Area	Page
1	1-A	Containment, Annular Area	X	9.5A-12
	1-B	Containment, Steam Generator Area	X	9.5A-13
	1-C	Containment, Reactor Cavity and Operating Deck	X	9.5A-13
2	--	Auxiliary Boiler		
3-B-1	--	RHR Pump and Hx Room	X	9.5A-20
3-B-2	--	RHR Pump and Hx Room	X	9.5A-24
3-BB	--	Containment Penetration Area	X	9.5A-28
3-H-1	--	Centrifugal Charging Pumps CCP1&2 Room	X	9.5A-46
3-H-2	--	Centrifugal Charging Pump CCP3 Room	X	9.5A-51
3-P-1	--	Ventilation Room		
3-P-5	--	Ventilation Room		
3-P-12	--	Ventilation Room		
3-Q-1	--	Auxiliary Feedwater Pump Room	X	9.5A-54
5-A-1	--	480 V Vital Switchgear, F Bus	X	9.5A-59
5-A-2	--	480 V Vital Switchgear, G Bus	X	9.5A-59
5-A-3	--	480 V Vital Switchgear, H Bus	X	9.5A-59
5-A-4	--	480 V Nonvital Switchgear and Hot Shutdown Panel Area	X	9.5A-74
6-A-1	--	Battery, Inverter and DC Switchgear, F Bus	X	9.5A-82
6-A-2	--	Battery, Inverter and DC Switchgear, G Bus	X	9.5A-82
6-A-3	--	Battery, Inverter and DC Switchgear, H Bus	X	9.5A-82
6-A-4	--	Reactor Trip Switchgear	X	9.5A-100
6-A-5	--	Electrical Area	X	9.5A-105
7-A	--	Cable Spreading Room	X	9.5A-111
7-C	--	Communications Room		
8-G	--	Safeguards Room - Unit 1	X	9.5A-122
10	--	12-kV Switchgear Room	X	9.5A-127
11-D	--	Hallway Outside Diesel Generator Rooms	X	9.5A-133
13-D	--	Excitation Switchgear Room	X	9.5A-138
13-E	--	Switchgear Ventilation Fan Room	X	9.5A-142
13-F	--	Storage Room		
14-B	--	Clean and Dirty Lube Oil		
15	--	Turbine Lube Oil Reservoir		
17	--	Unit 1 and 2 Warehouse		
26	--	Unit 1 and 2 Chemical and Gaseous Storage		
27-A	--	Boxed Waste Zone		
27-B	--	Drum Storage Zone		

INDEX TO FIRE HAZARD ANALYSES (UNIT 1)

Fire Area	Fire Zone	Description	Appendix R Area	Page
27-C	--	Contaminated Oil Storage		
28	--	Unit 1 Main Transformer	X	9.5A-147
30-A-1	--	Auxiliary Saltwater Pump 1-1 Vault	X	9.5A-152
30-A-2	--	Auxiliary Saltwater Pump 1-2 Vault	X	9.5A-152
35-A	--	Diesel Fuel Oil Transfer Pump Vault	X	9.5A-156
35-B	--	Diesel Fuel Oil Transfer Pump Vault	X	9.5A-156
AB-1	3-B-3	Boron Injection Tank, Unit 1	X	9.5A-159
	3-F	Containment Spray Pump, Unit 1	X	9.5A-164
	3-J-1	Component Cooling Water Pump 1-1	X	9.5A-168
	3-J-2	Component Cooling Water Pump 1-2	X	9.5A-168
	3-J-3	Component Cooling Water Pump 1-3	X	9.5A-168
	3-M	Safety Injection Pump, Unit 1		
	3-Q-2	Motor-Driven Auxiliary Feedwater Pump, Unit 1	X	9.5A-176
FB-1	3-0	Fuel Handling Building		
	31	Fuel Handling Building	X	9.5A-180
	S-8	Stairwell		
	S-9	Stairwell		
TB-1	11-A-1	Emergency Diesel Generator 1-1	X	9.5A-184
	11-A-2	Emergency Diesel Generator 1-1 Radiator	X	9.5A-184
TB-2	11-B-1	Emergency Diesel Generator 1-2	X	9.5A-184
	11-B-2	Emergency Diesel Generator 1-2 Radiator	X	9.5A-184
TB-3	11-C-1	Emergency Diesel Generator 1-3	X	9.5A-184
	11-C-2	Emergency Diesel Generator 1-3 Radiator	X	9.5A-184
TB-4	12-A	4.16-kV Cable Spreading Room	X	9.5A-194
	13-A	4.16-kV Switchgear Room, F Bus	X	9.5A-194
TB-5	12-B	4.16-kV Cable Spreading Room	X	9.5A-203
	13-B	4.16 kV Switchgear Room, G Bus	X	9.5A-203
TB-6	12-C	4.16 kV Cable Spreading Room	X	9.5A-212
	13-C	4.16 kV Switchgear Room, H Bus	X	9.5A-212
TB-7	12-E	Isophase Room	X	9.5A-220
	14-A	Main Turbine Building	X	9.5A-224
	14-C	Electrical Load Center		
	14-D	Turbine Deck	X	9.5A-232
	14-E	CCW Heat Exchangers	X	9.5A-236
	16	Machine Shop		
TB-14	--	Reverse Osmosis Area		
TB-15	--	Buttress Area Unit 1		
V-1	3-P-2	Ventilation Room		
	3-P-3	Ventilation Room	X	9.5A-241
	3-P-4	Ventilation Room		

INDEX TO FIRE HAZARD ANALYSES (UNIT 1)

Fire Area	Fire Zone	Description	Appendix R Area	Page
	3-P-9	Ventilation Room		
V-2	3-P-6	Ventilation Room		
	3-P-7	Ventilation Room		
	3-P-8	Ventilation Room		
	3-P-10	Ventilation Room		
	3-P-11	Ventilation Room		
	3-P-13	Ventilation Room		
4-A	--	Counting and Chemical Laboratory	X	9.5A-245
4-A-1	--	Chemical Lab Area, G Bus Compartment	X	9.5A-262
4-A-2	--	Chemical Lab Area, H Bus Compartment	X	9.5A-262
4-B	--	Showers, Lockers and Access Control	X	9.5A-273
4-B-1	--	G Bus Compartment	X	9.5A-288

INDEX TO FIRE HAZARD ANALYSES (COMMON AREA)

Fire Area	Fire Zone	Description	Appendix R Area	Page
4-B-2	--	H Bus Compartment	X	9.5A-288
34	--	Outside Building El 140 ft	X	9.5A-299
AB-1	3-A	Liquid Holdup Tank Area	X	9.5A-304
	3-AA	Auxiliary Building E1 115 ft - App. R Area	X	9.5A-309
	3-C	Auxiliary Building E1 54, 64 and 73 ft	X	9.5A-316
	3-L	Auxiliary Building E1 85 and 100 ft	X	9.5A-325
	3-R	Spent Fuel Pool, Unit 1		
	3-S	Fuel Handling Building E1 140 ft	X	9.5A-332
	3-W	Spent Fuel Pool, Unit 2		
	3-X	Auxiliary Building, E1 100 ft	X	9.5A-336
	8-B-1	Supply Fan Room		
	8-B-2	Supply Fan Room	X	9.5A-344
	S-2	Stairwell		
	S-3	Stairwell	X	9.5A-348
	S-4	Stairwell	X	9.5A-353
AB-2	8-B-5	Electrical Area/Ventilation Room		
	8-B-6	Electrical Area/Ventilation Room		
	S-5	Stairwell		
AB-3	8-B-7	Electrical Area/Ventilation Room		
	8-B-8	Electrical Area/Ventilation Room		
	S-1	Stairwell		
CR-1	8-A	Unit 1 Computer Room	X	9.5A-359
	8-B-3	Unit 1 CR Ventilation Equipment Room	X	9.5A-359
	8-B-4	Unit CR Ventilation Equipment Room	X	9.5A-359
	8-C	Control Room	X	9.5A-359
	8-D	Unit 2 Computer Room	X	9.5A-359
	8-E	Office	X	9.5A-359
	8-F	Shift Technical Advisor Office	X	9.5A-359
IS-1	30-A-5	Circulating Water Pump Room	X	9.5A-370
	30-B	Intake Structure Control Room		
3-CC	--	Containment Penetration Area	X	9.5A-374
3-D-1	--	RHR Pumps and Hx Room	X	9.5A-392
3-D-2	--	RHR Pumps and Hx Room	X	9.5A-396
3-I-1	--	Centrifugal Charging Pumps CCP1&2 Room	X	9.5A-400
3-I-2	--	Centrifugal Charging Pump CCP3 Room	X	9.5A-404
3-T-1	--	Auxiliary FW Pump Room	X	9.5A-408
3-V-1	--	HVAC, Filters, Fans		
3-V-5	--	HVAC, Filters, Fans		
3-V-12	--	HVAC, Filters, Fans		

INDEX TO FIRE HAZARD ANALYSES (UNIT 2)

Fire Area	Fire Zone	Description	Appendix R Area	Page
5-B-1	--	480 V Vital Switchgear, F Bus	X	9.5A-412
5-B-2	--	480 V Vital Switchgear, G Bus	X	9.5A-412
5-B-3	--	480 V Vital Switchgear, H Bus	X	9.5A-412
5-B-4	--	480 V Nonvital Switchgear and Hot Shutdown Panel	X	9.5A-429
6-B-1	--	Battery, Inverter, and DC Switchgear, F Bus	X	9.5A-437
6-B-2	--	Battery, Inverter, and DC Switchgear, G Bus	X	9.5A-437
6-B-3	--	Battery, Inverter, and DC Switchgear, H Bus	X	9.5A-437
6-B-4	--	Reactor Trip Switchgear	X	9.5A-455
6-B-5	--	Electrical Area	X	9.5A-460
7-B	--	Cable Spreading Room	X	9.5A-466
7-D	--	Communications Room		
8-H	--	Safeguards Room	X	9.5A-476
9	9A	Containment Building, Annular Area	X	9.5A-481
	9B	Containment Building, Steam Generator Area	X	9.5A-481
	9C	Containment Building, Reactor Cavity and Operating Deck	X	9.5A-481
18	--	Turbine Lube Oil Reservoir		
20	--	12-kV Switchgear Room and Cable Spreading Room	X	9.5A-489
22-C	--	Corridor Outside Diesel Generator Rooms	X	9.5A-495
24-D	--	Excitation Switchgear Room	X	9.5A-500
29	--	Unit 2 Main Transformer	X	9.5A-505
30-A-3	--	Auxiliary Saltwater Pump Room	X	9.5A-510
30-A-4	--	Auxiliary Saltwater Pump Room	X	9.5A-510
33	--	Security Diesel Generator Room		
AB-1	3-D-3	Boron Injection Tank, Unit 2	X	9.5A-514
	3-G	Containment Spray Pump, Unit 2	X	9.5A-519
	3-K-1	Component Cooling Water Pump 2-1	X	9.5A-522
	3-K-2	Component Cooling Water Pump 2-2	X	9.5A-522
	3-K-3	Component Cooling Water Pump 2-3	X	9.5A-522
	3-N	Safety Injection Pump, Unit 2		
	3-T-2	Motor Driven Auxiliary Feedwater Pump, Unit 2	X	9.5A-532
FB-2	3-U	Fuel Handling Building		
	32	Fuel Handling Building	X	9.5A-533
	S-10	Stairwell		

INDEX TO FIRE HAZARD ANALYSES (UNIT 2)

Fire Area	Fire Zone	Description	Appendix R Area	Page
	S-11	Stairwell		
TB-7	19-A	Main Turbine Building	X	9.5A-529
	19-B	Electrical Load Center		
	19-C	Oil Reclamation and Shortage Room		
	19-D	Turbine Deck	X	9.5A-536
	19-E	CCW Heat Exchangers	X	9.5A-540
	23-E	Isophase Room	X	9.5A-545
	S-6	Stairwell	X	9.5A-558
TB-8	22-A-1	Emergency Diesel Generator 2-1	X	9.5A-558
	22-A-2	Emergency Diesel Generator 2-1 Radiator	X	9.5A-558
TB-9	22-B-1	Emergency Diesel Generator 2-2	X	9.5A-558
	22-B-2	Emergency Diesel Generator 2-2 Radiator	X	9.5A-558
TB-17	22-C-1	Emergency Diesel Generator 2-3	X	9.5A-558
	22-C-2	Emergency Diesel Generator 2-3 Radiator	X	9.5A-558
TB-10	23-A	F Bus 4kV Cable Spreading Room	X	9.5A-567
	24-A	F Bus 4kV Switchgear Room	X	9.5A-567
TB-11	23-B	G Bus 4kV Cable Spreading Room	X	9.5A-575
	24-B	G Bus 4kV Switchgear Room	X	9.5A-575
TB-12	23-C	H Bus 4kV Cable Spreading Room	X	9.5A-587
	24-C	H Bus 4kV Switchgear Room	X	9.5A-587
TB-13	23-C-1	Corridor Outside 4kV Cable Spreading Room	X	9.5A-595
	24-E	Switchgear Ventilation Fan Room	X	9.5A-596
	25	Operations Ready Room		
	S-7	Stairwell	X	9.5A-601
TB-16	--	Buttress Area Unit 2/Technical Support Center		
V-3	3-V-2	HVAC Room		
	3-V-3	HVAC Room	X	9.5A-606
	3-V-4	HVAC Room		
	3-V-9	HVAC Room		
V-4	3-V-6	HVAC Room		
	3-V-7	HVAC Room		
	3-V-8	HVAC Room		
	3-V-10	HVAC Room		
	3-V-11	HVAC Room		
	3-V-13	HVAC Room		
36-A-1		ISFSI Storage Area		
36-A-2		ISFSI Security Building		

Note: Fire hazard analyses are provided for 10 CFR 50, Appendix R, Fire Areas/Zones only.

FIRE AREA 1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Unit 1 Containment Building, El. 91 through 140 ft - containment annulus area.

1.2 Description

Fire Area 1 is divided into three fire zones:

- 1-A Containment Annulus Area
- 1-B Reactor Steam Generator Area
- 1-C Reactor Cavity and Operating Deck

Fire Zone 1-A is the annular region within containment between El. 91 ft and the operating deck at El. 140 ft. The annular region is bounded by the containment wall and the shield wall separating 1-A from 1-B.

Fire Zone 1-B is a cylindrical shaped region in the central part of containment. It is separated from Zone 1-A by the shield wall and from 1-C by the concrete operating deck.

Fire Zone 1-C is comprised of the reactor cavity and the area above the reactor from El. 140 ft and above. The outer wall of this zone is the containment wall.

1.3 Boundaries

NOTE: ^{NC} designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

1.3.1 Fire Zone 1-A

- 3-hour rated containment barrier (outer wall)
- A nonrated reinforced concrete shield wall separates this zone from zone 1-B
- Nonrated openings and steel grating to 1-C
- A nonrated reinforced concrete shield ceiling separates this zone from 1-C
- Containment penetrations consisting of schedule 80 pipe sleeves at El. 115 ft to fire area 3-P-2 are in the area. The electrical conductors pass through a steel header plate and are encased in fire retardant epoxy. The space between the header plates is pressurized with nitrogen.

1.3.2 Fire Zone 1-B

- A nonrated reinforced concrete shield wall separates this zone from Zone 1-A.
- Nonrated reinforced concrete operating deck separates this zone from Zone 1-C. Nonrated opening, hatches, piping and ventilation penetrations are present.

1.3.3 Fire Zone 1-C

- 3-hour rated containment wall. [NC]
- Nonrated reinforced concrete separates this zone from Zones 1-A and 1-B. There are also nonrated openings into 1-B.
- Nonrated equipment and personnel hatches communicate through the containment wall (Ref. 6.8).

2.0 COMBUSTIBLES (for entire area)

2.1 Floor Area: 26,551 ft^2

2.2 In situ Combustible Loading Materials

- Oil (in RCPs, cranes, fan cooler motors)
- Grease (in valve operators, cranes, fan cooler motors)
- Cable
- Charcoal
- HEPA filters
- Resin
- Rubber
- PVC
- Neoprene
- Plastics

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and PG&E Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles

- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Fire Zone 1-A

3.1.1 Detection

- Smoke detection

3.1.2 Suppression

- Hose stations

3.2 Fire Zone 1-B

3.2.1 Detection

- Smoke detection above each RCP

3.2.2 Suppression

- Wet pipe automatic sprinklers over each RCP with remote annunciator
- Hose stations

3.3 Fire Zone 1-C

3.3.1 Detection

- Flame detection on operating deck

3.3.2 Suppression

- Hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Zone 1A

4.1.1 Chemical and Volume Control System

Pressurizer auxiliary spray valves 8145 and 8148 may be affected by a fire in this area. Redundant valves 8107, 8108, or HCV-142 will remain available to prevent uncontrolled pressure reduction. A cold shutdown repair will allow manual initiation of auxiliary spray. (Ref 6.9) Prior to initiating auxiliary spray, block valve 8000C is closed to prevent spurious opening of PCV-456.

Valves 8146 and 8147 may be affected by a fire in this area. An available seal injection flowpath will provide the required charging function. These valves can be manually closed in order to initiate auxiliary spray following a fire inside containment.

CVCS valves 8149A, 8149B, 8149C, LCV-459, and LCV-460 may be affected by a fire in this area. Valves 8149A, 8149B, and 8149C can be failed closed for letdown isolation.

CVCS valves 8166, 8167, and HCV-123 may be affected by a fire in this area. Since HCV-123 fails closed in the event of a fire, excess letdown will remain isolated and safe shutdown is not affected.

A fire in this area might result in the spurious closure of charging pump discharge flow control valve FCV-128. This valve can be opened from the control room after switching to manual control.

4.1.2 Emergency Power

A fire in this area may result in a loss of power supplies associated with PY17N. Redundant power supply PY16 remains available.

4.1.3 Main Steam System

Main steam system valves FCV-760, FCV-761, FCV-762, and FCV-763 may be affected by a fire in this area. The following redundant valves will remain available to isolate steam generator blowdown lines: FCV-151, FCV-250, FCV-154, FCV-248, FCV-157, FCV-246, FCV-160, and FCV-244. Therefore, safe shutdown is not affected.

A fire in this area may affect steam generator level for all four loops. Only one steam generator is necessary for safe shutdown. Therefore, steam generator level indication for SG 1-4, from LT-547 will remain available because it has been provided with a 1 hour fire wrap. (Ref. 6.10)

4.1.4 Reactor Coolant System

RCS valves 8000A, 8000B, 8000C, and pressurizer PORVs PCV-455C, PCV-456, and PCV-474 may be affected by a fire in this area. Valves 8000A, 8000B and 8000C are required closed if the pressurizer PORVs are open during hot standby to prevent uncontrolled pressure reduction. A 1-hour fire wrap is provided on junction box BJX112 and penetration boxes BTX12E, BTX19E and BTX26E and conduits containing circuits are blocked to ensure the integrity of the circuits for the subject valves. Conduits containing circuits for the pressurizer PORVs are administratively blocked to prevent inclusion of other circuits that could spuriously open the valves. Since PCV-455C, PCV-456 and PCV-474 fail closed, uncontrolled pressure reduction will not occur due to a fire in this area. Auxiliary spray remains available for depressurization via a cold shutdown repair if the PORVs are not available. Prior to initiating auxiliary spray, block valve 8000C is closed to prevent spurious opening of PCV-456.

RCS reactor vessel head vent valves 8078A, 8078B, 8078C and 8078D may be affected by a fire in this area. The valves can be failed closed for reactor coolant system isolation.

Pressurizer level transmitters LT-406, LT-459, LT-460 and LT-461 may be affected by a fire in this area. Only one of the four level transmitters is required for safe shutdown. Since the LT-406 circuitry is separated from the LT-459 circuitry by 20 ft with no intervening combustibles, either one of these level transmitters will be available for safe shutdown.

Source range monitors NE-31, NE-32, NE-51 and NE-52 may be affected by a fire in this area. Since NE-31 and NE-32 are separated by more than 20 ft with no intervening combustibles, one of these channels will be available to provide neutron flux indication. Therefore, safe shutdown will not be affected.

RCS pressure transmitter, PT-406 may be affected by a fire in this area. PT-403 and PT-405 will remain available to provide RCS pressure indication.

A fire in this area may fail PCV-455A and PCV-455B closed. Since these valves fail in the desired, closed position, safe shutdown is not affected.

Temperature indication on TE-410C, TE-413B, TE-423A, TE-423B, TE-433A, TE-433B, TE-443A and TE-443B may be affected by a fire. Due to the presence of 1-hour rated fire wraps, temperature indication on steam generator loops 3 and 4 will remain operational in the event of a fire. (Ref. 6.11)

4.1.5 Residual Heat Removal

RHR valves 8701 and 8702 may be affected by a fire in this area. These valves are normally closed with power removed and will not spuriously operate. These valves can be manually operated to their safe shutdown position.

4.1.6 Safety Injection System

SI valves 8808A, 8808B, 8808C and 8808D may be affected by a fire in this area. These valves can be manually closed for RCS pressure reduction.

4.2 Fire Zone 1B

4.2.1 Chemical and Volume Control System

CVCS valves LCV-459 and LCV-460 may be affected by a fire in this area. Valves 8149A, 8149B and 8149C remain available to provide letdown isolation.

4.2.2 Emergency Power

A fire in this area may result in a loss of power supplies associated with PY17N. Redundant power supply PY16 remains available.

4.2.3 Main Steam System

Main steam system valves FCV-760, FCV-761, FCV-762 and FCV-763 may be affected by a fire in this area. The following redundant valves remain available to isolate steam generator blowdown lines: FCV-151, FCV-250, FCV-154, FCV-248, FCV-157, FCV-246, FCV-160 and FCV-244. Therefore, safe shutdown is not affected.

4.2.4 Reactor Coolant System

RCS valves 8000A, 8000B, 8000C and pressurizer PORVs PCV-455C, PCV-456 and PCV-474 may be affected by a fire in this area. Valves 8000A, 8000B and 8000C, or the pressurizer PORVs, are required closed to prevent uncontrolled pressure reduction. Since PCV-455C, PCV-456 and PCV-474 fail closed in the

event of a fire, uncontrolled pressure reduction will not occur. Auxiliary spray remains available. Therefore, safe shutdown is not affected.

A fire in this area may affect instrument sensing lines for the following pressurizer level instruments: LT-459, LT-460, LT-461 and LT-406. These instrument sensing lines are either shielded by the pressurizer vessel or protected by a heat shield. No electrical circuitry for these instruments exists in this fire zone. Therefore, safe shutdown is not affected.

A fire in this zone may affect instrument sensing lines for PT-406. This instrument is either shielded by the pressurizer vessel or protected by a heat shield. No electrical circuitry for this instrument exists in this fire zone. Therefore, safe shutdown is not affected.

Source range monitors NE-31, NE-32, NE-51 and NE-52 may be affected by a fire in this area. Since NE-31 and NE-32 are separated by more than 20 ft with no intervening combustibles, one of these channels will be available to provide neutron flux indication in the event of a fire. Therefore, safe shutdown will not be affected.

The following instrumentation for hot leg and cold leg temperatures: TE-410C, TE-413B, TE-423A, TE-423B, TE-433A, TE-433B, TE-443A and TE-443B may be affected by a fire in this area. TE-410C and TE-411B, and TE-423A and TE-423B, are separated by over 20 ft from TE-433A and TE-433B, and TE-443A and TE-443B, with no intervening combustibles. Therefore, safe shutdown will not be affected.

RCS reactor vessel head vent valves 8078A, 8078B, 8078C, and 8078D may be affected by a fire in this area. The valves can be failed closed for reactor coolant system isolation.

4.2.5 Residual Heat Removal System

RHR valve 8702 may be affected by a fire in this area. 8702 is normally closed with its power removed during normal operations and will not spuriously open. This valve can be manually operated to its safe shutdown position.

4.3 Fire Zone 1C

4.3.1 Reactor Coolant System

RCS valves 8000A, 8000B, 8000C and pressurizer PORVs PCV-455C, PCV-456 and PCV-474 may be affected by a fire in this area. Valves 8000A, 8000B and 8000C are required closed if the pressurizer PORVs are open during hot standby to prevent uncontrolled pressure reduction. Since PCV-455C, PCV-456 and PCV-474 fail closed in the event of a fire, uncontrolled pressure reduction will not occur. Therefore, safe shutdown is not affected. Auxiliary spray will remain available for RCS pressure reduction.

Source range monitors NE-31, NE-32, NE-51 and NE-52 may be affected by a fire in this area. Since NE-31 and NE-32 are separated by more than 20 ft with no intervening combustibles, one of these channels will be available in the event of a fire. Therefore, safe shutdown will not be affected.

RCS reactor vessel head vent valves 8078A, 8078B, 8078C and 8078D may be affected by a fire in this area. The valves can be failed closed for reactor coolant system isolation.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the ability to achieve safe shutdown.

- Safe shutdown equipment utilized for safe plant shutdown are not adversely effected by a fire in this area due to spatial separation, installation of fire barriers, blocked conduits, or availability of redundant equipment.
- Automatic wet pipe sprinklers are provided over each RCP.
- Smoke detection is provided for Zone 1-A and above each RCP in Zone 1-B.
- Flame detection is provided on the operating deck of Zone 1-C.
- Manual firefighting equipment is provided for this area.

An RCP lube oil collection system is provided for the RCPs in Zone 1-B. A deviation from the requirements of 10 CFR 50, Appendix R, Section III.0 was requested. This deviation was granted in SSER 23. For additional information, refer to Appendix 9.5C. (Ref. 6.15)

A deviation from the requirements of 10 CFR 50, Appendix R Section III.G.2 was requested in the report on 10 CFR 50, Appendix R Review because a non combustible radiant energy shield between redundant shutdown divisions was not provided when separation was less than 20 ft. A 1-hour rated fire barrier was provided and SSER 23 concluded that the modifications brought the area into compliance and that no deviation was required.

6.0 REFERENCES

6.1 Drawing Nos. 515569, 515570, 515571
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R, Rev. 1
6.3 Deleted in Revision 13.
6.4 Calculation M-824, Combustible Loading
6.5 Drawing 065126, Fire Protection Information Report, Unit 1
6.6 Report on 10 CFR 50, Appendix R Review
6.7 SSER 23, June 1984
6.8 NECS File: 131.95, FHARE:94, Containment Personnel Airlock Doors
6.9 NECS File: 131.95, FHARE:101, Separation of Pressurizer PORV and Auxiliary Spray Valve Circuits in the Containment Annular Area
6.10 NECS File: 131.95, FHARE:105, Non-Rated Mechanical Panels in Containment
6.11 DCP A-47568, Containment Fire Wrap Mods
6.12 Calculation 134-DC, Electrical Appendix R Analysis
6.13 Calculation M-928, 10 CFR 50, Appendix R Safe Shutdown Analysis
6.14 NECS File: 131.95, FHARE: 97, Containment Electrical Penetrations
6.15 NECS File: 131 .95, FHARE: 115, Reactor Coolant Pump Lube Oil Flashpoint Temperature

FIRE AREA 3-B-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This fire area is located at the northern end of the Unit 1 Auxiliary Building and occupies El. 54 ft through 115 ft.

1.2 Description

This area contains residual heat removal pump 1-1 and RHR heat exchanger 1-1. The area extends upward to El. 115 ft to encompass the vertical heat exchanger shaft.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- 3-hour rated barrier separates this area from containment (El. 54 ft and 64 ft),[NC] Zone 3-B-3 (El. 73 ft), and Area 3-BB at higher elevations.
- A lesser rated penetration seal to Zone 3-B-3. (El. 73 ft) (Ref. 6.13 and 6.15)

South:

- 3-hour rated barrier separates this area from Zone 3-C (El. 54 ft and 64 ft), Area 3-H-1 (El. 73 ft),[NC] Zone 3-L and Area 4-A (El. 85 ft) and Zone 3-X and Area 5-A-4 (El. 100 ft).
- Ventilation opening without a fire damper communicates to Area 3-H-1 (El. 73 ft). (Ref. 6.15)

East:

- 3-hour rated barrier separates this area from zone 3-B-3 (El. 54 ft and 64 ft), Areas 3-H-1 (El. 73 ft),[NC] 3-BB (El. 85 ft) and Zone 3-X (El. 100 ft).
- A 1-1/2-hour rated door communicates to Zone 3-B-3 (El. 64 ft). (Ref. 6.15)
- Duct penetration without a fire damper penetrates to Zone 3-B-3 (El. 64 ft). (Ref. 6.15)
- A lesser rated penetration seal to Zone 3-B-3. (EL. 58 ft) and Area 3-BB (El. 85 ft) (Refs. 6.13 and 6.15)
- A 3-hour-equivalent rated double door with a monorail cutout and water spray protection communicates to Zone 3-B-3 (El. 64 ft). (Ref. 6.14 and 6.15)

- An open doorway and security gate and nonrated penetrations to Area 3-H-1 (El. 73 ft). NC (Ref. 6.15)
- Duct penetration without a fire damper penetrates to Zone 3-X (El. 100 ft). (Ref. 6.15)
- A 2-hour rated plaster blockout panel communicates to Fire Zone 3-B-3. (Refs. 6.10 and 6.15)

West:

- 3-hour rated barrier separates this area from below grade (El. 54 ft and 64 ft)NC and Zone 3-C (El. 64 ft), Zone 3-J-3 (El. 73 ft), and Areas 4-A-2 (El. 85 ft) and 5-A-4 (El. 100 ft).
- Duct penetration with no fire damper penetrates to Zone 3-C (El. 64 ft). (Ref. 6.15)

Ceiling:

- A 3-hour rated barrier with a 3-hour rated concrete equipment hatch communicates to Fire Zone 3-AA El. 115 ft on unprotected steel supports with unsealed gaps. (Refs. 6.8, 6.9 and 6.15)
- A 3-hour rated barrier communicates to Fire Zone 3-B-3 and Fire Area 3-H-1 above (El. 73 ft)
- A lesser rated penetration seal to Fire Zone 3-B-3 (El. 73 ft). (Refs. 6.13)

Floor:

- A 3-hour rated barrier to grade. NC

2.0 COMBUSTIBLES

2.1 Floor Area: 706 ft^2

2.2 In situ Combustible Materials

- Clothing/Rags
- PVC
- Grease
- Oil
- Misc. Class A Combustibles

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Partial smoke detection over the RHR pump and at the top of the heat exchanger (Ref. 6.6)

3.2 Suppression

- Water spray system for double door at El. 64 ft. (Ref. 6.3)
- Portable fire extinguishers in adjacent Zone 3-C
- Fire hose stations in adjacent Zone 3-C

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Residual Heat Removal System

RHR pump 1-1 and Recirc Valve FCV-641A may be lost due to a fire in this area. RHR pump 1-2 and its Recirc Valve FCV-641B will be available to provide the RHR function.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Safe shutdown will not be affected by the loss of safe shutdown functions in this zone due to the availability of redundant equipment.

- Limited and dispersed combustible loading.

- Smoke detection provided over RHR pump and heat exchanger.

- Manual fire fighting equipment is available for use.

The existing fire protection features provide a level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.2.

6.0 REFERENCES

6.1 DCPP Unit 1 review of 10 CFR 50, Appendix R (Rev. 1)
6.2 Drawing No. 515566, 515567, 515568, 515569
6.3 SSER 23, June 1984
6.4 Calculation M-824, Combustible Loading
6.5 Drawing 065126, Fire Protection Information Report, Unit 1
6.6 NECS File: 131.95, FHARE: 21, Evaluation Of Partial Smoke Detector Coverage
6.7 Deleted in Revision 13.
6.8 NECS File: 131.95, FHARE: 14, Concrete Equipment Hatches
6.9 PLC Report: Structural Steel Analysis for Diablo Canyon, Rev. 2 (7/08/86)
6.10 NECS File: 131.95, FHARE: 50, Plaster Block-out Panels in 3-hour Barriers
6.11 Calculation 134-DC, Electrical Appendix R Analysis
6.12 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.13 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.14 NECS File: 131.95, FHARE 159, Unrated Doors Protected by Local Automatic Sprinklers.
6.15 NECS File: 131 .95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.

FIRE AREA 3-B-2

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This fire area is located at the northern end of the Unit 1 Auxiliary Building and occupies El. 54 ft through 115 ft.

1.2 Description

This area contains residual heat removal pump 1-2 and RHR heat exchanger 1-2. The area extends upward to El. 115 ft to encompass the vertical heat exchanger shaft.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- 3-hour rated barrier separates this area from containment (El. 54 ft and 64 ft); [NC] Zone 3-C (El. 64 ft), Zones 3-B-3 and 3-F (El. 73 ft); and Area 3-BB at higher elevations.

South:

- 3-hour rated barrier separates this area from Zone 3-C (El. 54 ft and 64 ft), Area 3-H-2 and 3-H-1 (El. 73 ft), Zone 3-L (El. 85 ft) and Zone 3-X (El. 100 ft).
- Ventilation penetrations with 3-hour rated fire damper communicate to Area 3-H-2 (El. 73 ft).
- Duct penetration with no fire damper penetrates to Zone 3-X. El. 100 ft (Ref. 6.16).

East:

- 3-hour rated barrier separates this area from below grade (El. 54 ft and 64 ft)[NC] and Zones 3-C (El. 64 ft), 3-F (El. 73 ft), 3-M (El. 85 ft), and 3-X (El. 100 ft).
- Three duct penetrations with no fire dampers penetrate to Zone 3-C (El. 64 ft). (Refs. 6.3 and 6.16)
- One duct penetration with no fire damper penetrates to Zone 3-M (El. 85 ft). (Ref. 6.16)

West:

- 3-hour rated barrier separates this area from Zone 3-B-3 (El. 54 ft and 64 ft), Area 3-H-1 (El. 73 ft), and Zones 3-BB (El. 85 ft) and 3-X (El. 100 ft).
- Two duct penetrations with fire dampers penetrate to Zone 3-B-3 (El. 64 ft). (Ref. 6.3 and 6.16)
- A 1-1/2-hour rated door communicates to Zone 3-B-3 (El. 64 ft). (Ref. 6.16)
- A 3-hour-equivalent rated double door with a monorail cutout and water spray protection communicates to Zone 3-B-3 (El. 64 ft). (Ref. 6.15 and 6.16)
- Nonrated pipe penetrations to Area 3-H-1 (El. 73 ft). (Ref 6.16)
- A 3-hour rated door communicates to area 3-H-1 (El. 73 ft). (Ref 6.16)
- A 2-hour rated plaster blockout panel communicates to Zone 3-B-3 (El. 64 ft). (Ref. 6.10 and 6.16)
- Lesser rated penetration seal to Zone 3-B-3 (El. 58 ft) and Fire Area 3-H-1 (EL. 73ft) and 3-BB (El. 85 ft). (Refs. 6.14 and 6.16)

Ceiling:

- 3-hour rated barrier communicates to Fire Zone 3-B-3 and Fire Area 3-H-1 above (El. 73 ft)
- 3-hour rated barrier with a concrete equipment hatch communicating to Zone 3-AA (El. 115 ft). (Refs. 6.8 and 6.9)
- A lesser rated penetration seal to Fire Zone 3-B-3 (El. 73 ft). (Refs. 6.14)

Floor:

- 3-hour rated barrier to grade. [NC]

2.0 COMBUSTIBLES

2.1 Floor Area: 706 ft^2

2.2 In situ Combustible Materials

- Clothing/Rags
- PVC
- Oil
- Grease
- Misc. Class A combustibles

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Partial smoke detection over the RHR pump and at the top of the heat exchanger. (Ref. 6.6)

3.2 Suppression

- Water spray system for double door at El. 64 ft. (Ref. 6.3)
- Portable fire extinguishers in adjacent zones.
- Fire hose stations in adjacent zones.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Residual Heat Removal System

RHR pump 1-2 and Recirc Valve FCV-641B may be lost due to a fire in this area. RHR pump 1-1 and its Recirc Valve FCV-641A will be available to provide the RHR function.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Safe shutdown will not be affected by the loss of safe shutdown functions in this zone due to the availability of redundant equipment.
- Limited and dispersed combustible loading.

- Smoke detection provided over RHR pump and heat exchanger.

- Manual fire fighting equipment is available for use.

The existing fire protection features provide a level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.2.

6.0 REFERENCES

6.1 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.2 Drawing No. 515566, 515567, 515568, 515569
6.3 SSER 23, June 1984
6.4 Calculation M-824, Combustible Loading
6.5 Drawing 065126, Fire Protection Information Report, Unit 1
6.6 NECS File: 131.95, FHARE 21, Evaluation of Partial Smoke Detection Coverage
6.7 Deleted in Revision 13
6.8 NECS File: 131.95, FHARE: 14, Concrete Equipment Hatches
6.9 PLC Report: Structural Steel Analysis for Diablo Canyon, Rev. 2 (7/08/86)
6.10 NECS File: 131.95, FHARE: 50, Plaster Block-out Panels in 3-hour Barriers
6.11 NECS File: 131.95, FHARE: 136, Unrated HVAC Duct Penetrations
6.12 Calculation 134-DC, Electrical Appendix R Analysis
6.13 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.14 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.15 NECS File: 131 .95, FHARE 159, Unrated Doors Protected by Local Automatic Sprinklers.
6.16 NECS File: 131 .95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.

FIRE AREA 3-BB

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This fire area is the Unit 1 containment penetration area and is located between Unit 1 Containment Building and Auxiliary Building on El. 85 ft through 115 ft.

1.2 Description

Fire Area 3-BB is the electrical and mechanical penetration area for the containment.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

El. 85 ft

North:

- 3-hour rated barrier to containment building with an 8-inch seismic and vent gap separation. (Refs. 6.5 and 6.25)
- Ventilation louvers without fire dampers that communicate with the exterior (Fire Area 28). [NC] (Refs. 6.5 and 6.25)

South:

- 3-hour rated barrier to Fire Areas 3-B-1, 3-B-2, 4-A, 4-A-1, 4-A-2, and Zones 3-L and 3-M.
- Duct penetrations without fire dampers to Fire Areas 4-A-1 and 4-A-2. (Ref. 6.25)
- Lesser rated penetration seals to Fire Zones 3-L, 3-M, 4-A-2. (Refs. 6.21and 6.25)
- A 1-1/2-hour rated door to Fire Zone 3-L. (Refs. 6.5 and 6.25)
- A 1-1/2-hour rated door to Fire Zone S-3. (Refs. 6.5 and 6.25)

East:

- 3-hour rated barriers to below grade, [NC] Fire Zones S-3 and Fire Area 3-B-2.
- Lesser rated penetration seal to Fire Area 3-B-2 (Refs. 6.21 and 6.25)

West:

- 3-hour rated barrier to Fire Zone 14-A, and Fire Area 3-B-1.
- A 3-hour rated double door to Fire Zone 14-A.
- Three 3-hour rated fire dampers to Fire Zone 14-A.
- Penetration to Fire Zone 14-A. (Ref. 6.13)
- Lesser rated penetration seals to Fire Area 3-B-1 and Fire Zone 14-A. (Ref. 6.21 and 6.25)

Floor:

- 3-hour rated barrier to Zones 3-J-3, 3-B-3, 3-F, Fire Area 3-H-1 and to grade. NC
- Lesser rated penetration seal to Zone 3-J-3, 3-B-3, and 3-H-1. (Ref. 6.21 and 6.25)

Ceiling:

- Concrete slab with nonrated penetrations to the 100-ft elevation of 3BB. NC (Ref. 6.5)
- 3-hour rated barrier to Fire Zone 3-X.
- Lesser rated penetration seals to Fire Zone 3-X above. (Refs 6.21 and 6.25)

El. 100 ft

North:

- 3-hour rated barrier to containment building with an 8-inch seismic and vent separation. (Refs. 6.5 and 6.25)
- 3-hour rated barrier to fire zone 3-R with the exception of an 8-inch seismic gap.
- Ventilation louvers without fire dampers that communicate with the exterior (Fire Area 28). NC (Refs. 6.5 and 6.25)

South:

- 3-hour rated barrier to Fire Areas 3-B-1, 3-B-2, 5-A-1, 5-A-2, 5-A-3 and 5-A-4 and Zone 3-X.
- Unrated structural gap seal to Fire Zone 3-X. (Ref. 6.20)
- Lesser rated penetration seals to Fire Zone 3-X. (Refs. 6.21 and 6.25)
- A 1-1/2-hour rated door to Fire Zone 3-X. (Refs. 6.5 and 6.25)

East:

- 3-hour rated barrier to Fire Zones 3-O, 3-Q-2 and 3-R.

- A 1-1/2-hour rated door to Fire Zone 3-Q-2. (Refs. 6.5 and 6.25)
- Lesser rated penetration seals to Fire Zone 3-O and 3-Q-2. (Refs. 6.21 and 6.25)

West:

- 3-hour rated barrier to Fire Zone 14-A.
- 3-hour rated door to Fire Zone 14-A.

Floor/Ceiling:

- Concrete slab with nonrated penetrations to the same fire area. NC (Ref. 6.5)

<u>El. 115 ft</u>

North:

- 3-hour rated barrier to containment building with an 8-inch seismic and vent separation. (Refs. 6.5 and 6.25)
- Ventilation louvers without fire dampers that communicate with the exterior (Fire Area 28). NC (Refs. 6.5 and 6.25)
- A nonrated barrier to Fire Zone 3-P-2. NC (Ref. 6.14)
- Non-rated electrical penetrations to containment (Fire Area 1/1-A). (Ref. 6.26)

South:

- 3-hour rated barrier to Fire Areas 6-A-1, 6-A-2, 6-A-3, 6-A-4, and 7-A, and Fire Zone 3-AA.
- A 1-1/2-hour rated door to Fire Zone 3-AA. (Refs. 6.5 and 6.25)
- A lesser rated penetration seal to Fire Zone 3-AA. (Refs. 6.21 and 6.25)
- A nonrated penetration to Fire Zone 7-A. (Ref. 6.17)

East:

- 3-hour rated barrier to Fire Zone 3-R.
- A 1-1/2-hour rated door to Fire Zone 3-R. (Refs. 6.5 and 6.25)

West:

- 3-hour rated barrier to Fire Zone 14-A.
- Lesser rated penetration seals to Fire Zone 14-A. (Refs. 6.21 and 6.25)
- Nonrated blowout panels, which communicate with the main-steam pipe tunnel, Fire Zone 14-A, that have closed head water spray on the turbine building side. (Ref. 6.5, 6.22, 6.23, 6.24, and 6.25)

- A 3-hour-equivalent rated door to Fire Zone 14-A, with water spray on the turbine building side. (Ref. 6.24)
- Nonrated main steam line penetration with water spray on the turbine building side. (Refs. 6.11 and 6.25)

Floor:

- Concrete slab with nonrated penetrations to the same fire area. NC (Ref. 6.5)

Ceiling:

- 3-hour rated barrier. NC
- Unsealed pipe penetrations and a seismic gap communicate with Fire Area 34 (outside roof area) at El. 140 ft. (Refs. 6.5 and 6.25)

Protective Enclosure:

- A fire resistive enclosure with an approximate fire rating of 3 hours, although 1 hour is committed, for several conduits and pull boxes. (Refs. 6.9, and 6.16)

- Cables essential for safe shutdown pass through three concrete vaults (one for each vitality) in the southwest corner of the fire area at El. 85 ft. The vault walls extend above 85 ft floor level to form an 8-inch curb. The curb around the vaults reduces the possibility of combustible fluid leakage into the vaults due to a spill on the floor. The vaults are covered with 3/8-inch thick metal plates. One foot thick concrete walls provide sufficient separation between redundant cables in adjacent vaults. As discussed in Section 2 below, due to the negligible fixed combustibles at El. 85 ft and the unlikelihood of transient combustibles being present in the area, propagation of fire into the vaults is precluded. A deviation to the requirements of Appendix R, Section III.G.2 was approved for this configuration in SSER 23 (Refs. 6.5 and 6.19).

- A deviation to the requirements of Appendix R, Section III.G.2 was made based on the existing construction of the vaults which includes the concrete walls, the 3/8-inch checker plate covers, and the curb located around the vaults (Refs. 6.5 and 6.19).

(Note: The containment electrical assembly is not a tested configuration. (Ref. 6.10 and 6.26))

2.0 COMBUSTIBLES

2.1 Floor Area: 6900 ft (For each elevation)

2.2 In situ Combustible Materials

ELEVATION:	85 ft	100 ft	115 ft
	• Oil	• Cable	• Cable
	• Cable	• Grease	• Grease
	• Rubber	• Rubber	• Rubber
	• Clothing/Rags	• Miscellaneous	• Neoprene
	• Paper	• Polyethylene	• Polyethylene
	• PVC	• Oil	• Plastic
	• Wood	• Clothing/Rags	
		• Paper	
		• Plastic	

2.3 Transient Combustible Materials (total for all 3 elevations)

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity (for all 3 elevations)

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Partial smoke detection at each elevation of this zone.

  (1) El. 85 ft - post-LOCA only
  (2) El. 100 ft - at tray only
  (3) El. 115 ft - at tray only (Ref. 6.8)

3.2 Suppression

- Wet pipe automatic sprinkler protection throughout El. 100 and 115 ft.
- A closed head sprinkler to spray the blowout panels and adjacent door (El. 115 ft).
- Portable fire extinguishers.
- Fire hose stations.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Zone 3BB - 85 ft

4.1.1 Auxiliary Feedwater

A fire in this area may affect LCV-106, LCV-107, LCV-110, and LCV-111. Redundant valves LCV-113 and LCV-115 will remain available from AFW Pp 1-3 to steam generator Loops 3 and 4, respectively.

4.1.2 Component Cooling Water

A fire in this area may spuriously close FCV-364 and FCV-365. These valves can be manually opened in order to provide CCW to the RHR heat exchangers.

4.1.3 Containment Spray

Containment spray pump 1-2 may spuriously operate due to a fire in this area. Since valve 9001B will remain closed, this will not affect safe shutdown.

Containment pressure transmitter cables run through this zone and could cause a spurious CS actuation signal. Open knife switches and open breakers 52-HG-07 and 52-HH-09 to prevent CS pump operation.

4.1.4 Chemical and Volume Control System

A fire in this area may affect valves 8108 and HCV-142. Since redundant components (valves 8107, or 8145 and 8148) will remain available to isolate auxiliary spray. The charging injection flow path will remain available for RCS make-up. Safe shutdown is not affected.

Valves LCV-112B and LCV-112C may spuriously close or become nonfunctional due to a fire in this area. Charging pump suction path may be transferred to the Boric Acid Transfer System by automatically opening valve 8104 to either Boric Acid Transfer Pump 1-1 or 1-2. Valves SI-8805A and SI-8805B may also be affected by a fire in this area. The running charging pump can be tripped from the control room to prevent cavitation and a charging pump restarted after aligning the RWST valves and isolating the volume control tank (VCT) supply valves. Valve SI-8805A or SI-8805B can be manually opened to provide water

from the RWST to the charging pump suction. If necessary, valve LCV-112B or LCV-112C can be manually closed in order to isolate the volume control tank.

4.1.5 Emergency Power

A fire in this area may disable the diesel generator 1-1 automatic transfer circuit. Manual control will remain available in the control room to transfer and load the diesel generator. In addition, offsite power will remain available for safe shutdown.

4.1.6 Main Steam System

A fire in this area may spuriously close FCV-95 which will result in the loss of AFW pump 1-1. Redundant AFW pump 1-3 will remain available for safe shutdown to steam generators 1-3 and 1-4.

Pressure indication PT-514 may be lost due to a fire in this area. Indication from PT-515 and PT-516 will remain available.

4.1.7 Main Feed System

A fire in this area may affect 4-20mA DC control cables, which affect valves FCV-510, FCV-520, FCV-530, FCV-540, FCV-1510, FCV-1520, FCV-1530, and FCV-1540 and result in failure to isolate MFW. The MFW pumps are not affected in this fire area and can be tripped to isolate MFW flow to the steam generators.

4.1.8 Reactor Coolant System

RCS pressure indication PT-403 and PT-405 may be lost due to a fire in this area. PT-406 will remain available to provide RCS pressure indication.

4.1.9 Residual Heat Removal System

A fire in this area may affect RHR Pump 1-2 recirculation valve FCV-641B resulting in loss of control and spurious operation. Redundant RHR pump 1-1 will be available along with redundant RHR pump recirculation valve FCV-641A.

4.1.10 Safety Injection System

A fire in this area may prevent the operation of valves 8805A and 8805B. The BASTs will be available to provide RCS make-up until these valves can be manually opened to provide RWST water to the charging pumps. Manual valves 8460A, 8460B, 8476, and 8471 will need to be opened to align the BAST flowpath to the charging pump suction. Charging pump suctions may be transferred to the Boric Acid Transfer System by automatically opening valve 8104 to either Boric Acid Transfer Pump 1-1 or 1-2

4.2 Fire Zone 3BB -100 ft

4.2.1 Auxiliary Feedwater

A fire in this area may affect the following AFW valves: LCV-106, 107, 108, 109, 110, 111, 113, and 115. Steam generator 1-2 is credited for shutdown in this area because of availability of SG level, SG pressure and RCS temperature indicators on that loop. Manual action can be performed to locally align LCV-111 using AFW Pump 1-2, and LCV-110 can also be manually aligned to provide flow to a second steam generator.

4.2.2 Component Cooling Water

A fire in this area may spuriously close FCV-357and isolate RCP seal cooling. Seal injection will be available for RCP seal cooling.
Valves FCV-364 and FCV-365 may spuriously close due to a fire in this area. Either of these two valves can be manually opened to provide CCW to the RHR heat exchangers.

CCW Header C flow transmitter (FT-69) may be affected by a fire in this area. Flow in header C is not credited, therefore loss of flow indication will not affect safe shutdown.

4.2.3 Containment Spray

Containment spray pump 1-2 may spuriously operate due to a fire in this area. Since valve 9001B will remain closed, this will not affect safe shutdown.

4.2.4 Chemical and Volume Control System

A fire in this area may affect valves 8104 and FCV-110A. The RWST valves 8805A and 8805B will remain available to provide boration and makeup capability.

A fire in this area might result in the spurious closure of charging pump discharge flow control valve FCV-128. This valve can be opened from the control room after switching to manual control.

Valves 8107 and 8108 may be affected by a fire in this area. These valves will fail in the desired, open position. Redundant valves will be available to isolate auxiliary spray in hot standby.

A fire in this area may affect valves 8145, and HCV-142. Either valves 8145 and 8148 or HCV-142 are required closed in order to isolate auxiliary spray. A deviation in SER 23 was approved for this area to the extent that one shutdown division will remain free of fire damage. HCV-142 will remain available for auxiliary spray isolation since the cable is located in a conduit that is administratively blocked to prevent inclusion of other circuits that could spuriously operate HCV-142. Valve 8148 will remain available for pressure reduction. Valves 8146 and 8147 may be affected by a fire in this area. Since redundant components exist and these valves can be manually operated, safe shutdown is not affected.

A fire in this area may spuriously open valves 8149A, 8149B, 8149C, LCV-459 and LCV-460. Either valves LCV-459, LCV-460 or valves 8149A, 8149B and 8149C must be closed for letdown isolation. Operator action can be taken to fail 8149A, 8149B, and 8149C closed. Therefore, safe shutdown is not affected.

A fire in this area may spuriously open valves 8166 and 8167 and fail HCV-123 open. Circuits associated with valve HCV-123 are either embedded in the ceiling or protected with a fire barrier having an approximate fire rating of 3 hours, although only 1 hour is required, and the valve can be closed for excess letdown isolation. Therefore, safe shutdown will not be affected.

A fire in this area may cause HCV-142 to fail open. This valve is required operational for a fire in this area to provide auxiliary spray isolation. The circuits for HCV-142 are located in dedicated conduit and will remain available.

Valves LCV-112B and LCV-112C may be affected by a fire in this area. The running charging pump can be tripped from the control room to prevent cavitation and a charging pump restarted after aligning the RWST valves and isolating the VCT supply valves. These valves can be manually closed to isolate the volume control tank.

A fire in this area may affect circuits associated with flow transmitter, FT-128 and pressure transmitter, PT-142. Loss of charging pump header flow and pressure indication will not affect safe shutdown.

A fire in this area may affect circuits associated with letdown flow transmitter, FT-134. Operator action is credited to isolate letdown flowpath. FT-134 will not be available for diagnosis of loss of letdown flow.

A fire in this area may affect equipment and circuits associated with VCT level transmitter, LT-112. This instrument is credited for diagnosis of failure of VCT discharge valves LCV-112B and LCV-112C in the open position. The RWST supply valves are not affected in this area and would be available for safe shutdown.

4.2.5 Emergency Power

A fire in this area may disable diesel generator 1-1 automatic transfer circuit. Manual control will remain available in the control room to transfer and load the diesel generator. In addition, offsite power is not affected in this area and will remain available.

4.2.6 Main Feed System

A fire in this area may affect 4-20mA DC control cables, which affect valve FCV-510 and result in failure to isolate. The MFW pumps can be tripped from the control room to isolate MFW flow to the steam generators.

4.2.7 Main Steam System

A fire in this area may spuriously open FCV-151, 154, 157, 160, 244, 246, 248, 250, 760, 761, 762 and 763. Operator action can be taken to fail FCV-151, 154, 248, 250, 762 and 763 closed to isolate steam generator blowdown.

A fire in this area may prevent closing of FCV-41, FCV-42 and FCV-43 and may spuriously open FCV-24 and FCV-25. Operator action taken to fail SGBD valves FCV-762 and FCV-763 closed will also isolate power to FCV-43, and FCV-44. These valves can be manually closed to control reactor coolant system temperature.

A fire in this area may spuriously close FCV-95 which would disable AFW pump 1-1. However, redundant AFW pumps 1-2 and 1-3 will remain available. A fire in this area may result in the loss of level and pressure indication for all four steam generators. The separation between the exposed conduits for two of the four redundant trains of level indication (LT-517, LT-527, LT-537, LT-547 and LT-519, LT-529, LT-539 and LT-549) is at least 40 ft with no intervening combustibles. In addition, circuits associated with LT-519 and LT-549 are protected with a fire barrier having an approximate fire rating of 3 hours, although only 1 hour is committed, and will be available. Smoke detection and automatic sprinklers are also present which satisfies the separation requirement of

Appendix R. The conduits containing circuits for steam generator pressure indicators PT-526, PT-534, PT-535, PT-536, PT-544 and PT-545 are embedded in the ceiling. The exposed pull box covers for conduits containing circuits associated with PT-526, PT-536, PT-535 and PT-545 are protected by a fire barrier having an approximate fire rating of 3 hours, although only 1 hour is committed. Therefore, one train of pressure indication will remain available.

A fire in this area may affect circuits which prevent operation of the 10 percent dump valves PCV-19 and PCV-20. These valves can be manually operated to ensure safe shutdown.

<u>4.2.8 Reactor Coolant System</u>

Pressurizer PORVs (PCV-455C, 456 and 474) and blocking valves (8000A, 8000B and 8000C) may be affected by a fire in this area. The circuits for the PORVs are not routed with other circuits. Therefore, hot shorts are not credible. Since the PORVs will not spuriously open, uncontrolled pressure reduction will not occur. Auxiliary spray will remain available for RCS pressure reduction if the PORVs fail closed.

A fire in this area may affect pressurizer level indication (LT-406, LT-459, LT-460 and LT-461). The circuits associated with LT-460 are protected with a 1-hr fire barrier and will be available. The Appendix R separation requirements for LT-459 and LT-461 are satisfied because they are partially embedded in the ceiling of El. 100 ft and, when exposed, are separated by 40 ft with no intervening combustibles. This configuration, along with the detection and suppression systems, was approved in SSER 23. Therefore, safe shutdown is not affected.

RCS pressure indication from PT-403, PT-405 and PT-406 may be lost due to a fire in this area. Only one pressure transmitter is necessary for safe shutdown. The conduit and associated pull-box cover for PT-403 is protected by a fire barrier with a fire rating of approximately 3 hours, although a 1 hour barrier was committed. This configuration, along with the area-wide suppression and partial detection systems, was approved in SSER 23.

A fire in this area may affect temperature indication circuits TE-410C, TE-413B, TE-433A, TE-433B, TE-443A and TE-443B. TE-423A and TE-423B are not affected at El. 100 ft, therefore, SG 1-2 will be available for cooldown.

A fire in this area may cause the loss of indication from NE-51 and NE-52. Redundant components NE-31 and NE-32 will remain available.

A fire in this area may affect valves PCV-455A and PCV-455B. Since these valves fail in the desired, closed position, safe shutdown is not affected.

4.2.9 Residual Heat Removal System

A fire in this area may affect valves 8701 and 8702. These valves have their power removed during normal operations and will not spuriously open. 8701 and 8702 can be manually open for RHR operations.

4.2.10 Safety Injection System

A fire in this area may affect valves 8801A and 8801B. Redundant valves 8803A and 8803B can be closed to isolate the diversion flowpath.

A fire in this area might prevent the refueling water supply valves 8805A and 8805B from auto opening on low VCT level. However, manual operation of these valves, from the control room, remains available.

A fire in this area may affect accumulator isolation valves 8808A, 8808B, 8808C and 8808D. These valves can be manually closed to ensure safe shutdown.

4.2.11 HVAC

HVAC equipment S-43, S-44 and E-44 may be lost due to a fire in this area. Since S-43 of the opposite train may be affected, operator action may be necessary to install portable fans. (Refs. 6.28 and 6.29)

4.3 Fire Zone 3BB - 115 ft

4.3.1 Auxiliary Feedwater

A fire in this area may affect valves LCV-108, LCV-109, LCV-113 and LCV-115. Redundant valves LCV-110 and LCV-111 will remain available to align AFW flow to steam generators 1-1 and 1-2 via AFW Pump 1-2. In addition, AFW flow to steam generators 1-3 and 1-4 can be provided by manually operating these valves.

4.3.2 Component Cooling Water

A fire in this area may spuriously close valves FCV-364 and FCV-365. Manual action may be necessary to open these valves.

A fire in this area may affect circuits associated with CCW flow transmitter for Header C, (FT-69). This Instrument is credited to indicate a loss of CCW flow. Loss of the indicator will not affect CCW flow to C header and will not affect safe shutdown.

4.3.3 Containment Spray

Containment spray pump 1-2 may spuriously operate due to a fire in this area. However, the corresponding discharge valve, 9001B will remain closed. Therefore, the spurious containment spray pump operation has no impact on safe shutdown.

Containment pressure transmitter cables run through this zone and could cause a spurious CS actuation signal. Open knife switches and open breakers 52-HG-07 and 52-HH-09 to prevent CS pump operation.

4.3.4 Chemical and Volume Control System

A fire in this area may affect valves 8104 and FCV-110A. Valve 8104 can be manually opened in order to provide boric acid to the charging pumps.

Valves 8145 and 8148 may be affected by a fire in this area. Cold shutdown repair action can be taken to manually operate valve 8145 for RCS depressurization, and redundant valves will be available to isolate auxiliary spray. Therefore, safe shutdown is not affected.

A fire in this area might result in the spurious closure of charging pump discharge flow control valve FCV-128. This valve can be opened from the control room after switching to manual control.

Valves 8146 and 8147 may be affected by a fire in this area. These valves can be manually operated to provide pressurizer spray capability.

A fire in this area may spuriously open valves 8149A, 8149B, 8149C, LCV-459 and LCV-460. Operator action can be taken to fail 8149A, 8149B, and 8149C.

A fire in this area may spuriously open valves 8166, 8167 and fail close HCV-123. One of these valves is required closed to isolate excess letdown. Since HCV-123 fails closed when its associated supply breaker is opened, safe shutdown will not be affected.

Valve HCV-142 may spuriously open due to a fire in this area. However, safe shutdown is not affected since this valve fails in the desired, open position when using auxiliary spray. CCW to the RCP thermal barrier Heat exchanger will remain available to provide seal cooling.

Valves LCV-112B and LCV-112C may be affected by a fire in this area. The running charging pump can be tripped from the control room to prevent cavitation, and a charging pump restarted after opening the RWST supply valve and isolating the VCT supply. These valves can be manually closed in order to

isolate the volume control tank. If these valves are closed, then valve 8805A or 8805B must be opened to provide water to the charging pumps from the RWST.

A fire in this area may affect circuits associated with flow transmitter, FT-128 and pressure transmitter, PT-142. Loss of charging pump header flow and pressure indication will not affect safe shutdown.

A fire in this area may affect circuits associated with letdown flow transmitter, FT-134. Operator action is credited to isolate letdown flowpath. FT-134 will not be available for diagnosis of loss of letdown flow.

A fire in this area may affect equipment and circuits associated with VCT level transmitter, LT-112. This instrument is credited for diagnosis of failure of VCT discharge valves LCV-112B and LCV-112C in the open position. The RWST supply valves are not affected in this area and will remain available for safe shutdown.

4.3.5 Emergency Power

A fire in this area may disable diesel generator 1-1 automatic transfer circuit. Manual control will remain available in the control room to transfer and load the diesel generator. In addition, offsite power is not affected in this area and will remain available.

4.3.6 Main Steam System

A fire in this area may spuriously open valves FCV-151, 154, 157, 160, 244, 246, 760, 761, 762 and 763. Operator action can be taken to fail FCV-151, 154, 248, 250, 762 and 763 closed to isolate steam generator blowdown.

A fire in this area may affected valves FCV-43, FCV-44, FCV-22, FCV-23 and FCV-25. Manual action can be taken to close these valves.

A fire in this area may spuriously close FCV-95 which will disable AFW pump 1-1. However, AFW pumps 1-2 will remain available.

Level and pressure indications for all four steam generators may be lost due to a fire in this area. The separation between the conduits for two of the four redundant trains of level transmitters (LT-517, 527, 537, 547 and LT-519, 529, 539, 549) is 40 ft with no intervening combustibles. Since suppression and detection systems are provided, the separation requirement of Appendix R is satisfied. The circuits for steam generator 1-3 and 1-4 pressure transmitters are separated by 12 ft with no intervening combustibles and are protected by suppression and detection systems (Ref. 6.27). The separation and fire protection features in this area justify an exemption to the Appendix R

requirements. Furthermore, the separation between redundant trains of steam generator pressure transmitters PT-524 and (PT-515 and PT-525) is 15 ft-6 in. The separation between (PT-514 and PT-524) and (PT-536 and PT-546) is 23 ft. Because of the separation between redundant indication and the existence of suppression and detection systems, SSER 23 accepts that these conditions are equivalent to Appendix R criteria.

Valves PCV-19, PCV-20, PCV-21 and PCV-22 may be affected by a fire in this area. These valves can be manually operated to ensure safe shutdown.

4.3.7 Main Feed System

A fire in this area may affect 4-20mA DC control cables, which affect valves FCV-510, FCV-520, FCV-530, FCV-540, FCV-1510, FCV-1520, FCV-1530, and FCV-1540 and result in failure to isolate MFW. The MFW pumps are not affected in this fire area and can be tripped to isolate MFW flow to the steam generators.

4.3.8 Reactor Coolant System

A fire in this area may affect pressurizer PORVs PCV-455C, PCV-456 and PCV-474 and blocking valves 8000A, 8000B and 8000C. The PORVs can be manually closed using the emergency close switch of the hot shutdown panel during hot standby to prevent uncontrolled pressure reduction. Auxiliary spray will be used for pressure reduction in this area. Therefore, safe shutdown will not be affected.

A fire in this area may affect PCV-455A and PCV-455B. If these valves fail in the desired, closed position, safe shutdown is not affected. RCPs can also be tripped to mitigate spurious operation of the pressurizer spray valves.

A fire in this area may affect pressurizer level indication (LT-406, LT-459, LT-460 and LT-461). The conduits for LT-459 and LT-461 are embedded in the floor slab of El. 115 ft and stub up at the north end where they are separated from conduits KT350 and KT 358 by 40 ft with no intervening combustibles. Detection and suppression systems are provided. Therefore, this condition satisfies the separation requirements of Appendix R.

RCS pressure indication from PT-403, PT-405 and PT-406 may be lost due to a fire in this area. Only one pressure transmitter is necessary. Since the conduit for PT-403 is provided with a fire barrier having an approximate fire rating of 3 hour, although 1 hour is committed, and is protected by detection and suppression systems, the safe shutdown criteria of Appendix R is met.

A fire in this area may affect reactor coolant system temperature indication from TE-410C, TE-413B, TE-423A, TE-423B, TE-433A, TE-433B, TE-443A and

TE-443B. A deviation was approved in SSER #23 to the extent that at least one division of RCS temperature indicators would remain free of fire damage.

Reactor vessel head vent valves 8078A, 8078B, 8078C and 8078D may be affected by a fire in this area. Operator action can be taken to fail 8078A, 8078B, 8078C and 8078D closed.

A fire in this area may affect NE-31, NE-32 and NE-52. The separation between the circuits for redundant detectors NE-31 and NE-32 is 20 ft with no intervening combustibles. These circuits are also protected by automatic sprinklers and smoke detection. If NE-52 is lost, NE-51 will remain available to provide indication.

4.3.9 Residual Heat Removal System

A fire in this area may affect valves 8701 and 8702. These valves are normally closed with their power supply removed and will not spuriously open. These valves can be manually opened for RHR operations.

4.3.10 Safety Injection System

Valve 8801B may be lost due to a fire in this area. This valve is not required because redundant valve 8801A will remain available to align charging injection, and redundant valves 8803A and 8803B will remain available to isolate this path during pressure reduction.

A fire in this area may affect accumulator isolation valves 8808A, 8808B, 8808C and 8808D. These valves can be manually operated to ensure safe shutdown.

A fire in this area might prevent the refueling water supply valves 8805A and 8805B from auto opening on low VCT level. However, manual operation of these valves, from the control room, remains available.

4.3.11 HVAC

One train of required HVAC equipment S-43, S-44 and E-44 may be lost due to a fire in this area. Since S-43 of the opposite train may be affected, operator action may be necessary to install portable fans. (Refs. 6.28 and 6.29)

5.0 CONCLUSION

This area does not meet the requirements of 10 CFR 50, Appendix R, Section III.G.2. which requires the separation of redundant shutdown divisions by 20 ft, free of intervening combustibles, and the installation of area-wide fire detection and suppression systems.

- A deviation from these requirements was requested and granted in SSER 23.

The following features will mitigate the consequences of a design basis fire and assure the ability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Smoke detection provided for post accident sample area (El. 85 ft), cable tray area (El. 100 ft and 115 ft).
- Automatic wet pipe sprinkler provided for protection of safe shutdown circuitry (at El. 100 ft and 115 ft).

- Sprinklers on the blowout panels (El. 115 ft) will limit the potential spread of fire.

- Low Fire Severity.

- The physical location and separation of redundant safe shutdown functions, in this zone, minimize the effects of a design basis fire.

- Although only 1-hour fire barriers are required/credited for safe shutdown circuits associated with; junction box BTG14E; conduits KK204, KT359, KT354; and 3 embedded pull boxes at El. 100 ft (as previously accepted in SSER 23), these barriers were replaced with 3-hour barrier systems as a means of providing additional margin in the level of fire protection.

The existing fire protection provides an acceptable level of fire safety equipment to that provided by Section III G.2.

6.0 REFERENCES

6.1 Drawing Nos. 515568, 515569, 515570
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065126, Fire Protection Information Report, Unit 1
6.5 SSER 23, June 1984
6.6 DCN DC1-E-H-5497 Rev. 0, - 3 hr. Barrier of CCW Piping Penetration Area
6.7 DCN DC1-EA-11962, Flashing to Seal Walls of Fire Area 3-BB
6.8 DCN DC1-EE-13771, Provide Additional Smoke Detectors (El. 115 ft west of column line 2)

6.9 DCN DC1-EA-15251, Provide 1 Hour Barrier for Conduits and Pull Boxes
6.10 58 Fire Review Questions, Question No. 5
6.11 NECS File 131.95, FHARE 5 "Main Steam Line Penetration Protection"
6.12 Appendix 3 for EP M-10 Unit 1 - Fire Protection of Safe Shutdown Equipment
6.13 NECS File 131.95, FHARE 12 "Winch Cable Penetration For Post-LOCA Sampling Room Shield Wall"
6.14 NECS File 131.95 FHARE 91 "Nonrated Barrier Between Fire Area/Zone 3BB (3CC) and 3-P-2 (3-V-2)"
6.15 DCP A-47966
6.16 PG&E Design Change Notice DC1-EA-049070, Unit 1 ThermoLag Replacement
6.17 NECS File: 131.95, FHARE: 130, "Inaccessible Jumbo Duct Penetrants"
6.18 Calculation 134-DC, Electrical Appendix R Analysis
6.19 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.20 NECS File: 131.95, FHARE 134, "Non-rated Structural Gap Seals in Fire Barriers"
6.21 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.22 PG&E Letter to NRC DCL-84-185, 5/16/84 - Exemption Request on APP R Review Fire Doors
6.23 PG&E Letter to NRC, 10/14/83 - Schedule for Fire Door Modifications
6.24 NECS File: 131.95, FHARE 159, Unrated Doors Protected by Local Automatic Sprinklers.
6.25 NECS File: 131 .95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.
6.26 NECS File: 131 .95, FHARE: 97, Containment Electrical Penetration
6.27 NECS File: 131 .95, FHARE 162, Negligible Combustibles in Containment Penetration Area
6.28 Calculation M-911, Evaluation of Safe Shutdown Equipment During Loss of HVAC
6.29 Calculation M-912, HVAC Interactions For Safe Shutdown

FIRE AREA 3-H-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This fire area is located at the north side of the Auxiliary Building at El. 73 ft.

1.2 Description

This area houses the Unit 1 centrifugal charging pumps (1-1 and 1-2).

1.3 Boundaries

NOTE: NC designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- 3-hour rated barrier separates this area from Zones 3-B-3 and 3-J-3 and Areas 3-B-1. NC and 3-B-2.
- A 3-hour rated door communicates to Zone 3-B-3.
- A duct penetration with no fire damper penetrates to Zone 3-B-3. (Refs. 6.13 and 6.15)
- A ventilation opening with no fire damper communicates to Area 3-B-1. (Ref. 6.15)
- A 3-hour rated door communicates to Zone 3-J-3.

South:

- 3-hour rated barrier separates this area from Zone 3-C.
- Two duct penetrations without fire dampers penetrate into Zone 3-C. (Refs. 6.7 and 6.15)
- Two 3-hour-equivalent rated double doors with monorail cutouts and water spray protection communicate into Zone 3-C. (Ref. 6.14 and 6.15). There is a 2-hour rated blockout above each of the doors. (Ref. 6.8)
- A nonrated opening penetrates into Zone 3-C. (Ref. 6.7)

East:

- 3-hour rated barrier separates this area from Areas 3-H-2, 3-B-2 and Zone 3-C.
- 3-hour rated door communicates to area 3-B-2.

- Two 3-hour rated doors with water spray protection communicates to Area 3-H-2 and Zone 3-C. (Ref. 6.14 and 6.15). There is a 2-hour rated blockout above each door. (Ref. 6.8)
- Lesser rated penetration seals to Area 3-H-2 and 3-B-2 and Zone 3-C. (Ref. 6.13)

West:

- Open doorway, security gate, and non-rated penetrations to area 3-B-1. [NC] (Ref. 6.15)
- 3-hour rated barrier separates this area from Zone 3-J-3 and Area 3-B-1. [NC]
- Nonrated pipe penetrations penetrate into Area 3-B-1. [NC] (Ref. 6.15)

Floor/Ceiling:

- 3-hour rated barriers.
- A duct penetration without a fire damper communicates through the floor into Zone 3-C (Below). (Ref. 6.15)
- Lesser rated penetration seal to Fire Area 3-BB. (Ref. 6.13)

2.0 COMBUSTIBLES

2.1 Floor Area: 900 ft^2

2.2 In situ Combustible Materials

- Cable
- Plastic
- PVC
- Oil

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Partial smoke detection. (Ref. 6.10)

3.2 Suppression

- Automatic wet pipe sprinkler system (partial). (Ref. 6.10)
- Closed head water spray system protecting two double doors in south wall and one door in east wall.
- Portable fire extinguishers.
- Hose stations.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Chemical and Volume Control System

Circuitry for charging pumps 1-1, 1-2, 1-3 and ALOPs 1-1 and 1-2 may be damaged due to a fire in this area. Charging pump 1-3 can be manually started at the 4-kV switchgear room to provide charging flow.

4.2 Residual Heat Removal System

RHR pumps 1-1 and 1-2 may be lost due to a fire in this area. Either RHR pump 1-1 or 1-2 can be manually started at their respective 4-kV switchgear rooms to provide RHR flow.

A fire in this area may affect the AC power cables and DC control cables for FCV-641A and FCV-641B. Prior to starting either RHR Pump 2-1 or 2-2, the respective recirc can be manually opened, and then re-closed after the RHR pump reaches full flow.

4.3 Safety Injection System

Charging injection valves 8803A and 8803B may be affected by a fire in this area. RCS flow through the regenerative heat exchanger and RCP seals will be available. Redundant valves 8801A and 8801B to isolate diversion flow from charging injection are available, thus no manual actions are required.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Safe shutdown will not be adversely affected by the loss of equipment in this area due to the availability of redundant equipment and/or manual actions.

- Smoke detection over charging pumps.

- Automatic wet pipe sprinkler protection over the pumps.

- Manual fire fighting equipment is available for use.

The existing fire protection features provide a level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.2 Drawing No. 515567
6.3 SSER 23, June 1984
6.4 Calculation M-824, Combustible Loading
6.5 Drawing 065126, Fire Protection Information, Unit 1
6.6 SSER 31, April 1985
6.7 NECS File: 131.95, FHARE: 25, Nonrated Features in the Units 1 and 2 Centrifugal Charging Pump Rooms (CCP1 and CCP2)
6.8 NECS File: 131.95, FHARE: 50, Plaster Block-out Panels in 3-Hour Barriers
6.9 Appendix 3 for EP M-10 Unit 1 "Fire Protection of Safe Shutdown Equipment"
6.10 NECS File: 131.95, FHARE: 47, Partial Detection and Suppression Protection
6.11 Calculation 134-DC, Electrical Appendix R Analysis
6.12 Calculation M-928, 10CFR50, Appendix R Safe Shutdown Analysis
6.13 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.14 NECS File: 131.95, FHARE 159, Unrated Doors Protected by Local Automatic Sprinklers.

6.15 NECS File: 131 .95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.

FIRE AREA 3-H-2

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This area is located at the north side of the Auxiliary Building at El. 73 ft.

1.2 Description

This area houses the Unit 1 centrifugal charging pump (1-3).

1.3 Boundaries

North:

- 3-hour rated barrier separates this area from Zone 3-F and Area 3-B-2.
- Ventilation penetrations with 3-hour rated fire damper communicates to Area 3-B-2.
- A duct penetration with no fire damper penetrates to Zone 3-F. (Refs. 6.3 and 6.12)

South:

- 3-hour rated barrier separates this area from Zone 3-C.
- A duct penetration with no fire damper penetrates to Zone 3-C. (Refs. 6.3, 6.7 and 6.12)
- An open doorway with security gate communicates to Zone 3-F. (Refs. 6.3 and 6.12)

East:

- 3-hour rated barrier separates this area from Zone 3-F.

West:

- 3-hour rated barrier separates this area from Area 3-H-1 and Zone 3-C.
- A 3-hour rated fire door communicates to Area 3-H-1. There is a 2-hour rated plaster blockout above the door. (Ref. 6.8)
- Lesser rated penetration seals to Area 3-H-1. (Ref. 6.11)

Floor/Ceiling:

Floor: To Fire Zone 3-C and Area 3-B-2
Ceiling: To Fire Zones 3-L and 3-M.

- 3-hour rated barriers except for a duct penetration without a fire damper in the floor (to 3-C) and ceiling (to 3-M). (Refs. 6.3 and 6.12)

2.0 COMBUSTIBLES

2.1 Floor Area: 235 ft^2

2.2 In situ Combustible Materials

- PVC
- Lube Oil

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection

3.2 Suppression

- Automatic wet pipe system
- Portable fire extinguishers
- Fire hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Chemical and Volume Control System

Charging pump 1-3 may be lost due to a fire in this area. Redundant charging pumps 1-1 and 1-2 will be available to provide charging flow.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Safe shutdown will not be adversely affected by the loss of the equipment in this area due to the availability of redundant equipment and/or manual actions.

- Smoke detection over charging pumps.

- Automatic wet pipe sprinkler protection over the pumps.

- Manual fire fighting equipment is available for use.

The existing fire protection features provide a level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.2 Drawing No. 515567
6.3 SSER 23, June 1984
6.4 Calculation M-824, Combustible Loading
6.5 Drawing 065126, Fire Protection Information Report, Unit 1
6.6 SSER 31, April 1985
6.7 NECS File: 131.95, FHARE: 25, Nonrated Features in the Units 1 and 2 Centrifugal Charging Pump Rooms (CCP1 and CCP2)
6.8 NECS File: 131.95, FHARE: 50, Plaster Block-out Panels in 3-Hour Barriers
6.9 Calculation 134-DC, Electrical Appendix R Analysis
6.10 Calculation M-928, 10 CFR 50, Appendix R Safe Shutdown Analysis
6.11 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers

6.12 NECS File: 131 .95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.

FIRE AREA 3-Q-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

South end of the Unit 1 Fuel Handling Building adjacent to the Auxiliary Building, El. 100 ft.

1.2 Description

This fire area adjoins Zones 31 and 3-0 on the north; 3-A and 3-X on the South; 3-Q-2 on the west; and below grade on the east.

1.3 Boundaries

NOTE: NC designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- 3-hour barrier to below grade.NC
- 3-hour rated barrier separates this area from Zone 3-0 except for a nonrated concrete shield wall. (Ref. 6.14)
- 3-hour rated barrier separates this area from Zone 31 except for a 1-1/2-hour rated double door in a 2-hour rated plaster barrier. (Ref. 6.14)
- Unique penetration seals in plaster walls to Zone 31. (Ref. 6.9)
- Lesser rated penetration seals to Zone 31. (Ref. 6.12)

South:

- 3-hour barrier to below grade.NC
- 3-hour rated barrier separates this area from Zone 3-A, except for a 2-hour rated blockout. (Ref. 6.7)
- 3-hour rated barrier separates this area from Zone 3-X except for 2-hour rated blockout above a 3-hour rated double door. (Ref. 6.9)
- Unique penetration seals in plaster walls to Area 3-X. (Ref. 6.9)
- Lesser rated penetration seals to Zones 3-A and 3-X. (Ref. 6.12)

East:

- 3-hour rated wall to below grade. NC

West:

- Unique penetration seals in plaster walls to zone 3-Q-2. (Ref. 6.9)
- A 1-hour rated barrier separates this area from Zone 3-Q-2 with a 3-hour rated door and a 3-hour rated double door. (Ref. 6.13)
- A 1-1/2-hour rated damper communicates to Zone 3-Q-2. (Ref. 6.14)
- A duct penetration without a fire damper penetrates to Zone 3-Q-2. (Ref. 6.14)
- Lesser rated penetration seal to Zone 3-Q-2. (Ref. 6.12)

Floor/Ceiling:

Floor: To Fire Zone 3-P-3

Ceiling: To Fire Zone 3-R

- A duct penetration without a fire damper penetrates to Zone 3-R above. (Ref. 6.14) [CR V-9.5A (19) SAPN 50569573]
- Nonrated pipe penetrations to Zone 3-R above. (Ref. 6.8)
- An opening to a ventilation duct routed outside the fuel handling building at El. 140 ft. (Ref.6.2)

2.0 COMBUSTIBLES

2.1 Floor Area: 754 ft^2

2.2 In situ Combustible Materials

- Cable insulation
- Oil
- Grease
- Polyethylene
- Clothing/Rags
- Plastic
- Wood (fir)
- Rubber
- Hydrogen line - this line has a guard pipe and there is an excess flow valve at the source to isolate the line in case of a H2 line break.

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Area wide smoke detection

3.2 Suppression

- Area wide automatic wet pipe sprinklers
- Portable fire extinguishers
- Hose station

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Auxiliary Feedwater

AFW pump 1-1 may be affected by a fire in this area. AFW pumps 1-2 and 1-3 will remain available for safe shutdown.

Valves FCV-436 and FCV-437 are located in Fire Area 3-Q-1 and will be affected by a fire in this area. FCV-437 can be manually opened to provide a flowpath from the raw water storage reservoir to the AFW pumps 1-2 and 1-3.

The Raw Water Supply Valves for AFW Pump 1-1 (FCV-436) and AFW Pumps 1-2 and 1-3 (FCV-437), and AFW Pump 1-1 suction valve (1-121) are located in this fire area. A fire will not damage the normally closed (1-121 is normally open) manual valves. However, FCV-437 will need to be manually opened and 1-121 will need to be manually closed prior to CST inventory depletion to ensure that a suction source for AFW Pumps 1-2 and 1-3 is maintained.

4.2 Safety Injection System

A fire in this area may affect circuits associated with RWST Level Transmitter LT-920. This level transmitter is credited for diagnosis of spurious operation of equipment that may divert RWST inventory. There are no cables affected in this area that may result in diverting the RWST inventory. Therefore, loss of this instrument will not affect safe shutdown.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.
- Manual fire fighting equipment is available.
- Limited and dispersed combustible loading.
- Area wide smoke detection and automatic suppression are provided.

The existing fire protection features in this area provide an acceptable level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.2.

6.0 REFERENCES

6.1 Drawing No. 515569
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065126, Fire Protection Information, Unit 1
6.5 SSER 23, June 1984
6.6 Deleted in Revision 13.
6.7 NECS File: 131.95, FHARE 125, Lesser Rated Plaster Blockouts And Penetration Seal Configurations
6.8 NECS File: 131.95, FHARE 128, Nonrated Pipe Penetrations
6.9 NECS File: 131.95, FHARE 121, Pipe Penetration Seals Through Plaster Walls in the Unit 1 AFW Pump Rooms
6.10 Calculation 134-DC, Electrical Appendix R Analysis
6.11 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.12 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers

6.13 PG&E Letter DCL-84-329, 10/19/84 - 10 CFR 50 Appendix R Review Report.
6.14 NECS File: 131 .95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.

FIRE AREAS 5-A-1, 5-A-2, 5-A-3

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

These three fire areas are located in the northwest part of the Unit 1 Auxiliary Building, El. 100 ft.

1.2 Description

Fire Areas 5-A-1, 5-A-2, and 5-A-3 contain the 480V vital switchgear rooms (F, G, and H Buses respectively). These areas are situated side by side with Fire Area 5-A-2 located in the center. Area 5-A-1 is west of 5-A-2 and Fire Area 5-A-3 is east of 5-A-2. Due to the similarities between these three areas, they have been combined in one section.

1.3 Boundaries

1.3.1 Fire Area 5-A-1

North:

- A 3-hour rated barrier separates this area from Area 3-BB.

South:

- A 3-hour rated barrier with a nonrated seismic gap separates this area from Area 5-A-4. (Ref. 6.8)
- A 3-hour rated door communicates to Area 5-A-4.
- A protected duct penetration without a fire damper penetrates to Area 5-A-4. (Refs. 6.5 and 6.11)

East:

- A 3-hour rated barrier with a nonrated seismic gap separates this area from Area 5-A-2. (Ref. 6.8)
- A 3-hour rated door communicates to Area 5-A-2.
- A protected duct penetration without a damper communicates to Area 5-A-2. (Ref. 6.5)

West:

- A 3-hour rated barrier with a nonrated seismic gap separates this area from Area 5-A-4. (Ref. 6.8)
- A 3-hour rated door communicates to Area 5-A-4.
- Two protected duct penetrations without fire dampers penetrate to Area 5-A-4. (Refs. 6.5 and 6.11)
- A Lesser rated penetration seal to Area 5-A-4. (Ref. 6.15)

Floor/Ceiling:

- 3-hour rated barrier. Floor: To fire areas 4-A and 4-A-1
  Ceiling: To fire area 6-A-1

1.3.2 Fire Area 5-A-2

North:

- 3-hour rated barrier separates this area from Area 3-BB.

South:

- A 3-hour rated barrier with a nonrated seismic gap separates this area from Area 5-A-4. (Ref. 6.8)
- A 3-hour rated door communicates to Area 5-A-4.
- A duct penetration with a 1-1/2 rated fire damper penetrates to Area 5-A-4. (Refs. 6.5, 6.7, and 6.11)

East:

- A 3-hour rated barrier with a nonrated seismic gap separates this area from Area 5-A-3. (Ref. 6.8)
- A protected duct penetration without a fire damper penetrates to Area 5-A-3. (Refs. 6.5 and 6.7)
- A 3-hour rated door communicates to Area 5-A-3.

West:

- A 3-hour rated barrier with a nonrated seismic gap communicates to Area 5-A-1. (Ref. 6.8)
- A 3-hour rated door communicates to Area 5-A-1.
- A protected duct penetration without a fire damper penetrates to Area 5-A-1. (Ref. 6.5)

Floor/Ceiling:

- 3-hour rated barrier. Floor: To fire areas 4-A and 4-A-1
  Ceiling: To fire area 6-A-2

1.3.3 Fire Area 5-A-3

North:

- A 3-hour rated barrier separates this area from Area 3-BB.

South:

- A 3-hour rated barrier with a nonrated seismic gap separates this area from Area 5-A-4. (Ref. 6.8) In addition, localized sections of structural steel for blockwalls were not provided with 3-hour rated fireproofing. (Ref. 6.12)
- A 3-hour rated door communicates to Area 5-A-4.
- A duct penetration with a 1-1/2-hour rated fire damper penetrates to Area 5-A-4. (Refs. 6.5, 6.7, and 6.11)

East:

- A 3-hour rated barrier with a nonrated seismic gap separates this area from Area 5-A-4. (Ref. 6.8) In addition, localized sections of structural steel for blockwalls were not provided with fire proofing. (Ref. 6.12)
- A 3-hour rated door communicates to Area 5-A-4.

West:

- A 3-hour rated barrier with a nonrated seismic gap separates this area from Area 5-A-2. (Ref. 6.8)
- A 3-hour rated door communicates to Area 5-A-2.
- A protected duct penetration without a fire damper penetrates to Area 5-A-2. (Ref. 6.5)

Floor/Ceiling:

- Floor: 3-hour rated barrier to Fire Areas 4-A and 4-A-2.
- Ceiling: 3-hour rated barrier to Fire Area 6-A-3.

Protective Enclosure: (for all three areas)

- 1-hour rated fire resistive covering is provided for HVAC ducts in the fire areas. (Ref. 6.5)

2.0 COMBUSTIBLES (typical for each area)

2.1 Floor Area: 444 ft^2

2.2 In situ Combustible Materials

- Cable
- Plastic

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION (typical for each area)

3.1 Detection

- Smoke detection in each area

3.2 Suppression

- CO_2 hose stations
- Hose stations
- Portable fire extinguishers

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Area 5-A-1

4.1.1 Auxiliary Feedwater

AFW pump 1-3 may be lost due to a fire in this area. Steam generator 1-3 is credited for safe shutdown in this area. Redundant AFW pump 1-1 will remain available to provide AFW flow to steam generator 1-3.

AFW valves LCV-113 and LCV-115 may be affected by a fire in this area. Redundant AFW valve LCV-108 will remain available to provide AFW flow to steam generator 1-3 via AFW Pump 1-1. In addition LCV-109 will remain available to provide AFW flow to a second steam generator 1-4.

4.1.2 Chemical and Volume Control System

Charging pump 1-1 and ALOP 1-1 may be lost due to a fire in this area. Redundant charging pumps 1-2, 1-3 and ALOP 1-2 will be available to provide charging flow.

Boric acid transfer pump 1-1 may be lost due to a fire in this area. Redundant boric acid transfer pump 1-2 will be available for this function.

CVCS valve 8105 may be affected by a fire in this area. Since the VCT and the RWST will be aligned to the charging pump suction, safe shutdown will not be affected if 8105 were to close in the event of a fire.

CVCS valve 8107 may be affected by a fire in this area. Since valve 8107 has redundant components, this valve's position will not have an affect on safe shutdown.

A fire in this area may spuriously open let down orifice valves 8149A, 8149B, 8149C and LCV-459 or LCV-460. Operator action can be taken to fail 8149A, 8149B and 8149C closed. Therefore, safe shutdown is not affected.

Volume control outlet valve LCV-112B may be affected by a fire in this area. If LCV-112B is lost then valve 8805B can be opened to provide water from the RWST to the charging pump suction. Redundant valve LCV-112C will be available to isolate the volume control tank.

Level indication for BAST 1-2 from LT-106 may be affected by a fire in this area. If level indication for boric acid storage tank 1-2 is lost, borated water from the RWST will be available. Therefore, BAST level will not be required.

4.1.3 Component Cooling Water

CCW pump 1-1 and ALOP 1-1 may be lost due to a fire in this area. Redundant CCW pumps and ALOPs 1-2 and 1-3 will be available to provide CCW.

CCW valve FCV-430 may be affected by a fire in this area. If FCV-430 is lost, then CCW heat exchanger 1-1 will be unavailable. However, CCW heat exchanger 1-2 and redundant valve FCV-431 will be available for use.

CCW valve FCV-750 may be affected by a fire in this area. Since seal injection will remain available, this will provide adequate cooling and FCV-750 will not be required.

4.1.4 Emergency Power

A fire in this area may disable diesel generator 1-2 backup control circuit. The normal control circuit will remain available.

A fire in this area may disable diesel generator 1-3. Diesel generators 1-1 and 1-2 will remain available for safe shutdown.

A fire in this area may disable startup transformer 1-2. Onsite power from diesel generators 1-1 and 1-2 will remain available.

All power supplies on the "F" Bus may be lost due to a fire in this area. These power supplies are not necessary since redundant trains on the "G" and "H" Buses will be available.

A fire in this area may disable dc panel SD13 backup battery charger ED131. Normal battery charger ED132 will remain available.

4.1.5 Main Steam System

The following steam generator level and pressure instrumentation may be lost due to a fire in this area: LT-516, LT-526, LT-529, LT-536, LT-539, LT-546, PT-514, PT-524, PT-534 and PT-544. Redundant instrumentation for all four steam generators will be available for safe shutdown.

Valve PCV-19 may be affected by a fire in this area. Since this valve fails closed which is its desired position, safe shutdown can still be achieved. A redundant dump valve will be available for cooldown purposes.

Main steam system valve FCV-38 may be affected by a fire in this area. This valve can be manually operated in the event of a fire to ensure that AFW pump 1-1 can provide auxiliary feedwater to steam generator 1-3.

4.1.6 Makeup System

Condensate storage tank level indication LT-40 may be lost due to a fire in this area. Water from the raw water storage reservoir will be available through FCV-436 to provide auxiliary feedwater. The normally closed manual valve can be locally opened prior to CST depletion.

4.1.7 Reactor Coolant System

Loss of LT-406, LT-459, NE-31, NE-51, PT-406, TE-410C, TE-413B, TE-423A and TE-423B due to a fire will not affect safe shutdown since redundant components are available.

A fire in this area may affect pressurizer PORV PCV-474 and its block valve 8000A. Cables associated with PCV-474 are routed in a conduit that is administratively controlled to ensure that no sources of hot shorts are added. Therefore, the PORV will remain closed. A redundant PORV will remain available for pressure reduction.

4.1.8 Safety Injection System

A fire in this area may spuriously energize SI pump 1-1 and may prevent the operation of accumulator isolation valve 8808A. SI pump 1-1 and valve 8808A are required off and closed during RCS pressure reduction. Valve 8808A can be manually closed and SI pump 1-1 can be locally de-energized to ensure safe shutdown.

Valves 8801A, 8803A and 8805A may be lost due to a fire in this area. Safe shutdown is not affected since redundant valves are available.

ASW pump 1-1 may be lost due to a fire in this area. Redundant ASW pump 1-2 will remain available.

A fire in this area may affect ASW valve FCV-601. Valves FCV-495 and FCV-496 can be closed to provide ASW system integrity if FCV-601 spuriously opens.

A fire in this area may affect FCV-602. Since ASW pump 1-2 is used in this area, loss of FCV-602 will not affect safe shutdown.

4.1.9 HVAC

HVAC equipment E-103, E-43, S-43, S-44, S-69 and FCV-5045 may be lost due to a fire in this area. HVAC equipment E-103 and S-69 are not necessary during

a fire in this area. Since S-44 of the opposite train may be affected, operator action may be necessary to install portable fans. (Refs. 6.18 and 6.19)

4.2 Fire Area 5-A-2

4.2.1 Auxiliary Feedwater

AFW valves LCV-106, LCV-107, LCV-108, and LCV-109 may be affected by a fire in this area. Steam generators 1-1 and 1-2 are credited for safe shutdown in this area. Redundant valves LCV-110 and LCV-111 will remain available to provide AFW flow.

4.2.2 Chemical and Volume Control System

Charging pumps 1-2 and 1-3 and ALOP 1-2 may be lost due to a fire in this area. Redundant charging pump 1-1 and ALOP 1-1 will be available to provide charging flow.

Boric acid transfer pump 1-2 may be lost due to a fire in this area. Redundant boric acid transfer pump 1-1 will remain available.

Valve 8106 may be affected by a fire in this area. Since the RWST will be aligned to the charging pump suction, valve 8106 is not necessary during a fire in this area.

Valve 8108 may be affected by a fire in this area. Since valve 8108 has redundant components available to provide the same function, this valve's position will not have an affect on safe shutdown.

Valves 8104 and FCV-110A may be affected by a fire in this area. Safe shutdown is not affected since FCV-110A fails open and is still able to provide boric acid to the charging pump suction. Manual positioning of valve 8471 will be required if valve FCV-110A is used.

Valves 8146, 8147 and 8148 may be affected by a fire in this area. Safe shutdown is not affected because redundant valves exist to isolate auxiliary spray, provide a charging flowpath and to provide for pressure reduction.

Valves FCV-128 and HCV-142 may be affected by a fire in this area. Failure of HCV-142 will not affect safe shutdown since redundant valves and flowpaths are available for charging. Spurious closure of FCV-128 will isolate seal injection flow. A manual action will be taken to open FCV-128 after placing its controller in the control room to manual to provide seal injection to the RCPs.

Valve LCV-112C may be affected by a fire in this area. Redundant valve 8805A remains available in order to provide water from the RWST to the charging pump suction. The volume control tank can be isolated by closing redundant valve LCV-112B.

A fire in this area may affect the transmitter and circuits associated with charging pump header flow transmitter, FT-128, and pressure transmitter, PT-142. Because RWST valve 8805A and charging pump 1-1 is available for charging flow, the loss of these instruments will not adversely affect safe shutdown.

4.2.3 Component Cooling Water

CCW pump 1-2 and ALOP 1-2 may be lost due to a fire in this area. Redundant CCW pumps 1-1 and 1-3 and ALOPs 1-1 and 1-3 will be available to provide CCW.

CCW valve FCV-431 may be affected by a fire in this area. Redundant valve FCV-430 will remain available to allow use of CCW heat exchanger 1-1.

CCW valve FCV-365 may be affected by a fire in this area. If power to this valve is lost, it fails open which is its desired position. Redundant valve FCV-364 can also be available. The seal injection flowpath can also be affected due to fire-induced spurious closure of FCV-128. The potential for a loss of all seal cooling can occur if the valves in these flowpaths spuriously close simultaneously. A manual action will be taken to open FCV-128 after placing its controller in the control room to manual to provide seal injection to the RCPs.

4.2.4 Containment Spray

A fire in this area may spuriously energize containment spray pump 1-1 and may spuriously open valve 9001A. Operator action can be taken to trip CS pump 1-1. Therefore, safe shutdown will not be affected.

Valve 9003A may be affected by a fire in this area. Manual action can be taken to close valve 9003A.

4.2.5 Diesel Fuel Oil System

Diesel fuel oil pump 0-2 may be lost due to a fire in this area. Redundant diesel fuel oil pump 0-1 remains available.

Diesel fuel oil day tank valves LCV-85, LCV-86 and LCV-87 may be lost due to a fire in this area. Redundant valves LCV-88, LCV-89 and LCV-90 remain available.

4.2.6 Emergency Power

A fire in this area may disable the diesel generator 1-1 backup control circuit. The normal control circuit will remain available.

A fire in this area may disable diesel generator 1-2. Diesel generators 1-1 and 1-3 will remain available for safe shutdown. If power is available to bus SPG, breaker 52HG10 at SHG should be opened to preclude spurious operation of train "G" components.

All power supplies on the "G" Bus may lose power due to a fire in this area. These power supplies are not necessary since redundant trains on the "F" and "H" Buses will be available.

4.2.7 Main Steam System

The following instrumentation may be lost due to a fire in this area: LT-519, LT-549, PT-515, PT-525, PT-535 and PT-545. Since redundant trains of indication will be available for each steam generator, safe shutdown will not be affected.

Valve PCV-21 may be affected by a fire in this area. Since this valve fails in its desired position safe shutdown is not affected. Redundant components will remain available for cooldown.

Valves FCV-760 and FCV-761 may be lost due to a fire in this area. FCV-761 has redundant valves FCV-154 and FCV-248 while FCV-760 has redundant valves FCV-151 and FCV-250, which will be available for isolation of steam generator blowdown. Therefore, safe shutdown is not affected.

Valve FCV-95 may be lost due to a fire in this area which would disable AFW pump 1-1. Steam generators 1-1 and 1-2 are credited for safe shutdown in this area. Redundant AFW pump 1-2 will remain available to provide AFW to the steam generators 1-1 and 1-2.

Main steam isolation valves FCV-41, FCV-42 and bypass valve FCV-24 may be affected by a fire in this area. These valves can be manually closed during a fire.

4.2.8 Reactor Coolant System

The following instrumentation may be lost due to a fire in this area: LT-460, NE-32, TE-433A, TE-433B, TE-443A and TE-443B. All of these components have redundant components that are available for safe shutdown.

Pressurizer PORV PCV-455C and blocking valve 8000B may be affected by a fire in this area. Since PCV-455C fails closed and circuits are located in a conduit that is administratively controlled to prevent inclusion of hot short sources, safe shutdown is not affected. A redundant PORV will remain available for pressure reduction.

A fire in this area may prevent RCPs 1-1, 1-2, 1-3 and 1-4 from being tripped. In order to prevent uncontrolled pressure reduction, PCV-455A and PCV-455B should be verified shut to isolate normal spray. Operation of reactor coolant pumps will not affect safe shutdown for a fire in this area. Seal injection is available to provide RCP seal cooling.

Pressurizer heater groups 1-2, 1-3 and 1-4 may be affected by a fire in this area. Manual actions can be taken to de-energize heater group 1-4 and switch heater group 1-3 to the vital power source. Therefore, safe shutdown is not affected.

4.2.9 Residual Heat Removal System

RHR pump 1-1 and outlet valve 8700A may be lost due to a fire in this area. Redundant RHR pump 1-2 and outlet valve 8700B will be available to provide the RHR function.

RHR valve 8701 may be affected by a fire in this area. This valve is closed with its power removed during normal operation and will not spuriously open. This valve can be manually opened for RHR operations.

A fire in this area may affect power to FCV-641A. A fire in this area may also affect AC control cables which spuriously close FCV-641A, and DC control cables which spuriously trip RHR PP 1-1. Since the other train is available (RHR PP 1-2 and valves 8700B and FCV-641B) this will not affect safe shutdown.

4.2.10 Safety Injection System

SI valves 8801B, 8803B and 8805B may be lost due to a fire in this area. Redundant valves 8801A, 8803A and 8805A remain available to provide the same functions. Also, the PORVs will be available for pressure reduction. Therefore, safe shutdown is not affected.

Valve 8804A may be affected by a fire in this area. Since this valve can be manually closed, safe shutdown is not affected.

SI valves 8808B and 8808D may be affected by a fire in this area. Since these valves can be manually closed, safe shutdown is not affected.

A fire in this area may affect valve 8982A. Power to the valve is administratively removed by maintaining a toggle switch in the Control Room in the open position. The valve is normally closed, and spurious opening is not expected to occur. In addition, an operator action can be taken to open the power breaker to further preclude spurious operation. Therefore, safe shutdown will not be affected.

4.2.11 Auxiliary Saltwater System

ASW pump 1-2 may be lost due to a fire in this area. Redundant pump 1-1 will be available to provide the ASW function.

ASW valve FCV-603 may be affected by a fire in this area. Redundant valve FCV-602 remains available, to provide ASW.

4.2.12 HVAC

A fire in this area may affect E-101 and S-68. Redundant fans E-103 and S-67 and S-69 will remain available.

4.3 Fire Area 5-A-3

4.3.1 Auxiliary Feedwater

AFW pump 1-2 may be lost due to a fire in this area. Redundant AFW Pump 1-3 will be available to provide AFW.

Valves LCV-110 and LCV-111 are affected by a fire in this area. Steam generator 1-3 is credited for safe shutdown in this area. Redundant valve LCV-115 will remain available via AFW Pump 1-3. LCV-113 will also remain available to align AFW flow to a second steam generator.

4.3.2 Chemical and Volume Control System

CVCS valve 8145 may be affected by a fire in this area. Redundant valves 8107, 8108 or HCV-142 are available to isolate auxiliary spray and the PORVs will be available for RCS pressure reduction. Thus, no manual actions are required.

A fire in this area may result in the loss of boric acid storage tank 1-1 level indication from LT-102. Borated water from the RWST will remain available. Therefore, BAST level indication is not required.

A fire in this area may affect circuits associated with letdown flow transmitter, FT-134. Loss of this instrument will not be available for diagnosis of letdown flow isolation. Letdown isolation valves (LCV-459, LCV-460, 8149A, 8149B and

8149C) are not affected in this area and will remain available to isolate letdown. Loss of this indication will not affect safe shutdown.

4.3.3 Component Cooling Water

CCW pump 1-3 and ALOP 1-3 may be lost due to a fire in this area. Redundant pumps 1-1 and 1-2 and ALOPs 1-1 and 1-2 will be available to provide CCW. A fire in this area may spuriously close CCW return valve FCV-357. Since seal injection will remain available FCV-357 will not be required open.

CCW supply valve FCV-355 may spuriously close during a fire in this area. FCV-355 can be manually operated for safe shutdown.

CCW supply valve FCV-364 may be affected by a fire in this area. Safe shutdown will not be affected since this valve fails open which is the desired position.

4.3.4 Containment Spray

A fire in this area may spuriously start containment spray pump 1-2 and may spuriously open valve 9001B. Operator action can be taken to trip CS pump 1-2. Therefore, safe shutdown will not be affected.

A fire in this area may spuriously open valve 9003B. This valve can be manually closed to ensure safe shutdown.

4.3.5 Diesel Fuel Oil System

Diesel fuel oil pump 0-1 may be lost due to a fire in this area. Redundant diesel fuel oil pump 0-2 will remain available.

Diesel fuel oil day tank valves LCV-88, LCV-89 and LCV-90 may be lost due to a fire in this area. Redundant valves LCV-85, LCV-86 and LCV-87 remain available.

4.3.6 Emergency Power

A fire in this area may disable diesel generator 1-1. Diesel generators 1-2 and 1-3 will remain available for safe shutdown. If power is available to bus SPH, breaker 52HH10 at SHH should be opened to preclude spurious operation of train "H" components.

A fire in this area may disable diesel generator 1-3 backup control circuit. The normal control circuit will remain available.

All power supplies on the "H" Bus may be lost due to a fire in this area. These power supplies are not necessary since redundant trains on the "G" and "F" buses will be available.

A fire in this area may disable dc panel SD11 and SD12 backup battery charger ED121. Normal battery chargers ED11 and ED12 will remain available.

4.3.7 Main Steam System

The power to the following instrumentation may be lost due to a fire: LT-518, LT-528, LT-538, LT-548, PT-526 and PT-536. Safe shutdown is not affected since redundant trains of indication for all four steam generators are available.

A fire in this area may affect PCV-20. This valve fails in the desired, closed position. Redundant valves PCV-19, PCV-21 and PCV-22 will remain available for cooldown.

A fire in this area may spuriously close FCV-37. AFW pump 1-3 will remain available to provide auxiliary feedwater to the steam generators 1-3 and 1-4.

FCV-762 and FCV-763 may be lost due to a fire in this area. Redundant valves FCV-157 and FCV-246 for FCV-762 and FCV-160 and FCV-244 for FCV-763 will be available for isolation of steam generator blowdown. Therefore, safe shutdown is not affected.

Valves FCV-43 and FCV-44 may be affected by a fire in this area. These valves can be manually closed.

4.3.8 Reactor Coolant System

The following components may be lost due to a fire in this area: LT-461, NE-52 and PT-403. Since redundant trains will be available safe shutdown will not be affected.

Pressurizer PORV PCV-456 and blocking valve 8000C may be affected by a fire in this area. Since PCV-456 fails closed and circuits are located in a conduit that is administratively controlled to prevent inclusion of hot short sources, safe shutdown is not affected. A redundant PORV will remain available for safe shutdown.

A fire in this area may spuriously start reactor coolant pumps 1-1, 1-2, 1-3 and 1-4. Since the normal spray valves cannot be spuriously opened by a fire in this area, safe shutdown will not be affected. Seal injection will remain available for RCP seal cooling.

Pressurizer heaters 1-1,1-2, and 1-3 may be affected by a fire in this area. Manual actions can be taken to de-energize heater group 1-1 and switch heater group 1-2 to the vital power supply. Therefore, safe shutdown will not be affected. Loss of circuits for pressurizer heater 1-3 will not affect safe shutdown.

4.3.9 Residual Heat Removal System

RHR pump 1-2 and valve 8700B may be affected by a fire in this area. Since RHR pump 1-1 and valve 8700A remain available, safe shutdown is not affected.

Valve 8702 may be affected by a fire in this area. During normal operations this valve is closed with its power removed and will not spuriously open. This valve can be manually positioned for RHR operation.

A fire in this area may also affect AC power and control cables for FCV-641B and cause the valves to spuriously operate. FCV-641A will remain available.

4.3.10 Safety Injection System

SI pump 1-2 may spuriously operate due to a fire in this area. Local manual action may be required to defeat this spurious operation.

A fire in this area might prevent the refueling water supply valves 8805A and 8805B from auto opening on low VCT level. However, manual operation of these valves, from the control room, remains available.

Valve 8808C may be affected by a fire in this area. This valve can be manually closed to ensure safe shutdown.

A fire in this area may affect valve 8982B. Power to the valve is administratively removed by maintaining a toggle switch in the Control Room in the open position. The valve is normally closed, and spurious opening is not expected to occur. In addition, an operator action can be taken to open the power breaker to further preclude spurious operation. Therefore, safe shutdown is not affected.

4.3.11 Auxiliary Saltwater System

ASW valves FCV-495 and FCV-496 may be affected by a fire in this area. Valve FCV-601 will remain available to provide ASW system integrity.

4.3.12 HVAC

A fire in this area may affect E-44, S-43, S-44, S-67 and FCV-5046. HVAC equipment S-67 is not necessary in this fire area. Since S-43 of the opposite train may be affected, operator action may be necessary to install portable fans. (Refs. 6.18 and 6.19)

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.
- Automatic smoke detection is provided.
- Manual fire fighting equipment is available for use.
- The loss of safe shutdown functions in each fire area does not affect the redundant train.

The existing fire protection features provide an acceptable level of safety equivalent to that provided by Section III.G.2.

6.0 REFERENCES

6.1 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.2 Drawing No. 515569
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065162, Fire Protection Information Report, Unit 1
6.5 NECS File: 131.95, FHARE: 15, HVAC Ducts Wrapped with Pyrocrete
6.6 Appendix 3 for EP M-10 Unit 1 Fire Protection of Safe Shutdown Equipment
6.7 NECS File: 131.95, FHARE: 80, Fire Dampers Installed at Variance with Manufacturers Instructions
6.8 NECS File: 131.95, FHARE: 6, "Seismic Gap At Concrete Block Walls"
6.9 Deleted in Revision 14.
6.10 NECS File: 131.95, FHARE 73, Undampered Ducts
6.11 SSER 23, June 1984

6.12 NECS File: 131.95, FHARE 104, "Fire Proofing on Structural Steel for Block Walls"
6.13 Calculation 134-DC, Electrical Appendix R Analysis
6.14 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.15 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.16 NECS File: 131.95, FHARE 152, Evaluation of Fire Dampers in 480V Switchgear and Battery Rooms
6.17 NECS File: 131 .95, FHARE 100, Block Walls Structurally Modified with Columns, Beams and Steel Plates
6.18 Calculation M-911, Evaluation of Safe Shutdown Equipment During Loss of HVAC
6.19 Calculation M-912, HVAC Interactions For Safe Shutdown

FIRE AREA 5-A-4

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Northwest end of the Unit 1 Auxiliary Building, hot shutdown panel and nonvital 480V switchgear room area, El. 100 ft.

1.2 Description

The area houses the hot shutdown panel and 480V switchgear. It occupies the northwest corner of the Auxiliary Building at El. 100 ft. A "no storage" area sign is posted in the hot shutdown panel area.

1.3 Boundaries

North:

- A 3-hour rated barrier separates this area from Areas 3-BB, 3-B-1, and 14A.
- A 3-hour rated barrier with nonrated seismic gaps separates this area from Areas 5-A-1, 5-A-2, and 5-A-3. (Ref. 6.12)
- Three 3-hour rated doors communicate into Areas 5-A-1, 5-A-2, and 5-A-3 (One door to each Area). Three 1-1/2-hour rated fire dampers communicate to Areas 5-A-1, 5-A-2, 5-A-3 (1 damper in each area). (Refs. 6.23 and 6.11)

South:

- A 3-hour rated barrier with nonrated seismic gap seals separates this area from Area 5-B-4. (Ref. 6.12)
- 3-hour rated barrier separates this area from Area S-5 and S-1.
- Two 3-hour rated doors communicate to Area 5-B-4.
- A duct penetration without a fire damper penetrates to Zone S-5. (Refs. 6.21 and 6.23)

East:

- 3-hour rated barrier to area 5-A-1. (Ref. 6.25)
- 3-hour rated barrier separates the area from Zones 3-X and S-2 and Areas S-5 and 3-B-1.
- A 1-1/2-hour rated door communicate to Area S-5. (Ref. 6.23)
- A 3-hour rated door communicates to area 5-A-1.
- A protected duct penetration without a fire damper penetrates Area 5-A-1. (Refs. 6.4, 6.7, 6.8 and 6.23)

- A duct penetration without a fire damper penetrates Area 5-A-1(Refs. 6.4, and 6.23). This duct is a lesser rated penetration seal to Area 5-A-1(Refs. 6.20 and 6.23).

West:

- 3-hour rated barrier separates this area from Zone 14-A and 5-A-3. (Ref. 6.25 and 6.26)
- 3-hour rated barrier to Zone S-1.
- A 3-hour rated door communicates to area 5-A-3.
- Ventilation register with a 3-hour rated fire damper communicates with Zone S-1, the duct shaft. (Refs. 6.4, 6.9, and 6.24).

Floor/Ceiling:

- 3-hour rated barriers to Areas 4-A, 4-A-2 and 4-B below and Areas 6-A-1, 6-A-2, 6-A-3, 6-A-4 and 6-A-5 above.
- Nonrated equipment hatch communicates to Area 4-B below and Area 6-A-5 above. (Ref. 6.23)
- One duct penetration to Area 6-A-5 without fire damper. (Refs. 6.4, 6.8 and 6.23)

Protective Enclosure:

- 1-hour rated fire resistive is provided for several HVAC ducts. (Refs. 6.7 and 6.11)
- Conduit K7450 is provided with a fire resistive wrap with an approximate fire rating of 3 hours, although 1 hour was committed. (Refs. 6.10, 6.17, and 6.22)

2.0 COMBUSTIBLES

2.1 Floor Area: 2,622 ft^2

2.2 In situ Combustible Materials

- Cable Insulation
- Paper
- Rubber

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection in the area and inside hot shutdown panel.

3.2 Suppression

- CO_2 hose stations
- Hose stations
- Portable fire extinguishers

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Auxiliary Feedwater

A fire in this area may prevent the operation from the hot shutdown panel of AFW pumps 1-2 and 1-3. Since AFW pumps 1-2 and 1-3 will remain operational from the control room, safe shutdown will not be affected.

Control of valves LCV-106, LCV-107, LCV-108 and LCV-109 from the hot shutdown panel may be lost due to a fire in this area. Operation of LCV-106 and LCV-107 will remain available from the control room. These valves are required for operation of AFW flow via AFW Pump 1-1. Since AFW Pump 1-1 is not credited for safe shutdown in this area, safe shutdown is not affected.

Control of valves LCV-110, LCV-111, LCV-113 and LCV-115 from the Control Room or hot shutdown panel may be affected by a fire in this area. Steam generators 1-1 and 1-2 are credited for safe shutdown. Manual actions can be taken to align LCV-110 and LCV-111 to steam generators 1-1 and 1-2.

4.2 Chemical and Volume Control System

A fire in this area may prevent the operation of the following components from the hot shutdown panel: valve 8104, boric acid transfer pumps 1-1 and 1-2 and charging pumps 1-1 and 1-2. Since charging pumps 1-1 and 1-2, boric acid transfer pump 1-2 and valve 8104 will remain operational from the control room, safe shutdown will not be affected.

Valves 8149A, 8149B and 8149C may be lost due to a fire in this area. Redundant valves LCV-459 and LCV-460 will remain available to isolate letdown.

Valves HCV-142 and FCV-128 may be affected by a fire in this area. If HCV-142 cannot be closed to isolate auxiliary spray during hot standby, existing redundant valves can be closed. The charging injection flow path is not affected by a failure of either HCV-142 or FCV-128. Spurious closure of FCV-128 will isolate seal injection flow. To achieve cold shutdown,FCV-128 may have to be bypassed and HCV-142 manually operated to establish auxiliary spray flow.

A fire in this area may affect the transmitter and circuits associated with charging pump header flow transmitter, FT-128, and pressure transmitter, PT-142. Both charging pumps are available in this fire area to provide charging flow. Loss of these instruments will not affect safe shutdown.

A fire in this area may affect circuits associated with letdown flow transmitter, FT-134. Loss of this instrument will not be available for diagnosis of letdown flow isolation. Letdown isolation valves LCV-459 and LCV-460 are not affected in this area and will remain available to isolate letdown. Loss of this instrument will not affect safe shutdown.

4.3 Component Cooling Water

A fire in this area may prevent the operation of CCW pumps 1-1, 1-2 and 1-3 from the hot shutdown panel. However, operation of CCW pumps 1-1, 1-2 and 1-3 will remain available from the control room. Therefore safe shutdown will not be affected.

A fire in this area may spuriously close FCV-355. FCV-355 can be manually operated for safe shutdown.

Valves FCV-430 and FCV-431 may be affected by a fire in this area. FCV-430 can be manually operated to ensure safe shutdown.

A fire in this area may affect valve FCV-356. The seal injection flowpath can also be affected by fire-induced spurious closure of FCV-128. The potential for a loss of all RCP seal cooling can occur if the valves in these flowpaths spuriously close simultaneously. To provide water to the RCP thermal barrier heat exchanger, locally open FCV-356 after opening its power breaker.

A fire in this area may affect the circuits associated with the CCW flow transmitter on Header C (FT-69). This instrument is credited to indicate a loss of CCW flow. Loss of this indication will not affect flow to CCW Header C. Therefore, loss of this indicator will not affect safe shutdown.

4.4 Containment Spray

A fire in this area may spuriously open valve 9001B. Since containment spray pump 1-2 will remain available, safe shutdown will not be affected with this valve open.

4.5 Diesel Fuel Oil System

A fire in this area may affect Unit 2 power circuits for DFO transfer pumps 01 and 02. The circuits are protected by a fire barrier having an approximate rating of 3 hours although 1 hour was committed. Manual action may be necessary transfer power supplies from Unit 1 to Unit 2 in order to ensure safe shutdown.

4.6 Emergency Power System

A fire in this are may affect Startup Transformers 1-1, 1-2, 2-1 and 2-2. Onsite power will remain available from all diesel generators for both Units 1 and 2.

A fire in this area may result in a loss of power supplies associated with PY17N. Redundant power supply PY16 remains available.

A fire in this area may result in a loss of UNIT 2 power supplies associated with PY27N. Redundant power supply PY26 remains available.

4.7 Main Steam System

A fire in this area may result in the loss of the following equipment: PT-514, PT-524, PT-534 and PT-544. Since two other trains of pressure indication for each steam generator will remain available, safe shutdown will not be affected.

Valves FCV-248 and FCV-250 may be affected by a fire in this area. Valves FCV-761 and FCV-760 will remain available to isolate steam generator blowdown. Therefore, safe shutdown is not affected by a fire in this area.

A fire in this area may result in the loss of FCV-95. Since AFW pump 1-2 will remain available to provide AFW, FCV-95 is not necessary for safe shutdown.

Ten percent dump valves PCV-19, PCV-20, PCV-21 and PCV-22 may be affected by a fire in this area. Steam generator 1-1 and 1-2 are credited for safe shutdown. PCV-19 and PCV-20 can be manually operated to ensure safe shutdown.

4.8 Makeup System

Level for the condensate storage tank, LT-40 may be lost due to a fire in this area. Feedwater will be available from the raw water storage reservoir through valves FCV-437. The normally closed manual valve can be locally opened prior to CST depletion.

4.9 Reactor Coolant System

A fire in this area may affect the following components: LT-459, LT-460, NE-51, NE-52, TE-443A, TE-443B, TE-433A and TE-433B. Safe shutdown is not affected since redundant components will be available.

Pressurizer PORVs PCV-455C, 456 and PCV-474 may be affected by a fire in this area. Since PORV blocking valves and auxiliary spray remain available, safe shutdown will not be affected.

A fire in this area may spuriously start or prevent tripping of all four reactor coolant pumps. However, safe shutdown will not be affected since normal spray can be isolated which prevents inadvertent RCS pressure reduction. Seal injection will remain available for RCP seal cooling.

A fire in this area may spuriously energize pressurizer heater groups 1-1, 1-2, 1-3 and 1-4. These heater groups can be manually de-energized to ensure safe shutdown.

4.10 Safety Injection System

A fire in this area may prevent the refueling water supply valves 8805A and 8805B from auto opening on low VCT level. However, manual operation of these valves, from the control room, remains available.

A fire in this area may spuriously open accumulator isolation valve 8808C. Manual action can be taken to close this valve.

Circuits for containment sump isolation valve 8982B may be affected by a fire in this area. Power to the valve is administratively removed by maintaining a toggle switch in the Control Room in the open position. The valve is normally closed, and spurious opening is not expected to occur. Therefore, safe shutdown is not affected.

4.11 Auxiliary Saltwater System

A fire in this area may prevent the operation of ASW pumps 1-1 and 1-2 from the hot shutdown panel. However, safe shutdown will not be affected since the operation of ASW pumps 1-1 and 1-2 will remain available from the control room.

Valves FCV-495 and FCV-496 may be lost due to a fire in this area.
Valve FCV-601 will remain closed to provide ASW system integrity.

A fire in this area may spuriously close valves FCV-602 and FCV-603. Manual action can be taken to open valve FCV-602.

4.12 HVAC

HVAC equipment E-101, E-43, S-43 and S-44 may be affected by a fire in this area. Redundant equipment E-103 and E-44 is available for E-101 and E-43 respectively. If S-43 and S-44 are lost for at least 8 hours, portable fans must be used to provide HVAC. (Refs. 6.14 and 6.15)

5.0 CONCLUSION

This area does not meet the technical requirements of 10 CFR 50, Appendix R, Section III.G.3 because area wide automatic suppression system is not provided.

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- The loss of safe shutdown function in this area does not affect safe shutdown due to the availability of redundant functions and/or measures provided to preclude the effects of fire.

- Area wide smoke detection is provided.
- Manual fire fighting equipment is available.

The existing fire protection features provide an acceptable level of safety equivalent to that achieved by compliance with Section III.G.2.

6.0 REFERENCES

6.1 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.2 Drawing No. 515569
6.3 DCN-DC1-EE-9913 provides isolator on RPM Tach-Pack
6.4 SSER 23, June 1984
6.5 Calculation M-824, Combustible Loading
6.6 Drawing 065126, Fire Protection Information Report, Unit 1
6.7 NECS File: 131.95, FHARE: 15, HVAC Ducts Wrapped in Pyrocrete
6.8 NECS File: 131.95, FHARE: 73, Undampered Ducts
6.9 DCN DC0-EA-37379, Install Fire Dampers to Vent Shaft
6.10 DCN DC2-EA-22612 Rev. 0, Fireproof Conduit
6.11 NECS File: 131.95, FHARE: 80, Fire Dampers Installed at Variance with Manufacturer Instructions
6.12 NECS File: 131.95, FHARE: 6, "Seismic Gap At Concrete Block Walls"
6.13 Deleted in Revision 14.
6.14 Calculation M-911, Evaluation of Safe Shutdown Equipment During Loss of HVAC
6.15 Calculation M-912, HVAC Interactions For Safe Shutdown
6.16 DCNs DC1-EE-47591, DC1-EE-47593 and DC1-EE-47594 Provide Transfer Switches at the 4kV Switchgear and Mode Selector Switches at the Hot Shutdown Panel
6.17 PG&E Design Change Notice DC2-EA-049070, Unit 1 ThermoLag Replacement
6.18 Calculation 134-DC, Electrical Appendix R Analysis
6.19 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.20 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.21 NECS File: 131.95, FHARE 27, Undampered Duct Penetrations in Concrete Lined Shafts
6.22 SSER-31, April 1985
6.23 NECS File: 131 .95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.
6.24 NECS File: 131.95, FHARE 42, Fire Damper Installation for Fire Areas 5-A-4 and 5-B-4
6.25 NECS File: 131.95, FHARE 100, Block Walls Structurally Modified with Columns, Beams and Steel Plates

6.26 NECS File: 131.95, FHARE 104, Fireproofing on Structural Steel for Block Walls

FIRE AREAS 6-A-1, 6-A-2, 6-A-3

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Northwest side of the Unit 1 Auxiliary Building. Unit 1 battery, inverter, and dc switchgear rooms, El. 115 ft.

1.2 Description

Fire Areas 6-A-1, 6-A-2, and 6-A-3 are separate fire areas each containing redundant batteries, inverters, and dc switchgear, one train of which is required for safe shutdown. These fires areas are situated side by side, with Fire Area 6-A-2 located between Fire Area 6-A-1 to the west and Fire Area 6-A-3 to the east. Due to similarities between these three areas, they have been combined into one section.

Battery room ventilation is provided by a supply fan and an exhaust fan located in separate fire zones isolated by 25 ft of open space (Fire Zones 8-B-5 and 8-B-7). Either fan provides adequate flow to limit hydrogen concentration well below the explosive concentration. Additionally control room annunciation is provided for dc overvoltage which could result in excessive hydrogen generation. Ventilation for the inverter and dc switchgear room is provided by two 100 percent supply fans which also supply ventilation for the 480V vital switchgear and are unrelated to the battery room ventilation. (Ref. 6.9)

The battery rooms are separated from the inverter and switchgear rooms. (Ref. 6.6)

1.3 Boundaries

1.3.1 Fire Area 6-A-1

North:

- 3-hour rated barrier separates this area from Area 3-BB.

South:

- 3-hour rated barrier separates this area from Area 6-B-1. (Ref. 6.14)
- Unrated structural gap seal to Fire Area 6-B-1. (Ref. 6.12).
- A 3-hour rated door communicates to Area 6-B-1.

East:

- 3-hour rated barrier separates this area from Area 6-A-2.
- A 3-hour rated door communicates to Area 6-A-2.
- A ventilation opening with a 3-hour rated fire damper penetrates to Area 6-A-2.
- Four protected ducts with no fire damper penetrate Area 6-A-2. Dampers are provided at the registers. (Ref. 6.5)

West:

- 3-hour rated barrier separates this area from Areas 6-A-5.
- A 3-hour rated door communicates to Area 6-A-5.
- A ventilation opening with a 1 1/2-hour rated fire damper penetrates to Area 6-A-5. (Ref. 6.15).
- Three protected ducts with no fire damper penetrate to Area 6-A-5. Dampers are provided at the registers. (Ref. 6.5)

Floor/Ceiling:

- 3-hour rated barriers.

<u>1.3.2 Fire Area 6-A-2</u>

North:

- 3-hour rated barrier separates this area from Area 3-BB.

South:

- 3-hour rated barrier separates this area from Area 6-B-2. (Ref. 6.14)
- Unrated structural gap seal to Fire Area 6-B-2. (Ref. 6.12).
- A 3-hour rated door communicates to Area 6-B-2.

East:

- 3-hour rated barrier separates this area from Area 6-A-3.
- A 3-hour rated door communicates to Area 6-A-3.
- A ventilation opening with a 3-hour rated fire damper penetrates to Area 6-A-3.
- Four protected ducts with no fire damper penetrate to Area 6-A-3. Dampers are provided at the registers. (Ref6.5)

West:

- 3-hour rated barrier separates this area from Areas 6-A-1.
- A 3-hour rated door communicates to Area 6-A-1.
- A ventilation opening with a 3-hour rated fire damper penetrates to Area 6-A-1.
- Four protected ducts with no fire damper penetrate to Area 6-A-1. Dampers are provided at the registers. (Ref 6.5)

Floor/Ceiling:

- 3-hour rated barriers.

<u>1.3.3 Fire Area 6-A-3</u>

North:

- 3-hour rated barrier separates this area from Area 3-BB.

South:

- 3-hour rated barrier separates this area from Area 6-B-3. (Ref. 6.14)
- Unrated structural gap seal to Fire Area 6-B-3s. (Ref. 6.12)
- A 3-hour rated door communicates to Area 6-B-3.

East:

- 3-hour rated barrier separates this area from Area 6-A-4.
- A 3-hour rated door communicates to Area 6-A-4.
- Two protected ducts with no fire damper penetrate to Area 6-A-4. Dampers are provided at the registers. (Ref. 6.5)

West:

- 3-hour rated barrier separates this area from Areas 6-A-2.
- A 3-hour rated door communicates to Area 6-A-2.
- A ventilation opening with a 3-hour rated fire damper penetrates to Area 6-A-2.
- Four protected ducts with no fire damper penetrate Area 6-A-2. Dampers are provided at the registers. (Ref. 6.5)

Floor/Ceiling:

- 3-hour rated barriers

2.0 COMBUSTIBLES (typical for each area)

2.1 Floor Area: 672 ft^2

2.2 In situ Combustible Materials

- Paper
- Plastic
- Cable insulation
- Wood

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION (typical for each area)

3.1 Detection

- Smoke detection in the inverter, the dc switchgear rooms and the battery rooms. (Ref. 6.7)

3.2 Suppression

- CO_2 hose stations
- Fire hose stations
- Portable fire extinguishers

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Area 6-A-1

4.1.1 Auxiliary Feedwater

AFW pump 1-3 may be lost due to a fire in this area. Redundant AFW pumps 1-1 will be available to provide AFW to steam generator 1-3 and 1-4.

A fire in this area may affect AFW supply valves LCV-113 and LCV-115. Steam generator 1-3 and 1-4 is credited for safe shutdown. Redundant valves LCV-108 and LCV-109 will remain available for AFW flow from AFW pump 1-1.

4.1.2 Chemical and Volume Control System

Charging pump 1-1 and ALOP 1-1 may be lost due to a fire in this area. Redundant charging pump 1-2 and ALOP 1-2 and charging pump 1-3 will be available to provide charging flow.

Boric acid transfer pump 1-1 may be lost due to a fire in this area. Redundant boric acid transfer pump 1-2 will remain available

Valve 8105 may be affected by a fire in this area. Safe shutdown will not be affected since the RWST can be made available to provide a charging suction flowpath.

A fire in this area may affect valve 8107. Since valve 8107 has redundant components available to provide the required functions, this valve's position will not have an affect on safe shutdown.

A fire in this area may spuriously open valves 8149A, 8149B, 8149C, LCV-459 or LCV-460. Operator action can be taken to fail 8149A, 8149B and 8149C closed. Therefore, safe shutdown is not affected.

Valves 8146 and 8147 may fail open due to a fire in this area. This condition will not affect safe shutdown since the PORVs will remain available for pressure reduction.

Valve LCV-112B may be affected by a fire in this area. If control of this valve is lost, the VCT can be isolated by closing valve LCV-112C. Valve 8805B can be opened to provide water to the charging pumps from the RWST.

Boric acid storage tank 1-2 level indication from LT-106 may be lost due to a fire in this area. Borated water from the RWST will be available. Therefore, BAST level indication is not required.

4.1.3 Component Cooling Water

CCW pump 1-1 and ALOP 1-1 may be lost due to a fire in this area. Redundant CCW pumps and ALOPs 1-2 and 1-3 will be available to provide CCW.

FCV-430 may be affected by a fire in this area. Valve FCV-431 will remain available to enable the use of redundant CCW heat exchanger 1-2.

A fire in this area may spuriously close FCV-750. Since RCP seal injection will remain available, adequate RCP seal cooling will be provided and FCV-750 will not be required open.

4.1.4 Emergency Power

A fire in this area may disable the diesel generator 1-2 backup control circuit. The normal control circuit will remain available.

A fire in this area may disable diesel generator 1-3. Diesel generators 1-1 and 1-2 will remain available for safe shutdown.

A fire in this area may disable startup transformers 1-1, 1-2, 2-1 and 2-2. Onsite power from diesel generators 1-1 and 1-2 will remain available for Unit 1 and all three diesel generators 2-1, 2-2 and 2-3 will remain available for Unit 2.

All power supplies on the "F" Bus may be lost due to a fire in this area. These power supplies are not required since redundant trains on the "G" and "H" Buses will be available.

A fire in this area may disable dc panel SD13 backup battery charger ED131. Normal battery charger ED132 will remain available.

A fire in this area may result in a loss of power supplies associated with PY17N. Redundant power supply PY16 remains available.

4.1.5 Main Steam System

A fire in this area may affect the following instrumentation: LT-516, LT-526, LT-529, LT-536, LT-539, LT-546, PT-514, PT-524, PT-534 and PT-544. Safe shutdown is not affected since there are redundant trains of instrumentation for all four steam generators.

Valve PCV-19 may be affected by a fire in this area. Air can be isolated and vented to fail PCV-19 in the desired, closed position. Redundant dump valves (PCV-20, PCV-21 and PCV-22) will remain available to provide cooldown capability.

A fire in this area may spuriously close FCV-38. This valve can be manually opened to ensure safe shutdown.

4.1.6 Makeup System

Condensate storage tank level indication, LT-40 may be lost due to a fire in this area. Water from the raw water storage reservoir will remain available through valve FCV-436 in order to provide auxiliary feedwater. A manual action can be performed to locally open the normally closed valve prior to CST depletion.

4.1.7 Reactor Coolant System

A fire in this area may result in the loss of the following components: LT-406, LT-459, NE-31, NE-51, PT-406, PT-403, TE-410C, TE-413B, TE-423A and TE-423B. Since redundant instrumentation exists safe shutdown is not affected.

Pressurizer PORV blocking valve 8000A may be affected by a fire in this area. Since pressurizer PORV PCV-474 will remain closed, the position of valve 8000A will not affect safe shutdown.

A fire in this area may prevent the tripping of the four reactor coolant pumps. If the RCPs are not tripped, safe shutdown will not be affected because valves PCV-455A and PCV-455B will remain available to isolate normal spray. Seal injection will remain available for RCP seal cooling.

Pressurizer heater group 1-3 and 1-4 may spuriously operate due to a fire in this area. These heater groups can be manually tripped to defeat any spurious operation.

4.1.8 Safety Injection System

SI pump 1-1 and accumulator isolation valve 8808A are required off and closed. A fire in this area spuriously energize SI pump 1-1 and may open valve 8808A. Valve 8808A can be manually operated and SI pump 1-1 can be manually tripped to ensure safe shutdown.

A fire in this area may result in the loss of the following valves: 8801A, 8803A and 8805A. Redundant valves 8801B, 8803B and 8805B will remain available to ensure safe shutdown.

4.1.9 Auxiliary Saltwater System

ASW pump 1-1 may be lost due to a fire in this area. The redundant ASW pump 1-2 will remain available.

A fire in this area may spuriously open valve FCV-601. FCV-495 and FCV-496 can be closed to provide ASW system integrity.

Valve FCV-602 may be affected by a fire in this area. FCV-602 will be used with ASW pump 1-1. Since ASW pump 1-2 is used during a fire in this area, FCV-602 is not required.

4.1.10 HVAC

HVAC equipment E-103, E-43, S-43, FCV-5045 and S-69 may be affected by a fire in this area. E-103 and S-69 will not be necessary during a fire in this area. S-43, E-43 and FCV-5045 have the following redundant components: S-44, E-44 and FCV-5046. Therefore, safe shutdown is not affected by a fire in this area.

4.2 Fire Area 6-A-2

4.2.1 Auxiliary Feedwater

A fire in this area may affect valves LCV-106, LCV-107, LCV-108 and LCV-109. Steam generators 1-1 and 1-2 are credited for safe shutdown. Redundant valves LCV-110 and LCV-111 will remain available.

4.2.2 Chemical and Volume Control System

Charging pumps 1-2 and 1-3 and ALOP 1-2 may be lost due to a fire in this area. Redundant charging pump and ALOP 1-1 will be available to provide charging flow.

Boric acid transfer pump 1-2 may be lost due to a fire in this area. Redundant boric acid transfer pump 1-1 will remain available.

Valve 8106 may be affected by a fire in this area. Since the RWST will be aligned to the charging pump suction, safe shutdown will not be affected.

A fire in this area may cause valve 8108 to spuriously operate. Since valve 8108 has redundant components available, safe shutdown is not affected.

Valves 8104 and FCV-110A may be affected by a fire in this area. In order to provide boric acid to the charging pump suction, one of these valves must be open. FCV-110A fails open to provide a charging path, however, manual valve 8471 must also be opened. Valve 8104 can be opened from the hot shutdown panel in order to provide boric acid to the charging pump suction. Therefore, either of these two paths can be used to ensure safe shutdown.

A fire in this area may affect valves 8146, 8147 and 8148. Safe shutdown is not compromised because the PORVs will remain available for pressure reduction.

Valves FCV-128 and HCV-142 may be affected by a fire in this area. Valve HCV-142 is not necessary during a fire in this area because redundant components exist. Spurious closure of FCV-128 will isolate seal injection flow. An operator action can be taken in the control room to open FCV-128 after taking its controller to the manual mode of operation.

Volume control tank outlet valve LCV-112C may be affected by a fire in this area. If LCV-112C spuriously closes then valve 8805A can be opened to provide water from the RWST to the charging pump suction. Otherwise, the VCT may be isolated by closing LCV-112B.

Letdown isolation valves LCV-459 and LCV-460 may be affected by a fire in this area. However, safe shutdown is not affected since redundant valves 8149A, 8149B and 8149C will be available.

Boric acid storage tank 1-2 level indication from LT-106 may be lost due to a fire in this area. Borated water from the RWST will remain available. Therefore, BAST level indication is not required.

A fire in this area may affect the transmitter and circuits associated with charging pump header flow transmitter, FT-128, and pressure transmitter, PT-142. Because either charging pump 1-1 or 1-2 is not affected in this area, the loss of these instruments will not adversely affect safe shutdown.

4.2.3 Component Cooling Water

CCW pump 1-2 and ALOP 1-2 may be lost due to a fire in this area. Redundant CCW pumps and ALOPs 1-1 and 1-3 will be available to provide CCW.

Valve FCV-431 may be affected by a fire in this area. Redundant valve FCV-430 will remain available.

A fire in this area may spuriously close FCV-365, making RHR HX 1-1 unavailable. Redundant valve FCV-364 will be available and allow RHR HX 1-2 to be used.

A fire in this area may spuriously close valve FCV-356. The seal injection flowpath can also be affected in this area due to fire-induced spurious closure of FCV-128. The potential for a loss of all seal cooling can occur if the valves in these flowpaths spuriously close simultaneously. A operator action can be taken in the control room to open FCV-128 after taking its controller to the manual mode of operation, to provide RCP seal injection.

A fire in this area may affect circuits associated with CCW flow transmitters for Header B (FT-65) and Header C (FT-69). Redundant CCW Header A is credited for a fire in this fire area, and flow transmitter FT-68 will remain available. Loss of CCW to header C will also remain available, and loss of FT-69 indication will not affect flow to the header.

A fire in this area may affect circuits associated with the differential pressure transmitter for CCW Hx 1-2 (PT-6). Redundant CCW Hx 1-1 will remain available for safe shutdown. Loss of this instrument will not affect safe shutdown.

4.2.4 Containment Spray

A fire in this area may spuriously operate containment spray pump 1-1 and open 9001A. Operator action can be taken to trip CS pump 1-1. Therefore, safe shutdown will not be affected.

Valve 9003A may be spuriously opened due to a fire in this area. This valve can be manually closed in order to isolate containment spray.

4.2.5 Diesel Fuel Oil System

Diesel fuel oil pump 0-2 may be lost due to a fire in this area. Redundant diesel fuel oil pump 0-1 remains available.

Valves LCV-85, LCV-86 and LCV-87 may be lost due to a fire in this area. However, safe shutdown is not affected because redundant valves LCV-88, LCV-89 and LCV-90 will remain available.

4.2.6 Emergency Power

A fire in this area may disable the diesel generator 1-1 backup control circuit. The normal control circuit will remain available.

A fire in this area may disable diesel generator 1-2. Diesel generators 1-1 and 1-3 will remain available for safe shutdown.

A fire in this area may disable startup transformers 1-1, 1-2, 2-1 and 2-2. Onsite power from diesel generators 1-2 and 1-3 will remain available for Unit 1 and all three diesel generators will remain available for Unit 2.

All power supplies on the "G" Bus may be lost due to a fire in this area. These power supplies are not necessary since redundant trains on the "F" and "H" Buses will be available.

A fire in this area may result in a loss of power supplies associated with PY17N and PY16. Loss of power to PY17N and PY16 results in the spurious closure of FCV-128 when in the automatic mode. FCV-128 can be opened by setting its controller in the control room to manual.

4.2.7 Main Steam System

A fire in this area may affect the power supplies to the following instruments: LT-519, LT-549, PT-515, PT-525, PT-535 and PT-545. Since redundant instrumentation exists for each steam generator, safe shutdown will not be affected.

A fire in this area may affect valve PCV-21. Air can be isolated and vented to fail PCV-21 closed. Redundant dump valves (PCV-19, PCV-20 and PCV-22) will remain available to provide cooldown capability.

Valves FCV-760 and FCV-761 may be affected by a fire in this area. Redundant valves FCV-154 and FCV-248 for FCV-761 and FCV-151 and FCV-250 for FCV-760 remain available to isolate steam generator blowdown.

A fire in this area may affect valve FCV-95. AFW pumps 1-2 and 1-3 will remain available if FCV-95 is unable to provide steam to AFW pump 1-1.

Main steam isolation valves FCV-41, FCV-42 and bypass valve FCV-24 may be affected by a fire in this area. These valves can be manually operated to ensure safe shutdown.

4.2.8 Reactor Coolant System

A fire in this area may result in the loss of power for the following equipment: LT-460, NE-32, TE-433A, TE-433B, TE-443A and TE-443B. Since redundant components exist, safe shutdown is not affected.

Valves PCV-455C and 8000B may be affected by a fire in this area. PCV-455C will fail in the desired, closed position. Redundant valves PCV-456 and 8000C will be available for pressure reduction. Therefore, safe shutdown is not affected.

A fire in this area may prevent the tripping of reactor coolant pumps 1-1, 1-2, 1-3 and 1-4. Since PCV-455A and PCV-455B can isolate normal spray in order to prevent uncontrolled pressure reduction, safe shutdown will not be affected if the reactor coolant pumps continue to operate. Seal injection will remain available for seal cooling.

Pressurizer heaters groups 1-3 and 1-4 may be affected by a fire in this area. Manual actions can be taken to de-energize heater group 1-4 and switch heater group 1-3 to the vital power supply. Therefore, safe shutdown is not affected.

4.2.9 Residual Heat Removal System

RHR pump 1-1, FCV-641A and outlet valve 8700A may be lost due to a fire in this area. The redundant train RHR pump 1-2, FCV-641B, and 8700B will be available so safe shutdown will not be affected.

Valve 8701 may be affected by a fire in this area. This valve is closed with its power removed during normal operation and will not spuriously open. This valve can be manually operated for RHR operations.

4.2.10 Safety Injection System

Valves 8801B, 8803B and 8805B may be lost due to a fire in this area. Safe shutdown will not be affected because redundant valves 8801A, 8803A and 8805A will remain available.

Valves 8808B and 8808D may be affected by a fire in this area. These valves can be manually closed to ensure safe shutdown.

A fire in this area may damage circuits for valve 8982A. Power to the valve is administratively removed by maintaining a toggle switch in the Control Room in the open position. The valve is normally closed, and spurious opening is not expected to occur. In addition, an operator action can be taken to open the power breaker to the valve to further preclude spurious operation. Therefore, safe shutdown is not affected.

A fire in this area may spuriously open valve 8804A. This valve can be manually closed to ensure safe shutdown.

4.2.11 Auxiliary Saltwater System

ASW pump 1-2 may be lost due to a fire in this area. Redundant ASW pump 1-1 will be available to provide the ASW function.

Valve FCV-603 may be lost due to a fire in this area. Since redundant valve FCV-602 remains available, safe shutdown is not affected.

4.2.12 HVAC

A fire in this area may affect E-101 and S-68. Since these components are not required to be operational during a fire and redundant components are available, safe shutdown is not affected.

4.3 Fire Area 6-A-3

4.3.1 Auxiliary Feedwater

AFW pump 1-2 may be lost for a fire in this area. Redundant AFW pump 1-3 will be available to provide AFW to steam generators 1-3 and 1-4.

Valves LCV-110 and LCV-111 may be affected by a fire in this area. Redundant valves LCV-113 and LCV-115 will remain available to provide AFW flow to steam generators 1-3 and 1-4.

4.3.2 Chemical and Volume Control System

Valve 8145 may be affected by a fire in this area. Redundant components will remain available to isolate auxiliary spray and the PORVs can be used for RCS depressurization, safe shutdown will not be affected.

Boric acid storage tank 1-1 level indication from LT-102 may be lost due to a fire in this area. Borated water from the RWST will remain available. Therefore, BAST level is not required.

A fire in this area might result in the spurious closure of charging pump discharge flow control valve FCV-128. This valve can be opened from the control room after switching to manual control.

A fire in this area may affect valves LCV-459 and LCV-460. Redundant components 8149A, 8149B and 8149C are available to isolate letdown, safe shutdown is not affected.

A fire in this area may affect circuits associated with letdown flow transmitter, FT-134. Letdown isolation valves 8149A, 8149B, and 8149C will remain available to isolate letdown. Therefore, the loss of this indication will not affect safe shutdown.

4.3.3 Component Cooling Water

CCW pump 1-3 and ALOP 1-3 may be lost for a fire in this area. Redundant pumps and ALOPs 1-1 and 1-2 are available to provide CCW.

CCW valve FCV-357 may be affected by a fire in this area. Since seal injection will remain available, FCV-357 will not be required open.

A fire in this area may spuriously close FCV-355. FCV-355 can be manually operated for safe shutdown.

FCV-364 may spuriously close due to a fire in this area. If this valve closes, redundant RHR HX 1-1 will be available to provide this safe shutdown function.

A fire in this area may affect circuits associated with CCW flow transmitter for Header C (FT-69). Flow through CCW Header C is not credited in this fire area. Therefore, loss of flow indication will not affect safe shutdown.

4.3.4 Containment Spray

Circuits for containment spray pump 1-2 and outlet valve 9001B may be damaged by a fire in this area. Operator action can be taken to trip CS pump 1-2. Therefore, safe shutdown is not affected.

A fire in this area may spuriously open valve 9003B. This valve can be manually closed.

4.3.5 Diesel Fuel Oil System

Diesel fuel oil pump 0-1 may be lost due to a fire in this area. The redundant diesel fuel oil pump 0-2 remains available.

Valves LCV-88, LCV-89 and LCV-90 may be lost due to a fire in this area. Redundant valves LCV-85, LCV-86 and LCV-87 will remain available.

4.3.6 Emergency Power

A fire in this area may disable diesel generator 1-1. Diesel generators 1-2 and 1-3 will remain available for safe shutdown.

A fire in this area may disable the diesel generator 1-3 backup control circuit. The normal control circuit will remain available.

All power supplies on the H Bus may be lost due to a fire in this area. These power supplies are not necessary since redundant trains on the G and F Buses will be available.

A fire in this area may disable dc panel SD11 backup battery charger ED121. Normal battery charger ED11 will remain available.

A fire in this area may disable dc panel SD12 backup battery charger ED121. Normal battery charger ED12 will remain available.

A fire in this area may affect vital Uninterrupted Power Supply (UPS) IY13 and IY14 and vital instrument ac distribution panels PY 13 and PY14. Redundant UPS IY11 and IY12 and distribution panels PY11 and PY12 will remain available.

A fire in this area may result in a loss of power supplies associated with PY17N and PY16. Loss of power to PY17N and PY16 results in the spurious closure of FCV-128 when in the automatic mode. FCV-128 can be opened by setting its controller in the control room to manual.

4.3.7 Main Steam System

A fire in this area may result in the loss of the following components: LT-517, LT-527, LT-537, LT-547, PT-516, PT-526, PT-536, PT-546, LT-518, LT-528, LT-538 and LT-548. Since redundant trains of instrumentation exist for all four steam generators, safe shutdown is not affected.

Valves PCV-20 and PCV-22 may be affected by a fire in this area. Air can be isolated and verified to fail PCV-20 and PCV-22 closed. Safe shutdown is not affected. Redundant valve PCV-21 will remain available for cooldown.

A fire in this area may spuriously close FCV-37. Safe shutdown will not be affected since AFW pump 1-3 will remain available to provide AFW to the steam generators 1-3 and 1-4.

Valves FCV-762 and FCV-763 may spuriously open due to a fire in this area. Valves FCV-157 and FCV-246 can be shut to provide steam generator blowdown in place of FCV-762 and FCV-160 and FCV-244 can perform the same function for FCV-763.

A fire in this area may affect FCV-43 and FCV-44. These valves can be manually shut to ensure safe shutdown.

4.3.8 Reactor Coolant System

A fire in this area may affect LT-461, NE-52, PT-403 and PT-405. These instruments have redundant components available for safe shutdown.

A fire in this area may prevent all four reactor coolant pumps from being tripped. In order to prevent uncontrolled pressure reduction, PCV-455A and PCV-455B can be closed to isolate normal spray. Therefore, operation of the reactor

coolant pumps will not affect safe shutdown. Seal injection will remain available for RCP seal cooling.

Pressurizer heater groups 1-1, 1-2, 1-3 and 1-4 may be affected by a fire in this area. Manual actions can be taken to de-energize heater groups 1-1, 1-3 and 1-4 and switch heater group 1-2 to the vital power supply. Therefore, safe shutdown is not affected.

Pressurizer PORV PCV-456 and blocking valve 8000C may be affected by a fire in this area. Since PCV-456 fail closed during a fire and PCV-455C will remain available for pressure reduction, safe shutdown is not affected.

4.3.9 Residual Heat Removal System

RHR pump 1-2, valve FCV-641B and outlet valve 8700B may be lost for a fire in this area. The redundant train (RHR PP 1-1 and 8700A, and FCV641A) will be available to provide the RHR function.

Valve 8702 may be affected by a fire in this area. This valve is closed during normal operation and can not spuriously open. This valve can be manually operated for RHR operations.

4.3.10 Safety Injection System

SI pump 1-2 and valve 8808C are required off and closed during RCS pressure reduction. A fire in this area may spuriously operate SI pump 1-2 and may prevent the operation of 8808C. SI pump 1-2 can be manually de-energized and valve 8808C can be manually closed in order to achieve safe shutdown.

A fire in this area may damage circuits for valve 8982B. Power to the valve is administratively removed by maintaining a toggle switch in the Control Room in the open position. The valve is normally closed, and spurious opening is not expected to occur. Therefore, safe shutdown will not be compromised.

A fire in this area may affect circuits associated with RWST Level Transmitter LT-920. RWST inventory could be diverted due to spurious operation of Containment Spray pump and discharge valve. Manual action is credited to mitigate the spurious operation, and this indicator will not be available for diagnosis.

4.3.11 Auxiliary Saltwater System

Valves FCV-495 and FCV-496 may be affected by a fire in this area. FCV-601 will remain closed to provide ASW system integrity.

4.3.12 HVAC

One train of HVAC components (E-44, S-44, FCV-5046 and S-67) may be lost due to a fire in this area. S-67 is not required for a fire in this area. A redundant train of HVAC components (S-43, E-43 and FCV-5045) will remain available to provide the HVAC function.

4.3.13 Unit 2 Components

4.3.13.1 Main Steam System

A fire in this area may result in the loss of the following components: LT-517, LT-527, LT-537, LT-547, PT-516, PT-546. Since redundant trains of instrumentation exist for all four steam generators, safe shutdown is not affected.

4.3.13.2 Reactor Coolant System

A fire in this area may result in the loss of the RCS pressure transmitter PT-405. Redundant instruments PT-403 and PT-406 are not affected and will be available for safe shutdown.

5.0 CONCLUSION

- The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Loss of safe shutdown functions in an area does not adversely affect safe shutdown.

- Automatic smoke detection in inverter and dc switchgear rooms.

- Manual fire fighting equipment is available for use.

These areas meet the intent of 10 CFR 50, Appendix R, Section III.G and no exemptions or deviations have been requested.

6.0 REFERENCES

6.1 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.2 Drawing No. 515570
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065126, Fire protection Information Report, Unit 1
6.5 NECS File: 131.95, FHARE: 15, HVAC Ducts Wrapped With Pyrocrete 102
6.6 NECS File: 131.95, FHARE: 26, Non-rated Barrier
6.7 DCN DC0-EE-35151, Provide Smoke Detection for Battery Rooms
6.8 Deleted
6.9 Response to Q.21 of PG&E letter dated November 13, 1978
6.10 Calculation 134-DC, Electrical Appendix R Analysis
6.11 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.12 NECS File: 131.95, FHARE 134, “Non-rated Structural Gap Seals in Fire Barriers”
6.13 NECS File: 131.95, FHARE 152, Evaluation of Fire Dampers in 480V Switchgear and Battery Rooms
6.14 NECS File: 131 .95, FHARE 100, Block Walls Structurally Modified with Columns, Beams and Steel Plates
6.15 NECS File: 131 .95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.

FIRE AREA 6-A-4

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Northwest side of the Auxiliary Building, El. 115 ft.

1.2 Description

This fire area is east of the H Bus battery inverter and dc switchgear room, Fire Area 6-A-3. Unit 1 reactor trip switchgear and rod programmer area.

1.3 Boundaries

North:

- 3-hour rated barrier separates this area from Area 3-BB and Zone 3-AA.

South:

- 3-hour rated barrier separates this area from Area 6-B-4 and Zone S-5.
- Unrated structural gap seal to Fire Area 6-B-4. (Ref. 6.10)
- A 3-hour rated door communicates to Area 6-B-4.
- A duct penetration without a fire damper penetrates to Zone S-5. (Ref. 6.5)

East:

- 3-hour rated barrier separates this area from Zones 3-AA, S-2, and S-5.
- A 3-hour rated door communicates to Zone S-5.

West:

- 3-hour rated barrier separates this area from Area 6-A-3. (Ref. 6.11)
- A 3-hour rated door communicates to Area 6-A-3.
- Two duct penetrations without fire dampers penetrate to Area 6-A-3. (Ducts are protected within 6-A-3 with dampers at registers.)

Floor/Ceiling:

- 3-hour rated barriers separate this area from Area 5-A-4 below and Areas 7-A and 7-C above.

2.0 COMBUSTIBLES

2.1 Floor Area: 1,222 ft^2

2.2 In situ Combustible Materials

- Cable insulation
- Plastic
- Rubber
- Oil
- Paper

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection

3.2 Suppression

- CO_2 hose stations
- Hose stations
- Portable fire extinguishers

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Chemical and Volume Control System

Valve 8145 may be affected by a fire in this area. Redundant valves exist to prevent uncontrolled pressure reduction.

A fire in this area may affect cables associated with Centrifugal Charging Pump 1-3. Redundant charging pumps 1-1 and 1-2 will remain available for the RCS inventory control function

A fire in this area may affect circuits associated with letdown flow transmitter, FT-134. Letdown isolation valves LCV-459, LCV-460, 8149A, 8149B, and 8149C will remain available to isolate letdown. Therefore, the loss of this indication will not affect safe shutdown.

A fire in this area may result in spurious closure of charging pump discharge flow control valve FCV-128. This valve can be opened from the control room after switching to manual control.

4.2 Component Cooling Water

A fire in this area may spuriously close FCV-364. Heat exchanger 1-1 will be available for safe shutdown.

4.3 Emergency Power

A fire in this area may result in the loss of power supplies associated with PY17N and PY16. Loss of power to PY17N and PY16 results in the spurious closure of FCV-128 when in the automatic mode. FCV-128 can be opened by setting its controller in the control room to manual.

4.4 Main Steam System

A fire in this area may result in the loss of the following components: LT-517, LT-527, LT-537, LT-547, PT-516 and PT-546. Since each steam generator has a redundant train of components, safe shutdown is not affected.

4.5 Reactor Coolant System

A fire in this area may affect circuits for the reactor vessel vent valves 8078A, 8078B, 8078C and 8078D. Valves 8078A and 8078B are in series, likewise for 8078C and 8078D. Operator action can be taken to fail the valves closed. Therefore, safe shutdown is not affected.

Valve PCV-456 may be lost due to a fire in this area. Blocking valve 8000C may be closed for RCS isolation and pressure control. PCV-455C will remain available for pressure reduction.

RCS pressure indication, PT-405 may be lost due to a fire in this area. Redundant components PT-406 and PT-403 will remain available.

Pressurizer heater groups 1-1, 1-2, 1-3 and 1-4 may be affected by a fire in this area. Manual actions can be taken to de-energize heater 1-1 and 1-4 and switch heater groups 1-2 and 1-3 to the vital power supply. Therefore, safe shutdown is not affected.

4.5 Safety Injection System

A fire in this area may affect circuits for valve 8982B. Power to the valve is administratively removed by maintaining a toggle switch in the Control Room in the open position. The valve is normally closed, and spurious opening is not expected to occur. Therefore, safe shutdown will not be affected.

4.6 HVAC

S-44 and E-44 may be lost due to a fire in this area. Redundant components S-43 and E-43 will remain available to provide the HVAC function.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- The loss of safe shutdown functions located in this area will not affect safe shutdown capability.
- Automatic smoke detection is provided.
- Manual fire fighting equipment is provided.
- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

The existing fire protection features provide an acceptable level of safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.2.

6.0 REFERENCES

6.1 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.2 Drawing No. 515570
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065126, Fire protection Information Report, Unit 1
6.5 NECS File: 131.95, FHARE: 27, Undampered Duct Penetrations in Concrete Lined Shafts
6.6 NECS File: 131.95, FHARE: 15, HVAC Duct Wrapped in Pyrocrete
6.7 Deleted
6.8 Calculation 134-DC, Electrical Appendix R Analysis
6.9 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.10 NECS File: 131.95, FHARE 134, “Non-rated Structural Gap Seals in Fire Barriers”
6.11 NECS File: 131.95, FHARE 100, Block Walls Structurally Modified with Columns, Beams and Steel Plates

FIRE AREA 6-A-5

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Northwest corner of the Auxiliary Building, El. 115 ft.

1.2 Description

Unit 1 Electrical Area, 6-A-5, is just west of the F Bus battery inverter and dc switchgear room, Area 6-A-1. Raceways for safe shutdown functions are routed through this fire area. No storage in this area.

1.3 Boundaries

North:

- 3-hour rated barrier separates this area from Zone 14-A.

South:

- 3-hour rated barrier to S-1.
- 3-hour rated door communicates to Area 6-B-5 and is provided with a 2-hour rated blockout above the door. (Ref. 6.9)

East:

- 3-hour rated barrier separates this area from Area 6-A-1.
- A 3-hour rated door communicates to Area 6-A-1.
- A duct penetration with a 1-1/2-hour rated fire damper penetrates to Area 6-A-1. (Ref. 6.15)
- Three penetrations with no fire dampers penetrate to Area 6-A-1 via protected ductwork. (Refs. 6.7, 6.11 and 6.15)

West:

- 3-hour rated barrier separates this area from the Fire Zone 14-A and Area S-1.
- Two protected penetrations with no fire damper penetrates to Zone 14-A. (Refs. 6.7, 6.11 and 6.15)
- A protected (1-hour) duct without a fire damper communicates to Zone S-1. (Refs. 6.7, 6.10, 6.11 and 6.15)

Floor/Ceiling:

- 3-hour rated barriers.
- Two protected duct penetrations with no fire damper penetrate to Area 5-A-4 below. (Refs. 6.7, 6.8 and 6.15)
- Nonrated equipment hatches communicate to Area 5-A-4 below and Area 7-A above (Ref. 6.15). The nonrated hatch to Zone 7-A contains HVAC duct penetrants. (Ref. 6.12 and 6.15)
- Two duct penetrations with 3-hour rated dampers to Area 7A above.

Protective Enclosure:

- 1-hour rated fire resistive covering for several HVAC ducts. (Refs. 6.7, 6.11 and 6.15)

2.0 COMBUSTIBLES

2.1 Floor Area: 660 ft^2

2.2 In situ Combustible Materials

- Paper
- Cable insulation
- Plastic
- Rubber

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection

3.2 Suppression

- CO_2 hose stations
- Hose stations
- Portable fire extinguishers

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Auxiliary Feedwater

Valves LCV-110, LCV-111, LCV-113 and LCV-115 may require manual positioning due to a fire. Redundant valves LCV-106 and LCV-107 will remain available to provide AFW flow to steam generators 1-1 and 1-2.

4.2 Chemical and Volume Control System

Valves 8146 and 8147 may be affected by a fire in this area. Since these valves fail in the desired position and the PORVs are available for pressure reduction, safe shutdown can be achieved.

Valves LCV-459 and LCV-460 may be affected by a fire in this area. Redundant valves 8149A, 8149B and 8149C will remain available to isolate letdown.

A fire in this area may result in spurious closure of charging pump discharge flow control valve FCV-128. This valve can be opened from the hot shutdown panel after switching to manual control.

4.3 Component Cooling Water

A fire in this area may affect the following valves: FCV-355, FCV-356, FCV-430 and FCV-431. FCV-355, FCV-430 and FCV-431 can be manually opened for CCW flow. Operation of FCV-356 is not necessary because seal injection will be available.

A fire in this area may affect circuits associated with CCW flow transmitter for Header C (FT-69). Flow through CCW Header C is not credited in this fire area. Therefore, loss of flow indication will not affect safe shutdown.

4.4 Containment Spray

A fire in this area may spuriously open valve 9001B. Since CS pump 1-2 is not affected by a fire in this area, safe shutdown will not be affected.

4.5 Emergency Power System

A fire in this area may disable startup transformers 1-1, 1-2, 2-1 and 2-2. Onsite power will remain available from all diesel generators for both Units 1 and 2.

A fire in this area may result in a loss of power supplies associated with PY17N. Redundant power supply PY16 remains available.

A fire in this area may result in a loss of UNIT 2 power supplies associated with PY27N. Redundant power supply PY26 remains available.

4.6 Main Steam System

A fire in this area may spuriously open FCV-248 and FCV-250. FCV-761 and FCV-760 will remain available to isolate steam generator blowdown. Therefore, safe shutdown is not affected.

A fire in this area may fail PCV-20 to the desired closed position. Redundant dump valves will remain available for cooldown.

4.7 Makeup System

Condensate storage tank level indication from LT-40 may be lost due to a fire in this area. Water from the raw water storage reservoir will be available through FCV-436. Manual action can be performed to locally open this normally closed manual valve.

4.8 Reactor Coolant System

A fire in this area may result in the loss of power for the following components: NE-52, TE-443A, TE-443B, TE-433A and TE-433B. Safe shutdown is not affected because redundant instrumentation exists.

Control of all four reactor coolant pumps may be affected by a fire in this area. In order to prevent uncontrolled pressure reduction, PCV-455A and PCV-455B can be closed to isolate normal spray. Therefore, operation of the reactor coolant pumps will not affect safe shutdown. Seal injection will remain available for RCP seal cooling.

Pressurizer heater groups 1-3 and 1-4 may spuriously operate due to a fire in this area. These heater groups can be manually tripped to defeat any spurious

operation. Pressurizer heater group 1-2 may spuriously trip but will not affect safe shutdown.

4.9 Safety Injection System

Control of accumulator isolation valve, 8808C may be lost due to a fire in this area. This valve can be manually closed to ensure safe shutdown.

4.10 Auxiliary Saltwater System

Valves FCV-495 and FCV-496 may be lost due to a fire in this area. Redundant valve FCV-601 will remain closed to provide ASW system integrity.

A fire in this area may spuriously close FCV-602 and FCV-603. These valves can be manually opened to ensure safe shutdown.

4.11 HVAC

S-43 and E-43 may be lost due to a fire in this area. Redundant components E-44 and S-44 remain available to provide HVAC.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Loss of the safe shutdown functions in this area will not affect safe shutdown due to redundant equipment and/or measures taken to mitigate the effects of fire.

- Manual fire fighting equipment is available.

- Light combustible loading.

The existing fire protection features provide an acceptable level of safety equivalent to that provided by section III.G.2.

6.0 REFERENCES

6.1 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)

6.2 Drawing No. 515570
6.3 DCN - DC1-EE-9913 - Provides Isolators on RPM Tach Packs
6.4 SSER 23, June 1984
6.5 Calculation M-824, Combustible Loading
6.6 Drawing 065126, Fire Protection Information Report, Unit 1
6.7 NECS File: 131.95, FHARE: 15, HVAC Ducts Wrapped in Pyrocrete
6.8 NECS File: 131.95, FHARE: 73, Undampered Ducts
6.9 NECS File: 131.95, FHARE: 118, Appendix R Fire Area Boundary Plaster Barriers
6.10 DCN DCD-EH-37379, Install Fire Dampers to Vent Shaft
6.11 PG&E letter to NRC dated 7/15/83, Appendix R Deviation Request
6.12 NECS File: 131.95, FHARE: 126, HVAC Ducts through Modified Unrated Hatches
6.13 Calculation 134-DC, Electrical Appendix R Analysis
6.14 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.15 NECS File: 131 .95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.

FIRE AREA 7-A

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This area is located directly under the Control Room at El. 127 ft in the Auxiliary Building.

1.2 Description

Fire Area 7-A, Unit 1 cable spreading room, is directly under the Unit 1 Control Room and north of the Unit 2 cable spreading room.

1.3 Boundaries

North:

- 3-hour rated barrier separates this area from Fire Zone 14-A and Area 3-BB.
- A nonrated penetration to Fire Zone 3-BB. (Refs. 6.14 and 6.21)

South:

- 3-hour rated barrier separates this area from Area 7-B and Zone S-1. In addition, localized sections of structural steel for blockwalls were not provided with 3-hour rated fireproofing. (Refs. 6.13 and 6.21)
- Unrated structural gap seals to Fire Area 7-B. (Refs. 6.19 and 6.21)
- Two 3-hour rated doors communicate to Area 7-B.
- Lesser-rated Unistrut seals to Fire Area 7-B. (Refs. 6.20 and 6.21)

East:

- 3-hour rated barrier separates this area from Area 7-C and Zones 3-AA, S-5.
- Two 1-1/2-hour rated doors communicate to Area 7-C. (Refs. 6.8 and 6.21)
- A 1-1/2-hour rated door communicates to Zone S-5. (Refs. 6.8 and 6.21)
- A ventilation duct with a 3-hour rated damper communicates to Zone S-5. (Ref. 6.22)

West:

- 3-hour rated barrier separates this area from the Fire Zone 14-A and Zone S-1.
- A 1-1/2-hour rated fire damper communicates to Zone S-1. (Ref. 6.8)

Floor/Ceiling:

- 3-hour rated barrier.
  Floor: To Fire Areas 6-A-5, 6-A-4, 6-A-3, 6-A-2, and 6-A-1.
  Ceiling: To Fire Zomes 8-A, 8-C, 8-E, and Fire Area 8-G.
- Two ducts with 3-hour rated dampers to 6-A-5 below.
- Nonrated equipment steel hatch with HVAC duct penetrants to Area 6-A-5 below. (Refs. 6.15 and 6.21)
- Unrated penetrations to Zones 8-A, 8-C, and 8-E above. (Ref. 6.18 and 6.21)

2.0 COMBUSTIBLES

<u>2.1 Floor Area</u>: 3,612 ft^2

<u>2.2 In situ Combustible Loading</u>

- Cable
- Wood
- Paper
- Plastic
- Polyethylene
- Resin
- PVC

<u>2.3 Transient Combustible Loading</u>

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

<u>2.4 Fire Severity</u>

- Moderate

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection
- Heat detection

3.2 Suppression

- Total flooding CO_2 system actuated by heat detection (also protects Area 7-C)
- Hose stations
- Portable fire extinguishers

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Auxiliary Feedwater

A fire in this area may affect Auxiliary Feedwater Supply valves LCV-106, 107, 108, 109, 110, 111, 113, and 115. Manual actions will enable valves LCV-106, 107, 108, and 109 to be controlled from the hot shutdown panel. Valves LCV-110, 111, 113, and 115 can be manually operated.

The ability to operate AFW pumps 1-2 and 1-3 from the control room may be lost due to a fire in this area. Manual action can be taken to operate these pumps from the 4-kV switchgear or from the hot shutdown panel. (Ref. 6.10)

A fire in this area may affect FCV-37, FCV-38 and FCV-95. These valves are associated with AFW pump 1-1. AFW pump 1-1 is not necessary since AFW PPs 1-2 and 1-3 will remain available.

Condensate storage tank level indication from LT-40 may be affected by a fire in this area. Valves FCV-436 and FCV-437 can be manually opened in order to supply water from the raw water storage reservoir.

4.2 Chemical and Volume Control System

A fire in this area may affect valves 8801A, 8801B, 8803A, and 8803B. RCS flow through the charging injection flow path can be secured by manual operation of (either 8801A or 8801B) and (either 8803A or 8803B). Prior to initiation of auxiliary spray, charging injection flowpath will need to be isolated.

A fire in this area may affect valves 8107, 8108, 8145, 8148, FCV-128, 8146, 8147 and HCV-142. Operation of HCV-142 will remain available from the hot shutdown panel to isolate the auxiliary spray flowpath with the controller at the

hot shutdown panel placed in the manual mode. Charging flow to the RCS will remain available through the seal injection flow path.

Repairs and operator actions can be taken to use the auxiliary spray flow path and isolate diversion flowpaths for RCS pressure reduction. Valve 8145 can be operated from the dedicated shutdown panel, and valve HCV-142 can be operated from the hot shutdown panel.

A fire in this area may spuriously open 8166, 8167 and fail HCV-123 closed. Only one of these valves is required closed to provide excess letdown isolation. Since HCV-123 fails closed, safe shutdown is not affected.

A fire in this area may affect the ability to operate valves LCV-459, LCV-460, 8149A, 8149B and 8149C from the control room. Manual actions will enable valves 8149A, 8149B and 8149C to be operated from the hot shutdown panel to isolate letdown.

The ability to operate charging pumps 1-1 and 1-2 and 1-3 from the control room may be lost due to a fire in this area. Manual actions will enable charging pumps 1-1 and 1-2 to be operated from the 4-kV switchgear and the hot shutdown panel. Manual action can be taken to isolate circuits for Charging Pump 1-3 at 4kv switchgear SHG. (Ref. 6.10)

A fire in this area may result in spurious closure of the charging pump discharge flow control valve FCV-128 which must be opened if charging pump 1-1 or 1-2 are used for RCP seal flow. FCV-128 can be opened from the hot shutdown panel after taking the controller to manual.

A fire in this area may spuriously close valves 8105 and 8106. Since the RWST will be aligned to the charging pumps, these valves are not required open.

A fire in this area may result in the loss of boric acid storage tank 1-1 and 1-2 level indication from LT-102 and LT-106. Borated water from the RWST will remain available. Therefore, BAST level indication is not required.

The ability to operate boric acid transfer pumps 1-1 and 1-2 from the control room may be lost due to a fire in this area. Manual actions will enable these pumps to be operated from the hot shutdown panel.

Valves HCV-104 and HCV-105 may fail closed due to a fire in this area. Since these valves fail in the desired position, safe shutdown is not affected.

Valves FCV-110A and 8104 may be affected by a fire in this area. Manual actions can be taken to enable valve 8104 to be operated from the hot shutdown panel.

A fire in this area may spuriously open valves FCV-110B and FCV-111B. These valves can be manually closed to ensure safe shutdown.

A fire in this area may affect valves LCV-112B, LCV-112C, 8805A and 8805B. All of these valves can be manually operated to ensure safe shutdown.

A fire in this area may affect the transmitter and circuits associated with charging pump header flow transmitter, FT-128, and pressure transmitter, PT-142. Alternative shutdown from the hot shutdown panel is credited in this area, and these instruments are not credited.

A fire in this area may affect circuits associated with letdown flow transmitter, FT-134. Alternative shutdown from the hot shutdown panel is credited in this area, and this flow transmitter is not required. Letdown is isolated at the hot shutdown panel.

A fire in this area may affect equipment and circuits associated with VCT level transmitter LT-112. This instrument is credited for diagnosis of failure of the VCT discharge valves LCV-112B or LCV-112C to automatically close. Alternative shutdown from the hot shutdown panel is credited in this area, and this level transmitter is not required.

4.3 Component Cooling Water

A fire in this area may cause FCV-356, FCV-357 and FCV-750 to spuriously close and fail to provide component cooling water to the reactor coolant pump thermal barriers if seal injection is not available. Control of HCV-142 to provide seal injection for RCP seal cooling will be available at the hot shutdown panel. Therefore, safe shutdown is not compromised.

The ability to operate CCW pumps 1-1, 1-2 and 1-3 from the control room may be lost due to a fire in this area. Manual action will enable these pumps to be operated from the 4-kV switchgear or the hot shutdown panel. (Ref. 6.10)

A fire in this area may affect valves FCV-430 and FCV-431. Either of these valves can be manually operated in order to provide a CCW flowpath.

Valves FCV-364 and FCV-365 may be affected by a fire in this area. Either valve can be manually opened in order to ensure RHR system operation.

A fire in this area may spuriously close FCV-355. This valve can be manually opened if seal injection is not available.

A fire in this area may affect circuits associated with CCW flow transmitters for

Header A (FT-68), Header B (FT-65), and Header C (FT-69). Availability of these instruments is not credited for safe shutdown.

A fire in this area may affect circuits associated with the differential pressure transmitters for CCW Hx 1-1 (PT-5) and CCW Hx 1-2 (PT-6). Availability of these instruments is not credited for safe shutdown.

4.4 Containment Spray

A fire in this area may spuriously start two containment spray pumps or may spuriously open the discharge valves 9001A and 9001B. Operator action can be taken to trip CS Pumps 1-1 and 1-2. Therefore, safe shutdown will not be affected.

4.5 Emergency Power

A fire in this area may disable remote control and auto transfer of diesel generator 1-1. The diesel can be manually started and loaded at the diesel generator local panel and at the 4-kV switchgear room. (Ref. 6.11)

A fire in this area may disable remote control and auto transfer of diesel generator 1-2. The diesel can be manually started and loaded at the diesel generator local panel and at the 4-kV switchgear room. (Ref. 6.11)

A fire in this area may disable remote control and auto transfer of diesel generator 1-3. The diesel can be manually started and loaded at the diesel generator local panel and at the 4-kV switchgear room. (Ref. 6.11)

A fire in this area may spuriously trip the 480-volt feeder breakers. These breakers can be locally closed at the switchgear.

A fire in this area may result in a loss of power supplies associated with PY17N. Redundant power supply PY16 remains available.

4.6 Main Steam System

A fire in this area may spuriously open the main steam isolation valves (FCV-41, 42, 43 and 44) an their bypasses (FCV-22, 23, 24 and 25). These valves can be manually closed.

A fire in this area may supuriously open the steam generator inboard isolation valves (FCV-760, 761, 762 and 763) and the outboard isolation valves (FCV-151, 154, 157, 160 and FCV-244, 246, 248, 250). Operator action can be taken to close the valves and isolate SG blowdown. Therefore, safe shutdown will not be affected.

Steam generator pressure indication in the control room and hot shutdown panel may be lost due to a fire in this area. Steam generator pressure for steam generators 1-1, 1-2, 1-3, 1-4 can be read off of PI-518, PI-528, PI-538 and PI-548, respectively.

A fire in this area may result in the loss of steam generator level instruments LT-517, 518, 519, 527, 528, 529, 537, 538, 539, 547, 548 AND 549. Steam generator level indication will remain available from LT-516, 526, 536 and 546 at the dedicated shutdown panel.

A fire in this area may prevent the ten percent dump valves (PCV-19, 20, 21, 22) from being opened. These valves are required closed for hot standby and can be manually opened for subsequent cooldown.

4.7 Reactor Coolant System

A fire in this area may spuriously energize heater groups 1-1, 1-2, 1-3 and 1-4. These heaters can be manually de-energized.

Reactor coolant system pressure indication from PT-403 and PT-405 may be lost due to a fire in this area. This indication can be monitored using PT-406 at the dedicated shutdown panel.

A fire in this area may affect PORVs PCV-456, PCV-474 and PCV-455C and blocking valves 8000A, 8000B and 8000C. If the PORVs were to spuriously open due to a hot short, they can be closed from the hot shutdown panel in order to prevent uncontrolled pressure reduction. The auxiliary spray flowpath will be available for RCS pressure reduction. Therefore, safe shutdown is not affected.

A fire in this area may affect PCV-455A and PCV-455B. If these valves fail in the desired, closed position, safe shutdown is not affected. RCPs can also be tripped to mitigate spurious operation of the pressurizer spray valves.

A fire in this area may prevent reactor coolant pumps 1-1, 1-2, 1-3 and 1-4 from being secured. Manual actions at the 12-kV switchgear may be necessary to secure the reactor coolant pumps.

A fire in this area may affect all RCP seal cooling sources (seal injection and CCW to the RCP Thermal Barrier Heat Exchanger). To prevent thermal shock of the RCP seals, seal injection and CCW to the RCP TBHX can be isolated by operation of valves8382A, 8382B, 8396A and FCV-357. The charging injection flowpath will be credited for RCS makeup.

Source range monitors NE-31 and NE-32 may be lost due to a fire in this area. NE-51 and NE-52 will be available at the hot shutdown panel to provide source range indication.

Pressurizer level indication from LT-459, LT-460 and LT-461 may be lost due to a fire in this area. LT-406 will remain available at the dedicated shutdown panel to provide level indication.

A fire in this area may affect reactor vessel head vent valves 8078A, 8078B, 8078C and 8078D. Operator action can be taken to fail the valves closed. Safe shutdown is not affected.

Hot and cold leg temperature instrumentation in the control room may be lost due to a fire in this area. TE-410C and TE-413B will remain available at the dedicated shutdown panel.

4.8 Residual Heat Removal System

RHR pumps 1-1 and 1-2 may be affected by a fire in this area. Manual action can be taken to operate either RHR pump from the 4-kV switchgear to provide RHR flow.

Valves 8701 and 8702 are closed with their power removed during normal operations and will not spuriously open. Valves 8701 and 8702 can be manually operated for RHR operations.

A fire in this area may affect 8700A and 8700B. These valves can be manually operated to ensure safe shutdown.

A fire in this area may affect FCV-641A and FCV-641B or cause spurious operation of the valves. During the transition to cold shutdown conditions, prior to starting the RHR Pump, the respective recirc valve can be manually operated.

4.9 Safety Injection System

SI pumps 1-1 and 1-2 may spuriously operate due to a fire in this area. Local manual action may be required to defeat this spurious operation.

A fire in this area may spuriously open valves 8982A, 8982B, 9003A and 9003B may spuriously open due to a fire in this area. Power to 8982A and 8982B is administratively removed by maintaining a toggle switch in the Control Room in the open position. The valve is normally closed, and spurious opening is not expected to occur. However, an operator action can be taken to open the power breaker to preclude spurious opening of 8982A and 8982B. Valve 8980 can be manually operated in order to defeat any spurious signals.

Accumulator isolation valves 8808A, 8808B, 8808C and 8808D may be affected by a fire in this area. These valves can be manually closed which is the desired safe shutdown position.

A fire in this area may spuriously open valve 8804A. This valve can be manually closed to ensure safe shutdown.

A fire in this area may affect circuits associated with RWST Level Transmitter LT-920. Alternative shutdown capability is credited in this fire area, and this transmitter is not credited for safe shutdown.

4.10 Auxiliary Saltwater System

The ability to operate ASW pumps 1-1 and 1-2 from the control room may be lost due to a fire in this area. Manual actions can be taken to operate the pumps from the 4-kV switchgear or hot shutdown panel.

A fire in this area may affect valves FCV-495 and FCV-496 and may spuriously open FCV-601. Due to similar system pressures between Unit 1 and Unit 2, operation with FCV-601 open will not affect safe shutdown.

A fire in this area may spuriously close valves FCV-602 and FCV-603. These valves can be manually opened to ensure safe shutdown.

4.11 Unit 2 Components

4.11.1 Emergency Power

A fire in this area may cause loss of power supplies associated with PY27N. Redundant power supply PY26 remains available.

4.11.2 Main Steam System

Steam generator pressure indication in the control room and hot shutdown panel may be lost due to a fire in this area. Steam generator pressure for steam generators 2-1, 2-2, 2-3, 2-4 can be read off of PI-518, PI-528, PI-538 and PI-548, respectively.

A fire in this area may result in the loss of steam generator level instruments LT-517, 518, 519, 527, 528, 529, 537, 538, 539, 547, 548 and 549. Steam generator level indication will remain available from LT-516, 526, 536 and 546 at the dedicated shutdown panel.

4.11.3 Reactor Coolant System

Reactor coolant system pressure indication from PT-403 and PT-405 may be lost due to a fire in this area. This indication can be monitored using PT-406 at the dedicated shutdown panel.

Pressurizer level indication from LT-459, LT-460 and LT-461 may be lost due to a fire in this area. LT-406 will remain available at the dedicated shutdown panel to provide level indication.

Hot and cold leg temperature instrumentation in the control room may be lost due to a fire in this area. TE-410C and TE-413B will remain available at the dedicated shutdown panel.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.
- Smoke and heat detection are provided.
- Total flooding CO_2 system is provided.

The fire protection features provided in this area provide an acceptable level of fire safety equivalent to that provided by section III.G.

6.0 REFERENCES

6.1 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.2 Drawing No. 515572
6.3 DCN DC1-EE-11694 - Provides Isolation Contact on DG
6.4 DCN DC1-EE-11670 - Provides Disconnect Switch at HSD Panel
6.5 Calculation M-824, Combustible Loading
6.6 Drawing 065126, Fire Protection Information Report, Unit 1
6.7 SSER 23, June 1984
6.8 DCPP Unit 1 Report on 10 CFR 50, Appendix R Review (Rev. 0)
6.9 File 131.95, Memo from S. Lynch to P. Hypnar dated December 8, 1983 regarding current transformer protection

6.10 DCNs DC1-EE-47591, DC1-EE-47593, and DC1-EE-47594, Provide Transfer Switches at the 4kV Switchgear and Mode Selector Switches at the Hot Shutdown Panel
6.11 DCN DC1-EE-45132, Provides Local Control Capability for DGs.
6.12 DCN DC1-EE-47600, DG 1-3 Starting Circuit Power Supply Transfer Switch/APPR Modifications
6.13 NECS File: 131.95, FHARE: 104, "Fireproofing on Structural Steel for Block Walls"
6.14 NECS File: 131.95, FHARE: 130, "Inaccessible Jumbo Duct Penetrants"
6.15 NECS File: 131.95, FHARE: 126, HVAC Ducts through Modified Unrated Hatches
6.16 Calculation 134-DC, Electrical Appendix R Analysis
6.17 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.18 NECS File 131.95, FHARE 137, Unrated Penetrations through Unit 1 Control Room Floor (Barrier 458)
6.19 NECS File: 131.95, FHARE 134, "Non-rated Structural Gap Seals in Fire Barriers"
6.20 NECS File: 131.95, FHARE 147, "Evaluation of Lesser Rated Unistrut Configurations in 128 ft Cable Spreading Room."
6.21 NECS File: 131 .95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.
6.22 NECS File: 131.95, FHARE 80, Fire Dampers Installed at Variance with Manufacturer's Instructions

FIRE AREA 8-G

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This area is located in the northwest corner of the Unit 1 Auxiliary Building at El. 140 ft.

1.2 Description

Area 8-G, Unit 1 Safeguards Room, houses Unit 1 solid state protection cabinets. Automatic reactor trip, SIS, containment/ isolation, and other safeguard signals are generated from these cabinets.

1.3 Boundaries

North:

- 3-hour rated barrier separates this area from the outside Area 34.

South:

- 1-hour rated barrier separates this area from Zone 8-E. (Ref. 6.7)
- A duct penetration without a fire damper. (Ref. 6.9)

East:

- 3-hour rated barrier separates this area from Zone 8-A.
- A 3-hour rated door communicates to Area 8-A.
- A duct penetration without a fire damper (the duct is protected within Area 8-G) with a 3-hour rated fire damper at the outlet of the protected ductwork. (Ref 6.8)

West:

- 3-hour rated barrier separates this area from Fire Zone 14-D (Turbine Building).

Floor/Ceiling:

- 3-hour rated barrier. Floor: To Fire Area 7-A.
  Ceiling: To Fire Area 34.

2.0 COMBUSTIBLES

2.1 Floor Area: 225 ft^2

2.2 In situ Combustible Materials

- Cable Insulation

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection

3.2 Suppression

- Portable fire extinguishers
- Hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Auxiliary Feedwater

AFW pumps 1-2 and 1-3 may be lost due to a fire in this area. Redundant AFW pump 1-1 will be available to provide AFW.

4.2 Chemical and Volume Control System

CVCS valves 8107 or 8108 may be lost due to a fire in this area. Redundant CVCS valves HCV-142, or 8145 and 8148 remain available to isolate auxiliary spray and the PORVs will remain available for RCS pressure reduction.

CVCS valves 8149A, 8149B and 8149C may be lost due to a fire in this area. Redundant CVCS valves LCV-459 and LCV-460 remain available for letdown isolation. Operator action can also be credited to isolate letdown by de-energizing 8149A, 8149B, and 8149C to fail them in the closed position.

CVCS valves LCV-112B and LCV-112C may be lost due to a fire in this area. Redundant SIS valves 8805A and 8805B remain available to provide a flow path to the charging pumps. Manual action can be taken to operate either LCV-112B or LCV-112C to isolate the volume control tank.

4.3 Component Cooling Water

The ability to operate CCW pumps 1-1, 1-2 and 1-3 from the control room may be lost due to a fire in this area. Manual actions will enable these pumps to be operational from the 4-kV switchgear or the hot shutdown panel.

CCW valves FCV-356, FCV-357 and FCV-750, which provide component cooling water to reactor coolant pump thermal barriers, may be affected by a fire in this area. Since seal injection will be available to cool RCP seals, these valves are not required open and their position will not affect safe shutdown.

CCW valve FCV-355 may spuriously close due to a fire in this area. Operator action can be credited to manually open FCV-355.for safe shutdown.

4.4 Containment Spray

Containment spray pumps 1-1 and 1-2 and their associated discharge valves 9001A and 9001B are affected by a fire in this area. Operator action can be taken to trip CS pumps 1-1 and 1-2. Therefore, safe shutdown will not be affected.

4.5 Emergency Power

A fire in this area may disable diesel generators 1-1, 1-2 and 1-3 automatic transfer circuits. Manual control will remain available in the control room to transfer and load the diesel generator. Offsite power will remain available for safe shutdown.

4.6 Main Steam System

Main steam system inboard isolation valves FCV-760, 761, 762, 763 or outboard isolation valves FCV-151, 154, 157, 160 and FCV-244, 246, 248 and 250 may fail for a fire in this area. The ability to manually isolate the steam generator blowdown lines will remain available. Therefore, safe shutdown is not affected.

Main steam isolation valves FCV-41, FCV-42, FCV-43 and FCV-44 may be lost due to a fire in this area. Manual action may be necessary to close the valves.

A fire in this area may prevent the 10% dump valves PCV-19, PCV-20, PCV-21 and PCV-22 from being opened. These valves are required closed for hot standby and can be manually operated for cooldown purposes.

4.7 Reactor Coolant System

Control of pressurizer PORV PCV-456 will be lost due to completion of operator actions to SGBD valves. Control of PCV-455C will remain available.

4.8 Safety Injection System

SI pumps 1-1 and 1-2 may spuriously operate for a fire in this area. Local manual action may be required to defeat this spurious operation prior to RCS depressurization.

SI valves 8801A, 8801B, 8803A and 8803B may be affected by a fire in this area. A charging flowpath to the reactor will remain available through RCP seal injection. The PORV will remain available for pressure reduction.

SI valves 8805A and 8805B may be affected by a fire in this area. Manual actions may be required to provide water to the charging pumps.

SI accumulator isolation valves 8808A, 8808B, 8808C and 8808D may be affected by a fire in this area. Manual actions may be required to operate the valves.

4.9 Auxiliary Saltwater System

ASW pumps 1-1 and 1-2 may be lost due to a fire in this area. Manual actions will enable both pumps to be started from the 4-kV switchgear or the hot shutdown panel.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- The safe shutdown functions located in this area are not required once the reactor is tripped.

- Smoke detection is provided.

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

The existing fire protection features provide an level of safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.2.

6.0 REFERENCES

6.1 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.2 Drawing No. 515571
6.3 SSER 23, June 1984
6.4 Calculation M-824, Combustible Loading
6.5 Drawing 065126, Fire Protection Information Report, Unit 1
6.6 NECS File: 131.95, FHARE: 15, HVAC Duct Wrapped in Pyrocrete
6.7 NECS File: 131.95, FHARE: 75, 1-hour rated Barrier
6.8 NECS File: 131.95, FHARE: 80, Fire Dampers installed at Variance with Manufacturers Instruction
6.9 NECS File: 131.95, FHARE 129, Duct penetrations through common walls associated with fire zones 8-A, 8-D, 8-E, 8-F, 8-G, and 8-H
6.10 Calculation 134-DC, Electrical Appendix R Analysis
6.11 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis

FIRE AREA 10

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Unit 1, northeast corner of the Turbine Building at El. 76 ft and 85 ft.

1.2 Description

This area includes the 12-kV switchgear room at El. 85 ft and the 12-kV cable spreading room beneath at El. 76 ft. The cable spreading room is accessed by open stairwells communicating between the two elevations of this area.

1.3 Boundaries

North:

85' Elevation
- 2-hour rated barrier separates this area from the exterior (Fire Area 28). (Ref. 6.22)
- A 3-hour rated roll-up door communicates to Area 28.
- Unrated small diameter penetration to Area 28. (Ref. 6.17)
- Unsealed Bus duct penetration to Area 28. (Ref. 6.6)

76' Elevation (Ref 6.26)
- Unrated conduit penetration seals (Reference 6.25).

South:

85' Elevation
- A 3-hour rated barrier separates this area from Area 14-A. (TB-7)
- A 3-hour rated door communicates to Area 14-A.

76' Elevation (Ref 6.26)
- Unrated conduit penetration seals (Reference 6.25).

East:

85' Elevation
- A 2-hour rated barrier separates this area from Area 28. (Refs. 6.11 and 6.22)
- Three 3-hour rated roll-up doors (2 over wall louvers and 1 over a nonrated door) communicate to Area 28. (Refs. 6.11 and 6.16)
- Unsealed Bus duct penetration to Area 28. (Ref. 6.6)

76' Elevation (Ref 6.26)
- Unrated conduit penetration seals (Reference 6.25).

West:

85' Elevation
- A 3-hour rated barrier separates this area from Area 11-D. (Ref. 6.22)
- Unrated small diameter penetration to Area 11-D. (Ref. 6.17)
- A 3-hour rated fire damper communicates to Area 11-D.
- A 3-hour rated door communicates to Area 11-D.
- A 3-hour rated roll-up door communicates to Area 11-D.

76' Elevation (Ref 6.26)
- Unrated conduit penetration seals (Reference 6.25).

Floor/Ceiling:

- 3-hour rated barrier with the following exceptions:

  - A 2-hour rated enclosed stairwell with a nonrated ceiling and a 1 ½-hour rated door communicates to Area 12-E above (El. 107 ft). (Ref. 6.8)
  - A 3-hour rated concrete equipment plug communicates to Fire Zone 12-B (above) on unprotected steel supports with unsealed gaps. (Refs. 6.7 and 6.12)
  - Unprotected structural steel supporting the ceiling (El. 85 ft). (Ref. 6.12)
  - Lesser rated penetration seal to Area 12-E above. (Ref. 6.23)

Fire Resistive Enclosures:

- 2-hour fire resistive enclosures for F and G Bus power circuits are routed to Fire Zones 12-A, 12-B, and 12-C from 85 ft and above. Below 85 ft they are either enclosed in a noncombustible barrier or embedded in concrete. (Refs. 6.10, 6.11, 6.13, 6.14, 6.15, 6.16, 6.18, and 6.24)
- 3-hour fire resistive covering is provided for all the structural steel on El. 76 ft. (Refs. 6.5 and 6.12)

2.0 COMBUSTIBLES

<u>2.1 Floor Area</u>: 4095 ft^2 (El. 76 ft)
6160 ft^2 (El. 85 ft)

2.2 In situ Combustible Materials

El.	76 ft	85 ft
	• Cable insulation	• Cable insulation • Rubber • Paper • PVC • Wood (fir) • Fiberglass

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low (El. 76 ft)
- Low (El. 85 ft)

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection at both elevations.

3.2 Suppression

- Portable fire extinguishers
- CO_2 hose stations
- Hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Auxiliary Feedwater System

A fire in this area may disable AFW Pp 1-2 and 1-3 and level control valves LCV-110, LCV-111, LCV-113 and LCV-115 may be lost due to a fire in this area. Redundant AFW Pump 1-1 and associated valves LCV-106, LCV-107, LCV-108 and LCV-109 will remain available for safe shutdown.

4.2 Containment Spray

Containment spray pump 1-2 may spuriously operate due to a fire in this area. However, the corresponding discharge valve, 9001B will remain closed. Therefore, containment spray pump 1-2 will run on recirculation and safe shutdown is not affected. Containment spray pump 1-1 is protected by a 2-hour rated fire barrier and will not be affected.

4.3 Emergency Power

A fire in this area may disable the automatic transfer circuit for diesel generator 1-1. Manual control will remain available in the control room to transfer and load the diesel generator.
The circuits associated with diesel generators 1-1 and 1-3 are protected with a 2-hour fire rated enclosure and will remain available for safe shutdown.

A fire in this area may disable startup transformers 1-1, 1-2, 2-1 and 2-2. Manual action can be taken to locally trip the Startup Transformer breakers prior to starting and loading DGs 1-1, 1-2, and 1-3. Onsite power from diesel generators 1-1 and 1-3 will remain available for Unit 1 due to the 2-hr fire rated enclosure, and all three diesel generators will remain available for Unit 2.

A fire in this area may result in a loss of power supplies associated with PY17N. Redundant power supply PY16 remains available.

A fire in this area may result in a loss of UNIT 2 power supplies associated with PY27N. Redundant power supply PY26 remains available.

4.4 Reactor Coolant System

A fire in this area may affect all four reactor coolant pumps. Since spray isolation with PCV-455A and PCV-455B, thermal barrier cooling and seal injection will remain available, safe shutdown will not be affected if the RCPs are running.

4.5 Other Systems

A fire in this area may affect power and control circuits for safe shutdown equipment on Buses "F", "G" and "H". These buses are separated by a minimum 2 hour fire rated barrier. Evaluations have determined that this configuration will not affect safe shutdown. (Refs. 6.10, 6.13, 6.14, 6.15, 6.16, 6.19, and 6.24)

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Safe shutdown circuitry utilized in safe plant shutdown is not adversely affected due to the fire barriers provided (min. 2-hour enclosure) on F and G Bus and partial enclosure of H Bus) and the spatial separation provided (H Bus and F Bus DG). (Refs. 6.10, 6.13, 6.14, 6.15, 6.16 and 6.19)

- Smoke detection is provided at both elevations.

- Portable fire extinguishers and CO2 hose stations are available within the area and hose stations are nearby.

The existing fire protection provides an acceptable level of safety equivalent to that provided by 10 CFR 50, Appendix R Section III.G.

6.0 REFERENCES

6.1 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.2 Drawing No. 515562
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065126, Fire Protection Information Report, Unit 1
6.5 DCN-DC1 EA-35409, Structural Steel Fire Rated Covering
6.6 NECS File: 131.95, FHARE: 20, Unsealed Bus Duct Penetrations
6.7 NECS File: 131.95, FHARE: 14, Concrete Equipment Hatches
6.8 NECS File: 131.95, FHARE: 4, Stairwell Nonrated Ceiling
6.9 Deleted in Revision 12.
6.10 NECS File: 131.95, FHARE: 18, Conduits Not Enclosed in 2 hour Enclosure
6.11 SSER 8, November 1978

6.12 PLC Report: Structural Steel Analysis for Diablo Canyon Rev. 2 (07/08/86)
6.13 NECS File: 131.95, FHARE: 45, 3-M Fire Wrap Repair of Pyrocrete Enclosures
6.14 PG&E Design Change Notice DC1-EA-049070, Unit 1 ThermoLag Replacement
6.15 "Fire Endurance Test of Pyrocrete Box Fire Protective Envelopes," Test Report by Omega Point Laboratories, October 18, 1996 (PG&E Chron No. 231589)
6.16 PG&E Design Change Notice DC1-EC-049339, Pyrocrete Panels at Unit 1 12-kV Switchgear Room and Transit Panels below El. 85 ft
6.17 NECS File: 131.95, FHARE: 123, Unsealed penetrations with fusible link chain penetrations through fire barriers
6.18 Question 25, PG&E letter to NRC dated 8/3/78
6.19 NECS File: 131.95 FHARE 138, Drain Holes in Pyrocrete Panels in Fire Area 10 and 20
6.20 Calculation 134-DC, Electrical Appendix R Analysis
6.21 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.22 NECS File: 131.95, FHARE 133, Seismic/Construction Gaps in the 12-kV Switchgear Rooms
6.23 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.24 NECS File 131.95, FHARE 145, Pyrocrete Enclosure Thickness
6.25 NECS File 131.95, FHARE 151, Evaluation of Fire Area Boundaries for the 76' Elevation of Fire Areas 10 and 20
6.26 NECS File 131.95, FHARE 154, Removal of Below Grade 12-kV Cable Spreading Room Barriers from the Fire Protection Program.

FIRE AREA 11-D

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Unit 1 Turbine Building, corridor outside diesel generator rooms, El. 85 ft.

1.2 Description

Fire Area 11-D is the corridor at El. 85 ft in the Unit 1 Turbine Building that separates the diesel generator rooms (Zones 11-A-1, 11-A-2, and 11-A-3) from the 12-kV switchgear room (Fire Area 10).

1.3 Boundaries

NOTE: NC designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- A 3-hour rated barrier with a 3-hour rated double door separates this area from Area 28.

South:

- A 3-hour rated barrier with a 3-hour rated double door separates this area from Zone 14-A.

East:

- A 3-hour rated barrier with seismic gap separates this area from Area 10. (Ref. 6.15)
- Unrated small diameter penetration to Area 10. (Ref. 6.12)
- A duct penetration with a 3-hour rated damper to Area 10.
- A 3-hour rated door communicates to Area 10.
- A 3-hour rated roll-up door communicates to Area 10.

West:

- 3-hour rated barrier with unrated structural gap seal separates this area from Zones 11-A-1, 11-A-2, 11-B-1, 11-C-1. (Ref. 6.17)
- Three 3-hour rated roll-up doors (1 communicating with each Zone 11-A-1, 11-B-1, 11-C-1).

- Three small diameter unrated penetrations (1 communicating with each Zone 11-A-1, 11-B-1, 11-C-1). (Ref. 6.12)
- Three 3-hour rated doors (1 each to Zones 11-A-1, 11-B-1 and 11-C-1)
- Nonrated personnel access hatch to Zone 11-A-2. (Refs. 6.5 and 6.18)

Floor/Ceiling:

- Floor: concrete on grade [NC]
- Ceiling:
  - 3-hour rated barrier to Zones 12-A, 12-B and 12-C.
  - A duct penetration without a fire damper to Zone 12-B. (Ref. 6.5 and 6.19)

2.0 COMBUSTIBLES

2.1 Floor Area: 459 ft^2

2.2 In situ Combustible Materials

- Cable
- Rubber
- Clothing/Rags
- Plastics

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity:

- Low

3.0 FIRE PROTECTION

3.1 Detection

None

3.2 Suppression

- Automatic wet pipe sprinklers with remote annunciation
- Portable fire extinguishers
- Fire hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Diesel Fuel Oil System

A fire in this area may affect diesel fuel oil transfer pumps 01 and 02. The circuits for these pumps are enclosed in fire barriers. SSER 23 documents a deviation for this condition which has been accepted by the NRC. Offsite power will be available for safe shutdown in the event diesel fuel oil circuits are damaged by a fire. Therefore, safe shutdown will not be affected by a fire in this area.

A fire in this area may affect valves LCV-85, 86, 87, 88, 89 and 90. The circuits for these valves are enclosed in fire barriers and the deviation mentioned above also applies to these valves. Offsite power will be available for safe shutdown in the event diesel fuel oil circuits are damaged by a fire. Therefore, safe shutdown will not be affected by a fire in this area.

4.2 Emergency Power System

A fire in this area may affect the diesel generator 1-1 circuits that are enclosed in a fire barrier. Circuits which could spuriously energize the emergency stop switch are in embedded conduit, located between the stop switch and the relay cabinet in the diesel room, and will not be affected by a fire in this area. SSER 23 justifies any deviations from the requirements in Section III.G.2 of Appendix R. Offsite power will be available for safe shutdown in the event emergency diesel generator circuits are damaged in a fire. (Refs. 6.7, and 6.14)

A fire in this area may affect the diesel generator 1-2 circuits that are enclosed in a fire barrier. Circuits which could spuriously energize the emergency stop switch are in embedded conduit, located between the stop switch and the relay cabinet in the diesel room, and will not be affected by a fire in this area. SSER 23 justifies any deviations from the requirements in Section III.G.2 of Appendix R. In addition, offsite power will be available for safe shutdown in this

fire area. Therefore, the fire barriers protecting the diesel generator circuits are not necessary. (Ref. 6.14)

A fire in this area may affect the diesel generator 1-3 circuits that are enclosed in a fire barrier. Circuits which could spuriously energize the emergency stop switch are in embedded conduit, located between the stop switch and the relay cabinet in the diesel room, and will not be affected by a fire in this area. SSER 23 justifies any deviations from the requirements in Section III.G.2 of Appendix R. In addition, offsite power will be available for safe shutdown in this fire area. Therefore, the fire barriers protecting the diesel generator circuits are not necessary. (Ref. 6.14)

A fire in this area may affect the CO_2 system manual actuation switches for each Unit 1 diesel generator room. The cables for these switches are mineral insulated with a fire rating of 2-hours to preclude spurious actuation of the CO_2 suppression system and automatic closure of the diesel generator room rollup door.

5.0 CONCLUSION

The following features will adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Although not required, a fire rated enclosure is provided for redundant safe shutdown circuits.

- An automatic wet pipe sprinkler system.

- Manual fire fighting equipment is provided.

The existing fire protection for this area provides an acceptable level of safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 Drawing No. 515562
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065126, Fire Protection Information Report, Unit 1

6.5 SSER 23, June 1984
6.6 DCN DC1-EE-9913, Provide Isolator
6.7 DCN DC1-EA-15251, Provide 1 Hour Barriers
6.8 Deleted in Revision 13
6.9 Deleted in Revision 13
6.10 NCR DC0-91-EN-N027
6.11 DCN DC1-EA-47386
6.12 NECS File: 131.95, FHARE 123, Unsealed penetrations with fusible link chain in penetrants through fire barriers
6.13 Calculation 134-DC, Electrical Appendix R Analysis
6.14 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.15 NECS File: 131.95, FHARE 133, Seismic/Construction Gaps in the 12-kV Switchgear Rooms
6.16 Deleted
6.17 NECS File: 131.95, FHARE 30, Unrated Gaps in Appendix R Barriers in the Turbine Building
6.18 NECS File: 131.95, FHAR 157, Unprotected Fire Rated Assemblies and Lack of area-Wide Detection/Suppression.
6.19 NECS File: 131.95, FHARE 31, Undampered Duct Penetrations from the Fan Room

FIRE AREA 13-D

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

North end of Unit 1 Turbine Building at El. 119 ft, excitation switchgear room.

1.2 Description

This fire area is between the 4-kV switchgear rooms and 4-kV switchgear ventilation fan room at El. 119 ft. There is no safe shutdown equipment installed in this fire area. However, ventilation ducts providing cooling to safety-related 4-kV switchgear required for safe shutdown passes through this area.

1.3 Boundaries

North:

- A 2-hour rated barrier separates this area from Area 28 (exterior).
- A 3-hour rated fire damper communicates to Area 28.

South:

- A 3-hour rated barrier separates this area from Zone 12-E.
- Unrated structural gap seals to Fire Zone 12-E. (Ref. 6.15).
- A 1-1/2-hour rated door communicates to Zone 12-E. (Ref. 6.10)
- The non-rated gap assemblies in fire barriers to Zone 12-E were deemed acceptable. (Ref. 6.16)

East:

- A 3-hour rated barrier separates this area from Zones 13-A, 13-B, 13-C. (Ref. 6.20)
- Unrated structural gap seals to Fire Zones 13A, 13B, and 13C. (Ref. 6.15).
- Three 1-1/2-hour rated fire dampers (1 fire damper within protected ductwork communicates to each Zone: 13-A, 13-B, 13-C). (Ref. 6.19)
- Three 1-1/2-hour rated doors (1 door communicates to each Zone: 13-A, 13-B, and 13-C). (Ref. 6.19)

West:

- A 3-hour rated barrier separates this area from Area 13-E.
- Unrated structural gap seals to Fire Area 13-E. (Ref 6.15).

- Structural steel modifications for the block walls were deemed acceptable with no fireproofing. (Ref. 6.11)
- Four duct penetrations without fire dampers penetrate to Area 13-E. (Ref. 6.5)
- A 1-1/2 hour door communicates to Zone 13-E. (Ref. 6.18)
- Lesser rated penetration seals to Zone 13-E. (Ref. 6.17)

Floor/Ceiling: 3-hour rated with the following exceptions:

- 3-hour rated equipment hatches penetrate the floor and ceiling to Zones 12B and 14D, respectively. (Ref. 6.7) The steel supporting these hatches is unprotected. (Ref. 6.9)
- Undampered ventilation duct to Zone 12-A below. (Refs. 6.5 and 6.12)

Protective Enclosure:

- The duct work and supports of the 3 ducts penetrating the east wall to Zones 13-A, 13-B and 13-C have a 1-hour fire resistive coating. (Refs. 6.6 and 6.19)

2.0 COMBUSTIBLES

2.1 Floor Area: 1236 ft^2

2.2 In situ Combustible Materials

- Cable insulation
- Rubber
- Paper
- PVC

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Area wide smoke detection

3.2 Suppression

- CO_2 hose stations
- Hose stations
- Portable fire extinguishers

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Emergency Power

A fire in this area may disable the diesel generators 1-1, 1-2 and 1-3 automatic transfer circuit or may spuriously close their auxiliary transformer 12 circuit breaker. Manual actions will enable the diesels to either be locally loaded or loaded from the control room.

5.0 CONCLUSION

The following features will adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Loss of the safe shutdown circuitry in this area does not affect the ability to transfer to the emergency DGs.

- Area wide smoke detection is provided.

- Manual fire fighting equipment is provided.

The existing fire protection in this area provides an acceptable level of safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 Drawing No. 515564
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065126, Fire Protection Information Report, Unit 1
6.5 NECS File: 131.95, FHARE: 31, Undampered Duct Penetration from Fan Room
6.6 NECS File: 131.95, FHARE: 15, HVAC Duct Wrapped in Pyrocrete
6.7 NECS File: 131.95, FHARE: 14, Concrete Equipment Hatches
6.8 Deleted
6.9 PLC Report: Structural Steel Analysis for Diablo Canyon Rev. 2 (07/08/86)
6.10 Deleted in Revision 13.
6.11 NECS File: 131.95, FHARE: 106, Block Walls Modified in the 4kV Switchgear Area
6.12 NECS File: 131.95, FHARE: 136, Unrated HVAC Duct Penetrations
6.13 Calculation 134-DC, Electrical Appendix R Analysis
6.14 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.15 NECS File: 131.95, FHARE 134, “Non-rated Structural Gap Seals in Fire Barriers”
6.16 NECS File: 131.95, FHARE 135, “Gaps in Appendix A Fire Rated Boundaries”
6.17 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.18 SSER - 23
6.19 PG&E Letter to NRC dated 11/13/78, Docket Number 5-275-0L, 50-323-01
6.20 NECS File: 131 .95, FHARE 100, Block Walls Structurally Modified with Columns, Beams and Steel Plates

FIRE AREA 13-E

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This fire area is located at the north end of the Turbine Building at El. 107 ft and 119 ft.

1.2 Description

This fire area consists of the 4-kV switchgear ventilation fan room (El. 119 ft) and a triangular section above the southeast corner of fire zone 11-C-1 (El. 107 ft). The 4-kV switchgear ventilation supply fans are located at El. 119 ft. The air supply for these fans is from an El. 119 ft louvered opening in the north wall of the turbine building.

1.3 Boundaries

NOTE: NC designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

El. 107 ft

- 3-hour rated barrier to Fire Zone 11-C-2 (TB-3).

El. 119 ft

- A nonrated louvered opening to the exterior NC. (Ref. 6.22)

South:

El. 107 ft

- 3-hour barrier to Fire Zone 14-A (TB-7)
- 3-hour rated door to Fire Zone 14-A (TB-7)

El. 119 ft

- 3 hour barrier to Fire Zone 14-A (TB-7)
- 3-hour rated double door Fire Zone 14-A (TB-7)

East:

El. 107 ft

- 3-hour rated barrier to Fire Zone 12-A (TB-4) with the following exception:
  - A 1-1/2-hour rated door to Fire Zone 12-A (TB-4) (Ref. 6.22)
  - Unrated structural gap seal to Fire Zone 12-A (TB-4). (Ref. 6.17)

El. 119 ft

- 3-hour rated barrier to Fire Area 13-D with the following exceptions:
  - Unrated structural gap seals to Fire Area 13-D. (Ref. 6.17)
  - 1-1/2-hour rated door to Fire Area 13-D. (Ref. 6.22)
  - Four ducts without fire dampers communicate to Area 13-D. (Refs. 6.20 and 6.22)
  - Structural steel modifications for the block walls were deemed acceptable with no fireproofing. (Ref. 6.12)
  - Lesser rated penetration seals to Area 13-D. (Ref. 6.19)

- 3-hour rated barrier to Fire Zone 12-E with the following exception:
  - A duct without a fire damper to Fire Zone 12-E. (Refs. 6.21 and 6.22)
  - Unrated structural gap seals to Fire Zone 12-E. (Ref. 6.17)

West:

El. 107 ft

- A 3-hour rated barrier and door to fire zone 11-C-2. (Ref. 6.18)

El. 119 ft

- 3-hour rated barrier to Fire Area 13-F.
  - Structural steel modifications for the block walls were deemed acceptable with no fireproofing. (Ref. 6.12)
  - Unrated structural gap seals to Fire Zone 13-F. (Ref. 6.17).

- Two 1 1/2-hour rated doors to Fire Area 13-F. (Ref. 6.22)
- A duct with a 1-1/2-hour rated fire damper communicates to Fire Area 13-F. (Ref. 6.22)

Floor/Ceiling:

- 3-hour rated barrier and sealed diesel exhaust stack communicates with Fire Zone 14-D (TB-7) above and 11-C-2 (TB-3) below. (Ref. 6.18)
- Lesser rated penetration seals to Fire Zones 11-C-2 and 14-D. (Ref. 6.19)
- El. 107 ft and 119 ft of Area 13-E are joined by an open ventilation grating.
- Three 1-1/2-hour rated dampered ventilation ducts to Zones 12-A, 12-B and 12-C below El. 119 ft. (Ref. 6.22)
- An undampered ventilation duct to Zone 12-B below. (Refs. 6.20 and 6.13)

2.0 COMBUSTIBLES

2.1 Floor Area: 1,980 ft^2 (Ref. 6.13)

2.2 In situ Combustible Materials

- Cable
- Filters
- Rubber

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection is provided throughout the 119-ft elevation area.

3.2 Suppression

- A wet pipe automatic sprinkler system on El. 119 ft with remote annunciation.
- Portable fire extinguishers.
- CO_2 hose station.
- Fire hose station.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 HVAC

4-kV switchgear room supply fans S-67, 68, and 69 may be lost for a fire in this area. The 4-kV switchgear will not be affected by a loss of the supply fans. (Refs. 6.9 and 6.10)

5.0 CONCLUSION

Fire Area 13-E does not meet the requirements of Appendix R, Section III.G.2(a) in that ducts without fire dampers penetrate into Fire Areas TB-5, TB-7, and 13-D, and nonrated steel hatches to Areas TB-1 and TB-3.

The following fire protection features will adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- CO_2 hose and fire hose stations.

- Portable fire extinguishers.

- Limited and dispersed combustible loading.

- Smoke detection available at El. 119 ft.

- Automatic wet pipe sprinkler system at El. 119 ft.

The existing fire protection provides an acceptable level of fire safety equivalent to that provided by Section III.G because fans are not required for safe shutdown.

6.0 REFERENCES

6.1 Drawing Nos. 515562, 515563, 515564, 515565
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065126, Fire Protection Information Report, Unit 1
6.5 SSER 23, June 1984
6.6 SSER 8, November 1978
6.7 DCN DC1-EA-15261 - Provide 1 Hour Rating for Personnel and Equipment Hatches
6.8 Deleted
6.9 Calculation M-911, Evaluation of Safe Shutdown Equipment During Loss of HVAC
6.10 Calculation M-912, HVAC Interactions for Safe Shutdown.
6.11 Deleted in Revision 13
6.12 NECS File: 131.95, FHARE: 106, Block Walls Modified in the 4kV Switchgear Area
6.13 NECS File: 131.95, FHARE: 136, Unrated HVAC Duct Penetrations
6.14 DCP H-50117, Diesel Generator Air Flow Improvement Modification, Units 1 and 2
6.15 Calculation 134-DC, Electrical Appendix R Analysis
6.16 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.17 NECS File: 131.95, FHARE 134, “Non-rated Structural Gap Seals in Fire Barriers”
6.18 NECS File: 131.95, FHARE 30, Unrated Gaps in Appendix R Barriers in the Turbine Building
6.19 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.20 NECS File: 131.95, FHARE 31, Undampered Duct Penetrations from the Fan Room
6.21 NECS File: 131.95, FHARE 56, Undampered Ventilation Duct Penetrations
6.22 NECS File: 131 .95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.

FIRE AREA 28

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Yard area surrounding the Unit 1 buildings including the main transformer area.

1.2 Description

This fire area is the open yard area surrounding the Unit 1 power plant buildings at El. 85 ft. The fire area includes the transformer area located north of the containment. The fire area also includes the area north and northeast of the Turbine Building. The three main transformers and one spare main transformer are a minimum distance of 50 ft from the Turbine Building, the two auxiliary transformers and two spare auxiliary transformers are approximately 30 ft away from the Turbine Building, and the three startup transformers are approximately 20 ft away from the Turbine Building. Spilled oil will drain away from the Turbine and Containment Buildings due to the pavement grade. The pipe chase outside containment is approximately 40 ft away from one of the nearest transformers.

The I&C Building is also located in the fire area; it is approximately 30 ft west of the Unit 1 Turbine Building.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- El. 85 ft and 104 ft - 2-hour rated barrier to TB-14. [NC].
- Outside nonrated area.

South:

- El. 85 ft and 104 ft - 2-hour barrier to TB-14. [NC]
- El. 85 ft, 104 ft, and 119 ft - non-rated louvers to Fire Area 3-BB. [NC]. (Ref. 6.11)
- El. 85 ft, 104 ft, and 119 ft – non-rated barrier to Fire Zone 14-.A. [NC]
- 3-hour rated barrier to containment.

Turbine Building

- Unrated small diameter penetration to Fire Area 10. (Ref. 6.9)

- Unsealed bus duct penetration to Fire Area 10. (Ref. 6.10)
- 2-hour rated barrier to Fire Area 10. (Ref. 6.8)
- 3-hour rated barrier to Fire Area 11-D.
- Doors and ventilation openings fitted with Class "A" labeled devices to Fire Areas 10 and 11-D.
- Nonrated walls and louvers to common exhaust plenum for diesel generator Fire Zones 11-A-2 (Fire Area TB-1), [NC] 11-B-2 (TB-2) [NC] and 11-C-2 (TB-3) [NC] and north end of hallway (Fire Area 12-C). (Refs. 6.11 and 6.12)
- 2-hour rated gypsum board shaft type fire barrier interior walls at El. 107 ft and 119 ft to Fire Zones 12-C and 13-C and Fire Area 13-D. (Refs. 6.14 and 6.15)

East:

- Outside nonrated area.

West:

- El. 107 ft and 119 ft - 2 hour rated barrier to Fire Zone 12-E. [NC]
- El. 119 ft non-rated isophase bus penetrations to Fire Zone 12-E. [NC]
- Unsealed bus duct penetrations to Fire Area 10. (Ref. 6.10)
- 2-hour rated concrete barrier except for doors with ventilation openings fitted with Class "A" labeled devices to Fire Area 10. (Refs. 6.8 and 6.13)
- Nonrated walls and roll-up door fitted with Class "A" labeled devices to Fire Area TB-14 [NC] (reverse osmosis room - to be designated).
- 2-hour rated gypsum board shaft type fire barrier interior walls at El. 107 ft and 119 ft to Fire Zones 13-A, 13-B, 13-C, 12-A, 12-B, and 12-C. (Refs. 6.14 and 6.15)
- El. 85 ft, 104 ft and 119 ft - non-rated barrier to Fire Zone 14-A. [NC]

2.0 COMBUSTIBLES

2.1 Floor Area: 17,482 ft^2

2.2 In situ Combustible Materials

- Bulk Cable
- Transformer oil contained in the main transformer.

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- High

3.0 FIRE PROTECTION

3.1 Detection

- None

3.2 Suppression

- The three main transformers, two auxiliary transformers, and three startup transformers are provided with automatic spray systems with remote annunciation.
- Hose stations.
- Yard hydrant with fully equipped hose houses.
- Portable fire extinguishers.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Auxiliary Feedwater

Manual positioning may be required for AFW valves LCV-106, LCV-107, LCV-110 and LCV-111 due to a fire in this area. Redundant valves LCV-108, LCV-109, LCV-113 and LCV-115 are available to provide AFW to the steam generators.

4.2 Emergency Power

A fire in this area may result in a loss of power supplies associated with PY17N. Redundant power supply PY16 remains available.

A fire in this area may cause loss of UNIT 2 power supplies associated with PY27N. Redundant power supply PY26 remains available.

4.3 Main Steam System

Various instrumentation may be lost for a fire in this area. Steam generator 1-1 and 1-2 pressure instrumentation that may be lost are the following: PT-514, 515, 516, 524, 525, and 526. However, steam generator pressure indication from PT-534, 535, 536, 544, 545 and 546 will remain available for steam generators SG 1-3 and SG 1-4.

Main steam system valves FCV-24, FCV-25, FCV-41 and FCV-42 may fail for a fire in this area. These valves have a fusible link which melts and fails the valves closed. These valves can also be manually positioned to ensure safe shutdown.

A fire in this area may prevent PCV-19 and PCV-20 from opening and prevent the operation of the valves from the hot shutdown panel. Redundant valves PCV-21 and PCV-22 will remain available for cooldown. Isolation of these valves is ensured by removing air sources from instrument air, backup air, and accumulators. Manual actions will be required in the fire area. As a means to help mitigate potential spurious operation of equipment, the main feedwater pumps are tripped.

4.4 Main Feedwater System

A fire in this area may affect main feedwater valves FCV-1510, FCV-1520, FCV-510, and FCV-520. The main feedwater pumps may be tripped from the control room to stop main feedwater flow through the valves.

4.5 Reactor Coolant System

Source range monitor NE-51 may be lost for a fire in this area. Redundant source range monitors NE-31, 32 and 52 will be available to provide necessary indications to the operator.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- The redundant trains of safe shutdown functions located in this fire area are unaffected by fire in this area due to spatial separation by fire in this area due to spatial separation and barriers provided.

- Automatic water spray systems operate to control a fire involving the transformer area.

- Additional fire fighting equipment is provided.

- The grade of the transformer area is sloped to divert spilled oil away from the Turbine and Containment Buildings.

- Many exposed walls of adjacent fire areas/zones are at least 2-hour rated with penetrations sealed commensurate with the hazard.

This area complies with the requirements of 10 CFR 50, Appendix R, Section III.G and no exemptions have been requested.

6.0 REFERENCES

6.1 Drawing No. 515562
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation 134-DC, Electrical Appendix R Analysis
6.4 Calculation M-824, Combustible Loading Calculation
6.5 DCM M-62 App. A, ID of SSD Raceways/Fire Zones
6.6 Drawing 065126, Fire Protection Information Report, Unit 1
6.7 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.8 NECS File: 131.95 FHARE 133, Seismic/Construction Gaps in the 12kV Switchgear Rooms
6.9 NECS File: 131.95, FHARE 123, Unsealed Penetrations with Fusible Link Chain Penetrations
6.10 NECS File: 131.95, FHARE 20, Bus Duct Penetrations
6.11 SSER - 23
6.12 NECS File: 131.95, FHARE 30 unrated Gaps in Barriers
6.13 Question 25, PG&E Letter to NRC 8/3/78
6.14 Question 27, PG&E Letter to NRC 11/13/78
6.15 Question 29, PG&E Letter to NRC 11/13/78

FIRE AREAS 30-A-1 AND 30-A-2

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Both fire areas are in the Intake Structure (El. 2 ft).

1.2 Description

These areas consist of the ASW pump vaults inside the Intake Structure, surrounded by Fire Area IS-1 (Zone 30-A-5).

1.3 Boundaries

1.3.1 Fire Area 30-A-1

Northeast and Northwest:

- 3-hour rated wall with non-rated penetration seals to Fire Zone 30-A-5. (Ref. 6.6)

Southeast:

- 3-hour rated wall Fire Area 30-A-2.

Southwest:

- 3-hour rated wall with an nonrated steel watertight door to Fire Zone 30-A-5. (Ref. 6.10)

Ceiling:

- Penetrated by a ventilation stack without a fire damper. (Ref. 6.10)
- 3-hour rated concrete hatch to the exterior. (Ref. 6.7)

1.3.2 Fire Area 30-A-2

Northeast and Southeast:

- 3-hour rated wall with non-rated penetration seals to Fire Zone 30-A-5. (Ref. 6.6)

Northwest:

- 3-hour rated wall Fire Area 30-A-1.

Southwest:

- 3-hour rated wall with an nonrated steel watertight door to Fire Zone 30-A-5. (Ref. 6.10)

Ceiling:

- Penetrated by a ventilation stack without a fire damper. (Ref. 6.10)
- 3-hour rated concrete hatch to the exterior. (Ref. 6.7)

2.0 COMBUSTIBLES (Typical for each fire area)

2.1 Floor Area: 126 ft^2

2.2 In situ Combustible Materials

- Lubricating oil
- Cable insulation
- PVC
- Rubber

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- None
- Smoke detector outside of the entry to these areas in Fire Zone 30-A-5

3.2 Suppression

- Portable fire extinguishers available in adjacent fire area.
- Hose stations in the vicinity.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Area 30-A-1

4.1.1 Auxiliary Saltwater System

Circuitry for ASW pumps 1-1 and 1-2 may be damaged due to a fire in this area. ASW pump 1-2 may be locally started to provide ASW flow.

ASW valve FCV-495 may be affected for a fire in this area. Valves FCV-495 and FCV-601 are available, thus no manual actions are required.

4.1.2 HVAC

HVAC exhaust fan E-103 may be lost for a fire in this area. HVAC exhaust fan E-101 will be available to provide necessary HVAC support.

4.2 Fire Area 30-A-2

4.2.1 Auxiliary Saltwater System

Circuitry for ASW pumps 1-1 and 1-2 may be damaged by a fire in this area. ASW pump 1-1 can be locally started to provide ASW flow.

ASW valve FCV-496 may be affected for a fire in this area. Valves FCV 495 and FCV-601 are available, thus no manual actions are required.

4.2.2 HVAC

HVAC exhaust fan E-101 may be lost for a fire in this area. HVAC exhaust fan E-103 will be available to provide necessary HVAC support.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.
- 3-hour rated walls except for nonrated steel watertight doors and non-rated penetration seals.
- Steel watertight doors would be able to confine smoke and hot gases to one side of the barrier.
- Smoke detection is available immediately outside the entrance of the areas.
- Manual fire protection equipment is available in the immediate vicinity.

In these areas existing fire protection will provide an acceptable level of fire safety equivalent to that provided 10 CFR 50, Appendix R, Section III.G.2.

6.0 REFERENCES

6.1 Drawing No. 515580
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065126, Fire Protection Information Report, Unit 1
6.5 SSER 23, June 1984
6.6 FHARE 114, Non-Rated Penetration Seals in the ASW Pump Room Barriers
6.7 FHARE 14, Concrete Equipment Hatches
6.8 Calculation 134-DC, Electrical Appendix R Analysis
6.9 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.10 NECS File: 131 .95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.

FIRE AREAS 35-A AND 35-B

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Unit 1 Turbine Building, west buttress, below El. 85 ft.

1.2 Description

Fire Areas 35-A and 35-B are adjacent to each other and house the diesel fuel oil transfer pumps. Transfer Pump 0-1 is located in Area 35-A and Transfer Pump 0-2 is located in Area 35-B. The associated fuel oil piping, power and control circuitry for each transfer pump is also located in their respective fire area.

1.3 Boundaries

Fire Areas 35-A and 35-B are bounded by 3-hour rated barriers with the following exceptions: (Ref 6.8)

Ceiling

- A 3/8-inch thick steel hatch bounded by a 6" curb covers the access opening.
- Concrete hatches with caulked gaps provide restricted access for equipment removal.

Pipe Trench

- Sealed pipe penetrant communicates with each associated pump. The pipe trench associated with pump 0-1 is separated from the pipe branch for pump 0-2 by a 6-inch reinforced concrete barrier with a single sealed pipe penetration. DCN DC1-EA-35567 provided a seal for the open pipeway.

2.0 COMBUSTIBLES (typical for each Fire Area)

2.1 Floor Area: 105 ft^2 each Fire Area)

2.2 In situ Combustible Materials (each Fire Area)

- Fuel oil

2.3 Transient Combustible Materials (each Fire Area)

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Moderate

3.0 FIRE PROTECTION

3.1 Detection

- None

3.2 Suppression

- Portable fire extinguishers
- Hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Area 35-A

4.1.1 Diesel Fuel Oil System

Diesel fuel oil pump 0-1 may be lost due to a fire in this area. Diesel fuel oil pump 0-2 will remain available to provide fuel oil to the diesels.

4.2 Fire Area 35-B

4.2.1 Diesel Fuel Oil System

Diesel fuel oil pump 0-2 may be lost due to a fire in this area. Diesel fuel oil pump 0-1 will remain available to provide fuel oil to the diesels.

5.0 CONCLUSION

The following features mitigate the effects of the design basis fire and assure the capability to achieve safe shutdown:

- Concrete hatches are caulked. Restricting air supply for combustion and preventing spilled flammable/combustible liquids from above from entering.

- Manual fire fighting equipment is available.

- 3-hour rated reinforced concrete barriers.

- Curbing around steel hatches covers to prevent a path of entrance for flammable/combustible liquids.

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

The existing fire protection in each zone provides an acceptable level of safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.2.

6.0 REFERENCES

6.1 Drawing No. 515579
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065126, Fire protection Information Report, Unit 1
6.5 SSER 23, June 1984
6.6 Calculation 134-DC, Electrical Appendix R Analysis
6.7 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.8 NECS File: 131 .95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.

FIRE AREA AB-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This fire zone is in the Auxiliary Building at El. 54, 64 and 73 ft on the North side adjacent to containment and is called the Unit 1 Boron Injection Tank (BIT) room.

1.2 Description

Fire Zone 3-B-3 constitutes the corridor that separates the RHR pump rooms from each other at the 54-ft and 64-ft elevation. The Boron Injection Tank (which has been taken out of service) occupies this zone.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

El. 54 ft

North, South, East, West:

- 3-hour rated barriers: North to Containment [NC]
  South to Fire Zone 3C [NC]
  East to Fire Area 3-B-2
  West to Fire Area 3-B-1

Floor:

- 3-hour rated barrier to grade. [NC]

El. 64 ft

North:

- 3-hour rated barrier to containment. [NC]

South:

- 3-hour rated barrier with an opening to Zone 3-C. [NC]

East:

- 3-hour rated barrier to Fire Area 3-B-2.
- A 1-1/2-hour rated door to Fire Area 3-B-2. (Ref. 6.5)
- Two duct penetrations without fire dampers communicate to Fire Area 3-B-2. (Ref. 6.5)
- A 3-hour equivalent rated double door with a monorail cutout that has water spray protection communicates to Fire Area 3-B-2. (Ref. 6.12)
- Unsealed valve operator shaft penetrations to Fire Area 3-B-2. (Ref. 6.7)

West:

- 3-hour rated barrier to Fire Area 3-B-1.
- A 1-1/2-hour rated door to Fire Area 3-B-1. (Ref. 6.5)
- A duct penetration without a fire damper communicates to Fire Area 3-B-1. (Ref. 6.5)
- A 3-hour-equivalent rated double door with a monorail cutout that has water spray protection communicates to Fire Area 3-B-1. (Ref. 6.12)
- Lesser rated penetration seal to Fire Area 3-B-1. (Ref. 6.11)

Ceiling:

- 3-hour rated to 3-H-1.

El. 73 ft

North:

- 3-hour rated barrier to containment [NC]

South:

- 3-hour rated barrier to Fire Areas 3-B-1, 3-B-2 and 3-H-1.
- 3-hour rated door to Fire Area 3-H-1.
- A duct penetration without damper to Fire Area 3-H-1. (Ref. 6.5)
- A 2-hour rated plaster block-out panel communicates to Fire Areas 3-B-1 and 3-B-2. (Ref. 6.8).
- A lesser rated penetration seal to Fire Areas 3-B-1 and 3-B-2. (Ref. 6.11)

East:

- 3-hour rated barrier to Fire Zone 3-F and below grade. [NC]
- Two duct penetrations without dampers to Fire Area 3-F. [NC] (Ref. 6.6)

West:

- 3-hour rated barrier to below grade. NC

Ceiling:

- 3-hour rated to 3BB.
- Lesser rated penetration seals to Fire Area 3-BB. (Ref. 6.11)

Floor:

- 3-hour rated to Fire Areas 3-B-1 and 3-B-2.

2.0 COMBUSTIBLES

2.1 Floor Area: 583 ft^2

2.2 In situ Combustible Materials

- Oil
- Plastic

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- None

3.2 Suppression

- Portable fire extinguishers
- Fire hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Safety Injection System

SI valves 8803A and 8803B may be affected by a fire in this area. A charging path through the regenerative heat exchanger or the RCP seals will remain available. Also, valves 8801A and 8801B can be used to isolate the charging injection flow path during RCS pressure reduction. Thus, no manual actions are required.

4.2 Residual Heat Removal System

A fire in this area may affect DC control cables for RHR Pumps 1-1 and 1-2 recirculation valves, FCV-641A and FCV-641B. Prior to starting either RHR Pump 1-1 or 1-2 from the control room, manual operation can taken to locally open its respective recirculation valve.

5.0 CONCLUSION

The following features will adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Portable fire extinguishers and fire hose stations are available.

- Limited combustible loading.

- Redundant safe shutdown functions are located outside this zone.

The existing fire protection provides an acceptable level of fire safety equivalent to that provided by Section III.G.2.

6.0 REFERENCES

6.1 Drawing Nos. 515566, 515567
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation M-824 Combustible loading
6.4 Drawing 065126, Fire Protection Information Report, Unit 1
6.5 SSER 23, June 1984
6.6 NECS File: 131.95, FHARE: 67, Undampered Duct Penetration
6.7 Deleted in Revision 13.
6.8 NECS File: 131.95, FHARE: 50, Plaster Block-out Panels in 3-Hour Barriers
6.9 Calculation 134-DC, Electrical Appendix R Analysis
6.10 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.11 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.12 NECS File: 131 .95, FHARE 159, Unrated Doors Protected by Local Automatic Sprinklers.

FIRE AREA AB-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fire Zone 3-F is located in the Auxiliary Building at El. 73 ft on the northeast side and is called the Unit 1 Containment Spray Pump Area.

1.2 Description

This fire zone contains the Unit 1 containment spray pumps 1-1 and 1-2, the spray additive tank and a nonvital motor control center.

1.3 Boundaries

NOTE: ^{NC} designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- 3-hour rated barrier to Fire Zone S-3 and to below grade. ^{NC}

South:

- 3-hour rated barrier with a duct penetration without a damper to Fire Area 3-H-2. (Ref. 6.5)
- 3-hour rated barrier to Fire Zone S-3 and Fire Area 3-B-2.
- Non-rated barrier with openings to Fire Zone 3-C. ^{NC}

East:

- 3-hour rated barrier to Fire Zone S-3 and to below grade. ^{NC}
- A nonrated barrier to Fire Zone 3-A. ^{NC}
- A nonrated door to Fire Zone 3-A. ^{NC}

West:

- 3-hour rated barrier to Fire Areas 3-B-2 and 3-H-2, and to Fire Zones 3-B-3 ^{NC} and S-3.
- A 1-1/2-hour rated door to Fire Zone S-3.
- Two duct penetrations without dampers communicate with Fire Zone 3-B-3. ^{NC} (Ref. 6.6)

- An open doorway with a security gate communicates to Fire Area 3-H-2. (Ref. 6.9)
- Duct penetration without a damper to Fire Area 3-H-2. (Ref. 6.5)

Floor:

- 3-hour rated barrier to Zone 3-C and Fire Area S-3 below.

Ceiling:

- 3-hour rated barrier to Areas 3-P-3, [NC] S-3, 3-M, [NC] and 3-BB above.

2.0 COMBUSTIBLES

2.1 Floor Area: 2,870 ft^2

2.2 In situ Combustible Materials

- Cable
- Clothing/Rags
- Miscellaneous
- Lubricating Oil
- Wood
- Plastic
- Rubber

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection

3.2 Suppression

- Portable fire extinguishers
- Fire hose station

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Chemical and Volume Control System

Charging pump 1-3 may be lost due to a fire in this area. Redundant charging pumps 1-1 and 1-2 will be available to provide charging flow.

5.0 CONCLUSION

The following features will adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Limited combustible loading.

- Smoke detection.

- Fire protection equipment is provided.

- Redundant safe shutdown functions are outside this zone.

The existing fire protection provides an acceptable level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.2.

6.0 REFERENCES

6.1 Drawing No. 515567
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)

6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065126, Fire Protection Information Report, Unit 1
6.5 SSER 23, June 1984
6.6 NECS File: 131.95, FHARE: 67, Undampered Duct Penetrations
6.7 Calculation 134-DC, Electrical Appendix R Analysis
6.8 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis

FIRE AREA AB-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

These zones are in the northwest corner of the 75-ft elevation of the Auxiliary Building. The zones are side by side with 3-J-2 between 3-J-1 on the west and 3-J-3 to the east.

1.2 Description

These zones contain the component cooling water (CCW) pumps. Zone 3-J-1 contains CCW Pump 1-1. Zone 3-J-2 contains CCW Pump 1-2. Zone 3-J-3 contains CCW Pump 1-3. Zones 3-J-1 and 3-J-2 are similar in size but Zone 3-J-3 is larger.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

1.3.1 Fire Zone 3-J-1

North:

- 3-hour rated barrier to below grade. [NC]

South:

- Open to Fire Zone 3-C (see Note 1). (Ref. 6.3)

East:

- 1-hour rated barrier to Fire Zone 3-J-2. (Ref. 6.6)
- A duct penetration without a damper to Fire Zone 3-J-2. (Ref. 6.3)

West:

- 3-hour rated barrier to below grade. [NC]

Floor/Ceiling:

- 3-hour rated barriers.

1.3.2 Fire Zones 3-J-2

North:

- 3-hour rated barrier to below grade. [NC]

South:

- Open to Fire Zone 3-C (see Note). (Ref. 6.3)

East:

- 1-hour rated barrier to Fire Zone 3-J-3. (Ref. 6.6)
- Two duct penetrations without fire dampers communicate to Fire Zone 3-J-3. (Ref. 6.3)

West:

- 1-hour rated barrier to Fire Zone 3-J-1. (Ref. 6.3, 6.6)
- A duct penetration without a fire damper communicates to Fire Zone 3-J-1. (Ref. 6.3)

Floor/Ceiling:

- Duct penetration without a damper communicates to Fire Zone 3-C below. (Ref. 6.3)
- 3-hour rated barriers: Floor to Fire Zone 3-C
  Ceiling to Fire Areas 4A-1 and 4-A

1.3.3 Fire Zone 3-J-3

North:

- 3-hour rated barrier to below grade. [NC]

South:

- Open to Fire Zone 3-C (see Note). (Ref. 6.3)
- 3-hour rated barrier and door to Fire Area 3-H-1

East:

- 3-hour rated barrier to below grade. [NC]
- 3-hour rated barrier to Fire Area 3-B-1.
- 3-hour rated barrier to Fire Area 3-H-1.

West:

- 3-hour rated barrier to below grade. [NC]
- 1-hour rated barrier to Fire Zone 3-J-2. (Ref. 6.6)
- Two duct penetrations without dampers communicate to Fire Zone 3-J-2. (Ref. 6.3)

Ceiling/Floor:

- Two open penetrations to Zone 3-C below. (Ref. 6.7)
- 3-hour rated barriers: Floor: To Fire Zone 3-C
  Ceiling: To Fire Areas 4-A-1, 4-A-2, and 4-A (Ref. 6.11)
- Lesser rated penetration seal to Area 3-BB. (Ref. 6.10)

(Note: For all three zones the openings south to 3-C are provided with an approximately 4-inch-high curb to prevent oil spillage from communications between zones.) (Ref. 6.3)

2.0 COMBUSTIBLES

2.1 Fire Zones 3-J-1 and 3-J-2 (typical of each area)

2.1.1 Floor Area: 405 ft^2

2.1.2 In situ Combustible Materials

- Cable insulation
- Lubricating oil
- Grease

2.1.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.1.4 Fire Severity

- Low (3-J-1)
- Low (3-J-2)

2.2 Fire Zone 3-J-3

2.2.1 Floor Area: 781 ft^2

2.2.2 In situ Combustible Materials

- Cable insulation
- Lubricating oil
- Rubber

2.2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

Zone 3-J-1: Smoke detection provided

Zone 3-J-2: Smoke detection provided

Zone 3-J-3: Smoke detection provided

3.2 Suppression

Zone 3-J-1:

- Wet pipe automatic sprinkler system with remote annunciation
- Fire hose stations
- Portable fire extinguishers

Zone 3-J-2:

- Wet pipe automatic sprinkler system with remote annunciation
- Fire hose stations
- Portable fire extinguishers

Zone 3-J-3:

- Partial wet pipe automatic sprinkler system with remote annunciation is provided for the pump room and the pipe chase but not for the ante room.
- Fire hose station
- Portable fire extinguishers

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Zone 3-J-1

4.1.1 Component Cooling Water

CCW pump and ALOP 1-1 may be lost due to a fire in this area. SSER 23 justifies that CCW pumps 1-2 and 1-3 and ALOPs 1-2 and 1-3 will remain available in the event of a fire.

4.1.2 Diesel Fuel Oil System

Diesel fuel oil pump 0-2 may be affected by a fire in this area. The circuits for diesel fuel oil pump 0-2 are protected by a fire barrier. The circuits for diesel fuel oil pump 0-1 are located 15 ft away. SSER 23 justifies that diesel fuel oil pump 0-1 will remain operational to provide fuel oil to the diesel generators. However, offsite power will be available for safe shutdown in the event the diesel fuel oil pump circuits are damaged. (Ref. 6.9)

4.1.3 HVAC

Exhaust fan E-101 may be lost due to a fire in this area. Exhaust fan E-103 will be available to provide necessary HVAC support.

4.2 Fire Zone 3-J-2

4.2.1 Chemical and Volume Control System

Charging pump 1-3 and ALOPs 1-1 and 1-2 may be lost due to a fire in this area. Charging pumps 1-1 and 1-2 can be locally tripped at their respective switchgear. Redundant Charging Pump 1-3 will remain available for safe shutdown.

4.2.2 Component Cooling Water

CCW pumps 1-1 and 1-2 and ALOPs 1-1 and 1-2 may be lost due to a fire in this area. SSER 23 justifies that CCW pump 1-3 and ALOP 1-3 will be available to provide CCW flow.

4.2.3 Residual Heat Removal System

A fire in this area may affect an AC control cable for RHR Pp 1-1 recirc valve FCV-641A. Redundant recirc valve FCV-641B will remain available for cold shutdown functions using RHR Pump 1-2.

4.2.4 Safety Injection System

Valves 8803A and 8803B may be affected by a fire in this area. A charging path through the regenerative heat exchanger or the RCP seals will remain available. Also, valves 8801A and 8801B will remain available to isolate the charging injection flowpath during RCS pressure reduction. Thus, no manual actions are required.

4.3 Fire Zone 3-J-3

4.3.1 Chemical and Volume Control System

Charging pumps 1-1, 1-2 and 1-3 and ALOPs 1-1 and 1-2 may be lost due to a fire in this area. Charging pumps 1-1 and 1-2 can be locally started to provide charging flow.

4.3.2 Component Cooling Water

CCW pump 1-3 and ALOP 1-3 may be lost due to a fire in this area. SSER 23 justifies that CCW pumps 1-1 and 1-2 and ALOPs 1-1 and 1-2 will be remain available to provide CCW flow.

4.3.3 Residual Heat Removal System

A fire in this area may affect AC power cable for RHR Pump 1-2 recirculation valve FCV-641B and AC control cables for RHR Pumps 1-1 and 1-2 recirculation valves, FCV-641A and FCV-641B. Prior to starting either RHR Pump 1-1 or 1-2 from the control room, manual action can be taken to open its respective recirc valve (FCV-641A or FCV-641B).

4.3.4 Safety Injection System

Valves 8803A and 8803B may be affected by a fire in this area. A charging path through the regenerative heat exchanger or the RCP seals will remain available. Also, valves 8801A and 8801B will remain available to isolate the charging injection flowpath during RCS pressure reduction. Thus, no manual actions are required.

5.0 CONCLUSION

The following features will adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.
- Smoke detection in each zone.
- Automatic sprinkler system.

- Limited combustible loading.
- Manual suppression equipment is available.

The existing fire protection provides an acceptable level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.2.

6.0 REFERENCES

6.1 Drawing No. 515567
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 SSER 23, June 1984
6.4 Calculation M-824, Combustible Loading
6.5 Drawing 065126, Fire Protection Information Report, Unit 1
6.6 NECS File: 131.95, FHARE: 37, Rating of Barriers Between CCW Pump Rooms
6.7 NECS File: 131.95, FHARE: 124, Unsealed Penetrations through Barrier 119
6.8 Calculation 134-DC, Electrical Appendix R Analysis
6.9 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.10 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.11 NECS File: 131.95, FHARE 111, Glass Pipe Penetrants

FIRE AREA AB-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fire Zone 3-Q-2 is located in the south end of the Unit 1 Fuel Handling Building at El. 100 ft. This zone is adjacent to the northeast wall of the Auxiliary Building.

1.2 Description

This zone contains AFW Pump 1-2 and 1-3 and is actually in the Fuel Handling Building and is called the Unit 1 Auxiliary Feedwater Motor Driven Pump Room.

1.3 Boundaries

North:

- 3-hour rated barrier to Fire Zone 3-0.
- A 1-1/2-hour rated door to Fire Zone 3-0.

South:

- 3-hour rated barrier to Fire Zone S-3.

East:

- 1-hour rated barrier to Fire Zone 3-Q-1. (Ref. 6.11)
- A 3-hour rated double door and a 3-hour rated door to Fire Zone 3-Q-1.
- A 1-1/2-hour rated fire damper to Fire Zone 3-Q-1. (Ref. 6.5)
- A duct penetration without a damper to Fire Zone 3-Q-1. (Ref. 6.5)
- Unique penetration seals in plaster walls to Fire Zone 3-Q-1. (Ref. 6.7)
- Lesser rated penetration seals to Fire Zone 3-Q-1. (Ref. 6.10)

West:

- 3-hour rated barrier to Fire Zone 3-BB.
- Lesser rated penetration seals to Fire Zone 3-BB. (Ref. 6.10)
- A 1-1/2-hour rated door to Fire Zone 3-BB. (Ref. 6.5)

Floor/Ceiling:

- 3-hour rated barrier: Floor: To Fire Zone S-3
  Ceiling: To Fire Zone 3-R
- Ventilation opening communicates with Fire Zone 3-R above. (Ref. 6.6)

2.0 COMBUSTIBLES

2.1 Floor Area: 400 ft^2

2.2 In situ Combustible Materials

- Lubricants
- Cable
- Clothing/Rags
- Wood (fir)

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection is provided

3.2 Suppression

- Wet pipe automatic sprinkler system with remote annunciation.
- Portable fire extinguishers.
- Fire hose stations.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Auxiliary Feedwater

AFW pumps 1-2 and 1-3 may be lost due to a fire in this area. Redundant AFW pump 1-1 will be available to provide AFW.

5.0 CONCLUSION

The following features will adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.
- Portable fire extinguishers and hose stations.
- Redundant safe shutdown function located outside this zone.
- Limited and dispersed combustible loading.
- Automatic wet pipe sprinkler system.
- Smoke detection provided.

The existing fire protection features provide a level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 Drawing No. 515569
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065126, Fire Protection Information Report, Unit 1
6.5 SSER 23, June 1984

6.6 NECS File: 131.95, FHARE: 9, Ventilation Opening Above AFW Pump Room
6.7 NECS File: 131.95, FHARE 121, Pipe Penetration Seals Through Plaster Walls in the Unit 1 AFW Pump Rooms
6.8 Calculation 134-DC, Electrical Appendix R Analysis
6.9 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.10 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.11 PG&E Letter DCL-84-329 Dated 10/19/84

FIRE AREA FB-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This zone is located at the east end of the Unit 1 Fuel Handling Building at the 104-ft elevation.

1.2 Description

This zone consists of the Fuel Handling Building corridor.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- A 3-hour barrier to Zone 3-P-3. [NC]
- A 3-hour barrier to Zone 3-P-2. [NC]
- Duct penetrations without fire dampers penetrate to Zones 3-P-2 [NC] and 3-P-3. [NC] (Ref. 6.3)
- A 3-hour barrier to Zone S-9.
- A 1-1/2-hour rated door to Zone S-9.

South:

- A 2-hour fire rated barrier separates this zone from Area 3-Q-1.
- A 1-1/2-hour rated double door in a 2-hour rated plaster barrier communicates to Area 3-Q-1. (Refs. 6.10 and 6.11)
- A 3-hour fire rated barrier to Zone 3-R. [NC]
- Unique penetration seals in plaster walls to Area 3-Q-1. (Ref. 6.6)
- Lesser rated penetration seals to Area 3-Q-1. (Ref. 6.9)

East:

- A 3-hour rated barrier to below grade. [NC]

West:

- A 3-hour barrier to Zone 3-P-3. [NC]

- A 3-hour barrier to Zone 3-P-2 with a duct penetration without a fire damper. NC (Ref. 6.3)
- A 3-hour barrier to Zones S-8 and S-9.
- A non-rated door communicates to Zone 3-P-2. NC
- A 1-1/2-hour rated door communicates to Zone S-8.
- A 3-hour fire barrier to Zone 3-R. NC
- A 3-hour barrier to Zone 3-O. NC

Floor:

- A 3-hour rated floor to Zone 3-P-3. NC

Ceiling:

- Non-rated barrier to Zones 3-R NC and 3-P-4. NC
- Vent openings to 3-P-4. NC
- Vent opening to 3-R. NC

2.0 COMBUSTIBLES

2.1 Floor Area: 2,089 ft^2

2.2 In situ Combustible Materials

- Tray Cable
- Lube Oil

2.3 Transient Combustible Loading

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- None

3.2 Suppression

- Automatic wet pipe sprinklers

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Make-up System

Condensate storage tank level indication from LT-40 may be lost due to a fire in this area. Water from the raw water storage reservoir will remain available through FCV-436 and FCV-437. Manual action can be performed to locally open the normally closed manual valves. Manual valves 0-1557 and 0-280 are also located in this fire area, and will need to be manually operated to align RWSR to the AFW Pump suction flowpaths for both Units 1 and 2.

4.2 Safety Injection System

A fire in this area may affect circuits associated with RWST Level Transmitter LT-920. This level transmitter is credited for diagnosis of spurious operation of equipment that may divert RWST inventory. There are no cables affected in this area that may result in diverting the RWST inventory. Therefore, loss of this instrument will not affect safe shutdown.

5.0 CONCLUSION

The following features mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- A trained fire brigade is onsite at all times and is responsible for fire suppression.
- Redundant components are not affected by a fire in this area.
- Area wide fire suppression is provided.

This area complies with the requirements of 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 Drawing No. 515569
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 NECS File: 131.95, FHARE: 40, Undampered Ventilation Ducts
6.4 Calculation No. M-824, Combustible Loading
6.5 PG&E Letter to the NRC, Question No. 25, 8/3/78
6.6 NECS File: 131.95, FHARE 121, Pipe Penetration Seals Through Plaster Walls in the Unit 1 AFW Pump Rooms
6.7 Calculation 134-DC, Electrical Appendix R Analysis
6.8 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.9 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.10 SSER - 23
6.11 Deleted

FIRE AREAS TB-1, TB-2, TB-3

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Northwest corner of Unit 1 Turbine Building; consists of the diesel generator rooms (El. 85 ft) and the diesel generator air intakes (El. 85 ft and 107 ft).

1.2 Description

Fire Areas TB-1, TB-2, and TB-3 are divided into Fire Zones 11-A-1, 11-A-2, 11-B-1, 11-B-2, 11-C-1 and 11-C-2 to differentiate between the generator rooms and the ventilation intake and exhaust rooms.

Fire Zones 11-A-1, 11-B-1, and 11-C-1 contain diesel generators 1-1, 1-2, and 1-3 respectively. These areas are located side by side with 11-B-1, located between 11-C-1 on the south side and 11-A-1 on the north. Fire Zones 11-A-1, 11-B-1, and 11-C-1 are provided with curbs at all door openings to contain any oil leakage. Several 4-inch floor drains are provided underneath the day tanks in each diesel generator room. A common 4-inch pitched header, which is a minimum of 3-1/2 ft below the drain openings, connects the drains from each room with the Turbine Building sump. No fire traps are provided and the drainage system will drain the quantity of the postulated day tank fuel oil spillage to the Turbine Building sump.

The diesel generator intake and exhaust rooms (Fire Zones 11-A-2 (TB-1), 11-B-2 (TB-2), and 11-C-2 (TB-3)) communicate air between the 85-ft elevation, the 107-ft elevation and the exterior (Fire Area 28) area. The area north of Zone 11-A-1, which above the 107-ft elevation is separated by walls into Zone 11-A-2, 11-B-2 and 11-C-2, becomes an open common exhaust air plenum below the 107-ft elevation.

Due to the similarities of these three fire areas, they are evaluated together.

1.3 Boundaries

NOTE: ^{NC} designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

1.3.1 El. 85 ft

1.3.1.1 Fire Zones 11-A-1, 11-B-1, 11-C-1

North:

- 3-hour rated barrier from:

  - Zone 11-A-1 to Zones 11-A-2 (Ref. 6.7), 11-B-2 and 11-C-2.
  - Zone 11-B-1 to Zone 11-A-1. (Ref. 6.7)
  - Zone 11-C-1 to Zone 11-B-1. (Ref. 6.7)

South:

- 3-hour rated barrier from:

  - Zone 11-A-1 to Zone 11-B-1. (Refs. 6.7 and 6.16)
  - Zone 11-B-1 to Zone 11-C-1. (Refs. 6.7 and 6.16)
  - Zone 11-C-1 to Zone 14-A. (Ref. 6.7)

East:

- 3-hour rated barriers to Area 11-D. (Refs. 6.7 and 6.10)
- A 3-hour rated roll up door, one from each zone to Area 11-D.
- Unrated small diameter penetration one from each zone to Area 11-D. (Ref. 6.11)
- A 3-hour rated door, one from each Zone to Area 11-D.

West:

- 3-hour rated barrier.
- Two 3-hour rated roll-up doors.
- A drive shaft penetration.

All of the above exist between each of the following:

- Zone 11-A-1 to Zone 11-A-2
- Zone 11-B-1 to Zone 11-B-2
- Zone 11-C-1 to Zone 11-C-2

Floor/Ceiling:

- Floor: Reinforced concrete on grade. [NC]
- Ceiling: 3-hour rated, except for diesel exhaust stack 11-A-1 to 11-A-2, 11-C-1 to 11-C-2, 11-B-1 to 11-B-2. (Ref. 6.10)

1.3.1.2 Fire Zones 11-A-2, 11-B-2, 11-C-2 (Radiator Rooms) El. 85 ft

North:

- Nonrated barrier to the exterior (Fire Area 28) and radiator exhaust plenum [NC] (see Section 1.3.1.3). (Ref. 6.18)
- 3-hour rated barrier from: (Ref. 6.7)
  - Zone 11-B-2 to Zone 11-A-2
  - Zone 11-C-2 to Zone 11-B-2
- 3-hour rated door from:
  - Zone 11-B-2 to Zone 11-A-2
  - Zone 11-C-2 to Zone 11-B-2

South:

- 3-hour rated barrier from: (Ref. 6.7)
  - Zone 11-A-2 to Zone 11-B-2
  - Zone 11-B-2 to Zone 11-C-2
  - Zone 11-C-2 to Zone 14-A
- 3-hour rated door from:
  - Zone 11-A-2 to Zone 11-B-2
  - Zone 11-B-2 to Zone 11-C-2
- A 1-inch sliding steel door (DR No. 115) from 11-C-2 to Fire Zone 14-A. This door is normally locked shut and welded closed for plant security.

East:

- 3-hour rated barrier.
- Two 3-hour rated roll up doors.

- A drive shaft penetration.

All of the above exist between each of the following:

- Zone 11-A-2 to Zone 11-A-1
- Zone 11-B-2 to Zone 11-B-1
- Zone 11-C-2 to Zone 11-C-1

West:

- Nonrated barrier to the exterior. [NC] (Ref. 6.18)

Floor/Ceiling:

- Floor: Reinforced concrete on grade. [NC]
- Ceiling: Open to 107-ft elevations.

1.3.1.3 Fire Zones 11-A-2, 11-B-2, 11-C-2 North Common Exhaust Plenum (El. 85 ft)

North:

- The barriers of these zones adjacent to the exterior (Fire Area 28) have open louvers which provide flow paths for the diesel generator radiator exhaust. [NC] (Ref. 6.18)

South:

- 3-hour rated barrier to Zone 11-A-1. (Ref. 6.7)

East:

- 3-hour rated barrier to Area 11-D. (Ref. 6.7)
- A nonrated metal personnel access hatch to Area 11-D. (Refs. 6.17 and 6.18)

West:

- Nonrated barrier. NC (Ref. 6.18)

Floor/Ceiling:

- Floor: Reinforced concrete on grade. NC

1.3.2 El. 107 ft

North:

- Nonrated barriers to the exterior. NC (Ref. 6.18)
- 3-hour rated barrier and door from zone 11-B-2 to zone 11-A-2. (Ref. 6.7)
- A lesser rated penetration seal from Zone 11-B-2 to Zone 11-A-2. (Ref. 6.15)
- 3-hour rated barrier and door from zone 11-C-2 to zone 11-B-2. (Ref. 6.7)

South:

- 3-hour rated barrier from zone 11-C-2 to Zone 13-E.
- 3-hour rated barrier and door from zone 11-C-2 to zone 14-A. (Ref. 6.7)

East:

- 3-hour rated barriers from:
  - Zone 11-A-2 to Zone 11-B-2. (Ref. 6.7)
  - Zone 11-B-2 to Zone 11-C-2. (Ref. 6.7)
  - Zone 11-C-2 to Zones 13-E, 12-A, 12-B, 12-C. (Ref. 6.7)
- 3-hour rated door communicates from zone 11-C-2 to zone 13-E.

West:

- Nonrated barriers to the exterior NC (Refs. 6.9 and 6.18).
- 3-hour rated barriers from:
  - Zone 11-B-2 to Zone 11-A-2 (Ref. 6.7)
  - Zone 11-C-2 to Zone 11-B-2 (Ref. 6.7)

Floor/Ceiling:

- Floor:
  - 3-hour barrier to 11-A-1, 11-B-1 and 11-C-1 except for Diesel Exhaust Stacks. (Ref. 6.10)
  - Floor opening to 11-A-2 (common exhaust plenum). (Ref. 6.9)

- Ceiling: 3-hour barrier to 13-E and 13-F above. (Ref. 6.7)
  - Lesser rated penetration seals to Zones 13-E and 13-F. (Ref. 6.15)

2.0 COMBUSTIBLES

Fire Areas TB-1, TB-2, and TB-3 at El. 85 ft each have approximately the same area and combustible loading. At the 107-ft elevation there is no in situ combustible loading. The following information applies to each fire area.

2.1 Floor Area: 770 ft^2 (11-A-1, 11-B-1, 11-C-1),
1532 ft^2 (11-A-2) (Ref. 6.10)
1383 ft^2 (11-B-2) (Ref. 6.10)
1658 ft^2 (11-C-2) (Ref.6.10)

2.2 In situ Combustible Materials

- Lube oil
- Fuel oil
- Bulk Cable
- Polyethylene
- Plastic
- Rubber
- Paper

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants

- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Moderate (11-A-1, 11-B-1, 11-C-1)
- Low (11-A-2, 11-B-2, 11-C-2)

3.0 FIRE PROTECTION (applies for each area)

3.1 Detection

- Heat detection which: (a) releases east doors, (b) releases west doors, (c) activates CO_2 system.

3.2 Suppression

- Total flooding CO_2
- Portable fire extinguishers
- Fire hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Zones 11-A-1 and 11-A-2

4.1.1 Diesel Fuel Oil System

Diesel fuel oil pumps (DFO) 0-1 and the cables affecting the transfer of fuel to DG 1-1 from DFO pump 0-2 may be affected by a fire in this area. The ability to transfer diesel fuel to DG 1-2 and 1-3 from DFO pump 0-2 will remain available. In addition, offsite power will not be affected in this area and will remain available.

A fire in this area may result in the loss of LCV-85 and LCV-88 . Day tank level control for DGs 1-2 and 1-3 will be maintained by LCV-86 and LCV-87. In addition, offsite power will not be affected in this area and will remain available.

4.1.2 Emergency Power

A fire in this area may disable diesel generator 1-1. Diesel generators 1-2 and 1-3 will remain available. In addition, offsite power will not be affected in this area and will remain available.

4.2 Fire Zones 11-B-1 and 11-B-2

4.2.1 Diesel Fuel Oil System

Diesel fuel oil (DFO) pump 0-2 and circuits affecting the transfer of fuel to DG 1-2 from DFO pump 0-1 may be lost due to a fire in this area. The ability to transfer fuel to DGs 1-1 and 1-3 from DFO pump 0-1 will remain available. In addition, offsite power will not be affected in this fire area and will remain available.

Valves LCV-86 and LCV-89 may be lost due to a fire in this area. Day tank level control will be maintained by LCV-88 and LCV-90. In addition, offsite power will not be affected in this fire area and will remain available.

4.2.2 Emergency Power

A fire in this area may disable diesel generator 1-2. Diesel generators 1-1 and 1-3 will remain available for safe shutdown. In addition, offsite power will not be affected in this fire area and will remain available.

4.3 Fire Zones 11-C-1 and 11-C-2

4.3.1 Diesel Fuel Oil System

A fire in this area may prevent DFOS PPs 0-1 and 0-2 from providing fuel oil to DG 1-3. These pumps will be able to provide fuel oil to DGs 1-1 and 1-2. In addition, offsite power is not affected in this area and will remain available.

A fire in this area may cause LCV-87 and LCV-90 to be unavailable. Since DG 1-3 will be unavailable, these valves will not be necessary for safe shutdown. In addition, offsite power is not affected in this area and will remain available.

4.3.2 Emergency Power System

A fire in this area may disable DG 1-3. DGs 1-1 and 1-2 will remain available for safe shutdown. In addition, offsite power is not affected in this area and will remain available.

5.0 CONCLUSION

The following fire protection features will adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Manual fire fighting equipment is available for use in the areas.

- Floor drainage system will drain postulated day tank fuel oil spillage to the Turbine Building sump.

- A total flooding CO_2 suppression system is provided for the DG rooms.

- The drainage system described in Section 1.2 does not contain fire traps. A commitment to provide fire traps was accepted by the NRC in SSER 8. This commitment was then withdrawn and the existing floor drainage system justified and found acceptable. (Ref. 6.19)

- The fire hazard is minimal in the ventilation intake and exhaust rooms. Smoke and hot gases would either be vented outside through the louvers in the exterior wall or confined within the area by the fire rated perimeter construction until the fire brigade arrives.

The existing fire protection for the areas provides an acceptable level of safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.2.

6.0 REFERENCES

6.1 Drawing No. 515562
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065126, Fire Protection Information Report, Unit 1
6.5 SSER 23, June 1984
6.6 Deleted
6.7 NECS File: 131.95, FHARE: 30, Unrated Gaps in Appendix R Barriers in the Turbine Building
6.8 Deleted in Revision 13
6.9 DCP H-49117

6.10 PG&E Engineering Calculation File: 131.95, FHARE 103, Fire Barrier Configurations in the Emergency Diesel Generator Rooms
6.11 NECS File: 131.95, FHARE 123, Unsealed penetrations with fusible link chain penetrants through fire barrier
6.12 DCP H-50117, Diesel Generator Air Flow Improvement Modification for Units 1 and 2
6.13 Calculation 134-DC, Electrical Appendix R Analysis
6.14 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.15 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.16 NECS File: 131.95, FHARE 141, Fireproofing on Unistruts Attached to Structural Steel Members
6.17 NECS File: 131.95, FHARE 68, Non-rated Hatch
6.18 NECS File: 131 .95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.
6.19 NECS File: 131 .95, FHARE 29, Fire Trap for Diesel Generator Rooms

FIRE AREA TB-4

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fire Area TB-4 is in the northeast corner of the Unit 1 Turbine Building and consists of Fire Zone 12-A, at El. 107 ft, and Fire Zone 13-A, at El. 119 ft.

1.2 Description

Fire Area TB-4 consists of the 4-kV F Bus cable spreading room (at 107 ft), Fire Zone 12-A, the 4-kV F Bus switch gear room (at 119 ft), and Fire Zone 13-A, in the Turbine Building. At least two of the three vital divisions are required for safe shutdown.

1.3 Boundaries

1.3.1 Fire Zone 12-A (El. 107 ft)

North:

- A 2-hour rated barrier to Fire Zone 12-B (TB-5). (Refs. 6.5 and 6.19)
- Unrated structural gap seals to Fire Zone 12-B (TB-5). (Ref. 6.15)
- Two 3-hour rated doors to Fire Zone 12-B (TB-5).
- A 1-1/2-hour rated door to Fire Zone 12-B (TB-5). (Ref. 6.19)
- A lesser rated penetration seal to Fire Zone 12-B (TB-5). (Ref. 6.17)

South:

- 3-hour rated barrier to Fire Zone 14-A (TB-7), at col. line 5, C5.
- 2-hour rated barrier to Fire Zone 12-E (TB-7).
- Unrated structural gap seals to Fire Zone 12-E (TB-7). (Ref. 6.15)
- Two 1-1/2-hour rated doors to Fire Zone 12-E (TB-7). (Ref. 6.19)

East:

- 2-hour rated barrier to Fire Zone 12-E
- 2-hour rated barrier to the exterior (Area 28)
- 1-1/2-hour rated door to Fire Zone 12-E

West:

- 3-hour rated barrier to Fire Area 13-E and Zone 11-C-2 (Fire Area TB-3) (Ref. 6.16) and to Fire Zone 12-B (Fire Area TB-5).
- Unrated structural gap seals to Fire Area 13-E. (Ref. 6.15)
- A 1-1/2-hour rated door to Fire Area 13-E. (Ref. 6.18)

Floor/Ceiling:

Ceiling:

- 3-hour rated concrete slab.
- A ventilation duct without a 3-hour rated fire damper communicates with Fire Area 13-D (above). (Refs. 6.8 and 6.12)
- A ventilation duct with a 3-hour rated fire damper communicates with Fire Area 13-E (above). (Ref. 6.6)
- A vent opening to Fire Zone 13-A.

Floor:

- 3-hour rated concrete slab on unprotected steel to Fire Areas 10 and 11-D. (Ref. 6.9 and 6.21)

1.3.2 Fire Zone 13-A (El. 119 ft)

North:

- A 2-hour rated barrier to Fire Zone 13-B (Fire Area TB-5). (Ref. 6.20, 6.21 and 6.22)
- Unrated structural gap seals to Fire Zone 13-B (Fire Area TB-5). (Ref. 6.15)
- A 1-1/2-hour rated door to Fire Zone 13-B. (Ref. 6.20)

South:

- 3-hour rated barrier to Fire Zone 12-E (Fire Area TB-7).
- A 1-1/2-hour rated door to Fire Zone 12-E. (Ref. 6.20)

East:

- 2-hour rated barrier to the exterior (Area 28). (Ref. 6.20)

West:

- 3-hour rated barrier to Fire Area 13-D. (Ref. 6.22)
- Unrated structural gap seals to Fire Area 13-D. (Ref. 6.15)
- A 1-1/2-hour rated door to Fire Area 13-D. (Ref. 6.20)
- A 1-1/2-hour rated damper to Fire Area 13-D. (Ref. 6.20)
- 3-hour rated pyrocrete blockout around the door. (Ref. 6.10 and 6.23)

Floor/Ceiling:

Ceiling:

- 3-hour rated concrete slab.
- A ventilation exhaust opening to the main turbine deck (El. 140 ft) with a 3-hour rated fire damper.

Floor:

- 3-hour rated concrete slab.
- A vent opening to Fire Zone 12-A.

Protective Enclosure:

- All corner gaps are sealed, and structural steel have fire resistive coverings.

(Note: Some structural steel modifications for the block walls (at El. 119 ft) were deemed acceptable with no fireproofing. (Ref. 6.11))

2.0 COMBUSTIBLES

2.1 Fire Zone 12-A (107 ft)

2.1.1 Floor Area: 1482 ft^2

2.1.2 In situ Combustible Materials

- Bulk Cable
- Rubber
- Plastic

2.1.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.1.4 Fire Severity

- Low

2.2 Fire Zone 13-A (119 ft)

2.2.1 Floor Area: 855 ft^2

2.2.2 In situ Combustible Material

- Bulk Cable
- Rubber
- Plastic

2.2.3 Transient Combustible Material

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection is provided in Fire Zones 12-A and 13-A.

3.2 Suppression (for each zone)

- Portable fire extinguishers
- CO_2 hose station
- Fire hose station

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Zones 12-A and 13-A

4.1.1 Auxiliary Feedwater

AFW pump 1-3 may be lost for a fire in this area. Steam generators 1-3 and 1-4 are credited for safe shutdown in this area, and redundant AFW pump 1-1 will be available to provide AFW.

AFW valves LCV-113 and LCV-115 may be affected by a fire in this area. Redundant valves LCV-108 and LCV-109 will remain available to provide AFW flow to Steam Generators 1-3 and 1-4 via AFW Pump 1-1.

4.1.2 Chemical and Volume Control System

Charging pump 1-1 and ALOP 1-1 may be lost due to a fire in this area. Redundant charging pumps 1-2, 1-3 and ALOP 1-2 will remain available to provide charging flow.

Boric acid transfer pump 1-1 may be lost due to a fire in this area. Redundant boric acid pump 1-2 will be available for this function.

CVCS valve 8107 may be affected by a fire in this area. CVCS valves 8108, HCV-142, or 8145 and 8148 will remain available to isolate auxiliary spray. Two other charging flowpaths will remain available. The PORVs can be used for pressure reduction. Since valve 8107 has redundant components, safe shutdown is not affected.

CVCS valve LCV-112B may be affected by a fire in this area. SIS valve 8805B remains available to provide water from the RWST to the charging pump suction. The volume control tank can be isolated by closing LCV-112C.

Boric acid storage tank 1-2 level indication from LT-106 may be lost due to a fire in this area. Since borated water from the RWST will remain available, BAST level indication is not required.

4.1.3 Component Cooling Water

CCW pump 1-1 and ALOP 1-1 may be lost due to a fire in this area. CCW pumps and ALOPs 1-2 and 1-3 will remain available to provide CCW. CCW valve FCV-430 may be affected by a fire in this area making heat exchanger 1-1 unavailable for CCW cooling. Redundant valve FCV-431 will remain available making CCW heat exchanger 1-2 available. Thus no manual actions are required.

4.1.4 Emergency Power

A fire in this area may disable the backup control circuit for diesel generator 1-2. The normal control circuit will remain available.

A fire in this area may disable diesel generator 1-3. Diesel generators 1-1 and 1-2 will remain available for safe shutdown.

A fire in this area may disable Startup Transformer 1-2. Onsite power from diesel generators 1-1 and 1-2 will remain available for safe shutdown.

All power supplies on the "F" Bus may be lost due to a fire in this area. These power supplies are not necessary since redundant trains on the "G" and "H" Buses will be available.

A fire may disable dc panel SD13 backup battery charger ED131. Normal battery charger ED132 will remain available.

A fire in this area may result in a loss of power supplies associated with PY17N. Redundant power supply PY16 remains available.

4.1.5 Main Steam System

A fire in this area may result in the loss of LT-516, LT-526, LT-529, LT-536, LT-539, LT-546, PT-514, PT-524, PT-534 and PT-544. Since redundant instrumentation will be available all four steam generators, safe shutdown will not be affected.

Main steam system valve PCV-19 may fail due to a fire in this area. Since this valve fails in its desired position, safe shutdown can still be achieved. Redundant dump valves PCV-21 and PCV-22 will remain available for cooldown purposes using steam generators 1-3 and 1-4.

4.1.6 Makeup System

The level transmitter for the condensate storage tank, LT-40 may be lost due to a fire in this area. Feedwater will remain available through FCV-436 from the raw water storage reservoir. Manual action can be performed to locally open FCV-436 prior to CST depletion.

4.1.7 Reactor Coolant System

The following instrumentation may be lost due to a fire in this area: TE-410C, TE-413B, TE-423A, TE-423B, PT-403, PT-406, LT-406, LT-459, NE-31 and NE-51. Redundant instrumentation will be available to provide necessary indications to the operator.

RCS valve 8000A may be affected by a fire in this area. This valve is normally open and fails "as is." PCV-474 will remain closed to prevent uncontrolled pressure reduction through the PORV path.

4.1.8 Safety Injection System

SI pump 1-1 may spuriously operate due to a fire in this area. Local manual action may be required to defeat this spurious operation prior to RCS depressurization.

SI valves 8801A, 8803A and 8805A may be affected by a fire in this area. Since these valves have redundant components, safe shutdown is not affected.

SI valve 8808A may be affected by a fire in this area. Manual action may be necessary to close 8808A.

4.1.9 Auxiliary Saltwater System

Circuitry of ASW pumps 1-1 and 1-2 may be damaged by a fire in this area. ASW pump 1-2 can be started locally to provide ASW flow.

A fire in this area may affect valve FCV-602. This valve fails in the desired safe shutdown position.

4.1.10 HVAC

HVAC equipment E-103, E-43, S-43, FCV-5045 and S-69 may be lost due to a fire in this area. E-103 and S-69 will not be necessary during a fire in this area. S-43, E-43 and FCV-5045 have redundant components S-44, E-44 and FCV-5046 that will remain available to provide necessary HVAC support to the 480-volt switchgear.

5.0 CONCLUSION

The following fire protection features mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Smoke detection is provided for the fire area.

- Portable fire extinguishers, CO_2 hose stations and fire hose stations are available.

- Redundant safe shutdown capability is provided outside of this fire area.

In this fire area, existing fire protection features provide an acceptable level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.

6.0 REFERENCES

6.1 Drawing Nos. 515562, 515563, 515564, 515565
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065126, Fire Protection Information Report, Unit 1
6.5 SSER 8, November 1978
6.6 DCN DC1-EH-15047, Provide 3 hour related dampers to Fire Area 12-A
6.7 DCN DC1-E-E9408, Rev. 0, Alternate Means Provided to Start AFW Pumps
6.8 NECS File: 131.95, FHARE: 31, Undampered Duct Penetrations From the Fan Room
6.9 PLC report: Structural Steel Analysis for Diablo Canyon (Rev. 2) 7/8/86
6.10 DCN DC1-EA-15662 R4, provide 3-hour rated pyrocrete blockout

6.11 NECS File: 131.95, FHARE: 106, Block Walls Modified in the 4kV Switchgear Area
6.12 NECS File: 131.95, FHARE: 136, Unrated HVAC Duct Penetrations
6.13 Calculation 134-DC, Electrical Appendix R Analysis
6.14 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.15 NECS File: 131.95, FHARE 134, "Non-rated Structural Gap Seals in Fire Barriers"
6.16 NECS File: 131.95, FHARE 30, Unrated Gaps in Appendix R Barriers in the Turbine Building
6.17 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.18 SSER - 23
6.19 Question 27, PG&E Letter to NRC Dated 11/13/78
6.20 Question 29, PG&E Letter to NRC Dated 11/13/78
6.21 NECS File: 131 .95, FHARE 20, Bus Duct Penetrations
6.22 NECS File: 131 .95, FHARE 100, Block Walls Structurally Modified with Columns, Beams and Steel Plates
6.23 NECS File: 131 .95, FHARE 146, Gaps in Unistruts and Support Members through Pyrocrete Barriers

FIRE AREA TB-5

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fire Area TB-5 is in the Northeast corner of the Unit 1 Turbine Building and consists of Fire Zones 12-B, at El. 107 ft, and Fire Zone 13-B, at El. 119 ft.

1.2 Description

Fire Area TB-5 consists of the 4-kV "G" bus cable spreading at El. 107 ft, Zone 12-B, and the 4-kV "G" bus switchgear room at El. 119 ft in the Turbine Building. At least two of the three vital divisions are required for safe shutdown.

1.3 Boundaries

1.3.1 Fire Zone 12-B (El. 107 ft)

North:

- A 2-hour rated barrier to Fire Zone 12-C (TB-6). (Ref. 6.5 and 6.18)
- Unrated structural gap seals to Fire Zone 12-C. (Ref. 6.15)
- Two 3-hour rated doors to Fire Zone 12-C.
- A 1-1/2-hour rated door to Fire Zone 12-C. (Ref. 6.18)

South:

- A 2-hour rated barrier to Fire Zone 12-A (TB-4). (Ref. 6.18)
- Unrated structural gap seals to Fire Zone 12-A (TB-4). (Ref. 6.15)
- A 1-1/2-hour rated door to Fire Zone 12-A. (Ref. 6.18)
- Two 3-hour rated doors to Fire Zone 12-A.
- A lesser rated penetration seal to Fire Zone 12-A (TB-4). (Ref. 6.17)

East:

- 2-hour rated barrier to the exterior (Area 28). (Ref. 6.18)
- 2-hour rated barrier to Fire Zones 12-A and 12-C. (Ref. 6.18)

West:

- 2-hour rated barrier to Fire Zone 12-C. (Ref. 6.18)
- 3-hour rated barrier to Fire Zone 11-C-2 (TB-3). (Ref. 6.16)[O-9.5A(4)]
- Floor/Ceiling:

Ceiling: To Fire Zones 13-B, 13-D, and 13-E

- 3-hour rated concrete slab.
- 3-hour rated concrete equipment hatch to Fire Area 13-D. (Ref. 6.7) The equipment hatch is supported by removable steel beams, which are unprotected. (Ref. 6.8)
- A ceiling vent opening to Fire Zone 13-B. (Ref. 6.18)
- A ventilation duct without a fire damper communicates with Fire Area 13-E (above). (Refs. 6.9 and 6.12)
- A ventilation duct with a 3-hour rated fire damper communicates with Fire Area 13-E (above). (Ref. 6.6)

Floor: To Fire Areas 10 and 14-D

- 3-hour rated concrete slab on unprotected steel. (Refs. 6.8 and 6.20)
- 3-hour rated concrete equipment hatch to Fire Area 10. The equipment hatch is supported by removable steel beams, which are not fire protected. (Ref. 6.7)
- The floor is penetrated by a duct without a fire damper communicating with Fire Area 11-D below. (Ref. 6.9)

<u>1.3.2 Fire Zone 13-B (El. 119 ft)</u>

North:

- A 2-hour rated wall to Fire Zone 13-C (Fire Area TB-6). (Refs. 6.19, 6.20 and 6.21)
- Unrated structural gap seals to Fire Zone 13-C (Fire Area TB-6). (Ref. 6.15)
- A 1-1/2-hour rated door to Fire Zone 13-C (TB-6). (Ref. 6.19)

South:

- A 2-hour rated wall to Fire Zone 13-A (TB-4). (Refs. 6.19, 6.20 and 6.21)
- Unrated structural gap seals to Fire Zone 13-A (TB-4). (Ref. 6.15)
- A 1-1/2-hour rated door to Fire Zone 13-A. (Ref. 6.19)

East:

- 2-hour rated wall to the exterior (Area 28). (Ref. 6.19)

West:

- 3-hour rated wall to Fire Area 13-D. (Ref. 6.21)
- Unrated structural gap seals to Fire Area 13-D. (Ref. 6.15)

- A 1-1/2-hour rated door to Fire Area 13-D. (Ref. 6.19)
- A 1-1/2-hour rated damper to Fire Area 13-D. (Ref. 6.19)
- 3-hour rated pyrocrete blockout around the door. (Ref. 6.10 and 6.22)

Floor/Ceiling:

Ceiling:

- 3-hour rated concrete slab.
- 3-hour rated fire damper in a ventilation exhaust penetration to the main turbine deck (140-ft elevation) Fire Zone 14-D (Fire Area TB-7).

Floor: To Fire Zone 12-B

- 3-hour rated concrete slab.
- A floor vent opening to Fire Zone 12-B (below). (Ref. 6.18)

Protective Enclosure:

- All corner gaps are sealed and structural steel have fire resistive coverings.

(Note: Some structural steel modifications for the block walls (at E1.119 ft) were deemed acceptable with no fireproofing. (Ref. 6.11))

2.0 COMBUSTIBLES

2.1 Fire Zone 12-B (El. 107 ft)

2.1.1 Floor Area: 1,423 ft^2

2.1.2 In Situ Combustible Materials

- Cable insulation
- Miscellaneous
- Plastic
- Rubber

2.1.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags

- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.1.4 Fire Severity

- Low

2.2 Fire Zone 13-B (El. 119 ft)

2.2.1 Floor Area: 855 ft^2

2.2.2 In situ Combustible Materials

- Cable
- Plastic
- Rubber

2.2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection is provided in Fire Zones 12-B and 13-B.

3.2 Suppression (available for both zones)

- Portable fire extinguishers
- CO_2 hose stations
- Fire hose stations

4.0 SAFE SHUTDOWN

4.1 Fire Zones 12-Band 13-B

4.1.1 Auxiliary Feedwater

A fire in this area may affect LCV-106, LCV-107, LCV-108, and LCV-109. Steam generators 1-1 and 1-2 are credited for safe shutdown. Redundant valves LCV-110 and LCV-111 will remain available from AFW Pump 1-2.

4.1.2 Chemical and Volume Control System

Valve 8108 may be lost due to a fire in this area. Valve 8107 can be shut to isolate auxiliary spray. One other charging flowpath will be available. Also, the PORVs will be available for pressure reduction. Since this valve has redundant functions, safe shutdown is not affected.

A fire in this area may affect valves 8104 and FCV-110A. Safe shutdown is not affected because FCV-110A fails open and manual actions can be taken to open valve 8471 in order to provide boric acid flow.

Valves 8146, 8147 and 8148 may be affected by a fire in this area. Since redundant components are available safe shutdown is not affected.

Charging pumps 1-2 and 1-3 and ALOP 1-2 may be affected by a fire in this area. Redundant charging pump 1-1 and ALOP 1-1 will remain available for safe shutdown.

Boric acid transfer pump 1-2 may be affected by a fire in this area. Redundant boric acid transfer pump 1-1 will remain available.

HCV-142 may be affected by a fire in this area. HCV-142 is not necessary for a fire in this area since redundant components exist to isolate auxiliary spray (8107), to provide a charging flowpath (charging injection) and to provide for pressure reduction (PORVs).

A fire in this area might result in the spurious closure of charging pump discharge flow control valve FCV-128. This valve can be opened from the control room after switching to manual control.
A fire in this area may affect LCV-112C. Redundant valve 8805A will be available to provide water to the charging pump suction. The volume control tank can be isolated by closing LCV-112B.

4.1.3 Component Cooling Water

CCW pump and ALOP 1-2 may be lost due to a fire in this area. Redundant CCW pumps 1-1 and 1-3 and ALOPs 1-1 and 1-3 will be available to provide CCW.

A fire in this area may affect FCV-431. Redundant valve FCV-430 will enable the use of the other CCW train.

Valve FCV-365 may be affected by a fire in this area. Since this valve fails in the desired, open position and redundant valve FCV-364 will remain available, safe shutdown is not affected.

4.1.4 Containment Spray

Containment spray pump 1-1 may spuriously operate due to a fire in this area. However, the pump discharge valve, 9001A will not operate. Therefore, the spurious containment spray pump operation has no impact on safe shutdown.

4.1.5 Diesel Fuel Oil System

Diesel fuel oil pump 0-2 may be lost due to a fire in this area. Redundant diesel fuel oil pump 0-1 will remain available.

A fire in this area may affect valves LCV-85, LCV-86 and LCV-87. Redundant valves LCV-88, LCV-89 and LCV-90 will provide day tank level control for all diesels.

4.1.6 Emergency Power

A fire in this area may disable the diesel generator 1-1 automatic transfer circuit and backup control circuit. The normal control circuit and manual control will remain available in the control room to transfer and load the diesel generator. A fire in this area may disable diesel generator 1-2. Diesel generators 1-1 and 1-3 will remain available for safe shutdown.

A fire in this area may disable the backup control circuit for diesel generator 1-3. The normal control circuit will remain available.

A fire in this area may disable startup transformer 1-2. Onsite power from diesel generators 1-1 and 1-3 will remain available.

All power supplies on the "G" Bus may be lost due to a fire in this area. These power supplies are not necessary since redundant trains on the "F" and "H" buses will be available.

4.1.7 Main Steam System

A fire in this area may result in the loss of the following components: LT-519, LT-549, PT-515, PT-525, PT-535 and PT-545. Safe shutdown is not affected since redundant trains of instrumentation exists for all four steam generators.

PCV-21 may be affected by a fire in this area. Since this valve fails in the desired closed position, safe shutdown is not affected. Redundant dump valves PCV-19 and PCV-20 will be available for cooldown.

A fire in this area may affect FCV-95. This valve is not necessary since two other AFW pumps will remain available.

Valves FCV-41 and FCV-42 may be affected by a fire in this area. These valves can be manually closed to ensure safe shutdown.

A fire in this area may result in a loss of power supplies associated with PY17N and PY16. Loss of power to PY17N and PY16 results in the spurious closure of FCV-128 when in the automatic mode. This valve can be opened from the control room after switching to manual control.

4.1.8 Reactor Coolant System

A fire in this area may affect LT-460, NE-32, TE-433A, TE-433B, TE-443A and TE-443B. All of these components have redundant instrumentation for safe shutdown.

A fire in this area may affect valves 8000B and PCV-455C. PCV-455C fails closed. Since PCV-455C fails closed, uncontrolled pressure reduction will not occur. A redundant PORV is available for pressure reduction.

Control of reactor coolant pumps 1-1, 1-2, 1-3 and 1-4 may be lost due to a fire in this area. Safe shutdown is not affected if the ability to trip all four RCPs is lost.

Pressurizer heater groups 1-3 and 1-4 may be affected by a fire in this area. Manual actions can be taken to de-energize heater group 1-4 and switch heater group 1-3 to the vital power supply. Therefore, safe shutdown will not be affected.

A fire in this area may affect DC control cables that could result in loss of control of FCV-641A. Since the redundant train is available (RHR Pp 1-2 and FCV-641B), this will not affect safe shutdown.

4.1.9 Residual Heat Removal System

RHR pump 1-1 may be lost for a fire in this area. Redundant pump 1-2 will be available to provide the RHR function.

Valve 8701 may be affected by a fire in this area. This valve is closed with power removed during normal operations and will not spuriously open. Also, this valve can be manually operated for RHR operations.

4.1.10 Safety Injection System

A fire in this area may result in the loss of valves 8801B, 8803B and 8805B. Redundant valves 8801A, 8803A and 8805A will remain available for safe shutdown.

Valves 8808B and 8808D may be affected by a fire in this area. These valves can be manually closed to ensure safe shutdown.

4.1.11 Auxiliary Saltwater System

Circuitry for ASW pumps 1-1 and 1-2 may be damaged by a fire in this area. ASW pump 1-1 may be started locally to provide ASW flow.

A fire in this area may affect valve FCV-603. Since this valve fails in the desired, open position, safe shutdown is not affected.

4.1.12 HVAC

One train of required HVAC equipment, E-101 and S-68 may be lost due to a fire in this area. Neither of these components will be necessary because redundant HVAC equipment will be available to provide necessary HVAC support.

5.0 CONCLUSION

The following fire protection features will mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Smoke detection is provided for the fire area.

- Portable fire extinguishers, CO_2 hose stations and fire hose stations are available in the fire area.

- Redundant safe shutdown capability is provided outside of this fire area.

In this fire area, existing fire protection features provide an acceptable level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 Drawing Nos. 515562, 515563, 515564, 515565
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065126, Fire Protection Information Report, Unit 1
6.5 SSER 8, November 1978
6.6 DCN DC1-EH-15047, Provide 3-hour rated dampers to Fire Area 12-B
6.7 NECS File: 131.95, FHARE: 14, Concrete equipment hatch
6.8 PLC report: Structural Steel Analysis for Diablo Canyon (Rev. 2) 7/8/86
6.9 NECS File: 131.95, FHARE: 31, Undampered Duct Penetrations From the Fan Room
6.10 DCN DC1-EA-15662 R4, provide 3-hour rated pyrocrete blockout
6.11 NECS File: 131.95 FHARE: 106, Block Walls Modified in the 4kV Switchgear Area
6.12 NECS File: 131.95, FHARE: 136, Unrated HVAC Duct Penetrations
6.13 Calculation 134-DC, Electrical Appendix R Analysis

6.14 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.15 NECS File: 131.95, FHARE 134, "Non-rated Structural Gap Seals in Fire Barriers"
6.16 NECS File: 131.95, FHARE 30, Unrated Gaps in Appendix R Barriers in the Turbine Building
6.17 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.18 Question 27, PG&E Letter to NRC, Dated 11/13/78
6.19 Question 29, PG&E Letter to NRC, Dated 11/13/78
6.20 NECS File: 131 .95, FHARE 20, Bus Duct Penetrations
6.21 NECS File: 131.95, FHARE 100, Block Walls Structurally Modified with Columns, Beams and Steel Plates
6.22 NECS File: 131.95, FHARE 146, Gaps in Unistruts and Support Members through Pyrocrete Barriers

FIRE AREA TB-6

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fire Area TB-6 is in the Northeast corner of the Unit 1 Turbine Building and consists of Fire Zone 12-C at El. 107 ft, and Fire Zone 13-C at El. 119 ft.

1.2 Description

Fire Area TB-6 consists of the 4-kV H bus cable spreading room (El. 107 ft), Fire Zone 12-C, the 4-kV H Bus switchgear room (El. 119 ft), and Fire Zone 13-C, in the Turbine Building. At least two of the three vital divisions are required for safe shutdown.

1.3 Boundaries

1.3.1 Fire Zone 12-C (El. 107 ft)

North:

- A 2-hour rated barrier to the exterior. (Ref. 6.14)
- A 3-hour rated fire damper to the exterior.
- Nonrated barrier to the exterior, Area 28, (corridor area). (Ref. 6.8)

South:

- A 2-hour rated barrier to Fire Zone 12-B (Area TB-5). (Ref. 6.6 and 6.14)
- Unrated structural gap seals to Fire Zone 12-B (TB-5). (Ref. 6.13)
- A 1-1/2-hour rated door to Fire Zone 12-B (TB-5). (Ref. 6.14)
- Two 3-hour rated doors to Fire Zone 12-B (TB-5).

East:

- 2-hour rated barrier to the exterior (Area 28). (Ref. 6.14)
- 2-hour rated barrier to Fire Zone 12-B. (Ref. 6.14)

West:

- 3-hour rated barrier to Fire Zone 11-C-2 (TB-3). (Ref. 6.8)
- 2-hour rated barrier to Fire Zone 12-B. (Ref. 6.14)

- Floor/Ceiling:

Ceiling:

- 3-hour rated concrete slab.
- A ventilation duct with a 3-hour rated fire damper communicates with fire area 13-E (above). (Ref. 6.2)
- A ceiling vent opening without a fire damper communicates to Fire Zone 13-C. (Ref. 6.15)

Floor:

- 3-hour rated concrete slab on unprotected steel. (Refs. 6.7 and 6.16)

1.3.2 Fire Zone 13-C (El. 119 ft)

North:

- 2-hour rated barrier to the exterior (Area 28). (Ref. 6.15)

South:

- 2-hour rated barrier to Fire Zone 13-B (TB-5). (Refs. 6.15, 6.16 and 6.17)
- Unrated structural gap seals to Fire Zone 13-B. (Ref. 6.13)
- 1-1/2-hour rated door to Fire Zone 13-B. (Ref. 6.15)

East:

- 2-hour rated barrier to the exterior (Area 28). (Ref. 6.15)

West

- 3-hour rated barrier to Fire Area 13-D. (Ref. 6.17)
- Unrated structural gap seals to Fire Area 13-D. (Ref. 6.13)
- 1-1/2-hour rated door to Fire Area 13-D. (Ref. 6.15)
- 1-1/2-hour rated damper to fire Area 13-D. (Ref. 6.6)
- 3-hour rated pyrocrete barrier around the door. (Ref. 6.9 and 6.18)

Ceiling: To Fire Zone 14-D

- 3-hour rated concrete slab.
- A ventilation exhaust opening to the main turbine deck (El. 140 ft) with a 3-hour rated fire damper.

Floor: To Fire Zone 12-C

- 3-hour rated concrete slab.
- A vent opening to Fire Zone 12-C. (Ref. 6.15)

Protective Enclosure:

- All corner gaps are sealed, except at the north end of the west wall of Fire Zone 12-C where it abuts Fire Zone 11-C-2 (TB-3). Structural steel has fire resistive coverings. (Refs. 6.8 and 6.7)

(Note: Some structural steel modifications for the block walls (at El. 119 ft) were deemed acceptable with no fireproofing. (Ref. 6.10))

2.0 COMBUSTIBLES

2.1 Fire Zone 12-C (107 ft)

2.1.1 Floor Area: 1,437 ft^2

2.1.2 In situ Combustible Materials

- Cable insulation
- Rubber
- Plastic

2.1.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.1.4 Fire Severity

- Low

2.2 Fire Zone 13-C (119 ft)

2.2.1 Floor Area: 958 ft^2

2.2.2 In Situ Combustible Materials

- Cable
- Rubber
- Plastic

2.2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection is provided in Fire Zone 12-C and 13-C.

3.2 Suppression (available for both zones)

- Portable fire extinguishers
- CO_2 hose stations
- Fire hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Zones 12-C and 13-C

4.1.1 Auxiliary Feedwater

AFW pump 1-2 may be lost due to a fire in this area. Redundant AFW pumps 1-1 and 1-3 will be available to provide AFW.

A fire in this area may affect valves LCV-110 and LCV-111. Redundant valves LCV-106, LCV-107, LCV-108, and LCV-109 will remain available via AFW Pump 1-1, and LCV-113 and LV-115 will remain available via AFW Pump 1-3.

4.1.2 Chemical and Volume Control System

A fire in this area may result in the loss of boric acid storage tank 1-1 level indication from LT-102. Since borated water from the RWST will remain available, BAST level indication is not required.

Valve 8145 may be affected by a fire in this area. Since this valve fails in the desired closed position, and the PORVs will be available for pressure reduction, safe shutdown is not affected.

4.1.3 Component Cooling Water

CCW pump and ALOP 1-3 may be lost for a fire in this area. Redundant pumps and ALOPs 1-1 and 1-2 will be available to provide CCW.

A fire in this area may affect valve FCV-364. Since this valve fails in the desired, open position safe shutdown is not affected.

4.1.4 Containment Spray

Containment spray pump 1-2 may spuriously operate due to a fire in this area. However, the corresponding discharge valve 9001B will not operate. Therefore, the spurious containment spray pump operation has no impact on safe shutdown.

4.1.5 Diesel Fuel Oil System

Diesel fuel oil pump 0-1 may be lost due to a fire in this area. The redundant diesel fuel oil pump 0-2 remains available.

Valves LCV-88, LCV-89 and LCV-90 may be affected by a fire in this area. Redundant valves LCV-85, LCV-86 and LCV-87 will be available for day tank level control.

4.1.6 Emergency Power

A fire in this area may disable diesel generator 1-1. Diesel generators 1-2 and 1-3 will remain available for safe shutdown.

A fire in this area may disable the diesel generator 1-3 backup control circuit. The normal control circuit will remain available.

A fire in this area may disable startup transformer 1-2. Onsite power from diesel generators 1-2 and 1-3 will remain available for safe shutdown.

All power supplies on the "H" Bus may be lost due to a fire in this area. These power supplies are not necessary since redundant trains on the "G" and "F" Buses will be available.

A fire in this area may disable dc panel SD11 backup battery charger ED121. Normal battery charger ED11 will remain available.

A fire in this area may disable dc panel SD12 backup battery charger ED121. Normal battery charger ED12 will remain available.

A fire in this area may result in a loss of power supplies associated with PY17N. Redundant power supply PY16 remains available.

4.1.7 Main Steam System

A fire in this area may result in the loss of the following instrumentation: LT-518, LT-528, LT-538, LT-548, PT-526 and PT-536. Since redundant instrumentation exists for all four steam generators, safe shutdown is not affected.

PCV-20 may be affected by a fire in this area. This valve fails in the desired, closed position, safe shutdown will not be affected. A redundant dump valve will remain available.

A fire in this area may affect valves FCV-43 and FCV-44. These valves can be manually operated to ensure safe shutdown.

4.1.8 Reactor Coolant System

A fire in this area may result in the loss of LT-461, NE-52 and PT-403. Safe shutdown will not be affected since redundant components will be available.
A fire in this area may affect Pressurizer PORV and block valve PCV-456 and 8000C. Since redundant valves will remain available for pressure reduction safe shutdown will not be affected.

Control of reactor coolant pumps 1-1, 1-2, 1-3 and 1-4 may be lost due to a fire in this area. Operation of the reactor coolant pumps will not affect safe shutdown. RCP seal cooling will remain available via the seal injection flowpath or the CCW thermal barrier heat exchanger.

Pressurizer heater groups 1-1 and 1-2 may be affected by a fire in this area. Manual actions can be taken to de-energize heater group 1-1 and switching heater group 1-2 to the vital power supply. Therefore, safe shutdown is not affected.

4.1.9 Residual Heat Removal System

RHR pump 1-2 and FCV-641B may be lost for a fire in this area The redundant train is available (RHR Pp 1-1 and FCV-641A), this will not affect safe shutdown.

Valve 8702 may be affected by a fire in this area. This valve is closed and has its power removed during normal operations and will not spuriously open. Also, this valve can be manually operated for RHR operation.

4.1.10 Safety Injection System

SI pump 1-2 may spuriously operate due to a fire in this area. Local manual action may be required to defeat this spurious operation.

Accumulator isolation valve 8808C may be affected by a fire in this area. This valve can be manually closed.

4.1.11 Auxiliary Saltwater System

A fire in this area may affect valves FCV-495 and FCV-496. FCV-601 will remain closed to provide ASW system integrity.

4.1.12 HVAC

A fire in this area may result in the loss of one train of HVAC components (E-44, S-44, FCV-5046 and S-67). S-67 is not necessary for a fire in this area. The

HVAC function will be supplied by a redundant train of components (S-43, E-43 and FCV-5045).

5.0 CONCLUSION

The following fire protection features mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.
- Smoke detection is provided for the fire area.
- Portable fire extinguishers, CO_2 hose stations and fire hose stations are available in the fire area.
- Redundant safe shutdown capability is provided outside this fire area.

In this fire area, existing fire protection features provide an acceptable level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 Drawing Nos. 515562, 515563, 515564, 515565
6.2 DCN DC1-EH-15047, Provide 3-hour rated dampers to Fire Area 12-C
6.3 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.4 Calculation M-824, Combustible Loading
6.5 Drawing 065126, Fire Protection Information Report, Unit 1
6.6 SSER 8, November 1978
6.7 PLC report: Structural Steel Analysis for Diablo Canyon (Rev. 2) 7/8/86
6.8 NECS File: 131.95, FHARE: 30, Unrated Gaps in Appendix R Barriers in the Turbine Building
6.9 DCN DC1-EA-15662 R4, provide 3-hour rated pyrocrete blockout
6.10 NECS File: 131.95, FHARE: 106, Block Walls Modified in the 4kV Switchgear Area
6.11 Calculation 134-DC, Electrical Appendix R Analysis
6.12 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.13 NECS File: 131.95, FHARE 134, “Non-rated Structural Gap Seals in Fire Barriers”
6.14 Question 27, PG&E Letter to NRC, Dated 11/13/78
6.15 Question 29, PG&E Letter to NRC, Dated 11/13/78

6.16 NECS File: 131 .95, FHARE 20, Bus Duct Penetrations
6.17 NECS File: 131.95, FHARE 100, Block Walls Structurally Modified with Columns, Beams and Steel Plates
6.18 NECS File: 131 .95, FHARE 146, Gaps in Unistruts and Support Members through Pyrocrete Barriers

FIRE AREA TB-7

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Iso-Phase bus duct area, Unit 1 Turbine Building, El. 107 ft.

1.2 Description

This fire zone is a part of Fire Area TB-7 and occupies the elevations from 107 ft through 140 ft. An enclosed stairwell on the south wall provides access to Area 10 below and a stair along north wall provides access to Area 13-A at El. 119 ft.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- 3-hour rated barrier separates this zone from Zones 12-A and 13-A, and Area 13-D, with the following exceptions:
  - A 1-1/2-hour rated door communicates to zone 12-A and 13-A. (Ref. 6.14)
  - A 1-1/2-hour rated door communicates to Area 13-D. (Ref. 6.14)
  - Structural steel modifications for the block walls (at El. 119 ft) were deemed acceptable with no fireproofing. (Ref. 6.7)
  - Unrated structural gap seals to Fire Zone 12-A, Area 13-D. (Refs. 6.10 and 6.11)

South:

- 3-hour rated barrier separates this zone from Zone 14-A. [NC]
- A 3-hour rated door communicates to Zone 14-A. [NC]
- A nonrated isophase bus penetration communicates to Zone 14-A. [NC]
- 2-hour rated barrier separates Zone 12-E from Area 10 except for:
  - A 1-1/2-hour rated door communicates to Area 10.
  - Nonrated ceiling for stairwell communicating to Area 10. (Ref. 6.5)

East:

- 2-hour rated barrier separates this zone from Area 28, and Fire Area 10. NC
- A nonrated isophase bus penetration communicates to Area 28. NC

West:

- 2-hour rated barrier to Fire Area 10.
- 3-hour rated barrier separates this zone from Area 13-E (El. 119 ft).
- Unrated structural gap seals to Fire Area 13-E. (Ref. 6.10)
- 2-hour rated barrier separates this zone from Zone 12-A (El. 104 ft).
- A 1-1/2-hour rated door communicates to Zone 12-A. (Ref. 6.14)
- A duct penetration without a fire damper penetrates to Area 13-E. (Ref. 6.13)

Floor/Ceiling:

- 3-hour rated floor separates this zone from Area 10.
- Lesser rated penetration seal to Fire Area 10. (Ref. 6.12)
- 3-hour rated ceiling separates this zone from Zone 14-D NC with the exception of an open stairwell.

2.0 COMBUSTIBLES

2.1 Floor Area: 1,920 ft^2

2.2 In situ Combustible Materials

- Cable Insulation
- Rubber
- Plastic
- Wood

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood

- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

None

3.2 Suppression

- CO_2 hose stations
- Portable fire extinguishers
- Fire hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Emergency Power

A fire in this area may disable the diesel generators 1-1, 1-2 and 1-3 automatic transfer circuit or may spuriously close the auxiliary transformer 12 circuit breaker. After operator actions, the diesel can either be locally loaded or loaded from the control room. In addition, offsite power is not affected in this area and would be available for safe shutdown.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Manual fire fighting equipment is provided.

- Low fire severity.

- Safe plant shutdown will not be adversely impacted due to the loss of the safe shutdown functions located in this zone.

The fire protection in this area provides an acceptable level of safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.2 Drawing Nos. 515563, 515564, 515565
6.3 Calculation M-824, Combustible loading
6.4 Drawing 065126, Fire Protection Information Report, Unit 1
6.5 NECS File: 131.95, FHARE: 4, Stairwell Nonrated Ceiling
6.6 Deleted in Revision 14.
6.7 NECS File: 131.95, FHARE: 106, Block Walls Modified in the 4kV Switchgear Area
6.8 Calculation 134-DC, Electrical Appendix R Analysis
6.9 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.10 NECS File: 131.95, FHARE 134, “Non-rated Structural Gap Seals in Fire Barriers”
6.11 NECS File: 131.95, FHARE 135, “Gaps in Appendix A Fire Rated Boundaries”
6.12 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.13 NECS File: 131.95, FHARE 56, Undampered Ventilation Duct Penetration
6.14 Question 27, PG&E Letter to NRC, Dated 11/13/78

FIRE AREA TB-7

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Main condenser, feedwater, and condensate equipment area, Unit 1 Turbine Building El. 85 ft through 119 ft.

1.2 Description

This fire zone comprises the bulk of the Unit 1 Turbine Building at El. 85 ft, 104 ft, and 119 ft.

1.3 Boundaries

NOTE: NC designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

1.3.1 El. 85 ft

North:

- 3-hour rated barriers separate this zone from Areas 10, 14-B, and 11-D and Zones 11-C-1, 11-C-2. (Ref. 6.19)
- A 3-hour rated door communicates to Area 10.
- A 3-hour rated double door communicates to Area 11-D.
- A non-rated sliding door communicates to Zone 11-C-2. (Ref. 6.5)
- A non-rated barrier to area 28. NC

South:

- 3-hour rated barriers separate this zone from Areas 4A, 14-B, 14-E NC and Zone 16. NC
- Two duct penetrations with a 3-hour rated fire damper penetrates to Area 14-E. NC
- A 3-hour rated roll up door communicates to Zone 16. NC
- A 3-hour rated doors communicate to Area 14-B.
- The non-rated gap assemblies in fire barriers to Area 14-B were deemed acceptable. (Ref. 6.18)
- A 1-1/2-hour rated door communicates to Fire Zone 19-A. NC

East:

- A 3-hour rated barrier with a 3-hour door to Fire Area 4-B.
- A 3-hour rated barrier separates this zone from Areas 3-BB and 14-E. NC
- A 3-hour rated double door communicates to Area 3-BB.
- Three 3-hour rated fire dampers communicate to Area 3-BB.
- A nonrated barrier separates this zone from Area 28 NC and TB-14. NC
- A nonrated door communicates to Area 28. NC
- A penetration to Area 3-BB. (Ref. 6.10)
- A 1-1/2-hour rated exterior roll up fire door communicates to Fire Zone S-1.
- Lesser rated penetration seals to Area 3-BB. (Ref. 6.20)
- A 3-hour rated barrier with a 1-1/2-hour door to Fire Zone S-1.

West:

- A 3-hour rated barrier with 2 duct penetrations with 3-hour rated dampers to Fire Area 14-B.
- A nonrated barrier separates this zone from the buttress area TB-15. NC
- A nonrated roll-up door communicates to the buttress area TB-15. NC
- A nonrated door communicates to the exterior. NC
- A 3-hour rated door communicates to Fire Zone 16. NC
- A 3-hour rated barrier to Fire Zone 14-E. NC

Floor: Reinforced concrete on grade. NC

1.3.2 El. 104 ft

North:

- 3-hour rated barriers separate this zone from Area 13-E and Zones 11-C-2, 12-A and 12-E. NC
- A 3-hour rated door communicates to Zone 12-E.
- A 3-hour rated barrier and door communicates to Area 13-E. (Ref. 6.19)
- A 3-hour rated door communicates to zone 11-C-2
- A non-rated barrier and door to the exterior. NC

South:

- 3-hour rated barriers separate this zone from Areas 5-A-4 and 15 and Zone 16. NC
- A 3-hour rated door communicate to Area 15.
- Two 3-hour rated roll-up doors communicate to Zone 16. NC

East:

- A 3-hour rated barrier containing a duct opening with a 3-hour damper to Fire Area 15.
- A nonrated barrier separates this zone from Area 28. NC
- A 3-hour rated barrier separates this zone from Area 3-BB, and Zones 6-A-5 and S-1.
- A nonrated fire barrier separates this zone from Fire Area TB-14. NC
- A 3-hour rated door communicates to Area 3-BB.
- A 3-hour rated double door communicates to Area 15.

West:

- A 3-hour rated barrier with duct opening with a 3-hour rated damper to Fire Area 15.
- A nonrated barrier separates this zone from the exterior (Area 28). NC
- A 3-hour rated barrier with a 3-hour rated door to Fire Zone 16. NC

Floor:

- A nonrated steel hatch communicates to Fire Area 14-E (CCW Heat Exchanger Room). (Ref. 6.14)

1.3.3 El. 119 ft

North:

- 3-hour rated barriers separates this zone from Areas 13-E, 13-F NC and Zone 12-E. NC
- A 3-hour rated double door communicates to Zone 13-E.
- A nonrated Isophase bus penetration seal communicates to Zone 12-E. NC
- A non-rated barrier to the exterior. NC

South:

- 3-hour rated barriers separate this zone from Area 15 and Zones 14-C, NC 16, NC, and 6-A-5. NC.
- The non-rated gap assemblies in the fire barriers to Area 15 and Zone 14-C NC were deemed acceptable. (Ref. 6.18)
- A 3-hour rated double door communicates to Zone 16. NC
- Two 3-hour rated roll-up doors communicate to Zone 16. NC
- Two duct penetrations with 3-hour rated fire dampers penetrate to Area 15 and Zone 14-C.

- Non-rated pipe penetration to Area 15. (Ref. 6.15)
- A 3-hour-equivalent rated door communicate to Zone 14-C. [NC]

East:

- A nonrated barrier separates this zone from Area 28. [NC]
- A 3-hour rated barriers separates this zone from Area 3-BB, and Zones S-1, 6-A-5, and 14-C. [NC]
- A 3-hour-equivalent rated door and 2 sets of blowout panels, both of which are protected with directional water spray supply system, (Refs. 6.2 and 6.22, SSER 23, under "Fire Doors") communicates to Area 3-BB.
- Two nonrated duct penetrations penetrate to Zone 6-A-5. (Ref. 6.5)
- Two main steam line penetrations, provided with directional water spray system, communicate to Fire Area 3-BB. (Ref. 6.8)
- 3-hour rated doors communicate to Zones 14-C [NC] and S-1.
- Duct penetration with a 3-hour rated damper penetrates to 14-C. [NC]

West:

- A nonrated barrier separates this zone from the exterior (Area 28). [NC]
- 3-hour rated barrier to Fire Area 15.

Ceiling: 3-hour rated barrier with open stairwells to Fire Zone 14-D. [NC]

2.0 COMBUSTIBLES

2.1 Floor Area: 29,493 ft^2 (El. 85 ft),
30,698 ft^2 (El. 104 ft),
31,216 ft^2 (El. 119 ft)

2.2 In situ Combustible Materials

El.:	85 ft	104 ft	119 ft
	• Cable	• Cable	• Cable
	• Acetylene	• Alcohol	• Rubber
	• Resin	• Rubber	• Lube Oil
	• Rubber	• Lube Oil	• Clothing/Rags
	• Gasoline	• Clothing/Rags	• Paper
	• Lube Oil	• Paper	• Plastic
	• Clothing/Rags	• Plastic	• PVC
	• Paper	• PVC	
	• Plastic		
	• PVC		
	• Wood		

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low (El. 85 ft)
- Low (El. 104 ft)
- Low (El. 119 ft)

3.0 FIRE PROTECTION

3.1 Detection

- None

3.2 Suppression

- Automatic wet pipe sprinklers with remote annunciation area wide.
- Deluge spray systems for hydrogen seal oil unit, and feedwater pump turbines.
- Portable fire extinguishers.
- Hose stations.
- Directional water spray at nonrated door and blowout panels at El. 119 ft. (Ref. 6.2)

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Auxiliary Feedwater

A fire in this area may affect control of LCV-113 and LCV-115 from the control room and hot shutdown panel. Redundant valves LCV-106, LCV-107, LCV-108, LCV-109, LCV-110 and LCV-111 are not affected and will remain available.

4.2 Component Cooling Water System

A fire in this area may affect circuits associated with CCW flow transmitters for Header A (FT-68), Header B (FT-65), and Header C (FT-69). Loss of these instruments will not affect safe shutdown.

4.3 Emergency Power

The CO_2 Manual Actuation switches for the Unit 1 diesel generator rooms may be affected by a fire in this area. Although the switches are enclosed by a fire barrier, offsite power will be available for safe shutdown in the event of an inadvertent operation of the CO_2 system. (Refs. 6.12, 6.13 and 6.17).

A fire in this area may result in a loss of power supplies associated with PY17N. Redundant power supply PY16 remains available.

A fire in this area may cause loss of UNIT 2 power supplies associated with PY27N. Redundant power supply PY26 remains available (also applies to fire zone 16).

4.4 Reactor Coolant System

The control of reactor coolant pumps 1-1, 1-2, 1-3 and 1-4 may be lost due to a fire in this area. Operation of the reactor coolant pumps will not affect safe shutdown.

4.5 HVAC

Exhaust fan E-43 and supply fan S-43 may be lost due to a fire in this area. Safe shutdown is not affected because fans E-44 and S-44 will remain available to provide necessary HVAC support.

5.0 CONCLUSION

The following features mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Area wide automatic wet pipe sprinkler coverage.

- Manual fire fighting equipment is available.
- Train 1-1 AFW pump remains available for use if train 1-2 and 1-3 are lost.
- Isolators have been provided to preclude the effects of hot shorts in the RPM indication circuits.
- Substantial fire zone boundaries will confine the postulated fire to this zone.
- The nonrated door, blowout panels and main steam line penetrations communicating to 3-BB are provided with a directional water spray.

The existing fire protection for this area provides an acceptable level of safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

DCPP Unit 1 "Report on 10 CFR 50, Appendix R Review" included a deviation to the requirements of 10 CFR 50, Appendix R, Section III.G.2(b), due to redundant low signal RPM indication circuits. Isolators were provided to preclude premature trips of DGs due to short circuits. (Ref. 6.1)

6.0 REFERENCES

6.1 DCN DC1-EE-9913, Provide Isolator
6.2 DCN DC1-OM-21829, Provide sprinklers over blowout panel
6.3 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.4 Drawing Nos. 515562, 515563, 515564
6.5 SSER 23, June 1984
6.6 Calculation M-824, Combustible Loading
6.7 Drawing 065126, Fire Protection Information Report, Unit 1
6.8 FHARE: 5, Main steam penetrations
6.9 Deleted in Revision 13
6.10 FHARE: 12, Winch Cable Penetrations For Post-LOCA Sampling Room Shield Wall
6.11 Deleted in Revision 13
6.12 NCR DC0-91-EN-N027
6.13 DCN DC1-EA-47386
6.14 Deleted in Revision 13
6.15 NECS File: 131.95, FHARE 131, Non-rated Pipe Penetrations in the Clean and Dirty Lube Oil Room and Unit 1 and Unit 2 Turbine Lube Oil Reservoir Rooms
6.16 Calculation 134-DC, Electrical Appendix R Analysis
6.17 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis

6.18 NECS File: 131.95, FHARE 135, “Gaps in Appendix A Fire Rated Boundaries”
6.19 NECS File: 131.95, FHARE 30, Unrated Gaps in Appendix R Barriers in the Turbine Building
6.20 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.21 NECS File: 131.95, FHARE 120, CCW Heat Exchanger Rooms
6.22 NECS File: 131 .95, FHARE 159, Unrated Doors Protected by Local Automatic Sprinklers

FIRE AREA TB-7

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Unit 1 Turbine Deck, El. 140 ft.

1.2 Description

This fire zone comprises the Unit 1 Turbine Operating Deck at El. 140 ft.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- A nonrated barrier separates this zone from Area 28. [NC]

South:

- There is no boundary separating Zone 14-D from Zone 19-D.

East:

- A nonrated barrier separates this zone from Area 34 and the outside. [NC]
- A nonrated roll up door communicates to Area 34. [NC]
- A 3-hour rated barrier separates this zone from Area 8-G.
- A 3-hour rated barrier separates this zone from Area 8-E.
- A 3-hour-equivalent rated door communicates to Area 8-E.
- A 3 hour fire barrier separates this area from Area S-1.
- A 3-hour rated door communicates to Area S-1.
- A 3-hour rated barrier separates this zone from the Unit 2 office area.

West:

- A nonrated barrier separates this zone from Area 28. [NC]

Floor:

- 3-hour rated floor to Fire Zones 14-A, [NC] 13-F, [NC] 12-E, [NC] 14-C, [NC] 15, 16, [NC] 17, [NC] 13-A, 13-B, 13-C, 13-D, 13-E.

- Ventilation exhaust openings from Zones 13-A, 13-B, and 13-C with 3-hour fire dampers.
- Open stairwells to Zones 12-E and 14-A.
- A 3-hour rated equipment hatch communicates to Zone 13-D. (Ref. 6.4)
- Two 3-hour rated diesel exhaust stacks come from Zone 13-E and one 3-hour rated diesel exhaust stack comes from Zone 13-F.
- A 3-hour rated equipment hatch communicates to Zone 15. (Ref. 6.4)
- A lesser rated penetration seal to Zone 13-E. (Ref. 6.9)
- An open equipment hatch communicates to the 85-ft elevation of Zone 16. NC
- Unsealed blockout openings communicate to Zone 15. (Ref. 6.8)
- A non-rated vent and exhaust opening to Fire Zone 14-A. NC

Ceiling:

- A nonrated ceiling to the exterior .NC
- An open ventilation exhaust vent along the center ridge of the roof. NC

2.0 COMBUSTIBLES

2.1 Floor Area: 52,600 ft^2

2.2 In situ Combustible Materials

- Bulk Cable
- Hydrogen
- Rubber
- Lube Oil
- Clothing Rags
- Paper
- Plastic
- Wood (Fir)

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood

- Plastic
- Paper

Note: Temporary facilities, consisting of a Main Containment Access Facility Main (CAF) and CAF Annex, were added to the Unit 1 Turbine Deck at Elevation 140 ft to house personnel supporting the activities of the Unit 1 and Unit 2 Steam Generator Replacement Projects that were performed in 2008 and 2009. Following completion of the SGR Projects, the Main CAF was removed and the CAF Annex was left installed to support the Unit 2 and Unit 1 Reactor Vessel Closure Head (RVCH) Replacement Projects performed, respectively, in 2009 and 2010. These facilities will be used strictly for personnel occupancy purposes and will not be used for fabrication, welding, machining, or hot work. Placement of these temporary facilities has no adverse effect upon any assumptions for Fire Area TB-7, Fire Zone 14-D. While an increase in the combustion loading to this fire area will be experienced through placement of the temporary facilities, the facilities themselves are equipped with fire protection systems and equipment in order to meet the requirements of NFPA to ensure that Fire Area TB-7, Fire Zone 14-D continues to meet the level of safety required by 10 CFR 50, Appendix R, Section III.G. With the removal of the Main CAF, the Fire Hazards Analysis performed to support the placements and removals of temporary facilities on the Turbine Deck determined that the decrease in fire severity level from Moderate to Low was acceptable.

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Heat Detection at Bearing No. 10.

3.2 Suppression

- Water Deluge Systems for all Turbine Bearings except No. 10.
- Localized CO_2 System for Turbine Bearing No. 10.
- Hose Stations.
- Portable Fire Extinguishers.
- Wet Pipe Automatic Sprinkler System to various offices and occupied spaces in the Turbine Building 140 ft.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 HVAC

Exhaust and Supply fans E-43 and S-43 may be lost due to a fire in this area. Redundant supply and exhaust fans S-44 and E-44 will remain available. Therefore, safe shutdown is not affected.

5.0 CONCLUSION

The following features mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- A trained fire brigade is on-site at all times and is responsible for fire suppression responsibilities.
- Local (partial) fire detection is provided.
- Local (partial) fire suppression is provided.
- Manual fire suppression equipment is available.
- Redundant components are available for safe shutdown.

The existing fire protection for this area meets the level of safety required by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 Drawing No. 515565
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation M-824, Combustible Loading
6.4 NECS File: 131.95, FHARE: 14, Concrete Equipment Hatches
6.5 Drawing 065126, Fire Protection Information Report, Unit 1
6.6 Calculation 134-DC, Electrical Appendix R Analysis
6.7 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.8 NECS File: 131.95, FHARE 3, Valve Operator Shafts Through Barrier
6.9 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers

FIRE AREA TB-7

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fire Zone 14-E is part of Fire Area TB-7, and is located in the southeast corner of the Unit 1 Turbine Building at El. 85 ft.

1.2 Description

Fire Zone 14-E is the component cooling water heat exchanger room. This area is completely separated from the rest of the Turbine Building by 3-hour barriers constructed of reinforced concrete walls, concrete block walls, and fire rated covering (on the Turbine Building side only). The south end of this fire area extends above the 3-hour rated ceiling of the entry corridor and abuts the wall separating the machine shop from the machinery of the Turbine Building.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- 3-hour rated barrier to Fire Zone 14-A (TB-7). [NC] (Ref. 6.12)

South:

- 3-hour rated door to Fire Zone 14-A (TB-7). [NC]
- 3-hour rated unidirectional fire barrier to Fire Zone 14-A (TB-7). [NC] and Fire Area 16 (above 95 ft). [NC] (Ref. 6.12)

East:

- 3-hour rated barrier to Fire Zone 14-A (TB-7), [NC] Fire Area 4-A and 4-B. (Ref. 6.12)
- 3-hour rated fire damper to Fire Zone 14-A (TB-7). [NC]

West:

- 3-hour rated undirectional fire barrier to Fire Zone 14-A (TB-7). [NC] (Ref. 6.12)
- 3-hour rated fire door to 14-A (TB-7). [NC]
- 3-hour rated fire damper to 14-A (TB-7). [NC]

Floor/Ceiling:

- 3-hour rated reinforced concrete barrier with the following exceptions:
  - The upper portion of the south end of the fire area extends over an entry corridor to the plant. The corridor's ceiling is metal lath and plaster and is provided with automatic sprinklers.
  - A nonrated steel hatch that connects Fire Zone 14-E to the 104-ft elevation of Fire Zone 14-A. NC

Protective Enclosure:

- A reinforced concrete missile shield separates the redundant heat exchangers and extends approximately 2.5 ft beyond the ends and above the tops of the heat exchangers.

2.0 COMBUSTIBLES

2.1 Floor Area: 1,899 ft^2

2.2 In situ Combustible Materials

- Cable insulation
- Miscellaneous
- Rubber
- Lube Oil
- Clothing/Rags
- Plastic
- PVC
- Wood

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection is provided except under alcove area. (Ref. 6.9)

3.2 Suppression

- Automatic wet pipe sprinkler protection is provided with remote annunciation except for under the alcove area (north end of area). (Ref. 6.9)
- Portable fire extinguishers
- Fire hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Component Cooling Water

In the event of a fire in this area CCW valves FCV-430 and FCV-431 fail as is. Since one of these valves is normally open and the other is normally closed safe shutdown is not compromised because only one CCW flow path is required.

A fire in this area may affect circuits associated with CCW flow transmitters for Header A (FT-68), Header B (FT-65), and Header C (FT-69). Therefore, loss of these instruments will not affect safe shutdown.

A fire in this area may affect circuits associated with the differential pressure transmitters for CCW Hx 1-1 (PT-5) and CCW Hx 1-2 (PT-6). CCW pumps are not affected in this fire area, and fire damage to the CCW valves FCV-430 and FCV-431 will result in at least one of the valves failing in the open position. Therefore, loss of these instruments will not affect safe shutdown.

4.2 Auxiliary Saltwater System

ASW valves FCV-602 and FCV-603 may be affected by a fire in this area. Manual action may be required to position these valves.

5.0 CONCLUSION

This fire area does not meet the requirements of Appendix R, Section III.G.2(c) in that a 1 hour enclosure is not provided around one train of redundant safe shutdown equipment.

A deviation was requested, and granted as stated in SSER 23.

The following features will adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Smoke detection is provided.

- Failure of ASW valve circuits would result in loss of ASW to CCW heat exchangers but manual action can be taken to restore it.

- Failure of CCW valve circuits will result in motor operated valves failing as is with one valve open and one valve closed, providing adequate CCW cooling for safe shutdown.

- Wet pipe automatic sprinkler system.

- Fire hose stations and portable fire extinguishers.

- A missile barrier separates the two CCW heat exchangers.

The fire protection in this area produces an acceptable level of fire safety equivalent to that provided by Section III.G.

6.0 REFERENCES

6.1 Drawing No. 515562
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065126, Fire Protection Information Report, Unit 1
6.5 SSER 23, June 1984
6.6 Not used

6.7 Memorandum from G. A. Tidrick/C. E. Ward to P. R. Hypnar dated May 3, 1983, Re: CCW System, Files 140.061 and 131.91
6.8 DCN DC1-EE-9913, Provide RPM Tach Isolator
6.9 NECS File: 131.95, FHARE: 51, Lack of Suppression and Detection in Alcove Area.
6.10 Procedure: EP M-10, Emergency Procedure Fire Protection of Safe Shutdown Equipment.
6.11 Not used.
6.12 FHARE 120, CCW Heat Exchanger Room Boundary Walls
6.13 Calculation M-928, 10 CFR 50, Appendix R Safe Shutdown Analysis
6.14 Calculation 134-DC, Electrical Appendix R Analysis

FIRE AREA V-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fuel Handling Building, El. 85 ft, 93 ft, l00 ft, and 115 ft; Auxiliary Building Main Exhaust Fan Room No. 2, El. 115 ft; Auxiliary Building Exhaust Filter Room, El. 100 ft; Auxiliary Building Normal Concrete Exhaust Duct, El. 93 ft, and Plenum, El. 85 ft.

1.2 Description

This fire zone is located in the north end of the Unit 1 Fuel Handling Building at El. 100 ft and 115 ft and includes a concrete exhaust air duct at El. 93 ft running from the auxiliary building to this zone.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North: Three-hour rated barriers. [NC]

South: Three-hour rated barriers [NC] with the following exceptions:

El. 85 ft:

- A 1-hour rated barrier to Fire Zone 3-L. [NC] (Ref. 6.8)
- A 1-1/2 hour equivalent rated door communicating with Zone 3-L. [NC]
- Duct penetrations without fire dampers penetrate to Zones 3-A [NC] and 3-L [NC] (two ducts into 3-A and 3-L). (Ref. 6.9)

El. 100 ft:

- 3 nonrated doors communicating with Zone 3-P-2. [NC]
- Duct penetrations without fire dampers penetrate to Zone 31. [NC] (Ref. 6.5)

El. 115 ft:

- 5 nonrated doors communicating with Zone 3-P-9. [NC]
- A duct penetration without a fire damper penetrates to Zone 3-P-9. [NC]
- A vent penetration without a damper penetrates to Zone 3-P-9. [NC]

East: 3-hour rated barriers [NC] with the following exception:

- El. 100 ft - A duct penetration without a fire damper penetrates to the outside. [NC] (Ref. 6.5)
- El. 115 ft - non-rated barrier to the outside. [NC]

West: 3-hour rated barriers. [NC]

Floor/Ceiling:

- El. 85 ft and 115 ft - Duct Penetrations without fire dampers. [NC]

2.0 COMBUSTIBLES

2.1 Floor Area: 1,150 ft^2

2.2 In situ Combustible Materials

- Cable
- Oil
- Paper
- Plastic
- Rubber

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection at 115-ft elevation.

3.2 Suppression

- Portable fire extinguishers
- Hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Zone 3-P-3

4.1.1 Auxiliary Feedwater

AFW pumps 1-2 and 1-3 may be lost due to a fire in this area. AFW pump 1-1 will be available to provide auxiliary feedwater.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- AFW Pump l-l and Associated components are independent of this fire zone and remain available for safe shutdown. (Ref. Section 4.0)

- Smoke detection provided in areas of combustible loading only (El. 115 ft).

- Manual fire fighting equipment is available.

- Boundaries are 3-hour rated with limited lesser rated boundaries. While these lesser rated boundaries constitute a deviation to Appendix R, 3 hour requirements, the unusual configuration of this zone and the isolated location of the circuits in this zone assure the capability to achieve safe shutdown.

This area complies with the requirements of 10CFR50, Appendix R, Section III.G. No exemptions have been requested.

6.0 REFERENCES

6.1 Drawing Nos. 515568, 515569, 515570
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065126, Fire Protection Information Report, Unit 1
6.5 NECS File: 131.95, FHARE 40, Undampered Ventilation Ducts
6.6 Calculation 134-DC, Electrical Appendix R Analysis
6.7 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.8 NECS File: 131.95, FHARE 38, Undampered Ventilation Duct and Unrated Door in 1-Hour Rated Barrier
6.9 NECS File: 131.95, FHARE: 60, Undampered Ventilation Ducts

FIRE AREA 4-A

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fire Area 4-A is located in the Northwest corner of the Unit 1 Auxiliary Building, El. 85 ft.

1.2 Description

This is the chemical laboratory area. A 1-hour rated drop ceiling covers the entire area, except in the F, G, and H Bus compartments, separating all electrical conduits from the laboratory environment under the drop ceiling. Above the drop ceiling, safe shutdown circuits for buses F, G, and H are separated by a horizontal distance in excess of 20 ft or are separated by 2-hour rated walls, or 2-hour rated fire wrap. (Refs. 6.14, 6.15, 6.16 and 6.18)

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- 3-hour rated barrier separates this area from Areas 3-B-1, 3-BB and Fire Zone 14-A.
- 2-hour rated barrier separates this area from Areas 4-A-1, 4-A-2. (Ref. 6.17)
- 1-1/2-hour rated doors communicate to Areas 4-A-1, 4-A-2 (One into each area). (Ref. 6.17)
- A duct penetration with no fire damper penetrates to Areas 4-A-2 and 4-A-1. (Ref. 6.17)

South:

- Non rated barrier separates this area from Area 4-B. [NC] (Refs. 6.14, 6.15, and 6.17)
- Three 1-1/2-hour rated doors communicate to Area 4-B. [NC] (Ref. 6.17)
- Ten duct penetrations with 1-1/2-hour rated fire dampers penetrate to Area 4-B [NC]. (Ref. 6.17 and 6.8)
- A duct penetration with no fire damper penetrate to Area 4-B. [NC] (Ref. 6.17)

East:

- 2-hour rated barrier separates this area from Area 4-A-2 and Zone 3-L (Area AB-1). (Ref. 6.17)
- A duct penetration with no fire damper penetrates to Zone 3-L (Area AB-1). (Ref. 6.17)
- 2-hour rated barrier separates this area from Area 4-A-1. (Ref. 6.13)

West:

- Duct penetration with a 1-1/2-hour rated damper communicates to Fire Area 4-B. NC (Ref. 6.17)
- 3-hour rated barrier separates this area from Fire Zone 14-E
- Non rated barrier with a 1-1/2-hour rated door to Fire Area 4-B. NC (Refs. 6.14, 6.15, and 6.17)

Floor:

- 3-hour rated barrier to 3-J-1, 3-J-2, 3-J-3, 3-H-1, and 3C. (Ref. 6.19)

Ceiling:

- 3-hour rated barrier to 5-A-1, 5-A-2, 5-A-3 and 5-A-4.
- Ventilation duct penetrations with 1-1/2-hour rated fire dampers. (Ref. 6.17)
- A 1-hour rated drop ceiling covers the entire area. (Ref. 6.17)
- All access hatches, in the dropped ceiling, are 1-1/2-hour rated. (Ref. 6.17)

Above Ceiling:

- In Bus-G compartment, a 2-hour rated barrier separates Bus G safe shutdown circuit K6944 from VCT outlet valve conduits K7223 and K7229. (Refs. 6.14, 6.15, and 6.16).
- 2-hour fire wrap around Bus F safe shutdown circuit K6934 from barrier 194 to ceiling. (Refs. 6.14 and 6.15)

2.0 COMBUSTIBLES

2.1 Floor Area: 2,078 ft^2

2.2 In situ Combustible Materials

- Oil
- Class A
- Plastic
- Acetic Acid
- Acetylene
- Alcohol
- Methane
- Polyethylene
- Paper

- Rubber
- Foam Rubber
- Wood (fir)
- Clothing/Rags
- Leather
- PVC
- Resin

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection is provided and is area wide below the false ceiling. It is not area wide above the false ceiling. (Ref. 6.9)

3.2 Suppression

- Automatic wet pipe sprinklers beneath drop ceiling except in "F" Bus compartment.
- Localized sprinkler protection is provided for HVAC ducts above the drop ceiling.
- Hose stations
- Portable fire extinguishers

4.0 SAFE SHUTDOWN FUNCTIONS

(Note: Bus "F", "G" or "H" may be lost due to a fire in this area. Only one of these redundant buses may be lost due to a fire in this area as documented in SSER 23. The approved deviation credits the passive protection provided by the conduits, insignificant combustible loading above the ceiling, automatic detection

above and below the 1-hr fire rated ceiling, the automatic suppression system below the ceiling and physical separation of redundant cables to provide assurance that at least one division (2 out of 3 buses) would remain free of fire damage. Therefore, the analysis for this area is presented first with the "F" bus lost, then the "G" bus lost, and then the "H" bus lost. (Ref. 6.10))

4.1 4-A ("F" Bus Lost)

4.1.1 Auxiliary Feedwater

AFW pump 1-3 may be lost for a fire in this area. Redundant AFW pump 1-1 will remain available.

Valves LCV-110, LCV-111, LCV-113 and LCV-115 may be affected by a fire in this area. Redundant valves LCV-108 and 109 will remain available to supply AFW flow to steam generators 1-3 and 1-4 via AFW Pump 1-1.

4.1.2 Chemical and Volume Control System

A fire in this area may affect valve 8104. FCV-110A and manual valve 8471 will remain available to provide boric acid to the charging pumps.

Valve 8107 may be lost due to a fire in this area. Redundant valves 8108, HCV-142, or 8145 and 8148 can be shut to isolate auxiliary spray. The charging injection and seal injection flowpaths will remain available. The PORVs can be used for pressure reduction. Since this valve has redundant components, safe shutdown is not affected.

Charging pump 1-1 and ALOPs 1-1 and 1-2 may be lost due to a fire in this area. Redundant charging pump 1-2 can be locally started to provide charging flow. Charging pump 1-2 will remain available and may be started without its ALOP.

Both boric acid transfer pumps 1-1 and 1-2 may be lost due to a fire in this area. Based on a deviation granted in SSER 23, one pump will remain operational because of sufficient separation between circuits.

A fire in this area may spuriously operate valves LCV-112B and LCV-112C. The approved deviation in SSER 23 credits the passive protection provided by the conduits, insignificant combustible loading above the ceiling, automatic detection above and below the 1-hr fire rated ceiling, the automatic suppression system below the to provide assurance that cables would remain free of fire damage. Although it is therefore not anticipated that fire damage to these cables would occur, spurious closure of the VCT valve could cavitate a running charging pump. The running charging pumps can be tripped from the control room to prevent

cavitation, and charging pump 1-2 restarted after the RWST is aligned and the VCT supply valve is isolated.

Level indication for boric acid storage tank 1-2 from LT-106 may be lost due to a fire in this area. Borated water from the RWST will remain available. Therefore, BAST level indication is not required.

4.1.3 Component Cooling Water

CCW pump and ALOP 1-1 may be lost due to a fire in this area. Redundant CCW pumps and ALOPs 1-2 and 1-3 are available to provide CCW.

A fire in this area may affect valves FCV-430 and FCV-431. Although it is not anticipated that a fire in this area would damage the cables, both of these valves can be manually operated to ensure safe shutdown. The approved deviation credits the passive protection provided by the conduits, insignificant combustible loading above the ceiling, automatic detection above and below the 1-hr fire rated ceiling, the automatic suppression system below the ceiling to provide assurance that the cables would remain free of fire damage.

A fire in this area may spuriously close valve FCV-356. Safe shutdown will not be affected because seal injection will remain available, therefore RCP seal integrity will not be affected.

4.1.4 Diesel Fuel Oil System

Diesel fuel oil pumps 0-1 and 0-2 may be lost due to a fire in this area. Based on a deviation granted in SSER 23, one pump will survive and be available for use.

4.1.5 Emergency Power

A fire in this area may disable the backup control circuit for diesel generator 1-2. The normal control circuit will remain available.

A fire in this area may disable generator 1-3. Diesel generators 1-1 and 1-2 will remain available for safe shutdown.

A fire in this area may disable startup transformers 1-1, 1-2, 2-1 and 2-2. Onsite power from diesel generators 1-1 and 1-2 will remain available for Unit 1, and all diesel generators will remain available for Unit 2.

All power supplies on the "F" Bus may be lost due to a fire in this area. These power supplies are not necessary since redundant trains on the "G" and "H" Buses will be available.

A fire in this area may disable dc panel SD13 backup battery charger ED131. Normal battery charger ED132 will remain available.

4.1.6 Main Steam System

A fire in this area may result in the loss of the following components: LT-516, LT-526, LT-529, LT-536, LT-539, LT-546, PT-514, PT-524, PT-534 and PT-544. Safe shutdown is not affected because redundant trains of indication will remain available for all four steam generators.

Valve PCV-19 may be affected by a fire in this area. Since this valve fails in the desired, closed position, safe shutdown is not affected. A redundant dump valve will remain available for cooldown.

4.1.7 Makeup System

LT-40, level indication for the condensate storage tank may be lost. Feedwater will be available from the raw water storage reservoir via manual operation of FCV-436. Manual action can be performed to locally open normally closed manual valve FCV-436.

4.1.8 Reactor Coolant System

A fire in this area may result in the loss of the following components: LT-406, LT-459, NE-31, NE-51, PT-403, PT-406, TE-410C, TE-413B, TE-423A and TE-423B. All of these instruments have redundant components available for safe shutdown.

A fire in this area may affect valve 8000A. PCV-474 will remain closed to prevent uncontrolled pressure reduction through the PORV path.

Control of RCPs 1-1, 1-2, 1-3 and 1-4 may be lost due to a fire in this area. Safe shutdown is not affected if the ability to trip all four RCPs is lost.

4.1.9 Residual Heat Removal System

A fire in this area may affect AC power and control cables associated with RHR Pump 1-1 recirculation valve FCV-641A . Redundant pump RHR Pp 1-2 and associated recirc valve FCV-641B will remain available for safe shutdown.

4.1.10 Safety Injection System

SI pump 1-1 may spuriously operate due to a fire in this area. Local manual action may be required to defeat this spurious operation.

A fire in this area may affect valves 8801A, 8803A, 8805A and 8805B. Loss of valves 8801A and 8803A will not affect safe shutdown because redundant valves 8801B and 8803B can be opened to provide a charging injection flowpath. The PORVs can be used for pressure reduction. Although it is not anticipated that a fire would damage cables to valves 8805A and 8805B, they can be manually opened to provide RWST to the charging pumps. The approved deviation credits the passive protection provided by the conduits, insignificant combustible loading above the ceiling, automatic detection above and below the 1-hr fire rated ceiling, and the automatic suppression system below the ceiling to provide assurance that the cables would remain free of fire damage.

A fire in this area may affect accumulator isolation valve 8808A. This valve can be manually closed to ensure safe shutdown.

4.1.11 Auxiliary Saltwater System

ASW pump 1-1 may be lost due to a fire in this area. ASW pump 1-2 will remain available to provide the ASW function.

A fire in this area may affect valves FCV-495 and FCV-496. FCV-601 will remain closed to provide ASW system integrity.

A fire in this area may spuriously close FCV-602 and FCV-603. Although it is not expected that fire damage will occur to both valves, these valves can be manually opened to ensure safe shutdown. The approved deviation credits the passive protection provided by the conduits, insignificant combustible loading above the ceiling, automatic detection above and below the 1-hr fire rated ceiling, and the automatic suppression system below the ceiling to provide assurance that the cables would remain free of fire damage.

4.1.12 HVAC

Circuits for HVAC equipment E-101, E-103, E-43, S-43, FCV-5045 and S-69 are present in this area. E-101 should survive a fire in this area due to existing fire protection features and circuit operation as documented in SSER 23. S-69 is not necessary due to a fire in this area. The redundant HVAC train (S-44, E-44, FCV-5046) will remain available for safe shutdown. The approved deviation credits the passive protection provided by the conduits, insignificant combustible loading above the ceiling, automatic detection above and below the 1-hr fire rated ceiling, and the automatic suppression system below the ceiling to provide assurance that the cables would remain free of fire damage.

4.2 4-A (G Bus Lost)

4.2.1 Auxiliary Feedwater

AFW pump 1-3 may be lost due to a fire in this area. Redundant AFW pump 1-2 will be available.

A fire in this area may affect valves LCV-106, 107, 108 and 109 from AFW Pump 1-1 and LCV-110, 111, 113 and 115 from AFW Pumps 1-2 and 1-3. Steam generators 1-1 and 1-2 are credited for safe shutdown, if the “G” bus is lost. Although it is not expected that fire damage will occur to redundant cables, LCV-110 and LCV-111 can be manually operated to regulate AFW flow to the steam generators. The approved deviation credits the passive protection provided by the conduits, insignificant combustible loading above the ceiling, automatic detection above and below the 1-hr fire rated ceiling, and the automatic suppression system below the ceiling to provide assurance that the cables would remain free of fire damage.

4.2.2 Chemical and Volume Control System

Valve 8108 may be lost due to a fire in this area. Redundant valve 8107 can be closed to isolate auxiliary spray. An alternate charging flowpath is available. The PORVs will remain available for pressure reduction. Since redundant components are available, safe shutdown will not be affected.

A fire in this area may affect valves 8104 and FCV-110A. One of these valves must be open to provide boric acid to the charging pumps. FCV-110A fails open and 8471 can be manually operated. Therefore, safe shutdown is not affected.

A fire in this area may affect valves 8146, 8147 and 8148. Since these valves fail in the desired position and redundant components are available, safe shutdown is not affected.

A fire in this area may affect charging pumps 1-1, 1-2, 1-3 and ALOPs 1-1 and 1-2. Due to the fire barrier configuration specified in Ref. 6.14, a single fire will not affect both the Bus G and the VCT outlet valves LCV-112B, C. Therefore, at least one charging pump will remain available. If Charging Pump 1-1 is needed, it can be started locally at the switchgear.

Boric acid transfer pumps 1-1 and 1-2 may be lost due to a fire in this area. Based on a deviation granted in SSER 23, pump 1-1 will remain operational.

Valve HCV-142 may be lost due to a fire in this area. This valve is not necessary since redundant components will be available.

A fire in this area may affect valves LCV-112B, LCV-112C, SI-8805A, and SI-8805B. Although it is not expected that the cables would be damaged by a fire in this area, spurious closure of the VCT valve could cavitate a running charging pump. The running charging pump can be tripped from the control room to prevent cavitation, and charging pump 1-1 can be started locally after the RWST supply is aligned and the VCT supply isolated. If valves LCV-112B or LCV-112C spuriously close, then either valve SI-8805A or SI-8805B can be manually opened to provide water from the RWST to the charging pump suction. LCV-112B and LCV-112C can be manually closed to isolate the volume control tank. An approved deviation credits the passive protection provided by the conduits, insignificant combustible loading above the ceiling, automatic detection above and below the 1-hr fire rated ceiling, and the automatic suppression system below the ceiling to provide assurance that the cables would remain free of fire damage.

4.2.3 Component Cooling Water

CCW pumps and ALOPs 1-1 and 1-2 may be lost due to a fire in this area. Redundant CCW pump and ALOP 1-3 will remain available.

Valve FCV-431 may be affected by a fire in this area. Redundant valve FCV-430 will enable the use of CCW heat exchanger 1-1.

A fire in this area may affect valve FCV-365. Since this valve fails in the desired, open position, safe shutdown is not affected.

A fire in this area may spuriously close FCV-356. Because seal injection will remain available, RCP seal integrity will not be affected. Therefore, safe shutdown will not be affected.

4.2.4 Diesel Fuel Oil System

Diesel fuel oil transfer pumps 0-1 and 0-2 may be lost due to a fire in this area. As documented in SSER 23, one pump should survive and remain available.

Valves LCV-85, LCV-86 and LCV-87 may be lost due to a fire in this area. Day tank level control will be maintained by LCV-88, LCV-89 and LCV-90.

4.2.5 Emergency Power

A fire in this area may disable the backup control circuit for diesel generator 1-1. The normal control circuit will remain available.

A fire in this area may affect the normal control circuit for diesel generator 1-2. Although the backup control circuit will be available, bus SPG may be lost, and diesel generators 1-1 and 1-3 will remain available for safe shutdown.

A fire in this area may affect startup transformers 1-1, 1-2, 2-1 and 2-2. Onsite power will remain available from diesel generators 1-1 and 1-3 for Unit 1 and all three diesel generators for Unit 2.

All power supplies on the "G" Bus may be lost due to a fire in this area. These power supplies are not necessary since redundant trains on the "F" and "H" buses will be available.

4.2.6 Main Steam System

A fire in this area may result in the loss of the following components: LT-519, LT-549, PT-515, PT-525, PT-535 and PT-545. Since redundant trains of instrumentation are available for all four steam generators, safe shutdown will not be affected.

A fire in this area may affect valve PCV-21. Since this valve fails in the desired, closed position, safe shutdown is not affected. Redundant dump valves will remain available for cooldown.

Valve FCV-95 may be affected by a fire in this area. AFW 1-2 will remain available to provide AFW.

A fire in this area may affect valves FCV-41 and FCV-42. These valves can be manually closed to isolate the main steam lines.

4.2.7 Reactor Coolant System

A fire in this area may affect LT-460, NE-32, TE-433A, TE-433B, TE-443A and TE-443B. All of these instruments have redundant components available for safe shutdown.

Valves 8000B and PCV-455C may be affected by a fire in this area. Uncontrolled pressure reduction will not occur since PCV-455C fails closed. A redundant PORV is available for pressure reduction.

Control of RCPs 1-1, 1-2, 1-3 and 1-4 may be lost due to a fire in this area. Safe shutdown is not affected if the reactor coolant pumps continuously run. Seal injection will remain available to provide RCP seal cooling.

A fire in this area may affect heater groups 1-3 and 1-4. Manual actions can be taken to de-energize heater group 1-4 and switching heater group 1-3 to the vital power supply. Therefore, safe shutdown is not affected.

4.2.8 Residual Heat Removal System

A fire in this area may affect AC power and control cables associated with RHR Pump 1-1 and recirculation valve FCV-641A. Redundant pump RHR Pp 1-2 and associated recirc valve FCV-641B will remain available for safe shutdown.

A fire in this area may affect valve 8701. This valve is closed with its power removed during normal operations and will not spuriously open. Also, valve 8701 can be manually operated for RHR operations.

4.2.9 Safety Injection System

SI pump 1-1 may spuriously operate due to a fire in this area. Local manual action may be required to defeat this spurious operation.

Valves 8801B, 8803A, 8803B, 8805A and 8805B may be affected by a fire in this area. Valves 8801A and 8803A are not necessary because another charging flowpath through seal injection exists. Also, the PORVs will be available for pressure reduction. Although it is not expected that fire damage would affect redundant valves 8805A and 8805B, the valves can be manually operated to provide water from the RWST to the charging pumps. The approved deviation credits the passive protection provided by the conduits, insignificant combustible loading above the ceiling, automatic detection above and below the 1-hr fire rated ceiling, and the automatic suppression system below the ceiling to provide assurance that the cables would remain free of fire damage.

A fire in this area may affect valves 8808B and 8808D. These valves can be manually closed to their desired, safe shutdown position.

4.2.10 Auxiliary Saltwater System

ASW pump 1-1 and 1-2 may be lost due to a fire in this area. ASW pump 1-1 can be locally started to ensure safe shutdown.

A fire in this area may affect valves FCV-495 and FCV-496. FCV-601 will remain closed to provide ASW system integrity.

Valves FCV-602 and FCV-603 may spuriously close due to a fire in this area. Although it is not expected that fire damage would affect redundant valves, these valves can be manually opened to ensure safe shutdown. The approved deviation credits the passive protection provided by the conduits, insignificant

combustible loading above the ceiling, automatic detection above and below the 1-hr fire rated ceiling, and the automatic suppression system below the ceiling to provide assurance that the cables would remain free of fire damage.

4.2.11 HVAC

HVAC equipment E-101, E-103, S-68 and S-69 may be lost due to a fire in this area. Based on a deviation granted in SSER 23, E-103 will remain operational during a fire in this area. E-101, S-68 and S-69 are not necessary for safe shutdown. The approved deviation credits the passive protection provided by the conduits, insignificant combustible loading above the ceiling, automatic detection above and below the 1-hr fire rated ceiling, the automatic suppression system below the ceiling and physical separation of redundant cables to provide assurance that at least one train of ASW fans (E-103) would remain free of fire damage.

4.3 4-A ("H" Bus Lost)

4.3.1 Auxiliary Feedwater

AFW pumps 1-2 and 1-3 may be lost due to a fire in this area. Redundant pump 1-1 will be available to provide AFW.

A fire in this area may affect valves LCV-110, LCV-111, LCV-113 and LCV-115. Redundant valves LCV-106, LCV-107, LCV-108, and LCV-109 will remain available for safe shutdown.

4.3.2 Chemical and Volume Control System

Charging pumps and ALOPs 1-1 and 1-2 may be lost due to a fire in this area. Charging pump 1-2 can be manually started to provide charging flow.

A fire in this area might result in the spurious closure of charging pump discharge flow control valve FCV-128. This valve can be opened from the control room after switching to manual control.

Boric acid transfer pumps 1-1 and 1-2 may be affected by a fire in this area. As documented in SSER 23, one pump will survive and remain available.

Valve 8104 may be affected by a fire in this area. FCV-110A and manual valve 8471 will remain available to provide a path for boric acid to the charging pumps.

A fire in this area may spuriously close LCV-112B and LCV-112C. Valves SI-8805A and SI-8805B may also be affected by a fire in this area. The approved deviation credits the passive protection provided by the conduits, insignificant

combustible loading above the ceiling, automatic detection above and below the 1-hr fire rated ceiling, and the automatic suppression system below the ceiling to provide assurance that these cables would remain free of fire damage. Although it is not anticipated that fire damage to the cables would occur in this area, spurious closure of the VCT valve could cavitate a running charging pump. The running charging pump can be tripped from the control room, and charging pump 1-2 can be restarted locally after the RWST supply is aligned and the VCT supply is isolated. Either valve SI-8805A or SI-8805B can be manually opened to provide water from the RWST to the charging pumps. Valves LCV-112B and LCV-112C can be manually closed to isolate the volume control tank.

Level indication for boric acid storage tank 1-1 from LT-102 may be lost due to a fire in this area. Borated water from the RWST will remain available. Therefore, BAST level indication will not be required.
A fire in this area may affect valve 8145. This valve fails closed to isolate auxiliary spray during hot standby. Since the PORVs will be available for pressure reduction, valve 8145 is not necessary.

4.3.3 Component Cooling Water

CCW pumps 1-1 and 1-3 and ALOP 1-1 may be lost due to a fire in this area. Redundant CCW pump and ALOP 1-2 will remain available.

A fire in this area may spuriously close FCV-356. Since seal injection will remain available, RCP seal integrity will not be affected and safe shutdown can be achieved.

Valve FCV-364 may be affected by a fire in this area. This valve fails open upon loss of power which is the desired position for safe shutdown.

A fire in this area may affect valves FCV-430 and FCV-431. Although it is not expected that redundant valves would be affected by a fire, these valves can be manually operated. The approved deviation credits the passive protection provided by the conduits, insignificant combustible loading above the ceiling, automatic detection above and below the 1-hr fire rated ceiling, and the automatic suppression system below the ceiling to provide assurance that the cables would remain free of fire damage.

4.3.4 Diesel Fuel Oil System

Diesel fuel oil pumps 0-1 and 0-2 may be affected by a fire in this area. As documented in SSER 23 one pump will survive and remain available.

Valves LCV-88, LCV-89 and LCV-90 may be lost due to a fire in this area. Day tank level control will be maintained by redundant valves LCV-85, LCV-86 and LCV-87 will remain available.

4.3.5 Emergency Power

A fire in this area may affect diesel generator 1-1 normal control circuit. Although the backup control circuit will be available, bus SPH may be lost, and DGs 1-2 and 1-3 will be available for safe shutdown.

A fire in this area may disable the diesel 1-3 backup control circuit. The normal control circuit will remain available.

A fire in this area may disable startup transformers 1-1, 1-2, 2-1 and 2-2. Onsite power from diesel generators 1-2 and 1-3 will remain available for Unit 1, and all three diesel generators will remain available for Unit 2.

A fire in this area may result in a loss of power supplies associated with PY17N and PY16. Loss of power to PY17N and PY16 results in the spurious closure of FCV-128 when in the automatic mode. This valve can be opened from the control room after switching to manual control.

All power supplies on the "H" bus may be lost due to a fire in this area. These power supplies are not necessary since redundant trains on the "G" and "F" Buses will be available.

A fire in this area may disable dc panel SD11 and SD12 backup battery charger ED121. Normal battery chargers ED11 and ED12 will remain available.

4.3.6 Main Steam System

A fire in this area may result in the loss of the following components: LT-518, LT-528, LT-538, LT-548, PT-526 and PT-536. Since redundant trains of instrumentation exist for all four steam generators, safe shutdown will not be affected.

Valve PCV-20 may be affected by a fire in this area. Since this valve fails in the desired, closed position, safe shutdown is not affected. Redundant dump valves will remain available for cooldown.

A fire in this area may affect valves FCV-43 and FCV-44. These valves can be manually closed to ensure safe shutdown.

4.3.7 Reactor Coolant System

LT-461, NE-52 and PT-403 may be lost due to a fire in this area. All of these instruments have redundant components available for safe shutdown.

A fire in this area may affect pressurizer PORV PCV-456 and blocking valve 8000C. PCV-456 fails closed. Therefore, uncontrolled pressure reduction is prevented. Redundant PORV PCV-455C will remain available for pressure reduction.

The ability to trip RCPs 1-1, 1-2, 1-3 and 1-4 may be lost due to a fire in this area. Safe shutdown is not affected if the RCPs continuously run.

A fire in this area may affect pressurizer heater groups 1-1 and 1-2. Manual actions can be taken to de-energize heater group 1-1 and switch heater group 1-2 to the vital power supply.

A fire in this area may also affect power to pressurizer heater group 1-3. Loss of power to heater group 1-3 will not affect safe shutdown.

4.3.8 Residual Heat Removal System

RHR pump 1-2 and FCV-641A (Recirc valve for RHR Pump 1-1) may be lost due to a fire in this area. Redundant pump 1-1 will be available to provide the RHR function. and its recirc valve FCV-641A can be manually opened for safe shutdown.

Valve 8702 may be affected by a fire in this area. This valve is closed with its power removed during normal operation and will not spuriously open. Also, valve 8702 can be manually operated for RHR operations.

4.3.9 Safety Injection System

SI pump 1-1 may spuriously operate for a fire in this area. Local manual action may be required to defeat this spurious operation.

A fire in this area may affect valves 8805A and 8805B. Although it is not expected that redundant valves would be affected by a fire, one of these valves can be manually opened for charging suction. The approved deviation credits the passive protection provided by the conduits, insignificant combustible loading above the ceiling, automatic detection above and below the 1-hr fire rated ceiling, and the automatic suppression system below the ceiling to provide assurance that the cables would remain free of fire damage.

Valve 8803A may be lost due to a fire in this area. This valve is not necessary for safe shutdown since redundant charging paths and pressure reduction methods will remain available.

A fire in this area may affect accumulator isolation valve 8808C. This valve can be manually closed to ensure safe shutdown.

4.3.10 Auxiliary Saltwater System

ASW pump 1-1 may be lost due to a fire in this area. Redundant ASW pump 1-2 is available to provide the ASW function.

Valves FCV-495 and FCV-496 may be affected by a fire in this area. FCV-601 will remain available to provide ASW system integrity.

A fire in this area may spuriously close FCV-602 and FCV-603. Although it is not expected that fire damage would occur to redundant valves, these valves can be manually opened to defeat any spurious actions. The approved deviation credits the passive protection provided by the conduits, insignificant combustible loading above the ceiling, automatic detection above and below the 1-hr fire rated ceiling, and the automatic suppression system below the ceiling to provide assurance that the cables would remain free of fire damage.

4.3.11 HVAC

HVAC equipment E-44, S-44, FCV-5046 and S-67 may be lost due to a fire in this area. S-67 is not necessary for a fire in this area. A redundant train of HVAC equipment (S-43, E-43 and FCV-5045) will remain available for safe shutdown. A fire in this area may affect E-101 and E-103. As stated in SSER 23, one of these ASW pump fans will remain operational. The approved deviation credits the passive protection provided by the conduits, insignificant combustible loading above the ceiling, automatic detection above and below the 1-hr fire rated ceiling, and the automatic suppression system below the ceiling to provide assurance that at least one train of ASW fans (E-101) would remain free of fire damage.

Fan S-69 may be lost due to a fire in this area. Safe shutdown is not affected since this fan is not necessary for safe shutdown.

4.4 Unit 2

4.4.1 Emergency Power

A fire in this area may cause loss of UNIT 2 power supplies associated with PY27N. Redundant power supply PY26 remains available.

5.0 CONCLUSION

Several modifications have been incorporated to improve the fire protection provided in this area. (Refs. 6.6 and 6.7)

The following features will adequately mitigate the consequences of a design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.
- Smoke detection provided.
- Manual fire fighting equipment is available.
- Automatic sprinkler system.

The existing fire protection features provide a level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 Drawing No. 515568
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 SSER 23, June 1984
6.4 Calculation M-824, Combustible Loading
6.5 Drawing 065126, Fire Protection Information Report, Unit 1
6.6 DCN DC1-EA-15251 - Upgrade Wall
6.7 DCN DC1-EE-13771 - Provide Smoke Detection
6.8 NECS File: 131.95, FHARE: 77, Fiberglass HVAC Ducts
6.9 NECS File: 131.95, FHARE: 78, Smoke Detection in the False Ceiling Area
6.10 Chron No. 200042, Memo to File, Dated 12/4/92
6.11 Calculation 134-DC, Electrical Appendix R Analysis
6.12 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.13 NECS File: 131.95, FHARE 118, Appendix R Fire Area Boundary Plaster Barriers
6.14 NECS File: 131.95, FHARE 117, Rev. 1, Safe Shutdown Analysis For Modifying Fire Area 4-A and 4-B Boundary Barriers
6.15 DCP M-049536, Combine Fire Areas 4-A and 4-B
6.16 AT-MM AR A0635366, Install Fire Separation Barriers for Conduits K6944, K7223, and K7229.
6.17 NECS File: 131 .95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.

FIRE AREAS 4-A-1, 4-A-2

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

These two areas are located at the north end of the Auxiliary Building next to the counting and chemical laboratory, El. 85 ft.

1.2 Description

These areas are separate Fire Areas containing "G" and "H" bus circuitry. These areas are situated side by side with Fire Area 4-A-1 to the west and Fire Area 4-A-2 to the east. Due to similarities between these fire areas, they have been combined into one section.

1.3 Boundaries

1.3.1 Fire Area 4-A-1

North:

- 3-hour rated barrier separates this area from Area 3-BB.
- A duct penetration with no fire damper penetrates to Area 3-BB. (Ref. 6.5)

South:

- 2-hour rated barrier separates this area from Area 4-A. (Ref. 6.5)
- A 1-1/2-hour rated door communicates to Area 4-A. (Ref. 6.5)
- A duct penetration with no fire damper penetrates to Fire Zone 4-A. (Ref. 6.5)

East:

- 3-hour rated barrier separates this area from Area 4-A-2.

West:

- 2-hour rated barrier separates this area from Area 4-A. (Ref. 6.8)
- A 3-hour rated door communicates to Area 4-A.

Floor:

- 3-hour rated barrier to Zones 3-J-2 and 3-J-3.

Ceiling:

- 3-hour rated barrier to Areas 5-A-1 and 5-A-2.

1.3.2 Fire Area 4-A-2

North:

- 3-hour rated barrier separates this area from Area 3-BB.
- A duct penetration with no fire damper penetrates to Area 3 BB. (Ref. 6.5)
- A lesser rated penetration seal to Area 3-BB. (Ref.6.9)

South:

- 2-hour rated barrier separates this area from Area 4-A. (Ref. 6.5)
- A 1-1/2-hour rated door communicates to Area 4-A. (Ref. 6.5)
- A duct penetration with no fire damper penetrates to Area 4-A. (Ref. 6.5)

East:

- 3-hour rated barrier separates this area from Area 3-B-1.

West:

- 3-hour rated barrier separates this area from Area 4-A-1.
- A 2-hour rated barrier separates this area from Area 4-A. (Ref. 6.5)

Ceiling:

- 3-hour rated to areas 5-A-3 and 5-A-4.

Floor:

- 3-hour rated to area 3-J-3.

2.0 COMBUSTIBLES

2.1 Fire Area 4-A-1

2.1.1 Floor Area: 120 ft^2

2.1.2 In situ Combustible Materials

- Cable

2.1.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.1.4 Fire Severity

- Low

2.2 Fire Area 4-A-2

2.2.l Floor Area: 102 ft^2

2.2.2 In situ Combustible Materials

- Cable

2.2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.2.4 Fire Severity

- Low

3.0 FIRE PROTECTION (typical for each area)

3.1 Detection

- Smoke detection is provided.

3.2 Suppression

- Portable fire extinguishers in adjacent area/zones.
- Hose Stations in adjacent area/zones.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Area 4-A-1

4.1.1 Auxiliary Feedwater

Valves LCV-106, 107, 108 and 109 may be affected by a fire in this area. Redundant valves LCV-110 and LCV-111 will remain available to provide AFW flow to steam generators 1-1 and 1-2.

4.1.2 Chemical and Volume Control System

Charging pumps 1-2 and 1-3 and ALOP 1-2 may be lost due to a fire in this area. Redundant charging pump and ALOP 1-1 will be available to provide charging flow.

Boric acid transfer pump 1-2 may be lost for a fire in this area. Redundant boric acid transfer pump 1-1 will be available for this function.

Valve 8108 may be affected by a fire in this area. Redundant valve 8107 can be closed to isolate auxiliary spray. The charging injection flowpath will be available if the charging flowpath through the regenerative heat exchanger is disabled. The PORVs can be used for pressure reduction. Since valve 8108 has redundant components, safe shutdown will not be affected.

A fire in this area may affect valves 8104 and FCV-110A. Since valve FCV-110A fails in the desired open position, safe shutdown is not affected. Manual valve 8471 must also be opened if FCV-110A is used for boric acid transfer.

Valves 8146, 8147 and 8148 may be affected by a fire in this area. Valve 8148 fails closed and isolates auxiliary spray during hot standby. The PORVs will remain available for pressure reduction. Valves 8146 and 8147 fail in the desired open position which will allow charging through the regenerative heat exchanger. Also, the charging injection flowpath will be available. The PORVs can be used

for pressure reduction during cold shutdown. Since redundant components are available, safe shutdown is not affected.

A fire in this area may result in the loss of HCV-142. This valve is not necessary for a fire in this area. Therefore, safe shutdown is not affected.

Valve LCV-112C may be affected by a fire in this area. If this occurs, valve 8805A can be opened to provide water from the RWST to the charging pump suction and valve LCV-112B can be closed to isolate the volume control tank.

4.1.3 Component Cooling Water

A fire in this area may affect CCW pump and ALOP 1-2. CCW pumps and ALOPs 1-1 and 1-3 will remain available to provide component cooling water.

A fire in this area may affect valve FCV-431. Component cooling water heat exchanger 1-1 will remain available.

Valve FCV-365 may be affected by a fire in this area. Since this valve fails in the desired open and redundant valve will be available, safe shutdown is not affected.

4.1.4 Containment Spray

Containment spray pump 1-1 may spuriously operate due to a fire in this area. However, the discharge valve 9001A will not operate. Therefore, the spurious containment spray pump operation has no impact on safe shutdown.

4.1.5 Diesel Fuel Oil System

Diesel fuel oil pump 0-2 may be lost due to a fire in this area. The redundant diesel fuel oil pump 0-1 remains available.

A fire in this area may affect valves LCV-85, LCV-86 and LCV-87. Redundant valves LCV-88, LCV-89 and LCV-90 will remain available.

4.1.6 Emergency Power

A fire in this area may disable the diesel generator 1-1 backup control circuit. The normal control circuit will remain available.

A fire in this area may disable diesel generator 1-2. Diesel generators 1-1 and 1-3 will remain available for safe shutdown.

A fire in this area may disable startup transformer 1-2. Onsite power from diesel generators 1-1 and 1-3 will remain available for safe shutdown.

All power supplies on the G Bus may be lost due to a fire in this area. These power supplies are not necessary since redundant trains on the F and H Buses will be available.

A fire in this area may result in a loss of power supplies associated with PY17N. Redundant power supply PY16 remains available.

4.1.7 Main Steam System

A fire in this area may result in the loss of the following components: LT-519, LT-549, PT-515, PT-525, PT-535 and PT-545. Safe shutdown is not affected because redundant trains of components exist for all four steam generators.

Valve PCV-21 may be affected by a fire in this area. Since this valve fails in the desired closed position and a redundant dump valves PCV-19 and PCV-20 will remain available, safe shutdown will not be affected.

A fire in this area may prevent FCV-95 from delivering steam to AFW pump 1-1. Since AFW pump 1-2 will remain available to provide AFW flow to steam generators 1-1 and 1-2, safe shutdown will not be affected.

Valves FCV-41 and FCV-42 may be affected by a fire in this area. Manual actions can be taken to make these valves operational.

4.1.8 Reactor Coolant System

A fire in this area may result in the loss of the following components: LT-460, NE-32, TE-433A, TE-433B, TE-443A and TE-443B. Safe shutdown is not affected since redundant instrumentation exists.

Valves PCV-455C and 8000B may be affected by a fire in this area. Since PCV-455C fails in the desired, closed position and a redundant PORV will remain available, safe shutdown will not be affected.

Control of the reactor coolant pumps may be lost due to a fire in this area. Safe shutdown is not affected if the RCPs continuously run. CCW to the RCP thermal barrier heat exchanger will remain available to provide RCP seal cooling.

Heater groups 1-3 and 1-4 may be affected by a fire in this area. Manual actions can be taken to de-energize heater group 1-4 and switch heater group 1-3 to the vital power supply. Therefore, safe shutdown is not affected.

4.1.9 Residual Heat Removal System

RHR pump 1-1 and Recirc Valve FCV-641A may be lost due to a fire in this area. Redundant RHR pump 1-2 and recirc valve FCV-641B will be available to provide the RHR function.

Valve 8701 may be affected by a fire in this area. This valve is closed with power removed during normal operations and will not spuriously open. Also, this valve can be manually operated for RHR operations.

4.1.10 Safety Injection System

A fire in this area may result in the loss of the following valves: 8801B, 8803B, 8805B. The following redundant valves: 8801A, 8803A and 8805A will remain available to ensure safe shutdown.

Valves 8808B and 8808D may be affected by a fire in this area. These valves can be manually closed.

4.1.11 Auxiliary Saltwater System

ASW pump 1-2 may be lost due to a fire in this area. Redundant ASW pump 1-1 will be available to provide the ASW function.

A fire in this area may cause FCV-603 to be lost. Since a redundant ASW train will be available safe shutdown will not be affected.

4.1.12 HVAC

A fire in this area may result in the loss of fans E-101 and S-68. Since these fans are not required for a fire in this area, safe shutdown is not affected.

4.2 Fire Area 4-A-2

4.2.1 Auxiliary Feedwater

AFW pump 1-2 may be lost due to a fire in this area. Redundant pumps 1-1 and 1-3 will be available to provide AFW.

A fire in this area may affect valves LCV-110 and LCV-111. Redundant valves LCV-106, LCV-107, LCV-108, LCV-109, LCV-113, and LCV-115 will remain available.

4.2.2 Chemical and Volume Control System

Valve 8145 may be lost due to a fire in this area. The PORVs will remain available for pressure reduction. Since redundant components exist, valve 8145 will not be necessary.

A fire in this area may result in the loss of boric acid storage tank 1-1 level indication from LT-102. Borated water from the RWST will be available. Therefore, BAST level indication is not required.

4.2.3 Component Cooling Water

CCW pump and ALOP 1-3 may be lost for a fire in this area. Redundant CCW pumps and ALOPs 1-1 and 1-2 will be available to provide CCW.

Valve FCV-364 may be affected by a fire in this area. Since this valve fails in the desired, open position, safe shutdown is not affected.

4.2.4 Containment Spray

Containment spray pump 1-2 may spuriously operate due to a fire in this area. However, the corresponding discharge valve, 9001B will not operate. Therefore, the spurious containment spray pump operation has no impact on safe shutdown.

4.2.5 Diesel Fuel Oil System

One diesel fuel oil pump 0-1 may be lost due to a fire in this area. Redundant diesel fuel oil pump 0-2 remains available.

A fire in this area may result in the loss of the following valves: LCV-88, LCV-89 and LCV-90. These valves can be lost since redundant valves: LCV-85, LCV-86 and LCV-87 will be available.

4.2.6 Emergency Power

A fire in this area may disable diesel generator 1-1. Diesel generators 1-2 and 1-3 will remain available for safe shutdown.

A fire in this area may disable diesel generator 1-3 backup control circuit. The normal control circuit will remain available.

A fire in this area may disable startup transformer 1-2. Onsite power from diesel generators 1-2 and 1-3 will remain available.

All power supplies on the H Bus may be lost due to a fire in this area. These power supplies are not necessary since redundant trains on the G and F Buses will be available.

A fire in this area may disable dc panel SD11 backup battery charger ED121. Normal battery charger ED11 will remain available.

A fire in this area may disable dc panel SD12 backup battery charger ED121. Normal battery charger ED12 will remain available.

4.2.7 Main Steam System

A fire in this area may result in the loss of the following components: LT-518, LT-528, LT-538, LT-548, PT-526, and PT-536. Redundant components exist for all four steam generators, therefore, safe shutdown is not affected.

Valve PCV-20 may be affected by a fire in this area. Since this valve fails in its desired closed position and a redundant dump valve will remain available, safe shutdown is not affected.

A fire in this area may affect valves FCV-43 and FCV-44. These valves can be manually closed to ensure safe shutdown.

4.2.8 Reactor Coolant System

A fire in this area may result in the loss of the following instrumentation: LT-461, NE-52 and PT-403. Since all of these instruments have redundant components, safe shutdown is not affected.

Valves PCV-456 and 8000C may be affected by a fire in this area. Since PCV-456 fails in the desired, closed position and a redundant PORV will remain available for pressure reduction, safe shutdown is not affected.

Control of all four reactor coolant pumps may be lost due to a fire in this area. Safe shutdown is not affected if the RCPs continuously run as PCV-455A and PCV-455B can be verified shut.

A fire in this area may affect pressurizer heater groups 1-1 and 1-2. Manual actions can be taken to de-energize heater group 1-1 and switch heater group 1-2 to the vital power supply. Therefore, safe shutdown is not affected.

4.2.9 Residual Heat Removal System

RHR pump 1-2 and recirc valve FCV-641B may be lost for a fire in this area. Redundant RHR pump 1-1 and recirc valve FCV-641A will be available to provide the RHR function.

Valve 8702 may be affected by a fire in this area. This valve is closed with its power removed during normal operations and will not spuriously open. Also, this valve can be manually operated for RHR operations.

4.2.10 Safety Injection System

SI pump 1-2 may spuriously operate due to a fire in this area. Local manual action may be required to defeat this spurious operation. Valve 8808C may be affected by a fire in this area. This valve can be manually closed.

4.2.11 Auxiliary Saltwater System

A fire in this area may affect valves FCV-495 and FCV-496. FCV-601 will remain closed to provide ASW system integrity.

4.2.12 HVAC

A fire in this area may result in the loss of one train of required HVAC equipment (FCV-5046, E-44, S-44 and S-67). Fan S-67 is not required and a redundant train of HVAC equipment (FCV-5045, E-43 and S-43) will be available to provide necessary HVAC support.

5.0 CONCLUSION

The following features adequately mitigate consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Safe shutdown will not be adversely affected by the loss of the equipment in each area due to the availability of redundant systems.

- Smoke detection is provided.

- Manual fire fighting equipment is available.

- Limited combustible loading.

The existing fire protection features provide a level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.2 Drawing No. 515568
6.3 Drawing 065126, Fire Protection Information Report, Unit 1
6.4 Calculation M-824, Combustible Loading
6.5 SSER 23, June 1984
6.6 Calculation 134-DC, Electrical Appendix R Analysis
6.7 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.8 NECS File: 131.95, FHARE 118, Appendix R Fire Area Boundary Plaster Barriers
6.9 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers

FIRE AREA 4-B

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fire Area 4-B is located in the southwest corner of the Unit 2 Auxiliary Building at El. 85 ft.

1.2 Description

This fire area contains showers, lockers, restrooms, storage areas and the radiological access control area for Units 1 and 2. A nonrated suspended ceiling is provided throughout the zone. "No Storage Area" signs are posted under the equipment hatches.

1.3 Boundaries

NOTE: NC designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- 3-hour rated barrier to Fire Areas S-1 and S-5.
- Non rated barrier to Fire Area 4-A. NC (Refs. 6.19, 6.20, and 6.21)
- A duct penetration without a fire damper to Fire Zone 4-A. NC (Ref. 6.21)
- Three 1-1/2-hour rated fire doors to Fire Area 4-A. NC (Ref. 6.21)
- Nine duct penetrations with 1-1/2-hour rated fire dampers communicate to Fire Area 4-A. NC (Ref. 6.21 and 6.22)

South:

- 3-hour rated barrier to Fire Areas 3-D-1, 3-CC and Fire Zones 19-A, S-1, and S-5.
- 2-hour rated barrier to Fire Areas 4-B-1 and 4-B-2. (Ref. 6.21)
- Pyrocrete enclosure surrounds junction box BPG5 on the 4-B side of the barrier between 4-B and 4-B-2. (Ref. 6.15 and 6.21)
- Lesser rated penetration seals to Fire Area 4-B-2. (Ref. 6.18)

East:

- 3-hour rated barrier to Fire Zones 3-L, S-2 and S-5.
- A 1-1/2-hour rated door to Fire Zone S-5. (Ref. 6.21)
- A 1-1/2-hour rated double door to Fire Zone S-2. (Ref. 6.21)

- A duct penetration without a fire damper to Fire Zone 3-L. (Ref. 6.21)
- 3-hour rated barrier to Fire Areas 3-D-1.
- 2-hour rated barrier to Fire Area 4-B-1. (Ref. 6.2)
- 3-hour rated door to Fire Area 4-B-1.
- Non rated barrier to 4-A. NC (Refs. 6.18, 6.19 and 6.21)

West:

- 3-hour rated barrier to Fire Zone S-1.
- 3-hour rated barrier to Fire Areas 19-A and 14-A.
- Unrated small diameter penetration to Fire Area 19-A. (Ref. 6.14 and 6.21)
- A 3-hour rated door to Fire Area 19-A.
- A 3-hour rated roll-up door to Fire Area 19-A.
- A 1-1/2-hour rated door to Fire Zone S-1. (Ref. 6.21)
- Four duct penetrations with 3-hour rated fire dampers communicate with Fire Zone S-1. (Ref. 6.9)
- 2-hour rated barrier to Fire Area 4-B-2. (Ref. 6.21)
- 1-1/2-hour rated access hatch to Fire Area 4-B-2. (Ref. 6.21)
- Unrated HVAC duct penetration without a fire damper to Fire Area TB-7. (Ref. 6.11 and 6.21)

Floor:

- 3-hour rated barriers to Fire Zones 3-J-1, 3-K-1, 3-K-2, 3-K-3, 3C, and Fire Area 3-I-1.

Ceiling:

- 2 steel equipment hatches to Fire Area 5-A-4 and 5-B-4 above. (Ref. 6.21)
- 3-hour rated barriers to Fire Areas 5-A-4, 5-B-4, 5-B-3, 5-B-2, and 5-B-1.

Above Ceiling:

- 2-hour rated barrier to Fire Area 4-A around conduit K6944. (Refs. 6.18, 6.19 and 6.21)

Protective Enclosure:

- A fire rated enclosure with an approximate rating of 3 hours, although 1 hour is committed, provided for conduit K6944. (Refs. 6.7 and 6.13)

2.0 COMBUSTIBLES

2.1 Floor Area: 4,908 ft^2

2.2 In situ Combustible Materials

- Wood
- Cable insulation
- Clothing/Rags
- Polyethylene
- Rubber
- Leather
- Plastic
- Charcoal
- Alcohol
- Foam Rubber
- Resin
- Lube Oil
- Paper
- PVC

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection provided (both above and below suspended ceiling). (Ref. 6.8)

3.2 Suppression

- Wet pipe automatic sprinkler system with remote annunciation provided except for F bus area and above the suspended ceiling.

- Portable fire extinguishers available.
- Fire hose stations available.

4.0 SAFE SHUTDOWN FUNCTIONS

(Note: A fire in this area may cause a loss of Unit 2 480 V Bus SPF or SPH. The "G" Bus cables are protected by a fire barrier having an approximate fire rating of 3 hours, although 1 hour is committed. Only one of these redundant buses may be lost due to a fire in this area, as documented in SSER 31. The approved deviation is based on the low fire loading, automatic sprinkler systems below the suspended ceiling, automatic detection system above and below the ceiling, and a 1-hr fire barrier protecting the "G" 480-V switchgear SPG. Therefore, the losses and manual actions for this area are different based on which bus fails. (Ref. 6.12))

4.1 UNIT 1

4.1.1 Component Cooling Water System

A fire in this area may spuriously close FCV-355. FCV-355 can be manually operated for safe shutdown.

A fire in this area may spuriously close FCV-356. Since seal injection will remain available to the thermal barrier, FCV-356 is not necessary for safe shutdown.

Valves FCV-430 and FCV-431 may be affected by a fire in this area. These valves can be manually opened to ensure safe shutdown.

4.1.2 Containment Spray System

A fire in this area may spuriously open valve 9001B. Since CS PP 1-2 is not affected, this will not affect safe shutdown.

4.1.3 Diesel Fuel Oil System

Circuits for diesel fuel oil transfer pumps 0-1 and 0-2 are routed through this area. However, as documented in SSER 23, at least one pump is protected by a fire barrier. Offsite power will also be available for safe shutdown in the event the diesel fuel pump circuits are damaged by the fire. Therefore, safe shutdown will not be affected.

4.1.4 Safety Injection System

A fire in this area may spuriously open 8808C. This valve can be manually closed to ensure safe shutdown.

4.1.5 Saltwater System

Valves FCV-495 and FCV-496 may be affected by a fire in this area. FCV-601 will remain closed to provide ASW system integrity.

A fire in this area may spuriously close FCV-602 and FCV-603. FCV-602 can be manually opened to allow the use of ASW pump 1-1.

4.1.6 HVAC

A fire in this area may affect fan E-101 which provides HVAC for ASW pump 1-2. ASW pump 1-1 will remain available along with E-103 for HVAC.

4.1.7 Emergency Power

A fire in this area may result in a loss of power supplies associated with PY17N. Redundant power supply PY16 remains available.

4.2 UNIT 2

4.2.1 4-B (F Bus Lost)

4.2.1.1 Auxiliary Feedwater

AFW pump 2-3 may be lost for a fire in this area. Redundant AFW pumps 2-1 will remain available.

Valves LCV-110, LCV-111, LCV-113 and LCV-115 may be affected by a fire in this area. Redundant valves LCV-107 and LCV-108 will remain available.

4.2.1.2 Chemical and Volume Control System

A fire in this area may affect valve 8104. Borated water from the RWST is credited for a fire in this area. However, if the boric acid transfer is utilized, FCV-110A and manual valve 8471 will remain available. The approved deviation in SSER 31 is based on the low fire loading, automatic sprinkler systems below the suspended ceiling, automatic detection system above and below the ceiling, and the performance of manual actions to reestablish the flowpath, which all provide assurance that at least one train would remain available for safe shutdown.

Valve 8107 may be affected by a fire in this area. Redundant valves 8108 or HCV-142 can be closed to isolate auxiliary spray. Two other charging flowpaths (seal injection and charging injection) are available if the charging flowpath through the regenerative heat exchanger is disabled. The PORVs can be used for pressure reduction. Since valve 8107 has redundant components, safe shutdown will not be affected.

Charging pump 2-1 and ALOPs 2-1 and 2-2 may be lost due to a fire in this area. Redundant charging pump 2-2 can be locally started to provide charging flow. A deviation was approved in SSER 31 based on the low fire loading, automatic sprinkler systems below the suspended ceiling, automatic detection system above and below the ceiling, and the performance of manual actions, which all provide assurance that at least one train would remain available for safe shutdown.

Both boric acid transfer pumps 2-1 and 2-2 may be affected by a fire in this area. As documented in SSER 31, one pump will survive and remain available. In addition, borated water from the RWST would also be available.

A fire in this area may spuriously operate valves LCV-112B and LCV-112C. A deviation was approved in SSER 31 based on the low fire loading, automatic sprinkler systems below the suspended ceiling, automatic detection system above and below the ceiling, and the performance of manual actions to reestablish the flowpath, which all provide assurance that at least one train would remain available for safe shutdown. Although it is therefore not anticipated that redundant valves would be affected by a fire in this area, these valves can be manually operated to isolate the volume control tank. Valves 8805A and 8805B are required to be open to supply water to the charging pumps if LCV-112B or LCV-112C are closed.

Level indication for boric acid storage tank 2-1 from LT-106 may be lost due to a fire in this area. Borated water from the RWST will remain available. Therefore, BAST level indication is not required.

<u>4.2.1.3 Component Cooling Water</u>

CCW pump and ALOP 2-1 may be lost due to a fire in this area. Redundant CCW pumps and ALOPs 2-2 and 2-3 are available to provide CCW.

A fire in this area may affect valves FCV-430 and FCV-431. Both of these valves can be manually operated to ensure safe shutdown.

FCV-355 may spuriously close due to a fire in this area. FCV-355 can be manually operated for safe shutdown.

A fire in this area may spuriously close valve FCV-356. Safe shutdown will not be affected because seal injection will remain available, therefore RCP seal integrity will not be affected.

4.2.1.4 Containment Spray System

A fire in this area may spuriously open valve 9001B. Since CS PP 2-2 will remain off, safe shutdown is not affected.

4.2.1.5 Emergency Power

A fire in this area may disable the diesel generator 2-1 backup control circuit. However, power for the normal control circuit will remain available.

A fire in this area may disable diesel generator 2-3. Diesel generators 2-1 and 2-2 will remain available for safe shutdown.

A fire in this area may disable startup transformer 2-2. Onsite power from diesel generators 2-1 and 2-2 will remain available for safe shutdown.

All power supplies on the "F" Bus may be lost due to a fire in this area. These power supplies are not necessary since redundant trains on the "G" and "H" buses will be available.

A fire in this area may disable dc panel SD23 backup battery charger ED231. Normal battery charger ED232 will remain available.

A fire in this area may cause loss of power supplies associated with PY27N. Redundant power supply PY26 remains available.

4.2.1.6 Main Steam System

A fire in this area may result in the loss of the following components: LT-516, LT-526, LT-529, LT-536, LT-539, LT-546, PT-514, PT-524, PT-534 and PT-544. Safe shutdown is not affected because redundant trains of indication will remain available for all four steam generators.

Valve PCV-19 may be affected by a fire in this area. Since this valve fails in the desired, closed position and a redundant dump valve will remain available, safe shutdown is not affected.

4.2.1.7 Makeup System

LT-40, level indication for the condensate storage tank may be lost. Feedwater will be available from the raw water storage reservoir via FCV-436. Manual action can be performed to locally open normally closed manual valve FCV-436.

4.2.1.8 Reactor Coolant System

A fire in this area may result in the loss of the following components: LT-406, LT-459, NE-31, NE-51, PT-403, PT-406, TE-410C, TE-413B, TE-423A and TE-423B. All of these instruments have redundant components available for safe shutdown.

A fire in this area may affect valve 8000A. PCV-474 will remain closed to prevent uncontrolled pressure reduction through the PORV path.

Control of RCPs 2-1, 2-2, 2-3 and 2-4 may be lost due to a fire in this area. Safe shutdown is not affected if the RCPs continuously run. CCW to the thermal barrier heat exchanger or seal injection will remain available for RCP seal cooling.

4.2.1.9 Residual Heat Removal System

A fire in this area may affect AC power and control cables associated with RHR Pump 2-1. recirculation valve FCV-641A. Redundant Pump 2-2 and recirc valve FCV-641B will remain available for safe shutdown.

4.2.1.10 Safety Injection System

SI pump 2-1 may spuriously operate due to a fire in this area. Local manual action may be required to defeat this spurious operation prior to RCS depressurization.

A fire in this area may affect valves 8801A, 8803A, 8805A and 8805B. Loss of valves 8801A and 8803A will not affect safe shutdown because redundant valves 8801B and 8803B will be available to provide a charging injection flowpath. The PORVs can be used for pressure reduction. Although it is not anticipated that fire damage would occur to redundant valves 8805A and 8805B, the valves can be manually operated to provide RWST water to the charging pumps. A deviation was approved based on the low fire loading, automatic sprinkler systems below the suspended ceiling, automatic detection system above and below the ceiling, and manual actions to reestablish the flowpath, all of which provide assurance that at least one train would remain available for safe shutdown.

A fire in this area may affect accumulator isolation valves 8808A and 8808C. These valves can be manually closed to ensure safe shutdown.

4.2.1.11 Auxiliary Saltwater System

ASW pump 2-1 may be lost due to a fire in this area. ASW pump 2-2 will remain available to provide the ASW function.

A fire in this area may affect valves FCV-495 and FCV-496. FCV-601 will remain closed to provide ASW system integrity.

A fire in this area may spuriously close FCV-602 and FCV-603. Although it is not expected that fire damage would occur to the redundant valves, these valves can be manually opened to ensure safe shutdown. A deviation was approved based on the low fire loading, automatic sprinkler systems below the suspended ceiling, automatic detection system above and below the ceiling, and manual actions to reestablish the flowpath, all of which provide assurance that at least one train would remain available for safe shutdown.

4.2.1.12 HVAC

Circuits for HVAC equipment E-102, E-104, E-45, S-45, FCV-5045 and S-69 are routed through this area. As documented in SSER 31, E-102 should survive a fire in this area due to the existing fire protection features and circuit operation. S-69 is not necessary due to a fire in this area. The redundant HVAC train (S-46, E-46, FCV-5046) will remain available for safe shutdown. A deviation was approved based on the low fire loading, automatic sprinkler systems below the suspended ceiling, and automatic detection system above and below the ceiling to provide assurance that at least one train would remain available for safe shutdown.

4.2.2 4-B ("H" Bus Lost)

4.2.2.1 Auxiliary Feedwater

AFW pumps 2-2 and 2-3 may be lost due to a fire in this area. Redundant pump 2-1 will be available to provide AFW.

A fire in this area may affect valves LCV-110, LCV-111, LCV-113 and LCV-115. Redundant valves LCV-107 and LCV-108 will remain available to provide AFW flow to steam generators 2-2 and 2-3.

4.2.2.2 Chemical and Volume Control System

Charging pumps 2-1 and ALOPs 2-1 and 2-2 may be lost due to a fire in this area. Charging pump 2-2 can be manually started to provide charging flow. A deviation was approved based on the low fire loading, automatic sprinkler systems below the suspended ceiling, automatic detection system above and below the ceiling, and manual actions to reestablish the flowpath, all of which provide assurance that at least one train would remain available for safe shutdown.

Boric acid transfer pumps 2-1 and 2-2 may be lost due to a fire in this area. As documented in SSER 31, one pump will survive and remain available. In addition, borated water from the RWST would be available for safe shutdown.

Valve 8104 may be affected by a fire in this area. Borated water from the RWST is credited for a fire in this area. However, if the boric acid transfer is utilized, FCV-110A and 8471 will remain available to provide a path for boric acid to the charging pumps. A deviation was approved based on the low fire loading, automatic sprinkler systems below the suspended ceiling, automatic detection system above and below the ceiling, and manual actions to reestablish the flowpath, all of which provide assurance that at least one train would remain available for safe shutdown.

A fire in this area may spuriously close LCV-112B and LCV-112C. Either valve 8805A or 8805B will remain available to provide water from the RWST to the charging pumps. Although it is not anticipated that a fire will damage redundant valves LCV-112B and LCV-112C, the valves can be manually closed to isolate the volume control tank. A deviation was approved based on the low fire loading, automatic sprinkler systems below the suspended ceiling, automatic detection system above and below the ceiling, and manual actions to reestablish the flowpath, all of which provide assurance that at least one train would remain available for safe shutdown.

Level indication for boric acid storage tank 2-2 from LT-102 may be lost due to a fire in this area. Since borated water from the RWST will remain available, BAST level indication is not required.

A fire in this area may affect valve 8145. This valve fails closed to isolate auxiliary spray during hot standby. Since the PORVs will be available for pressure reduction, valve 8145 is not necessary.

4.2.2.3 Component Cooling Water

CCW pumps 2-1 and 2-3 and ALOP 2-1 may be lost due to a fire in this area. Redundant CCW pump 2-2 and ALOP 2-2 will remain available.

Valve FCV-364 may be affected by a fire in this area. This valve fails open upon loss of power which is the desired position for safe shutdown.

A fire in this area may affect valves FCV-430 and FCV-431. These valves can be manually operated.

A fire in this area may spuriously close FCV-355. FCV-355 can be manually operated for safe shutdown.

A fire in this area may spuriously close FCV-356. Since seal injection will be available to the RCP thermal barrier, this valve is not necessary for safe shutdown.

4.2.2.4 Containment Spray System

A fire in this area may spuriously open valve 9001B. Since CS PP 2-2 will remain off, safe shutdown is not affected.

4.2.2.5 Diesel Fuel Oil System

Diesel fuel oil pump 0-1 may be lost due to a fire in this area. Redundant diesel fuel oil pump 0-2 will remain available.

Valves LCV-88, LCV-89 and LCV-90 may be lost due to a fire in this area. Day tank level control will be maintained by redundant valves LCV-85, LCV-86 and LCV-87 will remain available.

4.2.2.6 Emergency Power

A fire in this area may disable diesel generator 2-2. Diesel generators 2-1 and 2-3 will remain available for safe shutdown.

A fire in this area may disable the diesel generator 2-3 backup control circuit. The normal control circuit will remain available.

The "H" Bus may be lost due to a fire in this area. Redundant buses "F" and "G" will remain available for safe shutdown.

A fire in this area may disable startup transformer 2-2. Onsite power from diesel generators 2-1 and 2-3 will remain available for safe shutdown.

All power supplies on the "H" bus may lose power due to a fire in this area. These power supplies are not necessary since redundant trains on the "G" and "F" buses will be available.

A fire in this area may disable dc panel SD21 backup battery charger ED221. Normal battery charger ED21 will remain available.

A fire in this area may disable dc panel SD22 backup battery charger ED221. Normal battery charger ED22 will remain available.

A fire in this area may cause loss of power supplies associated with PY27N. Redundant power supply PY26 remains available.

4.2.2.7 Main Steam System

A fire in this area may result in the loss of the following components: LT-518, LT-528, LT-538, LT-548, PT-526 and PT-536. Since redundant trains of instrumentation exist for all four steam generators, safe shutdown will not be affected.

Valve PCV-20 may be affected by a fire in this area. Since this valve fails in the desired, closed position, and a redundant dump valve will remain available, safe shutdown is not affected.

A fire in this area may affect valves FCV-43 and FCV-44. These valves can be manually failed closed by isolating air to the valve and then venting residual air to ensure safe shutdown.

4.2.2.8 Reactor Coolant System

LT-461, NE-52 and PT-403 may be lost due to a fire in this area. All of these instruments have redundant components available for safe shutdown.

A fire in this area may affect pressurizer PORV PCV-456 and blocking valve 8000C. PCV-456 fails closed. Therefore, uncontrolled pressure reduction is prevented. Redundant PORV PCV-455C will remain available for pressure reduction.

The ability to trip RCPs 2-1, 2-2, 2-3 and 2-4 may be lost due to a fire in this area. Safe shutdown is not affected if the RCPs continuously run. CCW to the thermal barrier heat exchanger or seal injection will remain available for RCP seal cooling.

A fire in this area may affect heater groups 2-1 and 2-2. Manual actions can be taken to deenergize heater group 2-1 and switch heater group 2-2 to the vital power supply. Therefore, safe shutdown is not affected.

4.2.2.9 Residual Heat Removal System

RHR pump 2-2 may be lost due to a fire in this area. Redundant pump 2-1 will be available to provide the RHR function.

A fire in this area may affect AC power and control cables associated with RHR Pump 2-1 recirculation valve FCV-641A. Prior to starting RHR Pp 2-1, manual action can be taken to locally open FCV-641A.

Valve 8702 may be affected by a fire in this area. This valve is closed with power removed during normal operations and will not spuriously open. Also, this valve can be manually operated for RHR operations.

4.2.2.10 Safety Injection System

SI pump 2-1 may spuriously operate for a fire in this area. Local manual action may be required to defeat this spurious operation.

A fire in this area may affect valves 8805A and 8805B. Although it is not expected that a fire will damage redundant valves in this area, one of these valves can be manually opened for charging suction. A deviation was approved based on the low fire loading, automatic sprinkler systems below the suspended ceiling, automatic detection system above and below the ceiling, and manual actions to reestablish the flowpath, all of which provide assurance that at least one train would remain available for safe shutdown.

Valve 8803A may be lost due to a fire in this area. This valve is not necessary for safe shutdown since redundant charging paths and pressure reduction methods will remain available.

A fire in this area may affect accumulator isolation valve 8808C. This valve can be manually closed to ensure safe shutdown.

4.2.2.11 Auxiliary Saltwater System

ASW pump 2-1 may be lost due to a fire in this area. Redundant ASW pump 2-2 is available to provide the ASW function.

Valves FCV-495 and FCV-496 may be affected by a fire in this area. FCV-601 will remain available to provide ASW system integrity.

A fire in this area may spuriously close FCV-602 and FCV-603. Although it is not expected that fire damage will affect redundant valves, these valves can be manually opened to defeat any spurious actions. A deviation was approved based on the low fire loading, automatic sprinkler systems below the suspended ceiling, automatic detection system above and below the ceiling, and manual actions to reestablish the flowpath, all of which provide assurance that at least one train would remain available for safe shutdown.

4.2.2.12 HVAC

HVAC equipment E-46, S-46, FCV-5046 and S-67 may be lost due to a fire in this area. S-67 is not necessary for a fire in this area. A redundant train of HVAC equipment (S-45, E-45 and FCV-5045) will remain available for safe shutdown.

A fire in this area may affect E-102 and E-104. SSER 31 documents that one of these ASW pump fans will remain operational. A deviation was approved based on the low fire loading, automatic sprinkler systems below the suspended ceiling, and automatic detection system above and below the ceiling to provide assurance that at least one train would remain available for safe shutdown.

Fan S-69 may be lost due to a fire in this area. Safe shutdown is not affected since this fan is not necessary for safe shutdown.

5.0 CONCLUSION

This area does not meet the requirements of 10 CFR 50, Appendix R, Section III.G.2, which requires the installation of an automatic fire detection and suppression system and the protection of one shut down division by a fire rated barrier. The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.
- Smoke detection provided.
- Manual fire fighting equipment available.
- Automatic sprinkler system.

The existing fire protection features provide a level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 Drawing Number 515568
6.2 DCPP Unit 2 review of 10 CFR 50, Appendix R (Rev.2)
6.3 SSER 23, June 1984
6.4 SSER 31, April 1985
6.5 Calculation M-824, Combustible Loading
6.6 Drawing 065126 and 065127, Fire Protection Information Report, Unit 1 and 2
6.7 DCN DC2-EA-22612, Upgrade Wall and Provide l Hour Barriers
6.8 DCN DC2-EA-14771, Provide area wide smoke detection
6.9 DCN DCO-EH-37379, Install fire dampers to vent shaft
6.10 Appendix 3 for EP M-10 Unit 2 Fire Protection of Safe Shutdown Equipment
6.11 NECS File: 131.95, FHARE: 58, Undampered Duct Penetrations
6.12 Chron No. 200042, Memo to File, Dated 12/4/92
6.13 PG&E Design Change Notice DC2-EA-050070, Unit 2 ThermoLag Replacement
6.14 NECS File: 131.95, FHARE 123, Unsealed penetrations with fusible link chain penetrants through fire barriers
6.15 DCN DC2-SA-50330, Restore the 2-Hour Fire Barrier Between Fire Area 4-B and 4-B-2
6.16 Calculation 134-DC, Electrical Appendix R Analysis
6.17 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.18 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.19 NECS File: 131.95, FHARE 117, Safe Shutdown Analysis For Modifying Fire Area 4-A and 4-B Boundary Barriers
6.20 DCP M-049536, Combine Fire Areas 4-A and 4-B
6.21 NECS File: 131.95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.
6.22 NECS File: 131 .95, FHARE 77, Fiberglass Fume Hood Exhaust Ducts

FIRE AREAS 4-B-1 AND 4-B-2

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

These two areas are located at the south end of the Auxiliary Building next to the Counting and Chemical Laboratory, El. 85 ft.

1.2 Description

These areas are separate fire areas containing "G" and "H" bus circuitry. These areas are situated side by side with Fire Area 4-B-1 to the west and Fire Area 4-B-2 to the east. Due to similarities between these fire areas, they have been combined into one section.

1.3 Boundaries

1.3.1 Fire Area 4-B-1

North:

- 2-hour rated barrier separates this area from Area 4-B. (Ref. 6.5)

South:

- 3-hour rated barrier separates this area from Area 3-CC.

East:

- 3-hour rated barrier separates this area from Area 4-B-2.

West:

- 2-hour rated barrier separates this area from Area 4-B. (Ref. 6.5)
- A 3-hour rated door communicates to Area 4-B.

1.3.2 Fire Area 4-B-2

North:

- 2-hour rated barrier separates this area from Area 4-B. (Ref. 6.5)
- Pyrocrete enclosure surrounds junction box BPG5 on the 4-B side of the barrier. (Ref. 6.7)

- Three lesser rated penetration seals to Fire Area 4-B. (Ref. 6.10)

South:

- 3-hour rated barrier separates this area from Area 3-CC.

East:

- 2-hour rated barrier with a 1 1/2-hour rated hatch separates this area from Area 4-B. (Ref. 6.5)

West:

- 3-hour rated barrier separates this area from Area 4-B-1.

Floor/Ceiling (for both areas 4-B-1 and 4-B-2):

- 3-hour rated barriers.
- Floor to areas 3-K-2 and 3-K-3
- Ceiling to areas 5-B-1, 5-B-2, 5-B-3, and 5-B-4

2.0 COMBUSTIBLES

2.1 Fire Area 4-B-1

2.1.1 Floor Area: 120 ft^2

2.1.2 In situ Combustible Materials

- Cable insulation

2.1.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.1.4 Fire Severity

- Low

2.2 Fire Area 4-B-2

2.2.1 Floor Area: 102 ft^2

2.2.2 In situ Combustible Materials

- Cable insulation

2.2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.2.4 Fire Severity

- Low

3.0 FIRE PROTECTION (typical for each area)

3.1 Detection

- Smoke detection provided.

3.2 Suppression

- Portable fire extinguishers
- Hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Area 4-B-1

4.1.1 Auxiliary Feedwater

Valves LCV-106, 107, 108 and 109 may be affected by a fire in this area. Redundant valves LCV-110, LCV-111, LCV-113 and LCV-115 will remain available for safe shutdown.

4.1.2 Chemical and Volume Control System

Charging pumps 2-2 and 2-3 and ALOP 2-2 may be lost due to a fire in this area. Redundant charging pump and ALOP 2-1 will be available to provide charging flow.

Boric acid transfer pump 2-2 may be lost due to a fire in this area. Redundant boric acid transfer pump 2-1 will be available for this function.

Valve 8108 may be affected by a fire in this area. Redundant valve 8107 can be shut to isolate auxiliary spray during hot standby. The charging injection flowpath will remain available if the charging flowpath through the regenerative heat exchanger is disabled. The PORVs can be used for pressure reduction. Since this valve has redundant components, safe shutdown will not be affected.

A fire in this area may affect valves 8104 and FCV-110A. Since valve FCV-110A fails in the desired open position, safe shutdown is not affected. Manual valve 8471 must also be opened if FCV-110A is used for boric acid transfer.

Valves 8146, 8147 and 8148 may be affected by a fire in this area. Valve 8148 fails in the desired, closed position to isolate auxiliary spray during hot standby. The PORVs will remain available for pressure reduction. Valves 8146 and 8147 are required open if charging through the regenerative heat exchanger is desired. These valves fail open which is desired position and another charging flow path exists through the charging injection flowpath. The PORVs can be used for pressure reduction. Since redundant components are available, safe shutdown is not affected.

A fire in this area may result in the loss of HCV-142. This valve is not necessary for a fire in this area. Therefore, safe shutdown is not affected.

Valve LCV-112C may be affected by a fire in this area. Valve 8805A will remain available to provide water from the RWST to the charging pump suction. The volume control tank can be isolated by closing LCV-112B.

A fire in this area may affect valves LCV-459 and LCV-460. Safe shutdown is not affected since redundant valves 8149A, 8149B, and 8149C will be available to isolate letdown.

4.1.3 Component Cooling Water

A fire in this area may affect CCW pump and ALOP 2-2. CCW pumps and ALOPs 2-1 and 2-3 will remain available to provide component cooling water.

A fire in this area may affect valve FCV-431. Component cooling water heat exchanger 2-1 will remain available.

Valve FCV-365 may be affected by a fire in this area. Since this valve fails in the desired open and redundant valve FCV-364 will be available, safe shutdown is not affected.

4.1.4 Containment Spray

Containment spray pump 2-1 may spuriously operate due to a fire in this area. However, the discharge valve 9001A will remain closed. Therefore, the spurious containment spray pump operation has no impact on safe shutdown.

4.1.5 Diesel Fuel Oil System

Diesel fuel oil pump 0-2 may be lost due to a fire in this area. The redundant diesel fuel oil pump 0-1 remains available.

A fire in this area may affect valves LCV-85, LCV-86 and LCV-87. Redundant valves LCV-88, LCV-89 and LCV-90 will remain available.

4.1.6 Emergency Power

A fire in this area may disable diesel generator 2-1. Diesel generators 2-2 and 2-3 will remain available for safe shutdown.

A fire in this area may disable the diesel generator 2-2 backup control circuit. The normal control circuit will remain available.

A fire in this area may disable startup transformer 2-2. Onsite power from diesel generators 2-2 and 2-3 will remain available for safe shutdown.

All power supplies on the "G" Bus may be lost due to a fire in this area. These power supplies are not necessary since redundant trains on the "F" and "H" buses will be available.

A fire in this area may cause loss of power supplies associated with PY27N and PY26, of which one is required. PY27N remains available from its redundant power supplies SHD and SP2D.

4.1.7 Main Steam System

A fire in this area may result in the loss of the following components: LT-519, LT-549, PT-515, PT-525, PT-535 and PT-545. Safe shutdown is not affected because redundant trains of components exist for all four steam generators.

Valve PCV-21 may be affected by a fire in this area. Since this valve fails in the desired closed position and a redundant dump valve will remain available, safe shutdown will not be affected.

A fire in this area may prevent FCV-95 from delivering steam to AFW pump 2-1. Since AFW pumps 2-2 and 2-3 will remain available, safe shutdown will not be affected.

Valves FCV-41 and FCV-42 may be affected by a fire in this area. Manual actions can be taken to make these valves operational.

4.1.8 Reactor Coolant System

A fire in this area may result in the loss of the following components: LT-460, NE-32, TE-433A, TE-433B, TE-443A and TE-443B. Safe shutdown is not affected since redundant instrumentation exists.

Valves PCV-455C and 8000B may be affected by a fire in this area. Since PCV-455C fails in the desired, closed position and a redundant PORV will remain available, safe shutdown will not be affected.

Control of the reactor coolant pumps may be lost due to a fire in this area. Safe shutdown is not affected if the RCPs continuously run. CCW to the thermal barrier heat exchanger will remain available for RCP seal cooling.

Heater groups 2-3 and 2-4 may be affected by a fire in this area. Manual actions can be taken to de-energize heater group 2-4 and switch heater group 2-3 to the vital power supply. Therefore, safe shutdown will not be affected.

4.1.9 Residual Heat Removal System

RHR pump 2-1 and Recirc Valve FCV-641A may be lost due to a fire in this area. Redundant RHR pump 2-2 and recirc valve FCV-641B will be available to provide the RHR function.

Valve 8701 may be affected by a fire in this area. This valve is closed with its power removed during normal operation and will not spuriously operate. Also, this valve can be manually operated for RHR operations.

4.1.10 Safety Injection System

A fire in this area may result in the loss of the following valves: 8801B, 8803B and 8805B. The following redundant valves: 8801A, 8803A and 8805A will remain available to ensure safe shutdown.

Valves 8808B and 8808D may be affected by a fire in this area. These valves can be manually closed.

4.1.11 Auxiliary Saltwater System

ASW pump 2-2 may be lost due to a fire in this area. Redundant ASW pump 2-1 will be available to provide the ASW function.

A fire in this area may cause FCV-603 to be lost. Since a redundant ASW train will be available safe shutdown will not be affected.

4.1.12 HVAC

A fire in this area may result in the loss of one train of required HVAC equipment (E-102 and S-68). Safe shutdown is not affected since these two fans are not required for a fire in this area.

4.2 Fire Area 4-B-2

4.2.1 Auxiliary Feedwater

AFW pump 2-2 may be lost due to a fire in this area. Redundant pumps 2-1 and 2-3 will be available to provide AFW.

A fire in this area may affect valves LCV-110 and LCV-111. Redundant valves LCV-106, LCV-107, LCV-108 and LCV-109 from AFW Pump 2-1 and LCV-113 and LCV-115 from AFW Pump 2-3 will remain available.

4.2.2 Chemical and Volume Control System

Valve 8145 may be lost due to a fire in this area. Since redundant components exist, this valve will not be necessary.

A fire in this area may result in the loss of boric acid storage tank 2-2 level indication from LT-102. Borated water from the RWST will be available. Therefore, BAST level indication is not required.

Valve FCV-110A may be affected by a fire in this area. Since this valve fails in the desired, closed position, and redundant valve 8104 is available, safe shutdown is not affected.

4.2.3 Component Cooling Water

CCW pump and ALOP 2-3 may be lost for a fire in this area. Redundant CCW pumps and ALOPs 2-1 and 2-2 will be available to provide CCW.

Valve FCV-364 may be affected by a fire in this area. Since this valve fails in the desired, open position, safe shutdown is not affected. Redundant valve FCV-365 will also remain available for safe shutdown.

4.2.4 Containment Spray

Containment spray pump 2-2 may spuriously operate due to a fire in this area. However, the corresponding discharge valve, 9001B will not operate. Therefore, the spurious containment spray pump operation has no impact on safe shutdown.

4.2.5 Diesel Fuel Oil System

Diesel fuel oil pump 0-1 may be lost due to a fire in this area. Redundant diesel fuel oil pump 0-2 remains available.

A fire in this area may result in the loss of the following valves: LCV-88, LCV-89 and LCV-90. These valves can be lost since redundant valves: LCV-85, LCV-86 and LCV-87 will be available.

4.2.6 Emergency Power

A fire in this area may disable diesel generator 2-2. Diesel generators 2-1 and 2-3 will remain available for safe shutdown.

A fire in this area may disable diesel generator 2-3 backup control circuit. The normal control circuit will remain available.

A fire in this area may disable startup transformer 2-2. Onsite power from diesel generators 2-1 and 2-3 will remain available for safe shutdown.

The power supply on the "H" Bus may be lost due to a fire in this area. Redundant trains on the "G" and "F" buses will be available.

A fire in this area may disable dc panel SD21 backup battery charger ED221. Normal battery charger ED21 will remain available.

A fire in this area may disable dc panel SD22 backup battery charger ED221. Normal battery charger ED22 will remain available.

A fire in this area may cause loss of power supplies associated with PY27N. Redundant power supply PY26 remains available.

4.2.7 Main Steam System

A fire in this area may result in the loss of the following components: LT-518, LT-528, LT-538, LT-548, PT-526, and PT-536. Redundant components exist for all four steam generators, therefore, safe shutdown is not affected.

Valve PCV-20 may be affected by a fire in this area. Since this valve fails in its desired closed position, and redundant dump valves will remain available for cooldown, safe shutdown is not affected.

A fire in this area may affect valves FCV-43 and FCV-44. These valves can be manually closed to ensure safe shutdown.

4.2.8 Reactor Coolant System

A fire in this area may result in the loss of the following instrumentation: LT-461, NE-52 and PT-403. Since all of these instruments have redundant components, safe shutdown is not affected.

Valves PCV-456 and 8000C may be affected by a fire in this area. Since PCV-456 fails in the desired, closed position, and PORV PCV-455C will be available for RCS pressure reduction, safe shutdown is not affected.

Control of reactor coolant pumps 2-1, 2-2, 2-3 and 2-4 may be lost due to a fire in this area. Safe shutdown is not affected if the RCPs continuously run. CCW to the thermal barrier heat exchanger or seal injection will remain available for RCP seal cooling.

A fire in this area may affect pressurizer heater groups 2-1, 2-2 and 2-3. Manual actions can be taken to de-energize heater group 2-1 and switch heater group 2-2 to the vital power supply. Loss of vital power to pressurizer heater group 2-3 will not affect safe shutdown.

4.2.9 Residual Heat Removal System

RHR pump 2-2 and Recirc Valve FCV-641B may be lost for a fire in this area. Redundant RHR pump 2-1 and recirc valve FCV-641A will be available to provide the RHR function.

Valve 8702 may be affected by a fire in this area. This valve is closed with its power removed during normal operations and will not spuriously open. Also, this valve can be manually operated for RHR operations.

4.2.10 Safety Injection System

SI pump 2-2 may spuriously operate due to a fire in this area. Local manual action may be required to defeat this spurious operation.

Valve 8808C may be affected by a fire in this area. This valve can be manually closed.

4.2.11 Auxiliary Saltwater System

A fire in this area may affect valves FCV-495 and FCV-496. FCV-601 will remain closed to provide ASW system integrity.

4.2.12 HVAC

A fire in this area may result in the loss of one train of required HVAC equipment (FCV-5046, E-46, S-46 and S-67). Fan S-67 is not required and a redundant train of HVAC equipment (FCV-5045, E-45 and S-45) will be available to provide necessary HVAC support.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Safe shutdown will not be adversely affected by the loss of the equipment in each area due to the availability of redundant systems.

- Smoke detection is provided.

- Manual fire fighting equipment is available.
- Limited combustible loading.

The existing fire protection features provide a level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.2 Drawing No. 515568
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065126, Fire Protection Information Report, Unit 1
6.5 DCPP Unit 2 Report on 10 CFR 50, Appendix R Review (Rev. 0)
6.6 NRC Supplemental Safety Evaluation Report 31 for Diablo Canyon Power Plant, April 1985
6.7 DCN DC2-SA-50330, Restore the 2-Hour Fire Barrier Between Fire Area 4-B and 4-B-2
6.8 Calculation 134-DC, Electrical Appendix R Analysis
6.9 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.10 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers

FIRE AREA 34

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Roof area above the Auxiliary Building (El. 140 ft and 154 ft).

1.2 Description

This area is the space above the Auxiliary Building between the Unit 1 and Unit 2 Containment Buildings and the Fuel Handling Building.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

Unit 1 Containment Building

- 3-hour rated walls with some nonrated personnel and equipment hatches. [NC] (Ref 6.7)

South:

Unit 2 Containment Building

- 3-hour rated walls and some nonrated personnel and equipment hatches. [NC] (Ref. 6.7)

East:

Fuel Handling Building

- Nonrated exterior walls and doors to Fire Area 3-S, [NC] 3-R, [NC] 3-W [NC] and S-3. [NC]

West:

Turbine Building

- Nonrated exterior walls. [NC]

Auxiliary Building

- 3-hour rated walls with some nonrated penetrations and/or openings. This fire area communicates with Fire Areas S-2, 8-B-3, NC 8-B-4, NC 8-B-5, NC 8-B-6, NC 8-B-7, NC and 8-B-8 NC through ventilation exhaust and intake openings without fire dampers.
- Nonrated exterior walls to Fire Areas 8-B-1 NC and 8-B-2. NC (Ref. 6.12).

Control Room

- 3-hour rated walls with penetrations sealed commensurate with the hazards to which they could be exposed to Fire Zones 8A, 8C, 8D, and Fire Areas 8H and 8G. (Ref. 6.13)

2.0 COMBUSTIBLES

2.1 Floor Area: 24,536 ft^2

2.2 In Situ Combustible Materials

- Bulk Cable
- Clothing/Rags
- Neoprene
- Polyethylene
- Paper
- Plastic
- Rubber
- Wood (fir)

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- None

3.2 Suppression

- Hose stations
- Portable fire extinguishers
- Wet pipe automatic sprinkler systems in both outage access control facilities

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Unit 1 Equipment

4.1.1 Chemical and Volume Control System

A fire in this area may result in the loss of boric acid storage tank 1-2 level indication from LT-106. Borated water from the RWST will remain available. Therefore, BAST level is not required.

4.1.2 Main Steam System

Ten percent dump valves PCV-21 and PCV-22 may be affected due to a fire in this area. Air can be isolated and vented to fail PCV-21 and PCV-22 closed. Redundant dump valves PCV-19 and PCV-20 will remain available for cooldown.

4.1.3 HVAC

Fans S-44, E-44, S-43 and E-43 may be lost due to a fire in this area. Operator actions may be necessary to install portable fans.

4.2 Unit 2 Equipment

4.2.1 Chemical and Volume Control System

A fire in this area may result in the loss of boric acid storage tank 2-1 and 2-2 level indication from LT-106 and LT-102, respectively. Borated water from the RWST will remain available. Therefore, BAST level is not required.

4.2.2 Main Steam System

A fire in this area may affect valve PCV-21 and PCV-22. Redundant dump valves PCV-19 and PCV-20 will remain available for cooldown.

4.2.3 HVAC

A fire in this area may affect fans S-45, E-45, S-46 and E-46. Operator action may be necessary to install portable fans. (Refs. 6.8 and 6.9)

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- The redundant train, of the 10% relief valves will not be affected by fire in this area due to spatial separation.

- Manual fire protection equipment is available in the vicinity to provide adequate capabilities.

- Automatic wet pipe sprinklers are provided for both Unit-1 and Unit-2 Outage Access Control Facilities. Flow alarms annunciate in the Control Room for immediate response by the fire brigade.

- Open-air location provides for rapid dissipation of heat and the products of combustion generated by a fire.

This fire area meets the requirements of 10 CFR 50, Appendix R, Section III.G and there are no exemptions requested.

6.0 REFERENCES

6.1 Drawing Nos. 515571, 515572
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 SSER 23, June 1984
6.4 SSER 31, April 1985
6.5 Calculation M-824, Combustible Loading

6.6 Drawing 065126 and 065127, Fire Protection Information Report, Units 1 and 2
6.7 NECS File: 131.95, FHARE: 94, Containment Personnel Airlock Doors
6.8 Calculation M-911, Evaluation of Safe Shutdown Equipment During Loss of HVAC
6.9 Calculation M-912, HVAC Interactions for Safe Shutdown
6.10 Calculation 134-DC, Electrical Appendix R Analysis
6.11 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.12 NECS File: 131.95, FHARE 155, Removal of Auxiliary Building Supply Fan Room Exterior Walls from the Fire Protection Program
6.13 NECS File: 131 .95, FHARE 89, Copper Pipes Through Foam Seals

FIRE AREA AB-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This zone is located at the east end of the Auxiliary Building and occupies El. 55 ft through 104 ft.

1.2 Description

This zone houses the liquid hold up tanks for both units and is compartmentalized for each hold up tank.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

El. 64 ft

North:

- A 3-hour rated barrier to below grade. [NC]

South:

- A 3-hour rated barrier to below grade. [NC]

East:

- A 3-hour rated barrier to below grade. [NC]

West:

- A nonrated barrier to fire zone 3-C. [NC]

Floor:

- A 3-hour barrier to below grade. [NC]

El. 73 ft

North:

- A 3-hour rated barrier to below grade. NC

South:

- A 3-hour rated barrier to below grade. NC

West:

- A nonrated door communicates to zone 3-F. NC
- A nonrated barrier to zone 3-F. NC
- A nonrated barrier to zone 3-C. NC
- A nonrated barrier to zone 3-G. NC
- A nonrated door communicates to zone 3-G. NC

East:

- A 3-hour barrier to below grade. NC

El. 85 ft

North:

- A 3-hour rated barrier to zone 3-P-3. NC
- A duct penetration without a fire damper to zone 3-P-3. NC (Ref. 6.4)

South:

- A 3-hour rated barrier to zone 3-V-3. NC
- A duct penetration without a fire damper to zone 3-V-3. NC (Ref. 6.4)

East:

- A 3-hour rated barrier to below grade. NC

West:

- A nonrated barrier to zone 3-L. NC
- A non-rated barrier containing duct penetration without dampers to Fire Areas 3-P-3 NC and 3-V-3. NC

El. 100 ft

North:

- A 3-hour rated barrier to Fire Area 3-Q-1, except for a 2-hour rated blockout. (Ref. 6.5)
- A lesser rated penetration seal to Fire Area 3-Q-1. (Ref. 6.9)

South:

- A 3-hour rated barrier to Fire Area 3-T-1, except for a 2-hour rated blockout. (Ref. 6.5)
- Lesser rated penetration seal to Fire Area 3-J-1. (Ref. 6.9)

East:

- A 3-hour rated barrier to below grade. NC

West:

- A nonrated barrier to zone 3-X. NC
- Six duct penetrations without fire dampers to Fire Zone 3-X. NC
- Two nonrated doors communicate to zone 3-X. NC

Ceiling:

- A nonrated barrier to zone 3-AA above. NC

2.0 COMBUSTIBLES

2.1 Floor Area: 2,832 ft^2

2.2 In situ Combustible Materials

- Rubber

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- None

3.2 Suppression

- None

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Chemical and Volume Control System

A fire in this area may spuriously close FCV-110A. Redundant valve 8104 will remain available for safe shutdown.

Boric acid storage tank 2-1 level indication from LT-106 may be lost due to a fire in this area. Borated water from the RWST will remain available. Therefore, BAST level indication is not required.

5.0 CONCLUSION

The following features mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- A trained fire brigade is on-site at all times and is responsible for fire suppression.
- Redundant components are available outside of the fire area.

These functions are considered adequate to assure that safe shutdown capability will not be compromised from a design basis fire in this zone/area.

6.0 REFERENCES

6.1 Drawings: 515566, 515567, 515568, 515569
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation No. M-824, Combustible Loading
6.4 FHARE 60, Undampered Ventilation Ducts
6.5 NECS File: 131.95, FHARE 125, Lesser rated plaster blockouts and penetration seal configurations
6.6 Drawing 065127, Fire Protection Information Report, Unit 2
6.7 Calculation 134-DC, Electrical Appendix R Analysis
6.8 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.9 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers

FIRE AREA AB-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fire Zone 3-AA is located on the east side of the Auxiliary Building at El. 115 ft. It runs from the Unit 1 Fuel Handling Building and Containment Penetration Area (3-BB) on the north to the Unit 2 Fuel Handling Building and Containment Penetration Area (3-CC) on the south.

1.2 Description

This zone contains the boric acid storage tanks and radwaste processing equipment. The north half of Fire Zone 3-AA contains the tanks for Unit 1; the south half contains Unit 2 equipment.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- 3-hour rated barriers to Fire Areas 3-BB and 6-B-4 and to Fire Zones S-2, S-3 and 3-R. [NC]
- Three 1-1/2-hour rated doors, one to Fire Area 3-BB and to Fire Zone S-3, one to Fire Zone S-2. (Ref. 6.12).
- Lesser rated penetration seal to Fire Area 3-BB. (Ref. 6.11)
- A 3-hour rated roll-up door to Fire Zone 3-R. [NC]
- Duct penetration without a fire damper communicates to Fire Zone 3-R. [NC]

South:

- 3-hour rated barriers to Fire Areas 3-CC and 6-A-4 and Fire Zones S-4 and 3-W, [NC] S-2.
- Three 1-1/2-hour rated doors, one to each of the Fire Area 3-CC and Zones S-4 and S-2. (Ref. 6.13)
- Two 3-hour rated roll-up doors to Fire Zone 3-W. [NC]
- Two duct penetration without fire dampers communicate to Fire Zone 3-W. [NC]

East:

- 3-hour rated barriers to Fire Zones S-3 and S-4.
- Nonrated barrier to the exterior (Fire Areas 28 and 29) (Grade Level).
- A nonrated door to the exterior (Area 28) (Grade Level).
- A nonrated roll up door to the exterior (Area 28) (Grade Level).

West:

- 3-hour rated barrier to Fire Areas 6-A-4 and 6-B-4, and to Zones S-3 and S-4.

Floor/Ceiling:

- Nonrated barriers: Floor to Fire Zones 3A, NC 3X, NC and 3C NC
  Ceiling to Fire Zone 3-S, NC and Areas 34, NC
  8-B-1, NC and 8-B-2. NC
- Duct penetrations without fire dampers communicate to Fire Zone 3-X. NC
- Equipment hatches to Fire Zones 3-X NC below, and 3-S NC above.
- A 3-hour rated concrete equipment hatch in 3-hour rated barrier communicates to Fire Zones 3-B-1, 3-B-2, 3-D-1, and 3-D-2 (below) on unprotected steel supports with unsealed gaps. (Refs. 6.7 and 6.8)

2.0 COMBUSTIBLES

2.1 Floor Area: 16,674 ft^2

2.2 In situ Combustible Loading

- Cable Insulation
- Lubricants
- Paper
- Wood
- Rubber
- Oil (#2 fuel)
- Miscellaneous Class A and B Combustibles

2.3 Transient Combustible Loading

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags

- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Partial smoke detection (in the vicinity of boric acid storage tanks and spent resin storage tanks.)

3.2 Suppression

- Portable fire extinguishers
- Fire hose stations
- Automatic sprinkler system in the vicinity of the radwaste compaction area

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Unit 1 Equipment

4.1.1 Auxiliary Feedwater

A fire in this area may affect condensate storage tank level indication from LT-40. FCV-436 and FCV-437 can be manually opened to supply water from the raw water storage reservoir.

4.1.2 Chemical and Volume Control System

Valves 8104 and FCV-110A may be affected by a fire in this area. One of these valves must be open to provide boric acid solution to the charging pumps. Valve 8104 can be manually opened to provide this function.

A fire in this area may spuriously open FCV-110B and FCV-111B. These valves can be manually closed.

Valves HCV-104 and HCV-105 may be affected by a fire in this area. One of these valves must be closed when a boric acid transfer pump is running. Therefore, since both of these valves fail closed, safe shutdown is not affected.

A fire in this area may affect valves LCV-112B, LCV-112C, 8805A and 8805B. The running charging pump 1-1 or 1-2 can be tripped from the control room, and then restarted after aligning the RWST supply and isolating the VCT supply valves. Both sets of valves can be manually operated to isolate the VCT (LCV-112B, 112C) and provide water to the charging pumps from the RWST (8805A and 8805B).

A fire in this area may result in the loss of LT-102 and LT-106 which provide BAST1-1 and 1-2 level indication. Borated water from the RWST will remain available. Therefore, BAST level is not required.

<u>4.1.3 Main Steam System</u>

A fire in this area may result in the loss of the following valves: FCV-244, FCV-246, FCV-248, FCV-250, FCV-151, FCV-154, FCV-157 and FCV-160. Since redundant components FCV-760, 761, 762 and 763 are available, safe shutdown will not be affected.

Main steam isolation valves FCV-43 and FCV-44 and their bypass valves FCV-22 and FCV-23 may be affected by a fire in this area. These valves can be manually operated to ensure safe shutdown.

<u>4.1.4 Reactor Coolant System</u>

A fire in this area may affect pressurizer heater groups 1-1. This heater group can be manually de-energized. Therefore, safe shutdown is not affected.

Control of reactor coolant pumps 1-2 and 1-4 may be lost due to a fire in this area. However, operation of these pumps will not affect safe shutdown. CCW to the thermal barrier heat exchanger or seal injection will remain available for RCP seal cooling.

<u>4.1.5 Residual Heat Removal System</u>

Control circuitry for RHR pumps 1-1, 1-2, FCV-641A and FCV-641B may be damaged by a fire in this area. Prior to locally starting either RHR Pump 1-1 or 1-2, locally open its respective recirc valve (FCV-641A or FCV-641B).

.

4.1.6 Safety Injection System

A fire in this area may affect RWST Level Transmitter LT-920. Spurious operation of equipment that may divert the RWST inventory is not affected in this fire area. Therefore, loss of this instrument will not affect safe shutdown.

4.2 Unit 2 Equipment

4.2.1 Auxiliary Feedwater

A fire in this area may affect condensate storage tank level indication from LT-40. FCV-436 and FCV-437 can be manually opened to supply water from RWSR.

4.2.2 Chemical and Volume Control System

Valves 8104 and FCV-110A may be affected by a fire in this area. One of these valves must be open to provide boric acid solution to the charging pumps. Valve 8104 can be manually opened to provide this function.

A fire in this area may spuriously open FCV-110B and FCV-111B. These valves can be manually closed.

Valves HCV-104 and HCV-105 may be affected by a fire in this area. One of these valves must be closed when a boric acid transfer pump is running. Therefore, since both of these valves fail closed, safe shutdown is not affected.

A fire in this area may affect valves LCV-112B, LCV-112C, 8805A and 8805B. The running charging pumps 2-1 and 2-2 can be tripped from the control room to prevent cavitation and restarted after aligning the RWST supply and isolating the VCT supply valves. Both sets of valves can be manually operated to isolate the VCT (LCV-112B, 112C) and provide water to the charging pumps from the RWST (8805A and 8805B).

A fire in this area may result in the loss of LT-102 and LT-106 which provide BAST 2-2 and 2-1 level indication. Borated water for the RWST will remain available. Therefore, BAST level is not required.

4.2.3 Main Steam System

A fire in this area may result in the loss of the following valves: FCV-244, FCV-246, FCV-248, FCV-250, FCV-151, FCV-154, FCV-157 and FCV-160. Since redundant components FCV-760, 761, 762 and 763 area available, safe shutdown will not be affected.

A fire in this area may result in the loss of LT-529 and LT-539 which provide steam generator 2-2 and 2-3 level indication. Redundant level transmitters will remain available for steam generator level indication.

4.2.4 Reactor Coolant System

A fire in this area may affect valve PCV-455A. Since this valve fails in the desired, closed position, safe shutdown is not affected.

A fire in this area may spuriously energize pressurizer heater group 2-1. This heater group can be manually tripped to ensure safe shutdown.

A fire in this area may affect valve PCV-455B and prevent RCP 2-2 from turning off. Safe shutdown is not affected if the reactor coolant pumps continuously run.

4.2.5 Residual Heat Removal System

RHR pumps 2-1, 2-2, FCV-641A and FCV-641B may be lost for a fire in this area. Prior to starting either RHR Pump 2-1 or 2-2, locally open its respective recirc valve (FCV-641A or FCV-641B).

4.2.6 Safety Injection System

A fire in this area may affect RWST Level Transmitter LT-920. Spurious operation of equipment that may divert the RWST inventory is not affected in this fire area. Therefore, loss of this instrument will not affect safe shutdown.

5.0 CONCLUSION

The following features will adequately mitigate the consequences of a design basis fire and assure the ability to achieve safe shutdown.

- Detection in the vicinity of the BA tanks and spent resin storage tanks.
- Automatic sprinklers in the south-east corner of the area.
- Manual action that will mitigate the effects of a design basis fire.

This zone meets the requirements of 10 CFR 50, Appendix R, Section III.G. and no exemptions or deviations have been requested.

6.0 REFERENCES

6.1 Drawing No. 515570
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.4 Calculation M-824, Combustible Loading
6.5 Drawing 065126 and 065127, Fire Protection Information Report, Units 1 and 2
6.6 Appendix 3 for EP M-10 Unit 1 - Fire Protection of Safe Shutdown Equipment
6.7 NECS File: 131.95, FHARE 14, Concrete Equipment Hatches
6.8 PLC Report: Structural Steel Analysis for Diablo Canyon, Rev. 2 (7/08/86)
6.9 Calculation 134-DC, Electrical Appendix R Analysis
6.10 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.11 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.12 SSER - 23
6.13 SSER - 31

FIRE AREA AB-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fire Zone 3-C is in the Auxiliary Building at elevations below 85 ft. It is the bulk of the center of the Auxiliary Building and is called the Units 1 and 2 Drain Receiving Tank and Gas Decay Tanks.

1.2 Description

This zone incorporates El. 54 ft, 64 ft and 73 ft except for various Units 1 and 2 pump and equipment rooms to the north and south of this zone. Fire Zone 3-C contains Unit 1 and 2 equipment drain tanks, floor drain tanks, waste gas compressors, gas decay tanks, Auxiliary Building sump pumps, radwaste filters, and waste concentrator tanks and associated transfer pumps. Additionally, Fire Zone 3-C contains the Tool Room Area, located on the 60-ft elevation bounded by column lines 19^{2} and 20^{3} by column lines H^{1} and L. (Reference 6.15)

(Note: The east-west corridor on the 64-ft elevation bounded by column lines 18^{6} and19^{2} by column lines H and L, and the north-south corridor on the 60-ft elevation bounded by column lines 19^{2} and 20^{3} by column lines H and J are subjected to a combustible loading limitation.)

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

El. 54 ft

North:

- 3-hour rated barrier to Fire Areas 3-B-1 and 3-B-2, Fire Zone 3-B-3, [NC] and to below grade. [NC]
- 3-hour rated barrier to Fire Zone S-2. This barrier includes an unsealed penetration covered by a grate. (Ref 6.17).
- A 1-1/2-hour rated door to Fire Zone S-2.
- Overflow openings to Fire Areas 3-B-1 and 3-B-2. (Ref. 6.3)

South:

- 3-hour rated barrier to Fire Areas 3-D-1 and 3-D-2, Fire Zone 3-D-3, NC and to below grade. NC
- 3-hour rated barrier to Fire Zone S-2. This barrier includes an unsealed penetration covered by a grate. (Ref 6.17).
- A 1-1/2-hour rated door to Fire Zone S-2.
- Overflow opening to Fire Areas 3-D-1 and 3-D-2. (Ref. 6.7)

East/West:

- 3-hour rated barrier to below grade. NC
- 3-hour rated barrier to the west to Fire Zone S-2. This barrier includes an unsealed penetration covered by a grate. (Ref 6.17)

<u>El. 60 ft – Tool Room Area (Unit 2 side of Fire Zone 3-C)</u>

North:

- 3-hour rated barrier to Fire Zone 3-C. NC
- 3 duct penetrations with 3-hour rated dampers to Fire Zone 3-C (Ref. 6.16).

South:

- 3-hour barrier to grade. NC

East:

- 3-hour rated barrier to Fire Area 3-D-1.

West:

- 3-hour rated barrier to Fire Zone 3-C.
- Two 3-hour rated doors to Fire Zone 3-C.

Ceiling:

- 3-hour rated barrier to Fire Area 3-I-1 and Fire Zones 3-K-1, 3-K-2, and 3-K-3.
- One duct penetration with a 3-hour rated damper to Fire Zone 3-K-2 (Ref. 6.16).

El. 64 ft

North:

- 3-hour rated barrier to Fire Areas 3-D-2, 3-B-1 and 3-B-2, and to Fire Zones S-2 and S-3.
- A 1-1/2-hour rated door to Fire Zone S-2.
- 1 1-1/2-hour rated doors to Fire Zone S-3.
- An opening in the 3-hour fire barrier to Fire Zone 3-B-3. [NC]

South:

- 3-hour rated barrier to Fire Areas 3-B-2, 3-D-1 and 3-D-2, and to Fire Zones S-2 and S-4, and to below grade. [NC]
- A 1-1/2-hour rated doors to Fire Zone S-4.
- A 1-1/2-hour rated door to Fire Zone S-2.
- An opening in the 3-hour fire barrier to Fire Zone 3-D-3. [NC]

East:

- A nonrated barrier to Fire Zone 3-A. [NC]
- 3-hour rated barrier to Fire Zones S-2, S-3, S-4, and below grade. [NC]
- 3-hour rated barrier with a duct penetration without a damper to Fire Areas 3-B-1 and 3-D-1. (Refs. 6.3 and 6.7)

West:

- 3-hour rated barrier to Fire Zones S-2, S-3, and S-4, and to below grade. [NC]
- A 1-1/2-hour rated door to Fire Zones S-2, S-3, and S-4.
- 3 duct penetrations without dampers to Area 3-B-2. (Refs. 6.3 and 6.11)
- 3-hour rated barrier with three undampered duct penetrations to each Fire Area 3-B-2 and 3-D-2. (Refs. 6.3 and 6.7)

Ceiling:

- Two open penetrations to the 73-ft elevation of 3-J-3. (Ref. 6.8)
- One duct penetration without a damper to Zone 3-J-2.

Floor:

- 3-hour barrier to grade. [NC]

El. 73 ft

North:

- 3-hour rated barrier to Fire Areas 3-H-1 and 3-H-2, and to Fire Zone S-2.
- A 1-1/2-hour rated door to Fire Zone S-2.
- Two 3-hour-equivalent rated fire doors with water spray directed on them communicate to Fire Area 3-H-1. (Ref. 6.18)
- Two duct penetrations without damper to Area 3-H-1. (Ref. 6.3)
- A duct penetration without damper to Area 3-H-2. (Ref. 6.3)
- Zone opens to Zone 3-F, 3-J-1, 3-J-2, and 3-J-3. (Ref. 6.3)
- A nonrated opening penetrates into Zone 3-H-1. (Ref. 6.9)
- Lesser rated penetration seals into Zone 3-H-1. (Ref. 6.14)

South:

- 3-hour rated barrier to Fire Areas 3-I-1 and 3-I-2, and to Fire Zone S-2.
- A 1-1/2-hour rated door to Fire Zone S-2.
- Two duct penetrations without dampers to Fire Area 3-I-1. (Ref. 6.7)
- Lesser rated penetration seal to Fire Area 3-I-1. (Ref. 6.14)
- A duct penetration without dampers to Fire Area 3-I-2. (Ref. 6.7)
- Two 3-hour-equivalent rated fire doors with water spray directed on them communicate to Fire Area 3-I-1. (Ref. 6.18)
- Zone opens to Zones 3-G, 3-K-1, 3-K-2 and 3-K-3. (Ref. 6.7)

East:

- 3-hour rated barrier to Fire Zone S-2.
- Nonrated barrier to Fire Zone 3-A. [NC]
- A 2-hour rated plaster blockout panel communicates to Areas 3-H-1 and 3-I-1. (Ref. 6.10)

West:

- Two 3-hour rated doors with water spray directed on them communicate to Areas 3-H-1 and 3-I-1. (Ref. 6.18)
- 3-hour rated barrier to Fire Zone S-2 and to below grade. [NC]

Ceiling:

- Duct penetrations communicate to Fire Zone 3-L. [NC]
- Two equipment hatches to Fire Zone 3-L. [NC]
- 3-hour rated barrier to Fire Zones 4A and 4B. (Ref. 6.19)

2.0 COMBUSTIBLES

2.1 Floor Area: 10,772 ft^2

2.2 In situ Combustible Materials

- Cable insulation
- Lube Oil
- Clothing/Rags
- Plastic
- Rubber
- Paper
- PVC
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

2.4.1 Fire Zone 3-C, Excluding Tool Room Area (Floor Area = 9131 ft^2)

- Low

2.4.2 Tool Room Area (Floor Area = 1641 ft^2)

- Low

2.5 Limitation of Combustible Loading

The east-west corridor on the 64-ft elevation bounded by column lines 18^{6} and 19^{2} by column lines H and L, and the north-south corridor on the 60-ft elevation bounded by column lines 19^{2} and 20^{3} by column lines H and J are limited in the amount of combustible material (plastic/rubber/Class A) that may be stored there. The limit is 375 lb for both of these areas. This ensures a fire duration of 3 minutes or less in these areas. No extension cords or flammable fluids can be stored in this area.

The Tool Room area, located on the 60-ft elevation bounded by column lines 19^{2} and 20^{3} by column lines H^{1} and L is limited in the amount of combustible material (plastic/rubber/Class A) that may be stored there. The limit is 10,000 lb. This ensures a fire-duration of 37 minutes or less in this area.

3.0 FIRE PROTECTION

3.1 Detection

- Partial smoke detection

3.2 Suppression

- Portable fire extinguishers
- Fire hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Unit 1 Equipment

4.1.1 Chemical and Volume Control System

A fire in this area may damage charging pump 1-3. Redundant charging pumps 1-1 and 1-2 will remain available for safe shutdown.

4.1.2 Diesel Fuel Oil System

Diesel fuel oil pump 0-1 and 0-2 may be affected by a fire in this area. SSER 23 justifies that at least one of these pumps will remain available for safe shutdown. Offsite power will also be available for safe shutdown in the event diesel fuel oil pump circuits are damaged by a fire. Therefore, safe shutdown will not be affected.

4.1.3 Residual Heat Removal System

Control circuitry for RHR pumps 1-2, FCV-641A and FCV-641B may be damaged by a fire in this area. Redundant RHR pump 1-1 will remain available. Prior to starting either RHR Pump 2-1 or 2-2, locally open its respective recirc valve (FCV-641A or FCV-641B) located in fire area 3D1 and 3D2 after opening its associated power supply breaker (52-2G-29 or 52-2H-15) located in SPG and SPH.

4.1.4 Auxiliary Saltwater System

ASW valves FCV-495 and FCV-496 may be affected by a fire in this area. Redundant valve FCV-601 will remain available, thus no manual actions are required.

4.2 Unit 2 Equipment

4.2.1 Chemical and Volume Control System

A fire in this area may damage charging pump 2-3. Redundant charging pumps 2-1 and 2-2 will remain available for safe shutdown.

4.2.2 Residual Heat Removal System

Control circuitry for RHR pumps 2-1, 2-2, FCV-641A and FCV-641B may be damaged by a fire in this area. Prior to starting either RHR Pump 2-1 or 2-2, locally open its respective recirculation valve (FCV-641A or FCV-641B) located in fire area 3D1 and 3D2 after opening its associated power supply breaker (52-2G-29 or 52-2H-15) located in SPG and SPH.

4.2.3 Auxiliary Saltwater System

ASW valves FCV-495 and FCV-496 may be affected by a fire in this area. Redundant valve FCV-601 will be available, thus no manual actions are required.

4.2.4 HVAC

A fire in this area may result in the loss of one train of E-102. Redundant HVAC equipment, E-104 will be available to provide necessary HVAC support.

5.0 CONCLUSION

This zone does not meet the requirements of 10 CFR 50, Appendix R, Section III G.2, because area wide automatic fire suppression is not provided in this zone.

- A request for a deviation was requested and was granted as stated in SSERs 23 and 31.

This zone does not meet requirements of 10 CFR 50, Appendix R, Section III.G.2, because doors installed in fire rated barriers that separate redundant shutdown divisions, are required to have a fire rating equal to the barrier:

- A request for a deviation was submitted and was granted as stated in SSERs 23 and 31.

The following features will adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Fire protection equipment is available.

- Limited combustible loading.

- Partial smoke detection is provided.

- Redundant functions are adequately protected from a fire in this zone.

The east-west corridor on the 64-ft elevation bounded by column lines $18^{\underline{6}}$ and $19^{\underline{2}}$ by column lines H and L, and the north-south corridor on the 60-ft elevation bounded by column lines $19^{\underline{2}}$ and $20^{\underline{3}}$ by column lines H and J are limited to a combustible loading of 4,000 Btus/ft^2. This limitation is to ensure the combustible load in this portion of Fire Zone 3-C is very low, which is credited in SSERs 23 and 31 for the vicinity around the CCW pump rooms. Section 9.6.1.7 of SSER 31 characterizes 4,600 Btu/ft^2 with an equivalent fire severity of 3.4 minutes as a "low fire load". The DCPP fire protection group has established, based on this SSER characterization, that 4,000 Btu/ft^2, with an equivalent fire severity of 3 minutes, is low combustible loading and will be used as the limitation for the area described above. A fire severity of 3 minutes is an insignificant fire and will not impact the CCW pump rooms above the area where the limitation is being imposed.

The Tool Room area is enclosed within 3-hour rated barriers, doors, and dampers to prevent a fire in this area from impacting the vicinity around the CCW pump rooms.

The existing fire protection will provide an acceptable level of fire safety equivalent to that provided by Section III G.2.

6.0 REFERENCES

6.1 Drawings 515566 and 515567
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 SSER 23, June 1984
6.4 Calculation M-824, Combustible Loading
6.5 Drawings 065126 and 065127, Fire protection Information Report, Units 1 and 2
6.6 DCPP Unit 2 - Review of 10 CFR 50, Appendix R (Rev. 2)
6.7 SSER 31, April 1985
6.8 NECS File: 131.95, FHARE: 124, Unsealed penetrations through barrier 119
6.9 NECS File: 131.95, FHARE: 25, Nonrated Features in the Units 1 and 2 Centrifugal Charging Pump Rooms (CCP1 and CCP2)
6.10 NECS File: 131.95, FHARE 50, Plaster Block-out Panels in 3-Hour Barriers
6.11 NECS File: 131.95, FHARE 136, Unrated HVAC Duct Penetrations
6.12 Calculation 134-DC, Electrical Appendix R Analysis
6.13 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.14 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.15 Design Change Package C-49819, Installation of Fire Barriers for Tool Room Area in 60 ft Elevation Auxiliary Building.
6.16 NECS File: 131.95, FHARE 149, Non-Rated Fire Dampers.
6.17 NECS File: 131.95, FHARE 156, Unsealed Penetrations in Barriers between Fire Zones 3-C and S-2 within Fire Area AB-1.
6.18 NECS File: 131 .95, FHARE 159, Unrated Doors Protected by Local Automatic Sprinklers.
6.19 NECS File: 131 .95, FHARE 111, Glass Pipe Penetrants

FIRE AREA AB-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This zone is the boric acid and waste evaporator area and is located at the west end of the Auxiliary Building at El. 85 and 100 ft. Note: The boric acid and waste evaporator have been abandoned in place.

1.2 Description

This fire zone consists of the bulk of the 85-ft elevation of the Auxiliary Building to the east of access control. The central portion of the zone extends up to El. 115 ft. This zone serves Unit 1 and Unit 2.

1.3 Boundaries

Elevation 85 ft

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- 3-hour rated barriers to Fire Areas 3-BB, 3-B-1 and 3-B-2, to Fire Zones 3-P-3, [NC] 3-M, [NC] S-2 and S-3.
- One 1-1/2-hour rated door to each of Zones 3-M [NC] and S-2 and Area 3-BB.
- Lesser rated penetration seals to Fire Area 3-BB. (Ref. 6.11)
- A 1-1/2-hour-equivalent rated door and exhaust duct penetration without a fire damper in 1-hour pyrocrete walls communicates with concrete exhaust ducts to Zone 3-P-3. [NC] (Ref. 6.6)

South:

- 3-hour rated barrier to Fire Areas 3-CC, 3-D-1, and 3-D-2, and to Fire Zones 3-V-3, [NC] 3-N, [NC] S-2, and S-4.
- One 1-1/2-hour rated door to each of 3-N, [NC] S-2, and S-4, and to Area 3-CC.
- A 1-1/2-hour-equivalent rated door and exhaust duct penetration without a fire damper in 1-hour pyrocrete walls communicates with concrete exhaust ducts to Zone 3-V-3. [NC] (Ref. 6.6)
- Lesser rated penetration seals to Area 3-CC. (Ref. 6.11)

East:

- 3-hour rated barrier to Fire Zones S-3, S-4, 3-M, NC and 3-N. NC
- Nonrated wall to Fire Zone 3-A.

West:

- 3-hour rated barrier to Fire Zones S-2, S-3, S-4, 3-M, NC 3-N, NC and 4B.
- 2-hour rated barrier to Fire Area 4-A.
- 1-1/2-hour rated doors communicate to Fire Zones S-3 and S-4.
- Duct penetrations without fire dampers communicate with Fire Areas 4-A and 4-B. (Ref. 6.13)

Floor/Ceiling:

- 3-hour rated barriers to Areas 3-H-1, 3-H-2, 3-I-1 and 3-I-2.
- Two equipment hatches to Fire Areas 3-C NC below and 3-X NC above.

<u>Elevation 100 ft</u>

North:

- A nonrated barrier to Fire Zone 3-X. NC

South:

- A nonrated barrier to Fire Zone 3-X. NC

East:

- A nonrated barrier to Fire Zone 3-X. NC

West:

- A 3-hour rated barrier to Fire Zone S-2.

Ceiling:

- A nonrated barrier to Fire Zone 3-AA. NC

(Note: Electrical and mechanical penetrations through rated fire area boundaries have seals installed which provide a fire rating commensurate with the hazard to which they may be exposed.)

2.0 COMBUSTIBLES

2.1 Floor Area: 7,588 ft^2

2.2 In situ Combustible Materials

- Cable insulation
- Lubricants
- Methane
- Alcohol
- Clothing/Rags
- Paper
- Wood (fir)
- Miscellaneous (RP)
- Plastic
- Rubber
- Polyethylene

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Partial smoke detection

3.2 Suppression

- Portable fire extinguishers
- Fire hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Unit 1 Equipment

4.1.1 Auxiliary Feedwater

AFW pumps 1-2 and 1-3 may be lost due to a fire in this area. Although AFW pump 1-2 and 1-3 circuits are protected by a fire barrier enclosure, redundant AFW pump 1-1 will remain available to provide AFW to the steam generators.

4.1.2 Chemical and Volume Control System

Valve 8104 may be lost due to a fire in this area. Valves FCV-110A and 8471 (manual valve) will remain available to provide boric acid solution to the Chemical and Volume Control System.

Charging pump 1-3 and ALOP 1-2 may be lost due to a fire in this area. Charging pump 1-1 and ALOP 1-1 will remain available to provide charging flow.

A fire in this area may affect valves LCV-112B, LCV-112C, 8805A and 8805B. The running charging pumps can be tripped from the control room, and charging pump 1-1 restarted after aligning the RWST supply valve and isolating the VCT supply valve. Valves LCV-112B and LCV-112C can be manually closed to isolate the volume control tank while valves 8805A and 8805B can be manually opened to provide water from the RWST to the charging pump suction.

Boric acid transfer pumps 1-1 and 1-2 may be lost due to a fire in this area. However, this is acceptable based on the boron inventory available through the RWST.

A fire in this area may affect FT-134. Because letdown isolation valves LCV-459, LCV-460, 8149A, 8149B, and 8149C are not affected in this fire area and will remain available to isolate letdown, this diagnostic indication is not required.

4.1.3 Main Steam System

Main steam system valves FCV-244, FCV-246, FCV-248, and FCV-250 may be affected by a fire in this area. Valves FCV-760, FCV-761, FCV-762 and FCV-763

will remain available to close the steam generator blowdown isolation lines in order to control reactor coolant temperature. Therefore, no manual actions are required.

4.1.4 Residual Heat Removal System

Control circuitry for RHR pumps 1-1 and 1-2 FCV-641A and AC control cables for FCV-641A and FCV-641B may be damaged by a fire in this area. Prior to starting either RHR Pump 1-1 or 1-2, locally open its respective recirc valve (FCV-641A or FCV-641B) located in fire area 3B1 and 3B2 after opening its associated power supply breaker (52-1G-29 or 52-1H-15) located in SPG and SPH.

4.2 Unit 2 Equipment

4.2.1 Auxiliary Feedwater

AFW pumps 2-2 and 2-3 may be lost for a fire in this area. Although AFW pump 2-2 and 2-3 circuits are protected by a fire barrier enclosure, redundant AFW pump 2-1 pump will be available to provide AFW.

4.2.2 Chemical and Volume Control System

Valve 8104 may be lost due to a fire in this area. Valves FCV-110A and 8471 (manual valve) will remain available to provide boric acid solution to the Chemical and Volume Control System.

Charging pumps 2-2 and 2-3, and ALOP 2-2 may be lost due to a fire in this area. Charging pump 2-1 and ALOP 2-1 remain available to provide charging flow.

A fire in this area may affect valves LCV-112B, LCV-112C, 8805A and 8805B. The running charging pumps can be tripped from the control room, and charging pump 2-1 can be restarted after aligning the RWST supply valve and isolating the VCT supply valve. Valves LCV-112B and LCV-112C can be manually closed to isolate the volume control tank while 8805A and 8805B can be manually opened to provide water from the RWST to the charging pump suction.

Boric acid transfer pumps 2-1 and 2-2 may be lost due a fire in this area. However, this is acceptable based on the boration capability available through the RWST.

A fire in this area may affect circuits associated with, FT-134. Because letdown isolation valves LCV-459, LCV-460, 8149A, 8149B, and 8149C are not affected

in this fire area and will remain available to isolate letdown, this diagnostic indication is not required.

4.2.3 Main Steam System

Main steam system valves FCV-244, FCV-246, FCV-248 and 250 may be affected by a fire in this area. Valves FCV-760, FCV-761, FCV-762 and FCV-763 remain available to close the steam generator blowdown isolation lines in order to control reactor coolant temperature. Therefore, no manual actions are required.

4.2.4 Residual Heat Removal System

RHR pumps 2-1 and 2-2 AC power cables for FCV-641A and AC control cables for FCV-641A and FCV-641B may be lost due to a fire in this area. Prior to starting either RHR Pump 2-1 or 2-2, locally open its respective recirc valve (FCV-641A or FCV-641B) located in fire area 3D1 and 3D2 after opening its associated power supply breaker (52-2G-29 or 52-2H-15) located in SPG and SPH.

5.0 CONCLUSION

The following features will adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3 hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.
- Low Fire Severity.
- Partial smoke detection is provided.
- Manual suppression equipment is available.
- Redundant safe shutdown functions are located outside this zone or protective enclosures are provided.

The existing fire protection features provide a level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 Drawings 515568 and 515569
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.4 Calculation M-824, Combustible Loading
6.5 Drawings 065126 and 065127, Fire Protection Information Report, Units 1 and 2
6.6 NECS File: 131.95, FHARE 38, Undampered Ventilation Duct and Unrated Door in 1-hour rated Barrier
6.7 Appendix 3 for EP M-10 Unit 1 Fire Protection of Safe Shutdown Equipment
6.8 PG&E Design Change Notice DC1-EA-049070, Unit 1 ThermoLag Replacement
6.9 Calculation 134-DC, Electrical Appendix R Analysis
6.10 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.11 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.12 Not Used.
6.13 SSER - 23

FIRE AREA AB-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This zone is located at the west end of the auxiliary building located at El. 140 ft.

1.2 Description

This zone consists of the hotshop.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- A nonrated barrier to zones 3-R [NC] and S-3. [NC]
- A nonrated door and a nonrated double door communicate to 3-R. [NC]

South:

- A nonrated barrier to zones 3-W [NC] and S-4. [NC]
- A nonrated door and a nonrated double door communicate to zone 3-W. [NC]

East:

- A nonrated barrier to the exterior. [NC]
- A nonrated roll up door communicates to the exterior. [NC]

West:

- A nonrated barrier to the exterior. [NC]
- A nonrated roll up door communicates to the exterior. [NC]
- Two nonrated doors communicate to the exterior. [NC]

Floor:

- An open equipment hatch communicates to zone 3-AA. [NC]
- A nonrated floor to zone 3-AA. [NC]

Ceiling:

- Nonrated ceiling to the exterior. NC

2.0 COMBUSTIBLES

2.1 Floor Area: 6,608 ft^2

2.2 In situ Combustible Materials

- Bulk Cable
- Acetylene
- Alcohol
- Rubber
- Lube Oil
- Clothing/Rags
- Leather
- Paper
- Plastic
- Wood (Fir)

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Flame Detection

3.2 Suppression

- Portable Fire Extinguishers
- Fire Stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Unit 1

4.1.1 Chemical and Volume Control System

Boric acid storage tank 1-2 level indication from LT-106 may be lost due to a fire in this area. Borated water from the RWST will remain available. Therefore, BAST level indication is not required.

4.2 Unit 2

4.2.1 Chemical and Volume Control System

Boric acid storage tank 2-1 level indication from LT-106 may be lost due to a fire in this area. Borated water from the RWST will remain available. Therefore, BAST level indication is not required.

5.0 CONCLUSION

The following features mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- A trained fire brigade is on-site at all times and is responsible for fire suppression.

- Local fire detection is provided.

- Manual fire suppression equipment is available.

- Redundant components are not affected by a fire in this area.

These features are considered adequate to assure that safe shutdown capability will not be compromised from a design basis fire in this zone/area. This area complies with the requirements of 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 Drawing No. 515571
6.2 DCPP Units 1 and 2 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation No. M-824, Combustible Loading
6.4 Drawings 065126 and 065127, Fire Protection Information Report, Units 1 and 2
6.5 Calculation 134-DC, Electrical Appendix R Analysis
6.6 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis

FIRE AREA AB-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fire Zone 3-X is at the 100-ft elevation of the Auxiliary Building and incorporates most of the east end of this elevation.

1.2 Description

This fire zone houses Unit 1 and 2 volume control tanks and CVCS demineralizers. This zone is the bulk of the Auxiliary Building at Elevation 100 ft and surrounds Fire Zone 3-L.

1.3 Boundaries

NOTE: NC designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- Non-rated barrier to Fire Zone 3-L. NC
- 3-hour rated barrier to Fire Areas 3-BB, 3-B-1, 3-B-2, and 3-Q-1, and Fire Zone S-3 and S-2.
- Unrated structural gap seal to Fire Area 3-BB. (Ref. 6.14)
- Lesser rated penetration seals to Fire Areas 3-BB and 3-Q-1. (Ref. 6.15)
- 3-hour rated double door to Fire Zone 3-Q-1.
- A 1-1/2-hour rated door to Fire Area 3-BB and Fire Zones 3-Q-1 and S-2. (Ref. 6.6.).
- A duct penetration without a fire damp to Fire Area 3-B-2. (Ref. 6.6)
- Unique penetration seals in plaster walls to Area 3-Q-1. (Ref. 6.10)

South:

- Non-rated barrier to Fire Zone 3-L. NC
- 3-hour rated barriers to Fire Areas 3-CC, 3-D-1, 3-D-2, and to Fire Zones S-2 and S-4.
- Unrated structural gap seal to Fire Area 3-CC. (Ref. 6.14)
- Lesser rated penetration seals to Area 3-CC and 3-T-1. (Ref. 6.15)
- 2-hour rated blockout above door to Fire Area 3-T-1. (Ref. 6.13).
- A 1-1/2-hour rated door to Areas 3-CC and 3-T-1, and to Fire Zone S-2.
- A duct penetration without a damper to Fire Area 3-D-2. (Ref. 6.7)
- 3-hour rated double door to Fire Area 3-T-1.

East:

- 3-hour rated barrier to Fire Areas 3-B-2 and 3-D-2, and to Fire Zones S-3 and S-4.
- A nonrated barrier to Fire Zone 3-A. [NC]
- Six duct penetrations without fire dampers to Fire Zone 3-A. [NC]
- Two unrated doors to Fire Zone 3-A. [NC]

West:

- 3-hour rated barrier to Fire Areas 3-B-1, 3-D-1, 5-A-4, 3-B-2, 3-D-2, and 5-B-4, and Fire Zones S-3 and S-4.
- 2 1-1/2-hour rated doors to Fire Zones S-3 and S-4.
- A nonrated barrier to Fire Zone 3-L. [NC]
- Duct penetrations without dampers to Fire Areas 3-B-1 and 3-D-1. (Refs. 6.6 and 6.7)

Floor/Ceiling:

- A nonrated barrier to Zones 3-L [NC] below and 3-AA [NC] above.
- 3-hour rated barrier to Fire Areas 3-BB (85-ft elevation) and 3-CC (85-ft elevation).
- 3-hour rated barrier to Fire Zones 3-M [NC] and 3-N [NC] below.

2.0 COMBUSTIBLES

<u>2.1 Floor Area</u>: 10,528 ft^2

<u>2.2 In situ Combustible Materials</u>

- Cable Insulation
- Wood
- Lube Oil
- Miscellaneous
- Polyethylene
- Plastic
- Rubber

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Partial detection in the vicinity of boric acid transfer pumps (east of column line T).

3.2 Suppression

- Fire hose stations.
- Partial wet pipe automatic sprinklers for the part of the zone east of column line T, near the boric acid transfer pumps.
- Portable fire extinguishers.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Unit 1 Equipment

4.1.1 Chemical and Volume Control System

Valves 8104 and FCV-110A may be affected by a fire in this area. Valve 8104 can be manually opened to ensure safe shutdown.

A fire in this area may affect valves FCV-110B and FCV-111B. These valves can be manually closed if the boric acid tank is used for safe shutdown.

Valves LCV-112B, LCV-112C, 8805A and 8805B may be affected by a fire in this area. The running charging pump can be tripped from the control room to prevent cavitation, and charging pumps 1-1 and 1-2 can be restarted after aligning the RWST supply valve and isolating the VCT supply valve. Valves LCV-112B and LCV-112C can be manually closed to isolate the volume control tank while 8805A and 8805B can be manually opened to provide water from the RWST to the charging pump suction.

A fire in this area might result in the spurious closure of charging pump discharge flow control valve FCV-128. This valve can be opened from the control room after switching to manual control.

Boric acid transfer pumps 1-1 and 1-2 may be lost due to a fire in this area. However, this is acceptable based on the boron inventory available through the RWST.

A fire in this area may affect charging pump 1-3. Redundant charging pumps 1-1 and 1-2 will remain available.

A fire in this area may affect the transmitter and circuits associated with charging pump header flow transmitter, FT-128, and pressure transmitter, PT-142. Loss of these instruments will not adversely affect safe shutdown.

A fire in this area may affect circuits associated with letdown flow transmitter, FT-134. Because letdown isolation valves LCV-459, LCV-460, 8149A, 8149B, and 8149C are not affected in this fire area and will remain available to isolate letdown, this diagnostic indication is not required.

A fire in this area may affect equipment and circuits associated with VCT level transmitter LT-112.

4.1.2 Main Steam System

Main steam system valves FCV-244, FCV-246, FCV-248 and FCV-250 may be affected by a fire in this area. Redundant valves FCV-760, FCV-761, FCV-762 and FCV-763 will remain available to close steam generator blowdown isolation lines in order to control reactor coolant temperature. Thus, no manual actions are required.

4.1.3 Reactor Coolant System

A fire in this area may spuriously energize pressurizer heater group 1-1. This heater group can be manually de-energized to ensure safe shutdown.

The control of reactor coolant pumps 1-2 and 1-4 may be lost due to a fire in this area. Operation of the RCPs will not affect safe shutdown.

4.1.4 Residual Heat Removal System

RHR pumps 1-1 and 1-2 may be lost due to a fire in this area. Either RHR pump 1-1 or 1-2 can be locally started.

A fire in this area may affect the AC control cables for FCV-641A and FCV-641B Prior to starting either RHR Pump 1-1 or 1-2, locally open its respective recirc valve (FCV-641A or FCV-641B) located in 3B1 and 3B2 after opening its associated power supply breaker (52-1G-29 or 52-1H-15) located in SPG and SPH.

4.1.5 Safety Injection System

A fire in this area may affect RWST Level Transmitter LT-920. This level transmitter is to credited for diagnosis of spurious operation of equipment that may divert RWST inventory. Spurious operation of equipment that may divert the RWST inventory is not affected in this fire area.

4.2 Unit 2 Equipment

4.2.1 Chemical and Volume Control System

Valves 8104 and FCV-110A may be affected by a fire in this area. Valve 8104 can be manually opened to ensure safe shutdown.

A fire in this area may affect valves FCV-110B and FCV-111B. These valves can be manually closed if the boric acid tank is used for safe shutdown.
Valves LCV-112B, LCV-112C, 8805A and 8805B may be affected by a fire in this area. The running charging pump can be tripped from the control room to prevent cavitation, and charging pumps 2-1 and 2-2 restarted after aligning the RWST supply valve and isolating the VCT supply valve. Valves LCV-112B and LCV-112C can be manually closed to isolate the volume control tank while 8805A and 8805B can be manually opened to provide water from the RWST to the charging pump suction.

A fire in this area may result in spurious closure of FCV-128. FCV-128 is desired to be open. FCV-128 can be opened from the Control Room by taking its controller to the Manual Mode of operation.

A fire in this area may affect FT-128, and pressure transmitter, PT-142. Because either charging pump 2-1 or 2-2 is not affected in this area, the loss of these instruments will not adversely affect safe shutdown.

A fire in this area may affect circuits FT-134. Because letdown isolation valves LCV-459, LCV-460, 8149A, 8149B, and 8149C are not affected in this fire area and will remain available to isolate letdown, this diagnostic indication is not required.

Boric acid transfer pumps 2-1 and 2-2 may be lost for a fire in this area. However, this is acceptable based on the boron inventory available through the RWST.

A fire in this area may affect charging pump 2-3. Redundant charging pumps 2-1 and 2-2 will remain available.

4.2.2 Main Steam System

Main steam system valves FCV-244, FCV-246, FCV-248, and FCV-250 may be affected by a fire in this area. Redundant valves FCV-760, 761, FCV-762, and FCV-763 will remain available to close steam generator blowdown isolation lines in order to control reactor coolant temperature. Thus, no manual actions are required.

4.2.3 Reactor Coolant System

A fire in this area may spuriously energize pressurizer heater group 2-1 and de-energize heater group 2-2. Pressurizer heater group 2-1 can be manually de-energized to ensure safe shutdown. Loss of power to heater group 2-2 will not affect safe shutdown.

A fire in this area may prevent RCP 2-2 from being secured. Operation of RCP 2-2 will not affect safe shutdown.

4.2.4 Residual Heat Removal System

RHR pumps 2-1 and 2-2 may be lost due to a fire in this area. Manual action can be performed to locally start either RHR pump.

A fire in this area may affect the AC control cables for FCV-641A and FCV-641B. Prior to starting either RHR Pump 2-1 or 2-2, locally open its respective recirc

valve (FCV-641A or FCV-641B) located in fire area 3D1 and 3D2 after opening its associated power supply breaker (52-2G-29 or 52-2H-15) located in SPG and SPH.

4.2.5 Safety Injection System

A fire in this area may affect RWST Level Transmitter LT-920. This level transmitter is credited for diagnosis of spurious operation of equipment that may divert RWST inventory. Spurious operation of equipment that may divert the RWST inventory is not affected in this fire area.

5.0 CONCLUSION

A fire in the shielded compartments housing the volume control tank, CVCS safe shutdown Valves 8104 and FCV-110A, and other miscellaneous valves would not result in a breach of the volume control tank or a significant release of radioactivity. Even if a volume control tank rupture were postulated, resulting offsite doses would be well below 10 CFR 100 limits (see Diablo Canyon FSAR Update, Table 15.5-52). The most likely fire in these compartments would be a minor grease fire associated with a valve motor operator. The fire would stay confined to the immediate vicinity of the affected component and would ultimately burn itself out as insufficient combustibles are present in the area to allow any significant propagation. Such a fire does not adversely affect safe shutdown capability. (Ref. 6.8)

The RCP seal water injection filters are individually enclosed within radiation barriers along with the other CVCS filters. The radiation barriers enclose each filter on three sides as well as on top and bottom. The only access to the filters is a narrow crawlway behind the filters. The flowpath through the seal water injection filters is one of several possible charging and boration flowpaths that can be used to attain safe shutdown. No combustible materials are located in this area, nor would any material be stored inside such a high radiation area. In the unlikely event of a fire caused by transient combustibles inside an RCP seal water injection filter compartment, the magnitude of any reasonably postulated fire would be insufficient to breach the pressure boundary of the piping or filter housing. Safe shutdown capability cannot be affected by a fire in the vicinity of the seal water injection filters.

Exemptions have been requested of, and granted by, the NRC from Appendix R Section III.G.2(a) for undampered duct penetrations from Fire Zone 3-X to Fire Areas 3-B-1 and 3-B-2 in SSER 23 and 3-D-1 and 3-D-2 in SSER 31.

The following features will adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3 hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shut down.

- Manual operator action can be performed and/or redundant safe shutdown functions are available outside the fire zone, which assure the ability to safely shut down the plant.

- Partial smoke detection.

- Partial wet pipe automatic sprinkler system.

This zone meets the requirements of 10 CFR 50, Appendix R Section III.G. and no exemptions or deviations have been requested.

6.0 REFERENCES

6.1 Drawing No. 515569
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.4 Calculation M-824, Combustible Loading
6.5 Drawings 065126 and 065127, Fire Protection Information Report, Units 1 and 2
6.6 SSER 23, June 1984
6.7 SSER 31, April 1985
6.8 FSAR Update, Table 15.5-52
6.9 Appendix 3 for EP M-10 Unit 1 Fire Protection of Safe Shutdown Equipment
6.10 NECS File: 131.95, FHARE 121, Pipe Penetration Seals through Plaster Walls in the Unit 1 Auxiliary Feedwater Pump Rooms
6.11 Calculation 134-DC, Electrical Appendix R Analysis
6.12 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.13 NECS File: 131.95, FHARE 118, Appendix R Fire Area Boundary Plaster Barriers
6.14 NECS File: 131.95, FHARE 134, “Non-rated Structural Gap Seals in Fire Barriers”
6.15 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers

FIRE AREA AB-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This zone is located at the south end of the Auxiliary Building at the 140-ft elevation.

1.2 Description

This zone consists of the Auxiliary Building Supply Fan Room.

1.3 Boundaries

NOTE: NC designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- A 3-hour barrier separates this zone from Zone S-2.
- A 3-hour barrier separates this zone from the exterior, Area 34 NC
- Open louvers to the exterior, Area 34. NC
- A 3-hour barrier separates this zone from 8-C.

South:

- Unrated barriers and open louvers separate this zone from the exterior, Area 34. NC.
- A 1-1/2 hour equivalent rated door communicates to the exterior, Area 34. NC

East:

- Unrated barriers to the exterior, Area 34. NC
- Open louvers to the exterior, Area 34. NC

West:

- Unrated barrier with open louvers to exterior Area 34. NC
- A 3-hour rated barrier separates this zone from Zone 8-C.

Floor:

- A 3-hour rated barrier to Zones 3-AA and 6-B-4.

- Two ventilation openings to 3-AA. (Ref. 6.4)

Ceiling:

- A 3-hour rated barrier to Zone 8-B-4.

2.0 COMBUSTIBLES

2.1 Floor Area: 1,737 ft^2

2.2 In situ Combustible Materials

- Foam Rubber
- Rubber
- Lube Oil
- Paper
- Plastic

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection is provided.

3.2 Suppression

- Local automatic sprinkler system (fan room only).

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Chemical and Volume Control System

Valve 8104 may be lost due to a fire in this area. Redundant valves FCV-110 and 8471 will be available to provide boric acid solution to the Chemical and Volume Control System.

Boric acid storage tank 2-1 and 2-2 level indication from LT-106 and LT-102 may be lost due to a fire in this area. Borated water from the RWST will remain available. Therefore, BAST level indication is not required.

A fire in this area may affect valves LCV-112B and 8805A. Redundant valves LCV-112C and 8805B will remain available for safe shutdown.

4.2 Main Steam System

The outboard steam generator blowdown isolation valves FCV-160, FCV-244, FCV-157, FCV-246, FCV-154 and FCV-151 may be lost due to a fire in this area. The redundant inboard steam generator blowdown isolation valves FCV-760, FCV-761, FCV-762 and FCV-763 will remain available.

A fire in this area may affect RWST Level Transmitter LT-920. Spurious operation of equipment that may divert the RWST inventory is not affected in this fire area.

5.0 CONCLUSION

The following features mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- A trained fire brigade is on-site at all times and is responsible for fire suppression.

- Local (partial) fire detection is provided.

- Local (partial) fire suppression is provided.

- Manual fire suppression equipment is available.

- Redundant components are available and manual operation can be taken to achieve safe shutdown.

The existing fire protection for this area provides an acceptable level of safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 Drawing No. 515571
6.2 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation No. M-824, Combustible Loading
6.4 PG&E Letter to NRC, Question No. 23 dated 11/13/78
6.5 Drawings 065126 and 065127, Fire Protection Information Report, Units 1 and 2
6.6 Calculation 134-DC, Electrical Appendix R Analysis
6.7 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.8 NECS File 131.95, FHARE 155, Removal of Auxiliary Building Supply Fan Room Exterior Walls from the Fire Protection Program

FIRE AREA AB-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fire Zone S-3 is a stairwell in the northeastern corner of the Auxiliary Building and runs from El. 64 ft up to El. 140 ft.

1.2 Description

This stairwell communicates with Unit 1 Fire Area 3-BB (85 ft) and with Zones 3-C (64 ft), 3-F (73 ft), 3-L, 3-BB, 3-P-3 (85 ft), 3-X (100 ft), 3-Q-2 (104ft), 3-R (115 ft, 140 ft), 3-AA (115 ft), and 3-S (140 ft).

1.3 Boundaries

NOTE: NC designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

Elevation 64 ft

North:

- 3-hour rated barrier to below grade.

South:

- 3-hour rated barrier to Fire Zone 3-C.
- A 1-1/2-hour rated door to Fire Zone 3-C.

East:

- 3-hour rated barrier to Fire Zone 3-C.
- A 1-1/2-hour rated door to Fire Zone 3-C.

West:

- 3-hour rated barrier to Fire Zone 3-C.

Elevation 73 ft

North:

- 3-hour rated barrier to Fire Zone 3-F.

South:

- 3-hour rated barrier to Fire Zone 3-F.

East:

- 3-hour rated barrier to Fire Zone 3-F.
- A l-l/2-hour rated door to Fire Zone 3-F.

West:

- 3-hour rated barrier to Fire Zone 3-F.

Elevation 85 ft

North:

- 3-hour rated barrier to below grade.
- A l-l/2-hour rated door to Fire Area 3-BB. (Ref. 6.7)

South:

- 3-hour rated barrier to Fire Zone 3-L.

East:

- 3-hour rated barrier to Fire Zones 3-P-3 and 3-L.
- A l-l/2-hour rated door to Fire Zone 3-L.

West:

- 3-hour rated barrier to Fire Area 3-BB and Zone 3-L.

Elevation 100 ft

North:

- 3-hour rated barrier to Fire Zone 3-Q-2.

South:

- 3-hour rated barrier to Fire Zone 3-X.

East:

- 3-hour rated barrier to Fire Zone 3-X.
- A 1-1/2-hour rated door to Fire Zone 3-X.

West:

- 3-hour rated barrier to Fire Zone 3-X.

Elevation 115 ft

North:

- 3-hour rated barrier to Fire Zone 3-R.
- A 1-1/2-hour rated door to Fire Zone 3-R.

South:

- 3-hour rated barrier to Fire Zone 3-AA.
- A 1-1/2-hour rated door to Fire Zone 3-AA.

East:

- 3-hour rated barrier to Fire Zone 3-AA.

West:

- 3-hour rated barrier to Fire Zone 3-AA.

Elevation 140 ft

North:

- 3-hour rated barrier to Fire Zone 3-R. [NC]

South:

- A nonrated barrier to Fire Zone 3-S. [NC]

East:

- 3-hour rated barrier to Fire Zone 3-R. [NC]
- Open to Fire Zone 3-S.

West:

- A nonrated barrier to Fire Zone 3-S. [NC]

2.0 COMBUSTIBLES

2.1 Floor Area: 162 ft^2

2.2 In situ Combustible Materials

- Bulk cable
- Paper
- Plastic

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

None

3.2 Suppression

- Fire hose stations available
- Portable fire extinguishers available

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Auxiliary Feedwater

AFW pumps 1-2 and 1-3 may be lost due to a fire in this area. AFW pump 1-1 will be available to provide flow to the steam generators.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Low Fire Severity.
- Portable fire extinguishers and fire hose stations are available.
- Redundant safe shutdown functions are located out of the influence of this fire zone.

This area meets the requirements of 10 CFR 50, Appendix R, Section III.G and no exemptions or deviations have been requested for this zone.

6.0 REFERENCES

6.1 Drawing Nos. 515566, 515567, 515568, 515569, 515570, 515571
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation M-824, Combustible Loading
6.4 Drawings 065126 and 065127, Fire Protection Information Report, Units 1 and 2
6.5 Calculation 134-DC, Electrical Appendix R Analysis
6.6 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.7 SSER - 31

FIRE AREA AB-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fire Zone S-4 is a stairwell in the southeastern corner of the Auxiliary Building and runs from at El. 64 ft up to El. 140 ft.

1.2 Description

This stairwell communicates with Unit 2 Fire Area 3-CC (85 ft) and with Fire Zones 3-C (64 ft), 3-G (73 ft), 3-L, 3-V-3, 3-CC (85 ft), 3-X, 3-T-2 (100 ft), 3-W (115 ft), 3-AA (115 ft), and 3-S and 3-W (140 ft).

1.3 Boundaries

NOTE: ^{NC} designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

Elevation 64 ft

North:

- 3-hour rated barrier to Fire Zone 3-C.
- A 1-1/2-hour rated door to Fire Zone 3-C.

South:

- 3-hour rated barrier to below grade.

East:

- 3-hour rated barrier to Fire Zone 3-C.
- A 1-1/2-hour rated door to Fire Zone 3-C.

West:

- 3-hour rated barrier to Fire Zone 3-C.

Elevation 73 ft

North:

- 3-hour rated barrier to Fire Zone 3-G.

South:

- 3-hour rated barrier to Fire Zone 3-G.

East:

- 3-hour rated barrier to Fire Zone 3-G.
- A 1-1/2-hour rated door to Fire Zone 3-G.

West:

- 3-hour rated barrier to Fire Zone 3-G.

Elevation 85 ft

North:

- 3-hour rated barrier to Fire Zone 3-L.

South:

- 3-hour rated barrier to below grade.
- 1-1/2-hour rated door to Fire Area 3-CC. (Ref. 6.7)

East:

- 3-hour rated barriers to Fire Zones 3-V-3 and 3-L.
- A 1-1/2-hour rated door to Fire Zone 3-L.

West:

- 3-hour rated barriers to Fire Area 3-CC and zone 3-L.

Elevation 100 ft

North:

- 3-hour rated barrier to Fire Zone 3-X.

South:

- 3-hour rated barrier to Fire Zone 3-T-2.

East:

- 3-hour rated barrier to Fire Zone 3-X.
- A 1-1/2-hour rated door to Fire Zone 3-X.

West:

- 3-hour rated barrier to Fire Zone 3-X.

Elevation 115 ft

North:

- 3-hour rated barrier to Fire Zone 3-AA.
- A 1-1/2-hour rated door to Fire Zone 3-AA.

South:

- 3-hour rated barrier to Fire Zone 3-W.
- A 1-1/2-hour rated door to Fire Zone 3-W.

East:

- 3-hour rated barrier to Fire Zones 3-AA.

West:

- 3-hour rated barrier to Fire Zone 3-AA.

Elevation 140 ft

North:

- A nonrated barrier to Fire Zone 3-S. NC

South:

- 3-hour rated barrier to Fire Zone 3-W. NC

East:

- 3-hour rated barrier to Fire Zone 3-W. NC
- Open to Fire Zone 3-S.

West:

- A nonrated barrier to Fire Zone 3-S. NC

2.0 COMBUSTIBLES

2.1 Floor Area: 162 ft^2

2.2 In situ Combustible Materials

- Paper
- Cable Insulation
- Plastics

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- None

3.2 Suppression

- Fire hose station available
- Portable fire extinguishers available

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Auxiliary Feedwater

AFW pumps 2-2 and 2-3 may be lost due to a fire in this area. AFW pump 2-1 will be available to provide AFW to the steam generators.

4.2 Chemical and Volume Control System

Boric acid storage tank 2-2 and 2-1 level indication from LT-102 and LT-106 may be lost due to a fire in this area. Borated water from the RWST will remain available. Therefore, BAST level indication is not required.

A fire in this area may affect RWST Level Transmitter LT-920. Spurious operation of equipment that may divert the RWST inventory is not affected in this fire area.

5.0 CONCLUSION

The following features adequately mitigate the consequences of a design basis fire and assure the capability to achieve safe shutdown:

- Low Fire Severity.

- Portable fire extinguishers and fire hose stations are available.

- Redundant safe shutdown functions are located out of the influence of this fire zone.

This area meets the requirements of 10 CFR 50, Appendix R, Section III.G, and no exemptions or deviations have been requested for this zone.

6.0 REFERENCES

6.1 Drawing Nos. 515566, 515567, 515568, 515569, 515570, 515571, 515577, 515578
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation M-824, Combustible Loading
6.4 Drawings 065127, Fire Protection Information Report, Unit 2

6.5 Calculation 134-DC, Electrical Appendix R Analysis
6.6 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.7 SSER - 31

FIRE AREA CR-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fire Area CR-1 is the Unit 1 and Unit 2 Control Room Complex. It is located in the west side of the Auxiliary Building at El. 140 ft and 163 ft.

1.2 Description

The area encompasses the following zones:

1) Fire Zone 8-A, Unit 1 Computer Room
2) Fire Zone 8-D, Unit 2 Computer Room
3) Fire Zone 8-C, Control Room
4) Fire Zone 8-E, Office
5) Fire Zone 8-F, Shift Technical Advisor Office
6) Fire Zone 8-B-3, Unit 1 Control Room Ventilation Equipment Room
7) Fire Zone 8-B-4, Unit 1 Control Room Ventilation Equipment Room

Fire Areas 8-G (Unit 1) and 8-H (Unit 2) are within the Control Room Complex, but are considered separate fire areas.

1.3 Boundaries

The boundaries described below are the boundaries of the zones and areas that constitute the perimeter of the Control Room Complex. The interior boundaries between the zones that constitute the Control Room Complex are not addressed. Fire Areas 8-G and 8-H are described in their respective analyses. The adequacy of the interior boundaries is addressed in several evaluations. (Refs. 6.10, 6.26)

NOTE: ^{NC} designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

FIRE AREA CR-1
FIRE ZONES
8-A, 8-B-3, 8-B-4
8-C, 8-D, 8-E, 8-F

Elevation 140 ft

North:

- 3-hour rated barrier from Zone 8-F to S-1.
- 3-hour rated barrier to the exterior (Fire Area 34) from Zones 8-C and 8-A, and Area 8-G. (Ref. 6.27)
- 3-hour rated barrier from Zone 8-C to S-5.

South:

- 3-hour rated barrier from Zone 8-C to 8-B-2.
- 3-hour rated barrier to the exterior (Fire Area 34) from Zones 8-C and 8-D, and Area 8-H.
- 3-hour rated barrier form Zone 8-E to S-1.

East:

- 3-hour rated barriers to Fire Zones 3-B-1, 3-B-2, S-2 and S-5.
- A 3-hour-equivalent rated door with sprinkler protection to Fire Zone S-5.
- A lesser rated penetration seal to Fire Zone 8-B-4. (Ref. 6.25)

West:

- 3-hour rated barrier from Zone 8-E and Area 8-G to Zone 14-D, from Zone 8-C to Zone S-1, and from Zone 8-F and Area 8-H to Zone 19-D.
- A lesser rated penetration seal from Zone 8-F to Zone S-1. (Ref. 6.25)
- A 3-hour-equivalent rated door with sprinkler protection from Zone 8-E to Zone 14-D.
- A 3/4-hour-equivalent rated door with sprinkler protection from Zone 8-C to Zone S-1. (Ref. 6.4)
- A lesser rated penetration seal from Zone 8-C to Zone S-1. (Ref. 6.25)

Floor/Ceiling:

- 3-hour rated barriers: Floor to Fire Areas 7A and 7B.
  Ceiling to Fire Areas 8-B-5, 8-B-6, 8-B-7 and 8-B-8.
- Unrated penetrations to Areas 7A and 7B below. (Refs. 6.23 and 6.24)

Protective Enclosure: (for CR-1)

- Ducts and supports in Zones 8-A, 8-C, and 8-D are provided with a 1-hour rated fire resistive covering. (Refs. 6.6, 6.13, 6.14 and 6.20)

(Note: For the interface to Fire Areas 8-G and 8-H, refer to the fire hazard analysis for the respective area. (Ref. 6.12))

Elevation 163 ft (Zones 8-B-3 and 8-B-4)

North:

- 3-hour rated barrier except for open louvers to the exterior (Fire Area 34). NC (Ref. 6.4)

South:

- 3-hour rated barrier except for open louvers to the exterior (Fire Area 34). NC (Ref. 6.4)

East:

- 3-hour rated barrier except for open louvers to the exterior (Fire Area 34). NC (Ref. 6.4)

West:

- 3-hour rated barrier except for duct penetrations down to El. 140 ft of Zone 8-C (same fire area).
- Lesser rated penetration seals to Zone 8-C. (Ref. 6.25)
- Zone S-2 is a stairwell (south of 8-B-3 and north of 8-B-4). There is a 1-1/2-hour rated door from 8-B-3 to S-2 and a 3-hour rated door from 8-B-4 to S-2.
- 1-1/2-hour rated door from Fire Zone 8-B-3 to 8-B-4. NC

2.0 COMBUSTIBLES

Fire Zone: 8-A

2.1 Floor Area: 464 ft^2

2.2 In situ Combustible Materials

- Cable
- Paper
- Wood
- Plastic
- Rubber

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

Fire Zone: 8-B-3

2.1 Floor Area: 1,988 ft^2

2.2 In situ Combustible Materials

- Cable
- Oil
- Clothing/Rags
- Paper
- Plastic
- Rubber

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

Fire Zone: 8-B-4

2.1 Floor Area: 1,988 ft^2

2.2 In situ Combustible Materials

- Cable
- Clothing/Rags
- Lube Oil
- Paper
- Plastic
- Rubber

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents

- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

Fire Zone: 8-C

2.1 Floor Area: 4,734 ft^2

2.2 In situ Combustible Materials

- Cable insulation
- Paper
- Resin
- Plastic
- Combustible vinyl ceiling lighting diffusers
- Carpet
- Ceiling tile
- Filter material
- Wood
- PVC

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

Fire Zone: 8-D

2.1 Floor Area: 464 ft^2

2.2 In situ Combustible Materials

- Cable
- Paper
- Plastic
- Rubber
- Wood (fir)

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

Fire Zone: 8-E

2.1 Floor Area: 315 ft^2

2.2 In situ Combustible Materials

- Clothing/Rags

- Paper
- Wood
- Plastic
- Rubber
- Bulk Cable
- Foam Rubber

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

Fire Zone: 8-F

2.1 Floor Area: 390 ft^2

2.2 In situ Combustible Materials

- Cable
- Paper
- Wood
- Plastic
- Rubber

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection is provided.

3.2 Suppression (Refs. 6.4 and 6.5)

- Wet pipe automatic sprinkler system for Zones 8-B-3, 8-B-4, and 8-E.
- Portable fire extinguishers.
- Fire hose station in the vicinity.

4.0 SAFE SHUTDOWN FUNCTIONS

The only cabinets in the Control Room which contain safety related cabling from redundant electrical circuits are in the operator's control panel and the main control board. These cabinets contain smoke detectors. Nonsafety-related panels (RODFW1 and RODFW2) and safety-related panels (POV1 and POV2) for Units 1 and 2 do not contain smoke detectors. FHARE 93 evaluates acceptability of not installing smoke detectors. (Ref. 6.15)

(Note: A fire in the control room is similar to fire in both areas 7-A and 7-B combined. Both units will require evacuation of the control room with

control taken locally at the hot shutdown panel. See fire areas 7-A (Unit 1) and 7-B (Unit 2) for operator actions that are required for this fire area.)

5.0 CONCLUSION

This area does not meet the requirements of 10 CFR 50, Appendix R, Section III.G.3, because it does not have an area-wide automatic fire suppression system installed in an area for which an alternate shutdown capability has been provided.

- A deviation from Section III.G.3 requirements was requested, and granted by the NRC as stated in SSER 23.

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3 hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.
- Alternate equipment remote to this location can be used to achieve safe shutdown.
- Smoke detection is provided.
- Portable fire extinguishers.
- This is a continuously manned area.
- The fire protection features provide an acceptable level of safety equivalent to that achieved by compliance with Section III.G.2.

6.0 REFERENCES

6.1 Drawing No. 515571
6.2 DCPP Unit 1 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.4 SSER 23, June 1984
6.5 SSER 31, April 1985

6.6 Calculation Number M-680 - Appendix R Safe Shutdown Equipment List
6.7 Calculation M-824, Combustible Loading
6.8 Drawings 065126 and 065127, Fire protection Information Report, Units 1 and 2
6.9 Deleted in Revision 21.
6.10 NECS File: 131.95, FHARE: 75, 1-hour rated Barrier
6.11 Deleted - Revision 6
6.12 Deleted in Revision 13.
6.13 NECS File: 131.95, FHARE: 15, HVAC Ducts Wrapped in Pyrocrete
6.14 NECS File: 131.95, FHARE: 80, Fire Dampers Installed at Variance with Manufacturers Instructions
6.15 NECS File: 131.95, FHARE: 93, Smoke Detectors in Control Room Cabinets
6.16 DCNs DC1-EE-47591, DC1-EE-47593, and DC1-EE-47594 Provide Transfer Switches at the 4kV Switchgear Panel and Mode Selector Switches at the Hot Shutdown Panel
6.17 DCN DC1-EE-45132, Provides Local Control Capacity for DGs
6.18 DG 1-3 Starting Circuit Power Supply Transfer Switch
6.19 DG 2-2 Starting Circuit Power Supply Transfer Switch
6.20 NECS File: 131.95, FHARE 129, Duct penetrations through common walls associated with fire zones 8-A, 8-D, 8-E, 8-F, 8-G, and 8-H
6.21 Calculation 134-DC, Electrical Appendix R Analysis
6.22 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.23 NECS File: 131.95, FHARE 137, Unrated Penetrations through Unit 1 Control Room Floor (Barrier 458)
6.24 NECS File: 131.95, FHARE 140, Unrated Penetrations through Unit 2 Control Room Floor (Barrier 458)
6.25 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.26 NECS File: 131.95, FHARE 153, Removal of Selected Fire Barriers Internal to Fire Area CR-1 from the Fire Protection Program
6.27 NECS File: 131 .95, FHARE 89, Copper Pipes through Foam Seals

FIRE AREA IS-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Intake structure, El. -2 ft and +18 ft, common (Units 1 and 2) intake structure.

1.2 Description

Fire Zone 30-A-5 compress the bulk of the intake structure at El. -2 ft. The intake structure contains functions for both units and is isolated from the power block by over 100 yards.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

Fire Zone 30-A-5 is bounded by a 3-hour rated barrier with the following exceptions:

- Non-rated doors to the exterior. [NC]
- Open stairways to the exterior. [NC]
- Non-rated concrete machinery access plugs and other openings to the exterior. [NC]
- Non-rated steel watertight doors and nonrated penetration seals communicating with Areas 30-A-1, 30-A-2, 30-A-3, and 30-A-4. (Refs. 6.13 and 6.16)
- Nonrated walls between this zone and 30-B [NC] (at stairs).
- 3-hour rated barriers to Fire Areas 30-A-1, 30-A-2, 30-A-3, and 30-A-4.

2.0 COMBUSTIBLES

2.1 Floor Area: 12,390 ft^2

2.2 In situ Combustible Materials

- Alcohol
- Charcoal
- Clothing/Rags
- Polyethylene
- Paper
- Plastic

- PVC
- Resin
- Rubber
- Oil
- Lube oil (in circ. pumps)
- Cable Insulation

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection at entrance to aux. saltwater pump vaults.

3.2 Suppression

- Heat activated - local application CO_2 system for each circulating water pump motor.
- Sprinkler head above junction boxes BJZ114 in Unit 1 and BJZ110 in Unit 2.
- Portable fire extinguishers.
- Hose stations.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 ASW Pumps and HVAC

Circuits for ASW pumps 1-1, 1-2, 2-1 and 2-2, and fans E-101, E-102, E-103 and E-104 may be damaged by a fire in this area. The circuits associated with redundant Unit 1 ASW pumps 1-1/1-2 and associated fans E-103/101, and redundant Unit 2 ASW pumps 2-1/2-2 and associated fans E-104/102 are separated by greater than 20 ft with no intervening combustibles. FHARE 110 evaluates the separation of redundant circuits. Therefore, at least one train of ASW pump and associated exhaust fan circuits for each unit will be available for safe shutdown. (Ref. 6.9)

4.2 ASW Inlet Gates

The gate operators for saltwater inlet gates 1-8, 1-9, 2-8, and 2-9 are located in this area. Each gate is normally open. A fire induced hot short within the gate operator local panel may spuriously close the gate if power is available to the gate operator. Therefore, to preclude spurious operation of the gates, the 480 V breaker for each operator is administratively controlled in the open position.

4.3 Emergency Power

A fire in this area may result in a loss of power supplies associated with PY17N. Redundant power supply PY16 remains available.

A fire in this area may cause loss of UNIT 2 power supplies associated with PY27N. Redundant power supply PY26 remains available (this also applies to fire zone 30-B).

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3 hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Local smoke detection (at entrance to ASW pump vaults). (Ref. Section 3.1)

- Local CO_2 suppression system for each circ. water pump motor. (Ref. Section 3.2)

- Sprinkler head above junction boxes BJZ114 in Unit 1 and BJZ110 in Unit 2.
- Manual firefighting equipment. (Ref. Section 3.2)
- “No Storage of Combustible Materials” is designated around perimeter of ASW pump vaults.
- Redundant train of safe shutdown functions are separated by a horizontal distance of 20 ft with no intervening combustibles, and one train will not be adversely affected by a fire in this zone.

This fire zone meets the requirements of 10 CFR 50, Appendix R, Section III.G, and no deviations are requested.

6.0 REFERENCES

6.1 Drawing No. 515580
6.2 Calculation M-928, “Appendix R Safe Shutdown Analysis”
6.3 Calculation M-824, Combustible Loading
6.4 Drawings 065126 and 065127, Fire Protection Information Report, Units 1 and 2
6.5 Deleted in Revision 13
6.6 Deleted in Revision 13
6.7 Field Change A-16160, Rev. 0 (DCN DC1-EA-47386) Provide 3 Hour Fire Wraps for Applicable Conduits in 30-A-5
6.8 Field Change A-16159, Rev. 0 (DCN DC2-EA-48386) Provide 3 Hour Fire Wraps for Applicable Conduits in 30-A-5
6.9 NECS File 131.95 FHARE 110, “Separation of Redundant ASW Pump and Exhaust Fan Circuits in the Intake Structure”
6.10 DCP M-49261, Add Fire Suppression Sprinkler Head, Units 1 and 2
6.11 SSER 23, June 1984
6.12 SSER 31, April 1985
6.13 FHARE 114, Non-Rated Penetration Seals in the ASW Pump Room Barriers
6.14 Calculation 134-DC, Electrical Appendix R Analysis
6.15 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.16 NECS File: 131 .95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.

FIRE AREA 3-CC

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This fire area is the Unit 2 Containment Penetration area and is located between Unit 2 Containment Building and Auxiliary Building on El. 85 ft up to 115 ft.

1.2 Description

Fire Area 3-CC is the electrical and mechanical penetration area for the containment.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

Elevation 85 ft

South:

- 3-hour rated barrier to Containment Building with an 8 inch seismic and vent gap separation. (Refs. 6.5 and 6.23)
- Ventilation louvers without fire dampers that communicate with the exterior. [NC] (Refs. 6.5 and 6.23)

North:

- 3-hour rated barrier to Fire Areas 3-D-1, 3-D-2, 4-B, 4-B-1, 4-B-2, and Zones 3-L and 3-N.
- A 1-1/2-hour rated door to Fire Zone 3-L. (Refs. 6.5 and 6.23)
- A 1-1/2-hour rated door to Fire Zone S-4. (Refs. 6.5 and 6.23)
- Lesser rated penetration seals to 3-D-2, 3-L, and 3-N. (Refs. 6.21 and 6.23)

East:

- 3-hour rated barriers to Fire Zone S-4 and Fire Area 3-D-2 and to below grade. [NC]

West:

- 3-hour rated barrier to Fire Zone 19-A and Fire Area 3-D-1.
- 3-hour rated double door to Fire Zone 19-A.

- Three 3-hour rated fire dampers to Fire Zone 19-A.
- A penetration to Fire Zone 19-A. (Ref. 6.14)
- Lesser rated penetration seals to Fire Zone 19-A. (Refs. 6.21 and 6.23)

Floor:

- 3-hour rated barrier to Fire Zones 3-K-3, 3-D-3, 3-G, Fire Area 3-I-1 and to grade. NC
- Lesser rated penetration seals to Fire Zone 3-K-3, 3-D-3, and 3-I-1. (Refs. 6.21 and 6.23)

Ceiling:

- Concrete slab with nonrated penetrations to the 100-ft Elevation of 3-CC. NC (Ref. 6.5)
- 3-hour rated barrier to Fire Zone 3-X.
- A lesser rated penetration seal to Fire Zone 3-X above. (Refs. 6.21 and 6.23)

Elevation 100 ft

South:

- 3-hour rated barrier to Containment Building with an 8-inch seismic and vent separation. (Ref. 6.5 and 6.23)
- 3-hour rated barrier to Fire Zone 3-W with the exception of the 8-inch seismic gap.
- Ventilation louvers without fire dampers that communicate with the exterior (Fire Area 29)NC (Refs. 6.5 and 6.23)

North:

- 3-hour rated barrier to Fire Areas 3-D-1, 3-D-2, 5-B-1, 5-B-2, 5-B-3, and 5-B-4, and Fire Zone 3-X.
- Unrated structural gap seal to Fire Zone 3-X. (Ref. 6.20)
- Lesser rated penetration seals to Fire Zone 3-X. (Refs. 6.21 and 6.23)
- A 1-1/2-hour rated door to Fire Zone 3-X. (Refs. 6.5 and 6.23)

East:

- 3-hour rated barrier to Fire Zones 3-U, 3-T-2, and 3-W.
- A 1-1/2-hour rated door to Fire Zone 3-T-2. (Refs. 6.5 and 6.23)
- Lesser rated penetration seals to Fire Zone 3-T-2 and 3-U. (Refs. 6.21 and 6.23)

West:

- 3-hour rated barrier to Fire Zone 19-A.
- 3-hour rated door to Fire Zone 19-A.

Floor/Ceiling:

- Concrete slab with nonrated penetrations. [NC] (Same Fire Area) (Ref. 6.5)

Elevation 115 ft

South:

- 3-hour rated barrier to containment building with an 8-inch seismic and vent separation. (Refs. 6.5 and 6.23)
- Ventilation louvers without fire dampers that communicate with the exterior. (Fire Area 29)[NC] (Refs. 6.5 and 6.23)
- A nonrated barrier to Fire Zone 3-V-2.[NC] (Ref. 6.16)
- Non-rated electrical penetrations to containment (Fire Area 9/9-A). (Ref. 6.24)

North:

- 3-hour rated barrier to Fire Areas 6-B-1, 6-B-2, 6-B-3, 6-B-4, 7-B and Fire Zone 3-AA.
- A 1-1/2-hour rated door to Fire Zone 3-AA. (Refs. 6.5 and 6.23)

East:

- 3-hour rated barrier to Fire Zone 3-W.
- A 1-1/2-hour rated door to Fire Zone 3-W. (Refs. 6.5 and 6.23)

West:

- 3-hour rated barrier to Fire Zone 19-A.
- Nonrated blowout panels, which communicate with the main steam pipe tunnel, Fire Zone 19-A, that have water spray on the Turbine Building side. (Refs. 6.5, 6.23 and 6.10)
- Lesser rated penetration seals to Fire Zone 19-A. (Refs. 6.21 and 6.23)
- A 3 hour equivalent rated door to Fire Zone 19-A, with water spray on the Turbine Building side (Latch removed). (Refs. 6.10, 6.12, 6.22 and 6.23)
- Nonrated seal on the main steam line penetration to Fire Zone 19-A. (Ref. 6.15 and 6.23)

Floor:

- Concrete slab with numerous penetrations. NC (Ref. 6.5)

Ceiling:

- 3-hour rated barrier. NC
- Unsealed pipe penetrations and a seismic gap communicate with Fire Area 34 (outside roof area) at El. 140 ft. (Refs. 6.5 and 6.23) NC

Protective Enclosures:

- Cables essential for safe shutdown pass through concrete vaults. (One for each vitality) in the northwest corner of the fire area at El. 85 ft. The vault walls extend above 85 ft floor level to form an 8-inch curb. The curb around the vaults eliminates the possibility of combustible fluid leakage into the vaults due to a spill on the floor. The vaults are covered with 3/8 in-thick metal plates. One-foot thick concrete walls provide sufficient separation between redundant cables in the adjacent vaults. As discussed in Section 2 below, due to the negligible fixed combustibles at El. 85 ft and unlikelihood of transient combustibles being present in the area, propagation of fire into the vaults is precluded.

  An exemption to the requirements of Appendix R, Section III.G.2 was made based on the existing construction of the vaults which includes the concrete walls, the 3/8-inch checker plate covers, and the curb located around the vaults. (Ref. 6.5)

- At El. 100 ft and 115 ft, partial area smoke detection and area wide automatic suppression are provided. Redundant instrument trains have less than 20-ft separation. Modifications to provide 1-hour fire barriers to "separate" these trains (or exemption requests where justified) have been made. Although 1-hour fire barriers are committed, a barrier which would provide approximately 3 hours of fire penetration was installed. Systems required for safe shutdown either have adequate redundancy available or credit is being taken to manually operate certain valves. Modifications to provide additional smoke detectors at El. 115 ft are incorporated and several penetration boxes are provided with fire barriers. (Refs. 6.8, 6.9 and 6.17)

- (Note: Containment electrical assembly is not a tested configuration. (Ref. 6.11 and 6.24))

2.0 COMBUSTIBLES

2.1 Floor Area: 6,900 ft^2 (for each area)

2.2 In situ Combustible Materials

ELEVATION:	85 ft	100 ft	115 ft
	• Oil	• Cable	• Cable
	• Wood	• Grease	• Grease
	• Clothing/Rags	• Rubber	• Rubber
	• Rubber	• Paper	• Hydrogen
	• Paper	• Clothing/Rags	• Neoprene
	• PVC	• Lube Oil	• Plastic
		• Polyethylene	• Polyethylene
		• Plastic	• Oil

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

ELEVATION:	85 ft	100 ft	115 ft
	Low	Low	Low

3.0 FIRE PROTECTION

3.1 Detection

- Partial smoke detection at each elevation of this zone. (Ref. 6.5)

  (1) El. 85 ft - Post-LOCA only
  (2) El. 100 ft - At tray only
  (3) El. 115 ft - At tray and area wide west of column Line L.

3.2 Suppression

- Wet pipe automatic sprinkler protection throughout El. 100 and 115 ft.
- A closed head sprinkler to spray the blowout panels and adjacent door (115 ft).
- Portable fire extinguishers.
- Fire hose stations.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Zone 3CC-85 ft

4.1.1 Auxiliary Feedwater

A fire in this area may affect LCV-106, LCV-107, LCV-110 and LCV-111. Redundant valves LCV-113 and LCV-115 will remain available to provide AFW flow to steam generators 2-3 and 2-4.

4.1.2 Component Cooling Water

A fire in this area may spuriously close FCV-364 and FCV-365. These valves can be manually opened in order to provide CCW to the RHR heat exchangers.

A fire in this area may affect circuits associated with CCW flow transmitter for Header C (FT-69). Flow through CCW Header C is not credited in this fire area. Therefore, loss of flow indication will not affect safe shutdown

4.1.3 Containment Spray

Containment spray pump 2-2 may spuriously operate due to a fire in this area. Since valve 9001B will remain closed, safe shutdown is not affected.

4.1.4 Chemical and Volume Control System

A fire in this area may affect valves 8108 and HCV-142. Redundant valves 8107, or 8145 and 8148 can be closed to isolate auxiliary spray. If control of valves 8108 and HCV-142 is lost, the charging injection flowpath will remain available. The PORVs can be used for pressure reduction. Since redundant components will remain available, safe shutdown is not affected.

A fire in this area may affect circuits associated with charging pump header flow transmitter, FT-128, and pressure transmitter, PT-142. Loss of charging pump header flow and pressure indication will not affect safe shutdown.

A fire in this area may affect circuits associated with letdown flow transmitter, FT-134. Operator manual actions are credited to isolate the letdown flowpath. This instrument will not be available for diagnosis of loss of letdown flow.

Valves LCV-112B and LCV-112C may spuriously close or become nonfunctional due to a fire in this area. Spurious closure of these valves could cavitate the running charging pump. Two other redundant charging pumps would remain available for safe shutdown. They can be started after a suction path is aligned and the VCT isolated. Valves 8805A and 8805B can be opened to provide water from the RWST to the charging pump suction. If necessary, valves LCV-112B and LCV-112C can be manually closed in order to isolate the volume control tank.

A fire in this area may affect equipment and circuits associated with VCT level transmitter LT-112. This instrument is credited for diagnosis of failure of the VCT discharge valves LCV-112B or LCV-112C to automatically close. This indication would not be available to provide diagnostic information. The RWST supply valves are not affected in this area and would be available to align to the charging suction path.

4.1.5 Emergency Power

A fire in this area may disable the diesel generator 2-2 automatic transfer circuit. Manual control will remain available in the control room to transfer and load the diesel generator. In addition, offsite power is not affected in this area and will remain available.

A fire in this area may cause loss of power supplies associated with PY27N. Redundant power supply PY26 remains available.

4.1.6 Main Steam System

A fire in this area may spuriously close FCV-95 which will result in the loss of AFW pump 2-1. Redundant AFW pumps 2-2 and 2-3 will remain available for safe shutdown.

A fire in this area may affect valves FCV-41, FCV-42, FCV-24 and FCV-25. These valves can be manually closed in order to control reactor coolant system temperature while in hot standby. Redundant MSIVs (FCV-43 and FCV-44) and bypass valves (FCV-22 and FCV-23) will remain available to isolate main steam for steam generators 2-2 and 2-3.

A fire in this area may spuriously operate PCV-19 and PCV-20. PCV-19 and PCV-20 may be failed closed by manually isolating instrument air, backup air, and nitrogen and venting the supply line. PCV-21 and PCV-22 will remain available if needed for cooldown purposes via steam generators 2-3 and 2-4.

A fire in this area may prevent PCV-19 and PCV-20 from opening. PCV-21 and PCV-22 will remain available if needed for cooldown purposes via steam generators 2-3 and 2-4.

A fire in this area may affect pressure indicators PT-514, PT-515, PT-516, PT-524, PT-525 and PT-526, making SG 2-1 and SG 2-2 unavailable. Pressure indicators for SG 2-3 and SG 2-4 are not affected, therefore, safe shutdown is not affected.

4.1.7 Main Feedwater System

A fire in this area may affect 4-20mA DC control cables which affect FCV-510. Trip main feedwater pumps from the control room.

4.1.8 Reactor Coolant System

RCS pressure indication PT-403 and PT-405 may be lost due to a fire in this area. PT-406 will remain available to provide RCS pressure indication.

4.1.9 Safety Injection System

A fire in this area may prevent the operation of valves 8805A and 8805B. Redundant borated water source from the Boric Acid Storage Tank is not affected at this elevation and will remain available. Operator manual action to locally open valves 8460A (or 8460B), 8476 and 8471 will need to be performed to align the BAST supply. In addition, the RWST supply valves can be manually opened to provide RWST water to the charging pumps.

4.2 Fire Zone 3CC-100 ft

4.2.1 Auxiliary Feedwater

A fire in this area may affect the following AFW valves: LCV-106, 107, 108, 109, 110, 111, 113, and 115. Steam generators 2-3 and 2-4 are credited for safe shutdown. Therefore, LCV-113 and LCV-115 can be manually operated to regulate the flow of auxiliary feedwater to the steam generator 2-3 and 2-4 from AFW Pump 2-3.

4.2.2 Component Cooling Water

A fire in this area may spuriously close FCV-357 and isolate CCW flow from RCP thermal barriers. Redundant valve HCV-142 will remain open and FCV-128 can be manually opened from the control room to provide seal injection flow to RCP seals. Therefore, safe shutdown is not affected.

Valves FCV-364 and FCV-365 may spuriously close due to a fire in this area. Either of these two valves can be manually opened to provide CCW to the RHR heat exchangers.

4.2.3 Containment Spray

Containment spray pump 2-2 may spuriously operate due to a fire in this area. However, the corresponding discharge valve, 9001B will not operate. Therefore, the spurious containment spray pump operation has no impact on safe shutdown.

Containment pressure transmitters 934 – 937 could cause a spurious CS actuation signal. Open knife switches and open breakers 52-HG-07 and 52-HH-09 to prevent CS pump operation.

4.2.4 Chemical and Volume Control System

A fire in this area may affect valves 8104 and FCV-110A. One of these valves is required open to provide boric acid to the charging pumps. Valve 8104 can be manually opened. Therefore safe shutdown is not affected.

Valves 8107 and 8108 may be affected by a fire in this area. These valves will fail in the desired, open position for auxiliary spray operation (RCS depressurization). During hot standby, these valves are required closed to isolate inadvertent auxiliary spray operation. Redundant valves (HCV-142 or 8145 and 8148) are physically separated with existing automatic suppression and partial coverage detection systems in the area. A deviation was approved for this configuration to ensure that a means to isolate auxiliary spray is available for hot standby.

A fire in this area may result in spurious closure of FCV-128. FCV-128 is desired to be open. FCV-128 can be opened from the Control Room by taking its controller to the Manual Mode of operation.

A fire in this area may affect valves 8145, 8148 and HCV-142. Either valves 8145 and 8148 or HCV-142 are required closed in order to isolate auxiliary spray for hot standby. During hot standby, these valves are required closed to isolate inadvertent auxiliary spray operation. Redundant valves (8107 or 8108,) are physically separated with existing automatic suppression and partial coverage detection systems in the area. A deviation was approved for this configuration to ensure that a means to isolate auxiliary spray is available for hot standby.

Valves 8146 and 8147 may be affected by a fire in this area. One of these valves is required open to provide a charging flowpath through the regenerative heat exchanger, and closed during RCS pressure reduction. Since redundant components exist to provide RCS makeup (HCV-142 via the seal injection

flowpath). During RCS pressure reduction, these valves can be manually operated. Therefore, safe shutdown is not affected.

A fire in this area may spuriously open valves 8149A, 8149B, 8149C, LCV-459, and LCV-460. Either valves LCV-459, LCV-460 or valves 8149A, 8149B, and 8149C must be closed for letdown isolation. Operator action can be taken to fail 8149A, 8149B, and 8149C closed. Therefore, safe shutdown is not affected.

A fire in this area may spuriously open valves 8166 and 8167. Redundant valve HCV-123 can be closed for excess letdown isolation. Therefore, safe shutdown will not be affected.

A fire in this area may cause HCV-142 to fail open. This valve is required operational for a fire in this area to provide auxiliary spray isolation and seal injection flow control. Operator action can be taken to control HCV-142 from the Hot Shutdown Panel.

Valves LCV-112B and LCV-112C may be affected by a fire in this area. The running charging pump can be tripped from the control room to prevent cavitation and then restarted when the RWST supply is aligned and the VCT supply is isolated. These valves can be manually closed to isolate the volume control tank. Either valve 8805A or 8805B can be opened to provide water from the RWST to the charging pump suction.

Containment pressure transmitters 934 – 937 could cause a spurious CS actuation signal. Open CS pump feeder breakers to prevent CS pump operation.

4.2.5 Emergency Power

A fire in this area may disable the diesel generator 2-2 automatic transfer circuit. Manual control will remain available in the control room to transfer and load the diesel generator. In addition, offsite power is not affected in this area and will remain available for safe shutdown.

4.2.6 Main Steam System

A fire in this area may spuriously open FCV-151, 154, 157, 160, 244, 246, 248, 250, 760, 761, 762 and 763. Operator action can be taken to isolate SG Blowdown flowpath.

A fire in this area may prevent closing of FCV-41, FCV-42, FCV-43, and FCV-44, and may spuriously open FCV-24 and FCV-25. These valves can be manually closed to control reactor coolant system temperature.

A fire in this area may spuriously close FCV-95 which would disable AFW pump 2-1. However, redundant AFW pump 2-3 will remain available to provide AFW flow to steam generators 2-3 and 2-4.

A fire in this area may affect level indication (LT-517 through 547, LT-518 through 548, and LT-519 through 549) for all four steam generators. The pullbox covers for this instrumentation are provided with a fire barrier having an approximate fire rating of 3 hours, although 1 hour is committed. This area is also protected by an automatic sprinkler system and partial-coverage smoke detection at this elevation. A deviation for the partial smoke detection was approved in SSER 31. Therefore, steam generator level indication will remain available.

A fire in this area may affect pressure transmitters for steam generators 2-1 and 2-2. The circuits for these transmitters are exposed and may be lost due to a fire. However, the pullbox covers for steam generators 2-3 and 2-4 are protected by a fire barrier having an approximate fire rating of 3 hours, although 1 hour is committed. This area is also protected by an automatic sprinkler system and partial-coverage smoke detection system at this elevation. A deviation for the partial smoke detection was approved in SSER 31. Therefore, these pressure transmitters will be available during a fire in this area.

A fire in this area may prevent valves PCV-19 and PCV-20 from opening. PCV-21 and PCV-22 will remain available for cooldown through steam generators 2-3 and 2-4.

4.2.7 Reactor Coolant System

Pressurizer PORVs (PCV-455C, 456, and 474) and blocking valves (8000A, 8000B, and 8000C) may be affected by a fire in this area. The blocking valves fail open but the PORVs can be manually closed using the emergency close switch from the hot shutdown panel to prevent uncontrolled pressure reduction. In addition, automatic suppression and partial-coverage smoke detection is provided at this elevation. A deviation for the partial smoke detection was approved in SSER 31. Redundant auxiliary spray valves will be utilized for RCS depressurization using a cold shutdown repair procedure.

A fire in this area may affect pressurizer level indication (LT-406, LT-459, LT-460, and LT-461). The pullbox covers for LT-459, LT-460, and LT-461 are protected by a fire barrier having an approximate fire rating of 3 hours, although 1 hour is committed, to ensure the availability of pressurizer level indication. LT-406 will not be available for safe shutdown.

RCS pressure indication from PT-403, PT-405 and PT-406 may be lost due to a fire in this area. Only one pressure transmitter is necessary for safe shutdown. The separation between the circuits for PT-405 and PT-403 from the circuits for

PT-406 is 25 ft with no intervening combustibles. An exemption was approved based on the partial detection and area wide suppression as documented in SSER 31.

A fire in this area may affect temperature indication circuits for TE-413A, TE-413B, TE-423A, TE-423B, TE-433A, TE-433B, TE-443A and TE-443B. The conduits for the instrumentation for SG 2-3 (TE-433A and TE-433B) and SG-2-4 (TE-443A and TE-443B) are provided with a fire barrier having an approximate rating of 3-hours, although 1 hour is committed. Therefore, these instruments will remain available following a fire. In addition, automatic suppression and partial-coverage smoke detection is provided at this elevation. A deviation for the partial smoke detection was approved in SSER 31.

The reactor vessel head vent valves 8078A, 8078B, 8078C and 8078D may be spuriously opened by a fire in this area. Operator action can be taken to fail the valves closed.

A fire in this area may cause the loss of indication from NE-51 and NE-52. Redundant components NE-31 and NE-32 are located at El. 115 ft and will remain available. In addition, automatic suppression and partial-coverage smoke detection is provided at this elevation.

A fire in this area may affect valves PCV-455A and PCV-455B. Since these valves fail in the desired, closed position, safe shutdown is not affected.

4.2.8 Residual Heat Removal System

A fire in this area may affect valves 8701 and 8702. These valves are closed with power removed during normal operations and will not spuriously open. Also, these valves can be manually opened for RHR operations.

4.2.9 Safety Injection System

A fire in this area may affect valves 8801A and 8801B. Redundant valves 8803A and 8803B can be closed to isolate the diversion flowpath.

A fire in this area may prevent the valves 8805A and 8805B from auto opening on low VCT level. However, these valves can be opened from the Control Room using its control switch.

A fire in this area may affect accumulator isolation valves 8808A, 8808B, 8808C and 8808D. These valves can be manually closed to ensure safe shutdown.

4.2.10 HVAC

HVAC equipment S-45, S-46 and E-46 may be lost due to a fire in this area. Since S-45 of the opposite train may be affected, operator action may be necessary to install portable fans. (Refs. 6.25 and 6.26)

4.3 Fire Zone 3CC-115 ft

4.3.1 Auxiliary Feedwater

A fire in this area may affect valves LCV-108, LCV-109, LCV-113 and LCV-115. Steam generators 2-3 and 2-4 are credited for safe shutdown in this area, and the associated LCVs can be manually operated to regulate auxiliary feedwater flow.

4.3.2 Component Cooling Water

A fire in this area may spuriously close valves FCV-364 and FCV-365. Manual action may be necessary to open these valves.

A fire in this area may affect circuits associated with CCW flow transmitter for Header C (FT-69). Flow through CCW Header C will not be affected due to loss of the instrument. Therefore, loss of flow indication will not affect safe shutdown.

4.3.3 Containment Spray

Containment spray pump 2-2 may spuriously operate due to a fire in this area. However, the corresponding discharge valve, 9001B will remain closed. Therefore, the spurious containment spray pump operation has no impact on safe shutdown.

4.3.4 Chemical and Volume Control System

A fire in this area may affect valves 8104 and FCV-110A. Valve 8104 can be manually opened in order to provide boric acid to the charging pumps.

Valves 8145 and 8148 may be affected by a fire in this area. Redundant valves 8107 and 8108 will remain available to isolate auxiliary spray. Cold shutdown repair will enable valves 8145 and 8148 to be manually operated to provide pressurizer spray capability.

Valves 8146 and 8147 may be affected by a fire in this area. If these valves spuriously close, then the charging injection flowpath can be used. Cold shutdown repair will enable valves 8146 and 8147 to be manually operated to provide pressurizer spray capability.

A fire in this area may spuriously open valves 8149A, 8149B, 8149C, LCV-459 and LCV-460. Operator action can be taken to fail valves 8149A, 8149B, and 8149C closed.

A fire in this area may spuriously open valves 8166, 8167 and close HCV-123. One of these valves is required closed to isolate excess letdown. Since HCV-123 fails closed, safe shutdown will not be affected.

Valve HCV-142 may spuriously open due to a fire in this area. However, safe shutdown is not affected since this valve fails in the desired, open position.

A fire in this area may result in spurious closure of FCV-128. FCV-128 is desired to be open. FCV-128 can be opened from the Control Room by taking its controller to the Manual Mode of operation.

Valves LCV-112B and LCV-112C may be affected by a fire in this area. The running charging pump can be tripped from the control room to prevent cavitation. A pump can be restarted after alignment of the RWST supply and isolation of the VCT supply valve. These valves can be manually closed in order to isolate the volume control tank. If these valves are closed, then valve 8805A or 8805B must be opened to provide water to the charging pumps from the RWST.

4.3.5 Emergency Power

A fire in this area may disable the diesel generator 2-2 automatic transfer circuit. Manual control will remain available in the control room to transfer and load the diesel generator. In addition, offsite power is not affected in this area and will remain available for safe shutdown.

4.3.6 Main Feedwater System

A fire in this area may affect MFW valves FCV-510, FCV-520, FCV-530, FCV-540 and bypass valves FCV-1510, FCV-1520, FCV-1530 and FCV-1540. These valves will fail in the desired closed position and will not affect safe shutdown. Main feedwater pumps are tripped from the control room.

4.3.7 Main Steam System

A fire in this area may spuriously open valves FCV-151, 154, 157, 160, 244, 246, 760, 761, 762, and 763. Operator action can be taken to isolate the SG blowdown flowpath.

A fire in this area may affected valves FCV-43, FCV-44, FCV-22, FCV-23, and FCV-25. Manual action can be taken to close these valves.

A fire in this area may spuriously close FCV-95 which will disable AFW pump 2-1. However, AFW pumps 2-2 and 2-3 will remain available.

A fire in this area may result in the loss of all but one train of steam generator level instrumentation for all four steam generators. There is at least 35 ft of separation between the circuits for LT-517, 527, 537 and 547 and the circuits for LT-519, 529, 539, and 549. Area-wide detection is not provided so an exemption was taken to the Appendix R requirements as justified in SSER 31. Therefore, at least one train of level indication for all four steam generators will remain available at this elevation.

The orientation of all four steam generator pressure indication circuits has been determined to be equivalent to the circuit separation and the detection and suppression criteria outlined in Appendix R. SSER 31 justifies this deviation. Therefore, steam generator pressure indication will not be lost due to a fire in this area.

Valves PCV-19, PCV-20, PCV-21, and PCV-22 may be affected by a fire in this area. Steam generators 2-3 and 2-4 are credited for safe shutdown. PCV-21 and PCV-22 can be manually operated for cooldown through steam generators 2-3 and 2-4.

4.3.8 Reactor Coolant System

A fire in this area may affect pressurizer PORVs PCV-455C, PCV-456, and PCV-474 and blocking valves 8000A, 8000B, and 8000C. The PORVs are required to be closed during hot standby to prevent uncontrolled pressure reduction. The PORV circuits are enclosed in a fire barrier having an approximate rating of 3 hours, although 1 hour is committed. Therefore, they can be manually closed by using the emergency close switch at the hot shutdown panel.

Heater groups 2-2 and 2-3 may be lost due to a fire in this area. This will not affect safe shutdown since the pressurizer heaters are not necessary to achieve cold shutdown conditions.

A fire in this area may affect pressurizer level indication (LT-406, LT-459, LT-460, and LT-461). The conduits for LT-459 and LT-461 are separated by 34 ft with no intervening combustibles. A deviation from the criteria of Appendix R, Section III.G.2 requiring full area detection in combination with area-wide suppression and 20 ft separation was made. SSER 31 documents this deviation.

RCS pressure indication from PT-403, PT-405 and PT-406 may be lost due to a fire in this area. Only one pressure transmitter is necessary. There is a 13 ft-8 inch separation between PT-405 and PT-406 with no intervening combustibles. An exemption to the Appendix R requirements was made based

on the low in-situ combustibles, the area wide suppression, the partial area detection. (Ref. SSER 31)

A fire in this area may affect reactor coolant system temperature indication from TE-413A, TE-413B, TE-423A, TE-423B, TE-433A, TE-433B, TE-443A and TE-443B. A fire barrier with an approximate rating of 3 hours, although 1 hour is committed, is provided for circuits associated with loops 3 and 4 temperature indication. In addition, automatic suppression and partial-coverage smoke detection is provided at this elevation. A deviation to the Appendix R requirements was justified in SSER 31. Therefore, safe shutdown will not be affected.

Reactor vessel head vent valves 8078A, 8078B, 8078C, and 8078D may spuriously open due to a fire in this area. Operator action can be taken to fail the valves closed. Therefore, safe shutdown is not affected.

A fire in this area may affect NE-31, NE-32 and NE-52. Redundant component NE-51 will remain available to provide indication.

A fire in this area may affect valves PCV-455A and PCV-455B. Since these valves fail in the desired, closed position, safe shutdown is not affected.

4.3.9 Residual Heat Removal System

A fire in this area may affect valves 8701 and 8702. These valves are closed with their power removed during normal operations and will not spuriously open. Also, these valves can be manually opened for RHR operations.

4.3.10 Safety Injection System

Valve 8801B may be lost due to a fire in this area. This valve is not required because redundant valve 8801A will remain available to align charging injection, and redundant valves 8803A and 8803B will remain available to isolate this path during pressure reduction.

A fire in this area may prevent the valves 8805A and 8805B from auto opening on low VCT level. However, these valves can be opened from the Control Room using its control switch.

A fire in this area may affect accumulator isolation valves 8808A, 8808B, 8808C, and 8808D. These valves can be manually operated to ensure safe shutdown.

4.3.11 HVAC

One train of required HVAC equipment S-45, S-46 and E-46 may be lost due to a fire in this area. Since S-45 of the opposite train may be affected, operator action may be necessary to install portable fans. (Refs. 6.25 and 6.26)

5.0 CONCLUSION

This area does not meet the requirements of 10 CFR 50, Appendix R, Section III.G.2. which requires the separation of redundant shutdown divisions by 20 ft, free of intervening combustibles, and the installation of area-wide fire protection and suppression systems.

- A deviation from these requirements was requested and granted in SSER 31.

The following features will mitigate the consequences of a design basis fire and assure the ability to achieve safe shutdown:

- Deviations to requirements for 3 hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.
- Smoke detection provided for cable tray areas (El. 100 ft and 115 ft).
- Automatic wet pipe sprinkler provided (El. 100 ft and 115 ft).
- Low Fire Severity.
- The physical location and separation of redundant safe shutdown functions; in this zone, minimize the effects of a design basis fire.

The existing fire protection provides an acceptance level of fire safety equipment to that provided by Section III G.2.

6.0 REFERENCES

6.1 Drawings Numbers: 515568, 515577, 515569, 515578, 515570
6.2 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation M-824, Combustible Loading
6.4 Drawings 065126 and 065127, Fire Protection Information Report, Units 1 and 2
6.5 SSER 31, April 1985

6.6 DCN DC2-EC-6497, Provide 3 Hour Barrier of CCW Piping Penetration Area
6.7 DCN DC2-EC-8115, Provide Ventilation and Fire Barriers in Alcove of Elevation 85 ft
6.8 DCN DC2-EE-14771, Provide Additional Smoke Detectors (Elev. 115’ West of Column Line 2)
6.9 DCN DC2-EA-22612, Provide 1-Hour Barrier for Conduits and Pullboxes
6.10 DCN DC2-EM-26455, Provide Water Spray for Opening Created by Steam Blowout Panels at Elev. 115 ft
6.11 Fire Review Questions, Question No. 5
6.12 DCN DC2-EA-22607, Remove Latch on Door 364-2 for HELB Considerations
6.13 Appendix 3 For EP M-10 Unit 2 Fire Protection of Safe Shutdown Equipment
6.14 NECS File: 131.95, FHARE: 12, Winch Cable Penetrations For Post LOCA Sampling Room Shield Wall
6.15 NECS File: 131.95, FHARE: 13, Unique Blockout Penetration Seal Through Barrier Between The Unit 2 Turbine/Containment Penetration Areas
6.16 NECS File: 131.95, FHARE: 91, "Nonrated Barrier Between Fire Area/Zone 3BB (3CC) and 3-P-2 (3-V-2)"
6.17 PG&E Design Change Notice DC2-EA-050070, Unit 2 ThermoLag Replacement
6.18 Calculation 134-DC, Electrical Appendix R Analysis
6.19 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.20 NECS File: 131.95, FHARE 134, “Non-rated Structural Gap Seals in Fire Barriers”
6.21 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.22 NECS File: 131.95, FHARE 159, Unrated Doors Protected by Local Automatic Sprinklers.
6.23 NECS File: 131 .95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.
6.24 NECS File: 131 .95, FHARE: 97, Containment Electrical Penetrations
6.25 Calculation M-911, Evaluation of Safe Shutdown Equipment During Loss of HVAC
6.26 Calculation M-912, HVAC Interactions For Safe Shutdown

FIRE AREA 3-D-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This fire area is located at the southern end of the Unit 2 Auxiliary Building and occupies El. 54 ft through 115 ft.

1.2 Description

The area contains residual heat removal pump 2-1 and RHR heat exchanger 2-1. The area extends upward to El. 115 ft to encompass the vertical heat exchanger shaft.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

South:

- 3-hour rated barrier separates this area from Containment (Elevation 54 ft and 64 ft), [NC] Zone 3-D-3 (Elevation 73 ft), and Area 3-CC at higher elevations.

North:

- 3-hour rated barrier separates this area from Zone 3-C (El. 54 ft and 64 ft), Area 3-I-1 (El. 73 ft), [NC] Zone 3-L and Area 4-B (El. 85 ft) and Zone 3-X and Area 5-B-4 (El. 100 ft).
- Ventilation opening without a fire damper communicates to area 3-I-1 (El. 73 ft). (Ref. 6.16)

East:

- 3-hour rated barrier separates this area from Zone 3-D-3 (El. 54 ft and 64 ft), Areas 3-I-1 (El. 73 ft), [NC] 3-CC (El. 85 ft) and Zone 3-X (El. 100 ft).
- A 1-1/2-hour rated door communicates to Zone 3-D-3 (El. 64 ft). (Ref. 6.16)
- Duct penetration without a fire damper penetrates to Zone 3-D-3 (El. 64 ft). (Ref. 6.16)
- A 3-hour-equivalent rated double door with a monorail cutout and water spray protection communicates to Zone 3-D-3 (El. 64 ft). (Ref. 6.15 and 6.16).
- An open doorway with a security grate and nonrated penetrations to area 3-I-1 (El. 73 ft). (Ref. 6.16)

- Duct penetration without a fire damper penetrates to Zone 3-X (El. 100 ft). (Ref. 6.16)
- A 2-hour rated plaster blockout panel communicates to Zone 3-D-3. (Ref. 6.11 and 6.16)

West:

- 3-hour rated barrier separates this area from below grade (El. 54 ft and 64 ft)[NC] and Zone 3-C (El. 64 ft), Zone 3-K-3 (El. 73 ft), and Area 4-B (El. 85 ft) and 5-B-4 (El. 100 ft).
- Duct penetration with no fire damper penetrates to Zone 3-C (El. 64 ft). (Ref. 6.16), however, this duct is protected by a 3-hour rated barrier in Fire Zone 3-C. This duct enclosure was installed to prevent a fire in the Tool Room (Fire Zone 3-C) from propagating into Fire Area 3-D-1.

Ceiling:

- 3-hour rated barrier communicates to Fire Zone 3-D-3 and Fire Area 3-I-1 above (El. 73 ft.)
- 3-hour rated barrier with a concrete equipment hatch communicating to Zone 3-AA (El. 115 ft). (Above) (Refs. 6.9, 6.10 and 6.16)
- Lesser rated penetration seal to Zone 3-D-3 (El. 73 ft). (Ref. 6.14)

Floor:

- 3-hour rated barrier to grade. [NC]

2.0 COMBUSTIBLES

2.1 Floor Area: 706 ft^2

2.2 In situ Combustible Materials

- Grease
- Oil
- Miscellaneous
- Clothing/Rags

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags

- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Partial smoke detection over the RHR pump and at the top of the heat exchanger shaft. (Ref. 6.7)

3.2 Suppression

- Water spray system for double door at El. 64 ft, on the 3-D-3 side of the door only. (Ref. 6.3)
- Fire hose stations.
- Portable fire extinguishers.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Residual Heat Removal System

RHR pump 2-1 may be lost for a fire in this area. RHR pump 2-2 will be available to provide the RHR function.

A fire in this area may affect AC power and DC control cables that could result in loss of power and control of FCV-641A. Since the redundant train is available (RHR Pp 2-2 and FCV-641B), this will not affect safe shutdown.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Safe shutdown will not be affected by the loss of safe shutdown functions in this zone due to the availability of redundant equipment.
- Low fire severity.
- Smoke detection provided over the RHR pump and RHR heat exchanger.
- Manual fire fighting equipment is available for use.

The existing fire protection features provide a level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.2.

6.0 REFERENCES

6.1 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.2 Drawing Nos. 515566, 515567, 515568, 515569
6.3 SSER 31, April 1985
6.4 Calculation M-824, Combustible Loading
6.5 Drawings 065126 and 065127, Fire Protection Information Report, Units 1 and 2
6.6 SSER 23, June 1984
6.7 NECS File: 131.95, FHARE: 21, Evaluation of Partial Smoke Detector Coverage
6.8 Deleted in Revision 13
6.9 NECS File: 131.95, FHARE 14, Concrete Equipment Hatches
6.10 PLC Report: Structural Steel Analysis for Diablo Canyon, Rev. 2 (7/08/86)
6.11 NECS File: 131.95, FHARE 50, Plaster Block-out Panels in 3-Hour Barriers
6.12 Calculation 134-DC, Electrical Appendix R Analysis
6.13 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.14 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.15 NECS File: 131 .95, FHARE 159, Unrated Doors Protected by Local Automatic Sprinklers.
6.16 NECS File: 131.95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.

FIRE AREA 3-D-2

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This fire area is located at the southern end of the Unit 2 Auxiliary Building and occupies El. 54 ft through 115 ft.

1.2 Description

This area contains residual heat removal pump 2-2 and RHR heat exchanger 2-2. The area extends upward to El. 115 ft to encompass the vertical heat exchanger shaft.

1.3 Boundaries

NOTE: ^{NC} designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

South:

- 3-hour rated barrier separates this area from containment (El. 54 ft and 64 ft) ^{NC}, Zone 3-C (64 ft.), Zones 3-D-3 and 3-G (El. 73 ft), and Area 3-CC at higher elevations.
- Two lesser rated penetration seals to Area 3-CC (El. 85 ft.). (Refs. 6.14 and 6.16)

North:

- 3-hour rated barrier separates this area from Zone 3-C (El. 54 ft and 64 ft), Areas 3-I-1, 3-I-2 (El. 73 ft), Zone 3-L (El. 85 ft), and Zone 3-X (El. 100 ft).
- Ventilation penetrations with 3-hour rated fire damper communicate to Area 3-I-2 (El. 73 ft).
- Duct penetration with no fire damper penetrates to Zone 3-X. (100 ft.) (Ref. 6.16)

East:

- 3-hour rated barrier separates this area from below grade (El. 54 ft and 64 ft), ^{NC} and Zones 3-C (El. 64 ft), 3-G (El. 73 ft), 3-N (El. 85 ft), and 3-X (El. 100 ft).
- 3 duct penetrations with no fire dampers penetrate to Zone 3-C (El. 64 ft). (Ref. 6.3 and 6.16)

- 1 duct penetration with no fire damper penetrates to Zone 3-N (El. 85 ft). (Ref. 6.16)

West:

- 3-hour rated barrier separates this area from Zone 3-D-3 (El. 54 ft and 64 ft), Area 3-I-1 (El. 73 ft), and Zones 3-CC (El. 85 ft) and 3-X (El. 100 ft).
- 2 duct penetrations without fire dampers penetrate to Zone 3-D-3 (El. 64 ft). (Ref. 6.16)
- A 1-1/2-hour rated door communicates to Zone 3-D-3 (El. 64 ft). (Ref. 6.16)
- A 3-hour-equivalent rated double door with a monorail cutout and water spray protection communicates to Zone 3-D-3 (El. 64 ft). (Refs. 6.15 and 6.16)
- A 3-hour rated door communicates to Area 3-I-1 (El. 73 ft) (Ref. 6.16)
- A 2-hour rated plaster blockout panel communicates to Zone 3-D-3. (Refs. 6.11 and 6.16).

Ceiling:

- 3-hour rated barrier communicates to Fire Zone 3-D-3 and Fire Area 3-I-1 above (El. 73 ft.).
- 3-hour rated barrier with a concrete equipment hatch communicating to Zone 3-AA (El. 115 ft). (Refs. 6.9 and 6.10)
- A lesser rated penetration seal to Fire Zone 3-D-3 (El. 73 ft.). (Ref. 6.14)

Floor:

- 3-hour rated barrier to grade [NC].

2.0 COMBUSTIBLES

2.1 Floor Area: 706 ft^2

2.2 In situ Combustible Materials

- Oil
- Grease
- Miscellaneous
- Clothing/Rags

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Partial smoke detection over the RHR pump and at the top of the heat exchanger shaft. (Ref. 6.7)

3.2 Suppression

- Water spray system for double door at El. 64 ft, on the 3-D-3 side of the door only. (Refs. 6.3 and 6.6)
- Fire hose stations.
- Portable fire extinguishers.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Residual Heat Removal System

RHR pump 2-2 may be lost due to a fire in this area. RHR pump 2-1 will be available to provide the RHR function.

A fire in this area may affect AC power and DC control cables that could result in loss of power and control of FCV-641B. Since the redundant train is available (RHR Pp 2-1 and FCV-641A), this will not affect safe shutdown.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify

that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Safe shutdown will not be affected by the loss of safe shutdown functions in this zone due to the availability of redundant equipment.
- Low fire severity.
- Smoke detection provided over the RHR pump and heat exchanger.
- Manual fire fighting equipment is available for use.

The existing fire protection features provide a level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.2.

6.0 REFERENCES

6.1 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.2 Drawing Nos. 515566, 515567, 515568, 515569
6.3 SSER 31, April 1985
6.4 Calculation M-824, Combustible Loading
6.5 Drawings 065126 and 065127, Fire Protection Information Report, Units 1 and 2
6.6 SSER 23, June 1984
6.7 NECS File: 131.95, FHARE: 21, Evaluation of Partial Smoke Detector Coverage
6.8 Deleted in Revision 13
6.9 NECS File: 131.95, FHARE 14, Concrete Equipment Hatches
6.10 PLC Report: Structural Steel Analysis for Diablo Canyon, Rev. 2 (7/08/86)
6.11 NECS File: 131.95, FHARE 50, Plaster Block-out Panels in 3-Hour Barriers
6.12 Calculation 134-DC, Electrical Appendix R Analysis
6.13 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.14 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.15 NECS File: 131.95, FHARE 159, Unrated Doors Protected by Local Automatic Sprinklers.
6.16 NECS File: 131 .95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.

FIRE AREA 3-I-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This fire area is located at the south side of the Auxiliary Building at El. 73 ft.

1.2 Description

This area houses the Unit 2 Centrifugal Charging Pumps (2-1 and 2-2).

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

South:

- 3-hour rated barrier separates this area from Zones 3-D-3 and 3-K-3, and Areas 3-D-1, [NC] and 3-D-2.
- 3-hour rated door communicates to Zone 3-D-3.
- A duct penetration with no fire damper penetrates to Zone 3-D-3. (Refs. 6.3 and 6.14)
- A ventilation opening with no fire damper communicates to Area 3-D-1. (Ref. 6.14)
- 3-hour rated door communicates to Zone 3-K-3.
- A 2-hour rated blockout panel communicates to Zone 3-K-3. (Ref. 6.8)

North:

- 3-hour rated barrier separates this area from Zone 3-C.
- Two duct penetrations without fire dampers penetrates into Zone 3-C. (Refs. 6.7 and 6.14)
- Two 3-hour-equivalent rated double doors with monorail cutouts and water spray protection communicate into Zone 3-C (Refs. 6.13 and 6.14). There is a 2-hour rated blockout above each door. (Ref. 6.8)

East:

- 3-hour rated barrier separates this area from Areas 3-I-2, 3-D-2 and Zone 3-C.
- 3-hour rated door communicates to Area 3-D-2. Two 3-hour rated doors with water spray protection communicates to Area 3-I-2 and Zone 3-C (Ref. 6.13 and 6.14). There is a 2-hour rated blockout above each door. (Ref. 6.8)

- Lesser rated penetration seal to Zones 3-C and 3-I-2. (Ref. 6.12)

West:

- 3-hour rated barrier separates this area from Zone 3-K-3 and Area 3-D-1. NC
- An open doorway, with security grate, communicates to Area 3-D-1. NC (Ref. 6.14)
- Nonrated pipe penetrations penetrate into Area 3-D-1. (Ref. 6.14)

Floor/Ceiling:

- 3-hour rated barriers: Floor: To areas 3-D-2, 3-D-3, 3-D-1, and Zone 3C.
  Ceiling: To Fire Area 4B and Zone 3L.
- A duct penetration without a fire damper communicates from the floor into Zone 3-C. (Ref. 6.14), however, this duct is protected by a 3-hour rated barrier in Fire Zone 3-C. This duct enclosure was installed to prevent a fire in Fire Zone 3-C from propagating into Fire Area 3-I-1.
- Lesser rated penetration seal to Area 3-CC. (Ref. 6.12)

2.0 COMBUSTIBLES

2.1 Floor Area: 900 ft^2

2.2 In situ Combustible Materials

- Lube Oil
- Plastic
- Cable Insulation
- PVC

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection (partial). (Ref. 6.9)

3.2 Suppression

- Automatic wet pipe sprinkler system (partial). (Ref. 6.9)
- Closed head water spray system protecting 2 double doors in south wall and 1 door in east wall.
- Portable fire extinguishers.
- Hose stations.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Chemical and Volume Control System

Charging pumps 2-1, 2-2, and 2-3 and required ALOPs 2-1 and 2-2 may be lost due to a fire in this area. Charging pump 2-3 can be started locally to provide charging flow.

4.2 Residual Heat Removal System

Control circuitry for RHR pumps 2-1 and 2-2 may be damaged by a fire in this area. Both RHR pumps 2-1 and 2-2 can be locally started to provide RHR flow.

A fire in this area may affect the AC power cables and DC control cables for FCV-641A and FCV-641B. Prior to starting either RHR Pump 2-1 or 2-2, locally open its respective recirc valve (FCV-641A or FCV-641B) after opening its associated power supply breaker (52-2G-29 or 52-2H-15).

4.3 Safety Injection System

SI valves 8803A and 8803B may be affected by a fire in this area. If these valves fail closed, the charging injection flowpath will be isolated. However, flowpaths through the regenerative heat exchanger and the RCP seals will remain available. Redundant valves 8801A and 8801B can be closed during pressure reduction.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3 hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Safe shutdown will not be adversely affected by the loss of the equipment in this area due to the availability of redundant equipment and/or manual actions.

- Smoke detection over charging pumps.

- Automatic wet pipe sprinkler protection over the pumps.

- Manual fire fighting equipment is available for use.

The existing fire protection features provide a level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.2 Drawing No. 515567
6.3 SSER 31, April 1985
6.4 Calculation M-824, Combustible Loading
6.5 Drawing 065127, Fire protection Information Report, Unit 2
6.6 SSER 23, June 1984
6.7 NECS File: 131.95, FHARE 25, Nonrated Features in the Units 1 and 2 Centrifugal Charging Pump Rooms (CCP1 and CCP2)
6.8 NECS File: 131.95, FHARE 50, Plaster Block-out Panels in 3-Hour Barriers
6.9 NECS File: 131.95, FHARE 47, Partial Detection and Suppression Protection
6.10 Calculation 134-DC, Electrical Appendix R Analysis
6.11 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.12 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.13 NECS File: 131.95, FHARE 159, Unrated Doors Protected by Local Automatic Sprinklers.
6.14 NECS File: 131 .95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.

FIRE AREA 3-I-2

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This area is located at the south side of the Auxiliary Building at El. 73 ft.

1.2 Description

This area houses the Unit 2 Centrifugal Charging Pump 2-3.

1.3 Boundaries

South:

- 3-hour rated barrier separates this area from Zone 3-G and Area 3-D-2.
- Ventilation penetrations with 3-hour rated fire damper communicates to Area 3-D-2.
- A duct penetration with no fire damper penetrates to Zone 3-G. (Refs. 6.3, and 6.12)

North:

- 3-hour rated barrier separates this area from Zone 3-C.
- A duct penetration with no fire damper penetrates to Zone 3-C. (Refs. 6.3, 6.7 and 6.12)
- An open doorway with security gate communicates to Zone 3-G. (Refs. 6.3 and 6.12)

East:

- 3-hour rated barrier separates this area from Zone 3-G.

West:

- 3-hour rated barrier separates this area from Area 3-I-1 and Zone 3-C.
- 3-hour rated fire door communicates to Area 3-I-1. There is a 2-hour rated blockout above the door. (Ref. 6.8)
- Lesser rated penetration seals to Area 3-I-1. (Ref. 6.11)

Floor/Ceiling:

Floor: To Fire Zone 3-C and Area 3-D-2.

Ceiling: To Fire Zones 3-L and 3-N.

- 3-hour rated barriers except for a duct penetration without a fire damper in the floor (to 3-C below) and ceiling (to 3-N above). (Refs. 6.3 and 6.12)

2.0 COMBUSTIBLES

2.1 Floor Area: 235 ft^2

2.2 In situ Combustible Materials

- Polyethylene
- Oil
- PVC

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection

3.2 Suppression

- Automatic wet pipe system
- Portable fire extinguishers
- Fire hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Chemical and Volume Control System

Charging pump 2-3 may be lost for a fire in this area. Redundant charging pumps 2-1 and 2-2 will remain available to provide charging flow.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3 hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.
- Safe shutdown will not be adversely affected by the loss of the equipment in this area due to the availability of redundant equipment and/or manual actions.
- Smoke detection over charging pumps.
- Automatic wet pipe sprinkler protection over the pumps.
- Manual fire fighting equipment is available for use.

The existing fire protection features provide a level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.2 Drawing No. 515567
6.3 SSER 31, April 1985
6.4 Calculation M-824, Combustible Loading
6.5 Drawing 065127, Fire protection Information Report, Unit 2
6.6 SSER 23, June 1984
6.7 NECS File: 131.95, FHARE 25, Nonrated Features in the Units 1 and 2 Centrifugal Charging Pump Rooms (CCP1 and CCP2)
6.8 NECS File: 131.95, FHARE 50, Plaster Block-out Panels in 3-Hour Barriers
6.9 Calculation 134-DC, Electrical Appendix R Analysis
6.10 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.11 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers.

6.12 NECS File: 131.95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.

FIRE AREA 3-T-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

North end of the Unit 2 Fuel Handling Building adjacent to the auxiliary building, El. 100 ft.

1.2 Description

This area adjoins Zones 32 and 3-U on the south; 3-A and 3-X on the north; 3-T-2 on the west; and below grade on the east.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

South:

- 3-hour barrier to below grade. [NC]
- 3-hour rated barrier separates this area from Zone 3-U except for a nonrated concrete shield wall. (Ref. 6.14)
- 2-hour rated plaster barrier separates this area from Zone 32 except for a 1-1/2-hour rated double door. (Refs. 6.11 and 6.14)
- Lesser rated penetration seals to Fire Zone 32. (Ref. 6.12)

North:

- 3-hour barrier to below grade. [NC]
- 3-hour rated barrier separates this area from Zone 3-A, except for a 2-hour rated blockout. (Refs. 6.8)
- Lesser rated penetration seals to Zones 3-A and 3-X. (Ref. 6.12)
- 2-hour rated plaster barrier separates this area from Zone 3-X except for a 1-1/2-hour rated double door. (Refs. 6.11 and 6.14).

East:

- 3-hour rated wall to below grade. [NC]

West:

- A 1-hour rated barrier separates this area from Zone 3-T-2 with a 3-hour rated double door. (Ref. 6.13)

- A 1-1/2-hour rated damper communicates to Zone 3-T-2. (Refs. 6.7 and 6.14)
- A duct penetration without a fire damper penetrates to Zone 3-T-2. (Ref. 6.14)
- Lesser rated penetration seals to Zone 3-T-2. (Ref. 6.12)

Floor/Ceiling:

Floor: To Fire Zone 3-V-3.

Ceiling: To Fire Zone 3-W.

- A duct penetration without a fire damper penetrates to Zone 3-W above. (Ref. 6.14)
- An opening to a ventilation duct routed outside the fuel handling building at El. 140 ft. (Ref. 6.2)

2.0 COMBUSTIBLES

2.1 Floor Area: 710 ft^2

2.2 In situ Combustible Materials

- Cable Insulation
- Clothing/Rags
- Oil
- Grease
- Polyethylene
- Plastic
- Wood (fir)
- Rubber
- Hydrogen line - this line has a guard pipe and there is an excess flow valve at the source to isolate the line in case of a H_2 line break

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents

- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Area wide smoke detection

3.2 Suppression

- Area wide automatic wet pipe sprinklers
- Portable fire extinguishers
- Hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Auxiliary Feedwater

AFW pump 2-1 may be affected in this area. AFW pumps 2-2 and 2-3 will remain available for safe shutdown.

Manual valves FCV-436 and FCV-437 andF AFW Pump 2-1 suction valve (2-121) are located in Fire Area 3-T-1. A fire will not damage the normally closed (2-121 is normally open) manual valves. However, FCV-437 will need to be manually opened and 2-121 will need to be manually closed prior to CST inventory depletion

4.2 Makeup System

Level for the condensate storage tank, LT-40 may be lost. Feedwater will be available from the raw water storage reservoir.

4.3 Safety Injection System

A fire in this area may affect circuits associated with RWST Level Transmitter LT-920. There are no cables affected in this area that may result in diverting the RWST inventory. Therefore, loss of this instrument will not affect safe shutdown.

5.0 CONCLUSION

The following fire protection features will adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3 hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.
- Redundant safe shutdown functions are independent of this fire area.
- Low Fire Severity.
- Area-wide smoke detection and automatic suppression are provided.
- Manual fire fighting equipment is available.

The existing fire protection features in this area provide an acceptable level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.2.

6.0 REFERENCES

6.1 Drawing No. 515577
6.2 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.3 Calculation M-624, Combustible Loading
6.4 Drawing 065127, Fire protection Information Report, Unit 2
6.5 SSER 31, April 1985
6.6 Deleted in Revision 13
6.7 NECS File: 131.95, FHARE 10, Undampered Ventilation Opening in the Unit 2 Auxiliary Feedwater Pump Rooms
6.8 NECS File: 131.95, FHARE 125, Lesser rated plaster blockouts and penetration seal configurations
6.9 Calculation 134-DC, Electrical Appendix R Analysis
6.10 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.11 NECS File: 131.95, FHARE 118, Appendix R Fire Area Plaster Barriers
6.12 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.13 PG&E Letter DCL-84-329 Dated 10/19/84
6.14 NECS File: 131.95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.

FIRE AREAS 5-B-1, 5-B-2, 5-B-3

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

These three fire areas are located in the southwest part of the Unit 2 Auxiliary Building, El. 100 ft.

1.2 Description

Fire areas 5-B-1, 5-B-2, and 5-B-3 contain the 480 V vital switchgear rooms (F, G, and H Buses, respectively). These areas are situated side-by-side with Fire Area 5-B-2 located in the center. Area 5-B-1 is west of 5-B-2 and Fire Area 5-B-3 is east of 5-B-2. Due to the similarities between these three areas, they have been combined into one section.

1.3 Boundaries

1.3.1 Fire Area 5-B-1

South:

- A 3-hour rated barrier separates this area from Area 3-CC.

North:

- A 3-hour rated barrier with a nonrated seismic gap separates this area from Area 5-B-4. (Ref. 6.7)
- A 3-hour rated door communicates to Area 5-B-4.
- A protected duct penetration without a fire damper penetrates to Area 5-B-4. (Ref. 6.5)

East:

- A 3-hour rated barrier with a nonrated seismic gap separates this area from Area 5-B-2. (Ref. 6.7)
- A 3-hour rated door communicates to Area 5-B-2.
- A protected duct without a damper penetrates to Area 5-B-2. (Refs.6.5 and 6.6)

West:

- A 3-hour rated barrier with a nonrated seismic gap separates this area from Area 5-B-4. (Ref. 6.7)
- A 3-hour rated door communicates to Area 5-B-4.
- Two protected duct penetrations without fire dampers penetrate to Area 5-B-4. (Refs. 6.5 and 6.8)

Floor/Ceiling:

- 3-hour rated barrier: Floor: To Fire Areas 4-B and 4-B-1.
  Ceiling: To Fire Area 6-B-1.

1.3.2 Fire Area 5-B-2

South:

- A 3-hour rated barrier separates this area from Area 3-CC.

North:

- A 3-hour rated barrier with a nonrated seismic gap separates this area from Area 5-B-4. (Ref. 6.7)
- Two 3-hour rated doors communicate to Area 5-B-4.
- A duct penetration with a 1-1/2-hour rated fire damper penetrates to Area 5-B-4. (Refs. 6.5, 6.6, and 6.13)

East:

- A 3-hour rated barrier with a nonrated seismic gap separates this area from Area 5-B-3. (Ref. 6.7)
- A protected duct penetration without a damper penetrates to Area 5-B-3. (Ref. 6.5)
- A 3-hour rated door communicates to Area 5-B-3.

West:

- A 3-hour rated barrier with a nonrated seismic gap communicates to Area 5-B-1. (Ref. 6.7)
- A 3-hour rated door communicates to Area 5-B-1.
- A protected duct penetration without a damper penetrates to Area 5-B-1. (Ref. 6.5)

Floor/Ceiling:

- 3-hour rated barrier: Floor: To Fire Areas 4-B and 4-B-1.
  Ceiling: To Fire Area 6-B-2.

1.3.3 Fire Area 5-B-3

South:

- A 3-hour rated barrier separates this area from Area 3-CC.

North:

- A 3-hour rated barrier with a nonrated seismic gap separates this area from Area 5-B-4. (Ref. 6.7)
- A 3-hour rated door communicates to Area 5-B-4.
- A duct penetration with a 1-1/2-hour rated fire damper penetrates to Area 5-B-4. (Refs. 6.5 and 6.13)

East:

- A 3-hour rated barrier with a nonrated seismic gap separates this area from Area 5-B-4. (Ref. 6.7)
- A 3-hour rated door communicates to Area 5-B-4.

West:

- A 3-hour rated barrier with a nonrated seismic gap separates this area from Area 5-B-2. (Ref. 6.7)
- A 3-hour rated door communicates to Area 5-B-2.
- A protected duct penetration without a damper penetrates to Area 5-B-2. (Ref. 6.5)

Floor/Ceiling:

- 3-hour rated barrier: Floor: To Fire Areas 4-B and 4-B-2.
  Ceiling: To Fire Area 6-B-3.

Protective Enclosure (for all three areas):

- 1-hour rated fire resistive covering is provided for HVAC ducts in the fire area. (Ref. 6.5)

2.0 COMBUSTIBLES (typical for each area)

2.1 Floor Area: 444 ft^2

2.2 In situ Combustible Materials

- Cable Insulation
- Plastic

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION (typical for each area)

3.1 Detection

- Smoke detection in each area.

3.2 Suppression

- CO_2 hose stations
- Hose stations
- Portable fire extinguishers

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Area 5-B-1

4.1.1 Auxiliary Feedwater

AFW pump 2-3 may be lost due to a fire in this area. Redundant AFW pump 2-1 will be available to provide AFW flow to steam generators 2-3 and 2-4.

AFW valves LCV-113 and LCV-115 may be affected by a fire in this area. Redundant valves LCV-108 and LCV-109 will remain available to provide AFW flow to steam generators 2-3 and 2-4.

4.1.2 Chemical and Volume Control System

CVCS valve 8105 may be affected by a fire in this area. Since the VCT and the RWST will be aligned to the charging pump suction, safe shutdown will not be affected if valve 8105 were to close in the event of a fire.

CVCS valve 8107 may be affected by a fire in this area. Redundant valves 8108, HCV-142, or 8145 and 8148 can be closed to isolate auxiliary spray during hot standby. Two other charging flowpaths can be used if 8107 spuriously closes and disables the regenerative heat exchanger charging flowpath. The PORVs will remain available for pressure reduction. Since valve 8107 has redundant components available, this valve's position will not affect safe shutdown.

Letdown orifice valves 8149A, 8149B and 8149C may be lost due to a fire in this area. Redundant valves LCV-459 and LCV-460 may also be affected in this area. Manual action can be performed to fail closed the orifice valves 8149A, 8149B and 8149C.

Charging pump 2-1 and ALOP 2-1 may be lost due to a fire in this area. Redundant charging pumps 2-2, 2-3 and ALOP 2-2 will be available to provide charging flow.

Boric acid transfer pump 2-1 may be lost due to a fire in this area. Redundant boric acid pump 2-2 will be available for this function.

Volume control tank outlet valve LCV-112B may be affected by a fire in this area. If LCV-112B is lost then valve 8805B can be opened to provide water from the RWST to the charging pump suction. LCV-112C can be closed to isolate the volume control tank.

BAST 2-1 level indication from LT-106 may be affected by a fire in this area. Borated water will be available from the RWST. Therefore, BAST level indication is not required.

4.1.3 Component Cooling Water

CCW pump 2-1 and ALOP 2-1 may be lost due a fire in this area. Redundant CCW pumps and ALOPs 2-2 and 2-3 will be available to provide CCW.

CCW valve FCV-430 may be affected by a fire in this area. If FCV-430 is lost, then CCW heat exchanger 2-1 will be unavailable. However, redundant CCW heat exchanger 2-2 and valve FCV-431 will be available for CCW supply.

CCW valve FCV-750 may be affected by a fire in this area. Since seal injection will remain available, this will provide adequate cooling and FCV-750 will not be required.

4.1.4 Emergency Power

A fire in this area may disable the diesel generator 2-1 backup control circuit. The normal control circuit may remain available.

A fire in this area may disable diesel generator 2-3. Diesel generators 2-1 and 2-2 will remain available. Breaker 52HF10 at SHF should be opened to preclude spurious operation of train "F" components.

A fire in this area may disable startup transformer 2-2. Onsite power will remain available from diesel generators 2-1 and 2-2.

All power supplies on the "F" bus may be lost. Redundant trains on the "G" and "H" buses will be available.

A fire in this area may affect 480 V power to IY22. The 125 VDC power supply to the UPS will remain available.

A fire in this area may disable dc panel SD23 backup battery charger ED231. Normal battery charger ED232 will remain available.

4.1.5 Main Steam System

The following steam generator level and pressure instrumentation may be lost due to a fire in this area: LT-516, LT-526, LT-529, LT-536, LT-539, LT-546, PT-514, PT-524, PT-534 and PT-544. Redundant instrumentation will be available for all four steam generators.

Steam generator 2-1 ten percent atmospheric dump valve PCV-19 may be affected by a fire in this area. Since this valve fails closed which is its desired position, safe shutdown can still be achieved. Redundant dump valves PCV-21 and PCV-22 will be available for cooldown purposes.

Main Steam System valve FCV-38 may be affected by a fire in this area. This valve can be manually operated in the event of a fire to ensure that AFW PP 2-1 can provide auxiliary feedwater to steam generator 2-3.

4.1.6 Makeup System

Condensate storage tank level indication LT-40 may be lost due to a fire in this area. Water from the raw water storage reservoir will be available through FCV-436 to provide auxiliary feedwater. Manual action can be performed to locally open this normally closed manual valve.

4.1.7 Reactor Coolant System

Loss of LT-406, LT-459, NE-31, NE-51, PT-406, PT-403, TE-413A, TE-413B, TE-423A and TE-423B will not affect safe shutdown since redundant components are available that are independent of this fire area.

A fire in this area may affect PZR PORV PCV-474 and its block valve 8000A. Circuit damage to PCV-474 due to a fire in this area would cause the valve to fail closed which is the desired safe shutdown position. A redundant PORV will remain available for pressure reduction.

4.1.8 Safety Injection System

SI pump 2-1 may spuriously operate due to a fire in this area. Local manual action may be required to defeat this spurious operation.

Accumulator isolation valve 8808A may be lost due to a fire in this area. Manual action may be necessary to close valve 8808A.

Valves 8801A, 8803A and 8805A may be lost due to a fire in this area. Safe shutdown is not affected since redundant valves 8801B, 8803B and 8805B are available.

4.1.9 Auxiliary Saltwater System

ASW pump 2-1 may be lost due to a fire in this area. Redundant ASW pump 2-2 will be available to provide ASW.

ASW valve FCV-602 may be lost due to a fire in this area. Redundant CCW heat exchanger inlet valve FCV-603 is used in place of FCV-602. Therefore, safe shutdown is not affected.

4.10 HVAC

HVAC equipment E-104, E-45, S-45, S-46, S-69 and FCV-5045 may be lost due to a fire in this area. HVAC equipment E-104 and S-69 are not necessary for a fire in this area. Since S-46 of the opposite train may be affected, operator action may be necessary to install portable fans. (Refs. 6.15 and 6.16)

4.2 Fire Area 5-B-2

4.2.1 Auxiliary Feedwater

AFW valves LCV-106, LCV-107, LCV-108 and LCV-109 may be affected by a fire in this area. Redundant valves LCV-110 and LCV-111 will remain available to regulate AFW flow to steam generators 2-1 and 2-2.

4.2.2 Component Cooling Water

CCW pump and ALOP 2-2 may be lost due to a fire in this area. Redundant CCW pumps and ALOPs 2-1 and 2-3 will be available to provide CCW.

CCW valve FCV-431 may be affected by a fire in this area. Redundant valve FCV-430 will remain available to allow use of CCW heat exchanger 1-1.

A fire in this area may affect valve FCV-365. Since this valve fails in the desired open position, safe shutdown is not affected.

A fire in this area may spuriously close valve FCV-356 and secure CCW to the RCP thermal barrier. The seal injection flowpath can also be affected in this fire area due to the fire induced spurious closure of FCV-128. The potential for a loss of all seal cooling can occur if the valves in these flowpaths spuriously close simultaneously. A manual action will be taken to open FCV-128 from the Control Room by taking FCV-128 controller to the Manual Mode of operation to provide seal injection to the RCPs. The position of FCV-356 will not affect safe shutdown.

4.2.3 Containment Spray

A fire in this area may spuriously energize containment spray pump 2-1 and may spuriously open valve 9001A. Operator action can be taken to trip CS Pump 2-1.

Valve 9003A may be affected by a fire in this area. Manual action can be taken to close valve 9003A.

4.2.4 Chemical and Volume Control System

Charging pumps 2-2 and 2-3 and ALOP 2-2 may be lost due to a fire in this area. Redundant charging pump and ALOP 2-1 will be available to provide charging flow.

Boric acid transfer pump 2-2 may be lost for a fire in this area. Redundant boric acid transfer pump 2-1 will be available for this function.

CVCS valve 8106 may be affected by a fire in this area. Since the RWST will be aligned to the charging pump suction, valve 8106 is not necessary during a fire in this area.

CVCS valve 8108 may be affected by a fire in this area. Redundant valve 8107 can be shut to isolate auxiliary spray during hot standby. If 8108 spuriously closes, another charging flowpath can be used. The PORVs will remain available for pressure reduction. Therefore, this valve's position will not have an affect on safe shutdown.

CVCS valves 8104 and FCV-110A may be affected by a fire in this area. Safe shutdown is not affected since FCV-110A fails open and is still able to provide boric acid to the charging pump suction. Manual positioning of valve 8471 will be required if valve FCV-110A is used.

CVCS valves 8146, 8147 and 8148 may be affected by a fire in this area. Safe shutdown is not affected because redundant valves exist to isolate auxiliary spray, provide a charging flowpath and provide for pressure reduction.

CVCS valve LCV-112C may be affected by a fire in this area. The running charging pump can be tripped from the control room to prevent cavitation. A pump can be started when the RWST supply is aligned and the VCT supply is isolated. Redundant valve 8805A remains available in order to provide water from the RWST to the charging pump suction. LCV-112B can be closed to isolate the volume control tank.

CVCS valves LCV-459 and LCV-460 may be lost due to a fire in this area. Redundant valves 8149A, 8149B and 8149C will remain available to provide letdown isolation. Therefore, safe shutdown is not affected.

A fire in this area may interrupt power to HCV-142. A fire in this area may also affect DC control cables which may cause HCV-142 and FCV-128 to spuriously close. Spurious closure of HCV-142 will not affect safe shutdown since redundant components exist to isolate auxiliary spray, to provide a charging flowpath, and to provide for pressure reduction. Spurious closure of FCV-128 will isolate RCP seal injection. A manual action will be taken to open FCV-128 from the Control Room by taking FCV-128 controller to the Manual Mode of operation to provide seal injection to the RCPs.

4.2.5 Diesel Fuel Oil System

Diesel fuel oil pump 0-2 may be lost due to a fire in this area. Redundant diesel fuel oil pump 0-1 remains available.

Diesel fuel oil day tank valves LCV-85, LCV-86 and LCV-87 may be lost due to a fire in this area. Redundant valves LCV-88, LCV-89 and LCV-90 remain available.

4.2.6 Emergency Power

A fire in this area may disable diesel generator 2-1. Diesel generators 2-2 and 2-3 will remain available for safe shutdown. If power is available to bus SPG, breaker 52HG10 at SHG should be opened to preclude spurious operation of train "G" components.

A fire in this area may disable the diesel generator 2-2 backup control circuit. The normal control circuit will remain available.

A fire in this area may disable startup transformer 2-2. Onsite power will remain available from diesel generators 2-2 and 2-3.

All power supplies on the "G" Bus may be lost due to a fire in this area. These power supplies are not necessary since redundant trains on the "F" and "H" Buses will be available.

A fire in this area may disable SD21 backup battery charger ED221. Normal battery charger ED21 will remain available.

A fire in this area may cause loss of power supplies associated with PY26. Redundant power supply PY27N remains available.

4.2.7 Main Steam System

The following instrumentation may be lost due to a fire in this area: LT-519, LT-549, PT-515, PT-525, PT-535 and PT-545. Since redundant trains will be available for each steam generator, safe shutdown will not be affected.

Valve PCV-21 may be affected by a fire in this area. Since this valve fails in its desired position safe shutdown is not affected. Redundant valves PCV-19 and PCV-20 will remain available for cooldown using steam generators 2-1 and 2-2.

Valves FCV-760 and FCV-761 may be lost due to a fire in this area. FCV-760 has redundant valves FCV-154 and FCV-248 while FCV-761 has redundant valves FCV-151 and FCV-250 which will be available for isolation of steam generator blowdown. Therefore, safe shutdown is not affected.

Valve FCV-95 may be lost due to a fire in this area. AFW pump 2-2 will remain available to provide AFW to the steam generators.

Main steam isolation valves FCV-41, FCV-42 and bypass valve FCV-24 may be affected by a fire in this area. These valves can be manually closed during a fire.

4.2.8 Reactor Coolant System

The following instrumentation may be lost due to a fire in this area: LT-460, NE-32, TE-433A, TE-433B, TE-443A and TE-443B. All of these components have redundant components that are available for safe shutdown.

Pressurizer PORV PCV-455C and blocking valve 8000B may be affected by a fire in this area. Since PCV-455C fails closed, safe shutdown is not affected. A redundant PORV will remain available for pressure reduction.

A fire in this area may prevent reactor coolant pumps 2-1, 2-2, 2-3, and 2-4 from being tripped. Safe shutdown is not affected if reactor coolant pumps continuously run.

Pressurizer heaters 2-3 and 2-4 may be affected by a fire in this area. Manual actions can be taken to de-energize heater group 2-4 and switch heater group 2-3 to the vital power source. Therefore, safe shutdown will not be affected.

4.2.9 Residual Heat Removal System

RHR pump 2-1 and valve 8700A may be lost due to a fire in this area. Redundant RHR pump 2-2 and valve 8700B will be available to provide the RHR function.

RHR valve 8701 may be affected by a fire in this area. This valve is closed with its power removed during normal operations and will not spuriously operate. Also this valve can be manually opened for RHR operations.

4.2.10 Safety Injection System

SI valves 8801B, 8803B and 8805B may be lost due to a fire in this area. Redundant valves 8801A, 8803A and 8805A remain available to provide the same functions. Also, the PORVs will be available for pressure reduction. Therefore, safe shutdown is not affected.

Valve 8804A may be affected by afire in this area. This valve can be manually closed. Therefore, safe shutdown is not affected.

SI valves 8808B and 8808D will not be affected by a fire in this area. These valves can be manually closed. Therefore, safe shutdown is not affected.

A fire in this area may affect valve 8982A. Power to the valve is administratively removed by maintaining a toggle switch in the Control Room in the open position. The valve is normally closed, and spurious opening is not expected to occur. However, an operator action can be taken to open the power breaker to the valve to further preclude spurious operation. Safe shutdown will not be affected.

4.2.11 Auxiliary Saltwater System

ASW pump 2-2 may be lost due to a fire in this area. Redundant pump 2-1 will be available to provide the ASW function.

ASW valve FCV-603 may be affected by a fire in this area. Redundant valve FCV-602 remains available, to provide ASW. Thus, no manual actions are required.

4.2.12 HVAC

A fire in this area may affect E-102 and S-68. Since these two components are not necessary during a fire, safe shutdown is not affected.

4.3 Fire Area 5-B-3

4.3.1 Auxiliary Feedwater

AFW pump 2-2 may be lost due to a fire in this area. Redundant pump 2-3 will be available to provide AFW.

A fire in this area may affect LCV-110 and LCV-111. Redundant valves LCV-113 and LCV-115 will remain available to provide AFW flow to steam generators 2-3 and 2-4.

4.3.2 Chemical and Volume Control System

A fire in this area may result in the loss of boric acid storage tank level LT-102. Borated water will be available from the RWST. Therefore, BAST level indication will not be required.

CVCS valve 8145 may be affected by a fire in this area. This valve will fail closed and does not affect safe shutdown. The PORVs are available, thus no manual actions are required.

A fire in this area may affect valve FCV-110A. Safe shutdown is not affected since this valve fails open which is its desired position. Also, valve 8104 will remain available for boric acid transfer.

A fire in this area may affect circuits associated with letdown flow transmitter, FT-134. Letdown isolation valves (LCV-459, LCV-460, 8149A, 8149B and 8149C) are not affected in this area and will remain available to isolate letdown. Loss of this indication will not affect safe shutdown.

4.3.3 Component Cooling Water

CCW pump and ALOP 2-3 may be lost due to a fire in this area. Redundant CCW pumps and ALOPs 2-1 and 2-2 will be available to provide CCW.

A fire in this area may spuriously close CCW return valves FCV-356 and FCV-357. Since seal injection will remain available, FCV-356 and FCV-357 will not be required open.

CCW supply valve FCV-355 may spuriously close during a fire in this area. FCV-355 can be manually operated for safe shutdown.

CCW supply valve FCV-364 may be affected by a fire in this area. Safe shutdown will not be affected since this valve fails open which is the desired position.

4.3.4 Containment Spray

A fire in this area may affect containment spray pump 2-2 and valve 9001B. Operator action can be taken to trip CS Pump 2-2.

A fire in this area may spuriously open valve 9003B. This valve can be manually closed to ensure safe shutdown.

4.3.5 Diesel Fuel Oil System

Diesel fuel oil pump 0-1 may be lost due to a fire in this area. Redundant diesel fuel oil pump 0-2 will remain available.

Diesel fuel oil day tank valves LCV-88, LCV-89 and LCV-90 may be lost due to a fire in this area. Redundant valves LCV-85, LCV-86 and LCV-87 remain available.

4.3.6 Emergency Power

Diesel generator 2-2 may be lost due to a fire in this area. Diesel generators 2-1 and 2-3 will remain available for safe shutdown. Manual actions should be taken to prevent the spurious operation of "H" Bus components.

Control power for the diesel generator 2-3 backup control circuit may be lost due to a fire in this area. Power for the normal control circuit will remain available.

A fire in this area may disable startup transformer 2-2. Onsite power will remain available from diesel generators 2-1 and 2-3.

All power supplies on the "H" Bus may be lost due to fire in this area. Redundant trains "G" and "F" will remain available.

DC panel SD21 backup battery charger ED221 may be lost due to a fire in this area. Normal battery charger ED21 will remain available.

A fire in this area may disable dc panel SD22 backup battery charger ED221. Normal battery charger ED22 will remain available.

4.3.7 Main Steam System

The following instrumentation may be lost due to a fire: LT-518, LT-528, LT-538, LT-548, PT-526 and PT-536. Safe shutdown is not affected since redundant trains of indication for all four steam generators are available.

A fire in this area may interrupt power to PCV-20. A fire in this area may also affect cables that could cause the valve to spuriously operate. Manual action can be taken to isolate the air and fail the ADV closed. Redundant dump valves PCV-21 and PCV-22 will be available for cooldown using steam generators 2-3 and 2-4.

A fire in this area may spuriously close FCV-37. AFW pump 2-3 will remain available to provide auxiliary feedwater to the steam generators.

FCV-762 and FCV-763 may be lost due to a fire in this area. Redundant valves FCV-157 and FCV-246 for FCV-762 and FCV-160, and FCV-244 for FCV-763, will be available for isolation of steam generator blowdown. Therefore, safe shutdown is not affected.

Valves FCV-43 and FCV-44 may be affected by a fire in this area. These valves can be manually closed.

4.3.8 Reactor Coolant System

The following components may be lost due to a fire in this area: LT-461, NE-52 and PT-403. Since redundant trains will be available safe shutdown will not be affected.

PZR PORV PCV-456 and blocking valve 8000C may be affected by a fire in this area. Since PCV-456 fails closed safe shutdown is not affected. A redundant PORV will remain available for safe shutdown.

A fire in this area may spuriously start reactor coolant pumps 2-1, 2-2, 2-3 and 2-4. Safe shutdown is not affected if the RCPs continuously run. CCW to the thermal barrier heat exchanger or seal injection will remain available for RCP seal cooling.

Pressurizer heaters 2-1 and 2-2 may be affected by a fire in this area. Manual actions can be taken to de-energize heater group 2-1 and switch heater group 2-2 to the vital power supply. Therefore, safe shutdown is not affected.

4.3.9 Residual Heat Removal System

RHR pump 2-2 and valves 8700B and FCV-641B may be affected by a fire in this area. Since RHR pump 2-1 and valves 8700A and FCV-641A remain available, safe shutdown is not affected.

Valve 8702 may be affected by a fire in this area. This valve is closed with its power removed during normal operations and will not spuriously open. Also, this valve can be manually opened for RHR operations.

4.3.10 Safety Injection System

SI pump 2-2 may spuriously operate due to a fire in this area. Local manual action may be required to defeat this spurious operation.

A fire in this area may prevent the valves 8805A and 8805B from auto opening on low VCT level. However, these valves can be opened from the Control Room using its control switch.

Valve 8808C may be affected by a fire in this area. This valve can be manually closed to ensure safe shutdown.

A fire in this area may affect valve 8982B. Power to the valve is administratively removed by maintaining a toggle switch in the Control Room in the open position. The valve is normally closed, and spurious opening is not expected to occur. However, an operator action can be performed to open the power breaker to the valve to further preclude spurious operation. Therefore, safe shutdown is not affected.

4.3.11 Auxiliary Saltwater System

ASW valves FCV-495 and FCV-496 may be affected by a fire in this area. Valve FCV-601 will remain available to provide ASW system integrity.

4.3.12 HVAC

A fire in this area may affect E-46, S-45, S-46, S-67 and FCV-5046. HVAC equipment S-67 is not necessary in this fire area. Since S-45 of the opposite train may be affected, operator action may be necessary to install portable fans. (Refs. 6.15 and 6.16)

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3 hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Automatic smoke detection is provided.

- Manual fire fighting equipment is available for use.

- The loss of safe shutdown functions in each fire area does not affect the redundant train.

The existing fire protection features provide an acceptable level of safety equivalent to that provided by Section III.G.2.

6.0 REFERENCES

6.1 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.2 Drawing No. 515569
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065127, Fire Protection Information Report, Unit 2
6.5 NECS File: 131.95, FHARE: 15, HVAC Duct Wrapped in Pyrocrete
6.6 NECS File: 131.95, FHARE: 80, Fire Dampers installed at Variance with Manufacturers Instructions
6.7 NECS File: 131.95, FHARE: 6, Seismic Gap At Concrete Block Walls
6.8 NECS File: 131.95, FHARE: 73, Undampered Ducts
6.9 Deleted in Revision 14.
6.10 AR A0211784 AE 08, NES Fire Protection's Evaluation of Exposed Structural Steel Anchor Bolts
6.11 Calculation 134-DC, Electrical Appendix R Analysis
6.12 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.13 SSER 31, April 1985
6.14 NECS File: 131.95, FHARE 152, Evaluation of Fire Dampers in 480V Switchgear and Battery Rooms
6.15 Calculation M-911, Evaluation of Safe Shutdown Equipment During Loss of HVAC
6.16 Calculation M-912, HVAC Interactions For Safe Shutdown

FIRE AREA 5-B-4

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Southwest end of the Auxiliary Building, hot shutdown panel and nonvital 480V switchgear room area, El. 100 ft.

1.2 Description

This area houses the hot shutdown panel and 480V switchgear. It occupies the southwest corner of the Auxiliary Building at El. 100 ft. A "No Storage" area sign is posted in the hot shutdown panel area.

1.3 Boundaries

South:

- A 3-hour rated barrier separates this area from Area 3-CC, 3-D-1, and Zone 19-A.
- A 3-hour rated barrier with nonrated seismic gaps separates this area from Areas-5-B-1, 5-B-2, 5-B-3. (Ref. 6.14)
- Four 3-hour rated doors communicate into Areas 5-B-1, 5-B-2, 5-B-3 (one each to Areas 5-B-1 and 5-B-3, and two to 5-B-2).
- Two 1-1/2-hour rated fire dampers communicate to Areas 5-B-2, 5-B-3 (one damper into each area). (Refs. 6.13 and 6.23)
- A protected duct without a fire damper to Fire Area 5-B-1. (Refs. 6.7 and 6.23)

North:

- A 3-hour rated barrier with nonrated seismic gap seals separates this area from Area 5-A-4. (Ref. 6.14)
- A 3-hour rated barrier separates this area from Zones S-5 and S-1.
- Two 3-hour rated doors communicate to Area 5-A-4.
- A duct penetration without a fire damper penetrates to Zone S-5. (Ref. 6.21 and 6.23)

East:

- A duct penetration without a damper to Fire Area 5-B-1. (Refs. 6.8 and 6.23)
- A 3-hour rated barrier separates this area from Zones 3-X, S-2, S-5 and Areas 5-B-1, and 3-D-1.
- A 3-hour rated door communicates to Fire Area 5-B-1.

- A protected duct penetration without a damper to Area 5-B-1. (Refs. 6.7, 6.13 and 6.23)

West:

- Vent register with a 3-hour rated fire damper communicates with Zone S-1, the duct shaft. (Refs. 6.4, and 6.22)
- A 3-hour rated barrier separates this area from Zone 19-A.
- A 3-hour rated barrier and door to Fire Area 5-B-3 and Zone S-1.

Floor/Ceiling:

- 3-hour rated barriers: Floor: To Fire Areas 4-B and 4-B-2.
  Ceiling: To Fire Areas 6-B-1, 6-B-2, 6-B-3, 6-B-4, and 6-B-5
- Nonrated equipment hatch communicates to area 4-B below and Area 6-B-5 above. (Ref. 6.23)
- One duct penetrations to Area 6-B-5 without a fire damper. (Refs. 6.8 and 6.23)

Protective Enclosure:

- 1-hour rated fire resistive covering is provided for several HVAC ducts. (Refs. 6.7 and 6.13)
- Conduit K7438 is provided with a fire resistive wrap with an approximate fire rating of 3 hours, although a 1 hour fire barrier is committed. (Refs. 6.9 and 6.18)

2.0 COMBUSTIBLES

<u>2.1 Floor Area: 2,622 ft2</u>

<u>2.2 In situ Combustible Materials</u>

- Cable insulation
- Rubber
- Paper

<u>2.3 Transient Combustible Materials</u>

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags

- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection in the area and inside hot shutdown panel.

3.2 Suppression

- CO_2 hose stations
- Portable fire extinguishers

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Auxiliary Feedwater

A fire in this area may prevent the operation from the hot shutdown panel of AFW pumps 2-2 and 2-3. Since AFW pumps 2-2 and 2-3 will remain operational from the control room, safe shutdown will not be affected.

Control of valves LCV-106, LCV-107, LCV-108 and LCV-109 from the hot shutdown panel may be affected by a fire in this area. Operation of valves LCV-106 and LCV-107 will remain available from the control room if FCV-95 is not affected by a fire in this area and AFW Pump 2-1 is utilized.

Valves LCV-110, LCV-111, LCV-113 and LCV-115 may be affected by a fire in this area. Manual actions can be taken to ensure operation of these valves when AFW Pumps 2-2 or 2-3 are utilized for safe shutdown.

4.2 Chemical and Volume Control System

A fire in this area may prevent the operation of the following components from the hot shutdown panel: valve 8104, boric acid transfer pumps 2-1 and 2-2 and charging pumps 2-1 and 2-2. Since charging pumps 2-1 and 2-2, boric acid

transfer pump 2-2 and valve 8104 will remain operational from the control room, safe shutdown will not be affected.

Valves 8149A, 8149B and 8149C may be lost due to a fire in this area. Redundant valves LCV-459 and LCV-460 will remain available to isolate letdown.

Valves HCV-142 and FCV-128 may be affected by a fire in this area. If HCV-142 cannot be closed to isolate auxiliary spray during hot standby, existing redundant valves can be closed. The charging injection flow path is not affected by a failure of either HCV-142 or FCV-128. Spurious closure of FCV-128 will isolate seal injection flow. To achieve cold shutdown, FCV-128 may have to be bypassed and HCV-142 manually operated to establish auxiliary spray flow.

Valve 8145 may be affected by a fire in this area. During hot standby, valves 8107 and 8108 can be used to isolate auxiliary spray, but during cold shutdown, valve 8148 will be available to allow the use of auxiliary spray. Since redundant components will be available, safe shutdown is not affected.

A fire in this area may affect the transmitter and circuits associated with charging pump header flow transmitter, FT-128, and pressure transmitter, PT-142. Both charging pumps are available in this fire area to provide charging flow. Loss of these instruments will not affect safe shutdown.

A fire in this area may affect circuits associated with letdown flow transmitter, FT-134. Letdown isolation valves LCV-459 and LCV-460 are not affected in this area and will remain available to isolate letdown. Loss of this instrument will not affect safe shutdown.

4.3 Component Cooling Water

A fire in this area may prevent the operation of CCW pumps 2-1, 2-2 and 2-3 from the hot shutdown panel. However, operation these pumps will remain available from the control room. Therefore, safe shutdown will not be affected.

Valves FCV-355, FCV-430 and FCV-431 may be affected by a fire in this area. Valves FCV-355 and FCV-430 can be manually operated to ensure safe shutdown.

A fire in this area may affect valve FCV-356. The seal injection flow can also be affected in this area due to fire induced spurious closure of FCV-128. The potential for a loss of all RCP seal cooling can occur if the valves in these flowpaths spuriously close simultaneously. To provide CCW to the RCP thermal barrier heat exchanger, locally open FCV-356 after opening its power breaker.

A fire in this area may affect circuits associated with CCW flow transmitters for Header A (FT-68) and Header B (FT-65). All three CCW pumps will remain

available in this area to provide CCW flow to either header. Therefore, loss of these instruments will not affect safe shutdown.

A fire in this area may affect circuits associated with the differential pressure transmitters for CCW Hx 2-1 (PT-5) and CCW Hx 2-2 (PT-6). All three CCW pumps will remain available in this area to provide CCW flow to either header. Therefore, loss of these instruments will not affect safe shutdown.

A fire in this area may affect the circuits associated with the CCW flow transmitter on Header C (FT-69). This instrument is credited to indicate a loss of CCW flow. Loss of this indication will not affect flow to CCW Header C. Therefore, loss of this indicator will not affect safe shutdown.

4.4 Containment Spray

A fire in this area may spuriously open valve 9001B. Since containment spray pump 2-2 will remain available, safe shutdown will not be affected with this valve open.

4.5 Diesel Fuel Oil System

A fire in this area may affect the Unit 2 power circuits for diesel fuel oil transfer pumps 01 and 02. Offsite power is not affected in this area and would remain available for safe shutdown. However, if onsite power using the diesel generators is utilized, the circuits are protected by a fire barrier having an approximate rating of 3 hours, although 1 hour was committed. Operator action may be required to manually transfer the power supply from Unit 1 to Unit 2.

4.6 Emergency Power

A fire in this area may disable diesel generator 2-3 backup control circuit. The normal control circuit will remain available.

A fire in this area may result in a loss of power supplies associated with PY27N. Redundant power supply PY26 remains available.

4.7 Main Steam System

A fire in this area may result in the loss of the following equipment: PT-514, PT-524, PT-534 and PT-544. Since two other trains of pressure indication for each steam generator will remain available, safe shutdown will not be affected.

A fire in this area may result in the loss of FCV-95. Since AFW pumps 2-2 and 2-3 will remain available to provide AFW, FCV-95 is not necessary for safe shutdown.

A fire in this area may affect valves PCV-19, PCV-20, PCV-21 and PCV-22. Operator action may be required to manually open each valve.

4.8 Makeup System

Level for the condensate storage tank, LT-40 may be lost due to a fire in this area. Feedwater will be available from the raw water storage reservoir through valves FCV-436 and FCV-437.

4.9 Reactor Coolant System

A fire in this area may affect the following components: LT-459, LT-460, NE-51 and NE-52. Safe shutdown is not affected since redundant components will be available.

Pressurizer PORVs PCV-455C, 456 and PCV-474 may be affected by a fire in this area. Since the block valves are available for PORV isolation and auxiliary spray remains available, safe shutdown will not be affected.

A fire in this area may cause reactor coolant pumps 2-1, 2-2, 2-3 and 2-4 to spuriously start. Safe shutdown is not affected if the RCPs continuously run. CCW to the thermal barrier heat exchanger or seal injection will remain available for RCP seal cooling.

Pressurizer heater groups 2-1, 2-2, 2-3 and 2-4 may be affected by a fire in this area. Since these heaters can be manually tripped, safe shutdown will not be affected.

4.10 Residual Heat Removal System

RHR pump 2-2 may be lost due to a fire in this area. Redundant RHR pump 2-1 will remain available for safe shutdown.

4.11 Safety Injection System

A fire in this area may prevent the valves 8805A and 8805B from auto opening on low VCT level. However, these valves can be opened from the Control Room using its control switch.

A fire in this area may spuriously open accumulator isolation valve 8808C. Manual action can be taken to close this valve.

Containment sump isolation valve 8982B may be affected by a fire in this area. Power to the valve is administratively removed by maintaining a toggle switch in the Control Room in the open position. The valve is normally closed, and

spurious opening is not expected to occur. Therefore, safe shutdown is not affected.

4.12 Auxiliary Saltwater System

A fire in this area may prevent the operation of ASW pumps 2-1 and 2-2 from the hot shutdown panel. However, safe shutdown will not be affected since the operation of ASW pump 2-1 and 2-2 from the control room will remain available.

Valves FCV-495 and FCV-496 may be lost due to a fire in this area. Valve FCV-601 will remain closed to provide ASW system integrity.

A fire in this area may spuriously close valves FCV-602 and FCV-603. A deviation was approved in this area for lack of automatic suppression and inadequate separation of redundant valves. Since only ASW pump 2-1 may be available for a fire in this area, FCV-602 must be credited. Manual action can be taken to open valve FCV-602.

4.13 HVAC

HVAC equipment E-102, E-45, E-46, S-45 and S-46 may be affected by a fire in this area. Redundant equipment E-104 is available for E-102. The other fans can be lost because portable fans can be used to provide HVAC.
(Refs. 6.16 and 6.17)

5.0 CONCLUSION

This area does not meet the technical requirements of 10 CFR 50, Appendix R, Section III.G.3 because area-wide automatic suppression system is not provided.

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3 hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- The loss of safe shutdown functions in this area does not affect safe shutdown due to the availability of redundant functions and/or measures provided to preclude the effects of fire.

- Area wide smoke detection is provided.

- Manual fire fighting equipment is available.

The existing fire protection features provide an acceptable level of safety equivalent to that achieved by compliance with Section III.G.2.

6.0 REFERENCES

6.1 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.2 Drawing No. 515569
6.3 DCN-DC2-EE-10913, provides isolator on RPM Tach-Pack
6.4 SSER 31, April 1985
6.5 Calculation M-824, Combustible Loading
6.6 Drawing 065127, Fire Protection Information Report, Unit 2
6.7 NECS File: 131.95, FHARE: 15, HVAC Duct Wrapped in Pyrocrete
6.8 NECS File: 131.95, FHARE: 73, Undampered Ducts
6.9 DCN DC2-EA-22612, Fireproof Conduit
6.10 DCN DC2-EE-12765, ASW Pump 2-1 Switch Control
6.11 Deleted in Revision 13
6.12 Appendix 3 for EP M-10 Unit 2 Fire Protection of Safe Shutdown Equipment
6.13 NECS File: 131.95, FHARE: 80, Fire Dampers Installed at Variance with Manufacturers Instructions
6.14 NECS File: 131.95, FHARE: 6, Seismic Gaps At Concrete Block Walls
6.15 Deleted in Revision 14.
6.16 Calculation M-911, Evaluation of Safe Shutdown Equipment During Loss of HVAC
6.17 Calculation M-912, HVAC Interactions for Safe Shutdown
6.18 PG&E Design Change Notice DC2-EA-050070, Unit 2 ThermoLag Replacement
6.19 Calculation 134-DC, Electrical Appendix R Analysis
6.20 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.21 NECS File: 131.95, FHARE 27, Undampered Duct Penetrations in Concrete Lined Shafts
6.22 NECS File: 131.95, FHARE 42, Fire Dampers Installation for Areas 5-A-4 and 5-B-4
6.23 NECS File: 131.95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.

FIRE AREAS 6-B-1, 6-B-2, 6-B-3

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Southwest side of the Unit 2 Auxiliary Building. Unit 2 battery, inverter, and dc switchgear rooms, El. 115 ft.

1.2 Description

Fire Areas 6-B-1, 6-B-2, and 6-B-3 are separate fire areas, each containing redundant batteries, inverters, and dc switchgear, one train of which is required for safe shutdown. These fire areas are situated side by side, with Fire Area 6-B-2 located between Fire Area 6-B-1 to the west and Fire Area 6-B-3 to the east. Due to similarities between these three areas, they have been combined into one section.

Battery room ventilation is provided by a supply fan and an exhaust fan located in separate fire zones isolated by 25 ft of open space (Fire Zones 8-B-6 and 8-B-8). Either fan provides adequate flow to limit hydrogen concentration well below the explosive concentration. Additionally, control room annunciation is provided for dc overvoltage which could result in excessive hydrogen generation. Ventilation for the inverter and dc switchgear room is provided by two 100 percent supply fans which also supply ventilation for the 480V vital switchgear and are unrelated to the battery room ventilation. (Ref. 6.7)

The battery rooms are separated from the inverter and switchgear rooms. (Ref. 6.6)

1.3 Boundaries

1.3.1 Fire Area 6-B-1

South:

- 3-hour rated barrier separates this area from Area 3-CC.

North:

- 3-hour rated barrier separates this area from Area 6-A-1.
- Unrated structural gap seal to Fire Area 6-A-1. (Ref. 6.14)
- A 3 hour door communicates to Area 6-A-1.

East:

- 3-hour rated barrier separates this area from Area 6-B-2.
- A 3-hour rated door communicates to Area 6-B-2.
- Four protected ducts with no fire damper penetrate Area 6-B-2. Dampers are provided at the registers. (Ref. 6.5)

West:

- 3-hour rated barrier separates this area from Area 6-B-5.
- A 3-hour rated door communicates to Area 6-B-5.
- Three protected ducts with no fire damper penetrate Area 6-B-5 dampers are provided at the registers. (Ref.6.5)

Floor/Ceiling:

- 3-hour rated barriers: Floor: To Fire Areas 5-B-1 and 5-B-4.
  Ceiling: To Fire Area 7-B.

<u>1.3.2 Fire Area 6-B-2</u>

South:

- 3-hour rated barrier separates this area from Area 3-CC.

North:

- 3-hour rated barrier separates this area from Area 6-A-2.
- Unrated structural gap seal to Fire Area 6-A-2. (Ref. 6.14)
- A 3-hour rated door communicates to Area 6-A-2.

East:

- 3-hour rated barrier separates this area from Area 6-B-3.
- A 3-hour rated door communicates to Area 6-B-3.
- Four protected ducts with no fire damper penetrate Area 6-B-3. Dampers are provided at the registers. (Ref. 6.5)

West:

- 3-hour rated barrier separates this area from Areas 6-B-1.
- A 3-hour rated door communicates to Area 6-B-1.

- Four protected ducts with no fire damper penetrate Areas 6-B-1. Dampers are provided at the registers. (Ref. 6.5)

Floor/Ceiling:

- 3-hour rated barriers: Floor: To Fire Areas 5-B-2 and 5-B-4.
  Ceiling: To Fire Area 7-B.

1.3.3 Fire Area 6-B-3

South:

- 3-hour rated barrier separates this area from Area 3-CC.

North:

- 3-hour rated barrier separates this area from Area 6-A-3. (Ref. 6.16)
- Unrated structural gap seal to Fire Area 6-A-3. (Ref. 6.14)
- A 3-hour rated door communicates to Area 6-A-3.

East:

- 3-hour rated barrier separates this area from Area 6-B-4.
- A 3-hour rated door communicates to Area 6-B-4.
- Two protected ducts with no fire dampers penetrate Area 6-B-4. Dampers are provided at the registers. (Ref. 6.5)

West:

- 3-hour rated barrier separates this area from Area 6-B-2.
- A 3-hour rated door communicates to Area 6-B-2.
- Four protected ducts with no fire damper penetrate Area 6-B-2. Dampers are provided at the registers. (Ref. 6.5)

Floor/Ceiling:

- 3-hour rated barriers: Floor: To Fire Areas 5-B-3 and 5-B-4.
  Ceiling: To Fire Area 7-B.

2.0 COMBUSTIBLES (typical for each area)

2.1 Floor Area: 672 ft2

2.2 In situ Combustible Materials

- Misc. combustibles
- Cable insulation
- Plastic
- Paper

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION (typical for each area)

3.1 Detection

- Smoke detection in the inverter, the dc switchgear rooms and the battery rooms. (Ref. 6.8)

3.2 Suppression

- CO_2 hose stations
- Fire hose stations
- Portable fire extinguishers

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Area 6-B-1

4.1.1 Auxiliary Feedwater

AFW pump 2-3 may be lost due to a fire in this area. Redundant AFW pump 2-2 will be available to provide AFW flow to steam generators 2-1 and 2-2. Redundant AFW Pump 2-1 will be available after performing manual action to open steam supply valve FCV-38.

A fire in this area may affect AFW supply valves LCV-113 and LCV-115. Redundant valves LCV-110 and LCV-111 will remain available to provide AFW flow to steam generators 2-1 and 2-2 from AFW Pump 2-2. Steam generators 2-3 and 2-4 are credited for safe shutdown in this area. Valves LCV-108 and LCV-109 will remain available and a manual action to operate LCV-113 and LCV-115 can be performed to feed steam generators 2-3 and 2-4.

In addition, if FCV-38 is not affected by the fire and AFW Pp 2-1 is utilized, then LCV-106, LCV-107 will be available.

4.1.2 Chemical and Volume Control System

Charging pump and ALOP 2-1 may be lost due to a fire in this area. Redundant charging pumps 2-2 and 2-3 and ALOP 2-2 will be available to provide charging flow.

Boric acid transfer pump 2-1 may be lost due to a fire in this area. Redundant boric acid transfer pump 2-2 will remain available.

Valve 8105 may be affected by a fire in this area. Safe shutdown will not be affected since the RWST can be made available to provide a charging suction flowpath.

A fire in this area may affect valve 8107. Valves 8108, HCV-142 or 8145 and 8148 may be shut to isolate auxiliary spray. Two other charging flowpaths are available if valve 8107 spuriously closes and blocks the charging flowpath through the regenerative heat exchanger. The pressurizer PORVs will remain available to provide pressure reduction capabilities. Since valve 8107 has redundant components, safe shutdown is not affected.

A fire in this area may spuriously open valves 8149A, 8149B, 8149C, LCV-459 or LCV-460. Manual operator action can be taken to fail 8149A, 8149B, and 8149C closed.

Valves 8146 and 8147 may fail open due to a fire in this area. This condition will not affect safe shutdown since the PORVs will remain available for pressure reduction.

Valve LCV-112B may be affected by a fire in this area. If control of this valve is lost, the VCT can be isolated by closing valve LCV-112C. Valve 8805B can be opened to provide water to the charging pumps from the RWST.

A fire in this area may affect equipment and circuits associated with VCT level transmitter LT-112. This instrument is credited for diagnosis of failure of the VCT discharge valves LCV-112B or LCV-112C to automatically close. Therefore, loss of this instrument will not affect safe shutdown.

Boric acid storage tank 2-1 level, LT-106 may be lost due to a fire in this area. Borated water from the RWST will remain available. Therefore, BAST level indication is not required.

4.1.3 Component Cooling Water

CCW pump and ALOP 2-1 may be lost due to a fire in this area. Redundant CCW pumps and ALOPs 2-2 and 2-3 will be available to provide CCW.

FCV-430 may be affected by a fire in this area. Valve FCV-431 will remain available to enable the use of redundant CCW heat exchanger 2-2.

A fire in this area may spuriously close FCV-750. Since RCP seal injection will remain available, adequate RCP seal cooling will be provided and FCV-750 will not be required open.

A fire in this area may affect circuits associated with CCW flow transmitters for Header A (FT-68) and Header C (FT-69). FT-65 will remain available to CCW Header B. CCW to header C will also remain available, and loss of FT-69 indication will not affect flow to the header.

A fire in this area may affect circuits associated with the differential pressure transmitters for CCW Hx 2-1 (PT-5). Flow through redundant CCW Hx 2-2 will remain available.

4.1.4 Emergency Power

A fire in this area may disable the diesel generator 2-1 backup control circuit. Power for the normal control circuit will remain available.

A fire in this area may disable diesel generator 2-3. Diesel generators 2-1 and 2-2 will remain available for safe shutdown.

A fire in this area may disable startup transformer 2-2. Onsite power will remain available from diesel generators 2-1 and 2-2.
Power supplies on the F bus may be lost due to a fire in this area. Redundant trains on the G and H buses will be available.

A fire in this area may affect the 480 V power supply to Uninterrupted Power Supply (UPS) IY22. The 125 Vdc backup power supply will remain available.

A fire in this area may disable dc panel SD23 backup battery charger ED231. Normal battery charger ED232 will remain available.

A fire in this area may result in a loss power supplies associated with PY27N and PY26. Loss of power to PY27N and PY26 results in spurious closure of FCV-128 when in automatic Mode. FCV-128 can be opened by placing the controller in the Control Room to the Manual Mode.

4.1.5 Main Steam System

A fire in this area may affect the following instrumentation: LT-516, LT-526, LT-529, LT-536, LT-539, LT-546, PT-514, PT-524, PT-534 and PT-544. Safe shutdown is not affected since there are redundant trains of instrumentation for all four steam generators.

A fire in this area may fail valve PCV-19 to the desired, closed position for hot standby. Redundant dump valves PCV-20, PCV-21 and PCV-22 will remain available for cooldown.

A fire in this area may spuriously open FCV-248 and FCV-250. However, safe shutdown is not affected because valves FCV-761 and FCV-760 will remain available to isolate steam generator blowdown lines.

Valve FCV-25 may be spuriously opened by a fire in this area. This valve can be manually closed to ensure safe shutdown.

A fire in this area may spuriously close FCV-38. This valve can be manually opened to provide steam supply to AFW Pump 2-1.

4.1.6 Makeup System

Condensate storage tank level indication, LT-40 may be lost due to a fire in this area. Water from the raw water storage reservoir will remain available through valve FCV-436 and FCV-437 in order to provide auxiliary feedwater. Operator action can be performed to locally open manual valve FCV-436 to provide raw water to AFW Pump 2-1 or locally open manual valve FCV-437 to provide raw water to AFW Pump 2-2.

4.1.7 Reactor Coolant System

A fire in this area may result in the loss of the following components: LT-406, LT-459, NE-31, NE-51, PT-406, PT-403, TE-423A and TE-423B. Since redundant instrumentation exists, safe shutdown is not affected.
Pressurizer PORV blocking valve 8000A may be affected by a fire in this area. Since pressurizer PORV PCV-474 will remain closed, the position of valve 8000A will not affect safe shutdown.

A fire in this area may prevent the tripping of the four reactor coolant pumps. Safe shutdown is not affected if the RCPs continuously run.

A fire in this area may spuriously energize pressurizer heater group 2-4. This heater group can be manually tripped to ensure safe shutdown. Pressurizer heater group 2-3 may be affected by a fire in this area but will de-energize and not affect safe shutdown.

4.1.8 Safety Injection System

SI pump 2-1 may spuriously operate due to a fire in this area. Local manual action may be required to defeat this spurious operation.

A fire in this area may result in the loss of the following valves: 8801A, 8803A and 8805A. Redundant valves 8801B, 8803B and 8805B will remain available to ensure safe shutdown.

Valve 8808A may be affected by a fire in this area. This valve can be manually operated to its safe shutdown position.

4.1.9 Auxiliary Saltwater System

ASW pump 2-1 may be lost due to a fire in this area. The redundant ASW pump 2-2 will remain available.

Valve FCV-602 may be affected by a fire in this area. FCV-602 will be used with ASW pump 2-1. Since ASW pump 2-2 is used during a fire in this area, FCV-602 is not required.

4.1.10 HVAC

HVAC equipment E-104, E-45, S-45, FCV-5045 and S-69 may be affected by a fire in this area. E-104 and S-69 will not be necessary during a fire in this area. S-45, E-45 and FCV-5045 have the following redundant components: S-46, E-46 and FCV-5046. Therefore, safe shutdown is not affected by a fire in this area.

4.2 Fire Area 6-B-2

4.2.1 Auxiliary Feedwater

A fire in this area may affect valves LCV-106, LCV-107, LCV-108 and LCV-109. Redundant valves LCV-110 and LCV-111 will remain available to provide AFW flow to steam generators 2-1 and 2-2.

4.2.2 Chemical and Volume Control System

Valve 8106 may be affected by a fire in this area. Since the VCT or RWST will be aligned to the charging pump suction, safe shutdown will not be affected.

A fire in this area may cause valve 8108 to spuriously operate. Valve 8107 can be shut to isolate auxiliary spray. If valve 8108 spuriously closes, one other charging flowpath is available. The PORVs will remain available for pressure reduction. Since valve 8108 has redundant components, safe shutdown is not affected.

Valve 8104 may be lost due to a fire in this area. FCV-110A and manual valve 8471 will remain available to provide boric acid to the charging pump suction.

A fire in this area may affect valves 8146, 8147 and 8148. Safe shutdown is not compromised because the PORVs will remain available for pressure reduction and other charging flowpaths exist.

Charging pumps 2-2 and 2-3 and ALOP 2-2 may be lost due to a fire in this area. Redundant charging pump and ALOP 2-1 will be available to provide charging flow.

Boric acid transfer pump 2-2 may be lost due to a fire in this area. Redundant boric acid transfer pump 2-1 will remain available.

Valves FCV-128 and HCV-142 may be affected by a fire in this area. Spurious closure of HCV-142 will not affect safe shutdown as redundant components exist to isolate auxiliary spray (8107), to provide a charging flowpath (charging injection), and to provide for pressure reduction (PORVs). Spurious closure of FCV-128 will result in isolation of seal injection flow. An operator action can be taken in the Control Room to open FCV-128 after taking its controller to the Manual Mode of operation.

Volume control tank outlet valve LCV-112C may be affected by a fire in this area. If LCV-112C spuriously closes then valve 8805A can be opened to provide water from the RWST to the charging pump suction. Otherwise, the VCT may be isolated by closing LCV-112B.

Letdown isolation valves LCV-459 and LCV-460 may be affected by a fire in this area. These valves are desired closed for letdown isolation. This can be accomplished by closing valves 8149A, 8149B and 8149C. Therefore, safe shutdown is not affected.

Level indication for the boric acid storage tank 2-1, LT-106 may be lost due to a fire in this area. Borated water from the RWST will be available. Therefore, BAST level indication will not be required.

A fire in this area may affect the transmitter and circuits associated with charging pump header flow transmitter, FT-128, and pressure transmitter, PT-142. Both charging pumps are available in this fire area to provide charging flow. Loss of these instruments will not affect safe shutdown.

4.2.3 Component Cooling Water

CCW pump and ALOP 2-2 may be lost due to a fire in this area. Redundant CCW pumps and ALOPs 2-1 and 2-3 will be available to provide CCW. Valve FCV-431 may be affected by a fire in this area. Redundant valve FCV-430 will remain available.

A fire in this area may fail open FCV-365, which is the desired position for safe shutdown. Redundant valve FCV-364 will be available and allow RHR HX 2-2 to be used.

A fire in this area may spuriously close valve FCV-356. This valve can be manually opened to ensure safe shutdown.

A fire in this area may affect circuits associated with CCW flow transmitters for Header B (FT-65) and Header C (FT-69). All three CCW pumps will remain available in this area to provide CCW flow to either header. Therefore, loss of these instruments will not affect safe shutdown.

The seal injection flowpath can also be affected in this fire area due to fire induced spurious closure of FCV-128. The potential for a loss of all RCP seal cooling can occur if the valves on these flowpaths spuriously close simultaneously. A manual action will be taken in the Control Room to open FCV-128 after taking its controller to the Manual Mode of operation.

A fire in this area may affect circuits associated with the differential pressure transmitters for CCW Hx 2-2 (PT-6). CCW Pp 2-1 will remain available to provide flow to CCW Hx 2-1. Therefore, loss of this instrument will not affect safe shutdown.

4.2.4 Containment Spray

A fire in this area may affect containment spray pump 2-1 and open 9001A. Manual operator action can be taken to trip CS Pump 2-1.

Valve 9003A may be spuriously opened due to a fire in this area. This valve can be manually closed in order to isolate containment spray.

4.2.5 Diesel Fuel Oil System

Diesel fuel oil pump 0-2 may be lost due to a fire in this area. Redundant diesel fuel oil pump 0-1 remains available.

Valves LCV-85, LCV-86 and LCV-87 may be lost due to a fire in this area. However, safe shutdown is not affected because redundant valves LCV-88, LCV-89 and LCV-90 will remain available.

4.2.6 Emergency Power

A fire in this area may disable diesel generator 2-1. Diesel generators 2-2 and 2-3 will remain available for safe shutdown.

A fire in this area may disable the diesel generator 2-2 backup control circuit. The normal control circuit will remain available.

A fire in this area may disable startup transformer 2-2. Onsite power will remain available from diesel generators 2-2 and 2-3.

All power supplies on the "G" bus may be lost due to a fire in this area. These power supplies are not necessary since redundant trains on the "F" and "H" buses will be available.

A fire in this area may affect backup power supply cables to ED231 and BAT22. No power losses will occur if these cables are lost.

A fire in this area may result in a loss power supplies associated with PY27N and PY26. Loss of power to PY27N and PY26 results in spurious closure of FCV-128 when in the Automatic Mode. FCV-128 can be opened by placing the controller in the Control Room to the Manual Mode.

4.2.7 Main Steam System

The instrumentation that may be lost due to a fire in this area is as follows: LT-519, LT-549, PT-515, PT-525, PT-535 and PT-545. Since redundant instrumentation exists for each steam generator, safe shutdown will not be affected.

A fire in this area may fail valve PCV-21 closed. A fire in this area could also affect cables that could cause the valve to spuriously open. Spurious operation of the valve can be mitigated by locally isolating air to PCV-21 to fail if closed. Redundant dump valves PCV-19, PCV-20 and PCV-22 will remain available for safe shutdown.

Valves FCV-760 and FCV-761 may be affected by a fire in this area. Redundant valves FCV-154 and FCV-248 for FCV-761 and FCV-151 and FCV-250 for FCV-760 remain available to isolate steam generator blowdown.

A fire in this area may affect valve FCV-95. AFW pump 2-2 will remain available to provide AFW flow to steam generators 2-1 and 2-2 if FCV-95 is unable to provide steam to AFW pump 2-1.

Main steam isolation valves FCV-41, FCV-42 and bypass valve FCV-24 may be affected by a fire in this area. These valves can be manually operated to ensure safe shutdown.

4.2.8 Reactor Coolant System

A fire in this area may result in the loss of the following equipment: LT-460, NE-32, TE-433A, TE-433B, TE-443A and TE-443B. Since redundant components exist, safe shutdown is not affected.

Valves PCV-455C and 8000B may be affected by a fire in this area. PCV-455C fails in the desired, closed position and redundant valves PCV-456 and 8000C will be available for pressure reduction. Therefore, safe shutdown is not affected.

A fire in this area may prevent the tripping of reactor coolant pumps 2-1, 2-2, 2-3 and 2-4. Since PCV-455A and PCV-455B can be shut to prevent uncontrolled pressure reduction, safe shutdown will not be affected. Seal injection will remain available for RCP seal cooling.

Pressurizer heaters groups 2-3 and 2-4 may be affected by a fire in this area. Manual actions can be taken to de-energize heater group 2-4 and switch heater group 2-3 to the vital power supply. Therefore, safe shutdown is not affected.

4.2.9 Residual Heat Removal System

RHR pump 2-1, valve FCV-641A and valve 8700A may be lost due to a fire in this area. Redundant RHR pump 2-2 and valve FCV-641B will be available so safe shutdown will not be affected.

Valve 8701 may be affected by a fire in this area. This valve is closed with its power removed during normal operations; therefore, it will remain closed. This valve can be manually opened for RHR operations.

4.2.10 Safety Injection System

Valves 8801B, 8803B and 8805B may be lost due to a fire in this area. Safe shutdown will not be affected because redundant valves 8801A, 8803A and 8805A will remain available.

A fire in this area may spuriously open valve 8804A. This valve can be manually closed to ensure safe shutdown.

Valves 8808B and 8808D may be affected by a fire in this area. These valves can be manually closed to ensure safe shutdown.

A fire in this area may affect valve 8982A. Power to the valve is administratively removed by maintaining a toggle switch in the Control Room in the open position. The valve is normally closed, and spurious opening is not expected to occur.

However, an operator action can be taken to open the power breaker to further preclude spurious operation. If valve 8982A has opened after opening its respective power breaker, valve 8980 may be de-energized and manually closed. Therefore, safe shutdown is not affected.

4.2.11 Auxiliary Saltwater System

ASW pump 2-2 may be lost due to a fire in this area. Redundant ASW pump 2-1 will be available to provide the ASW function.

Valve FCV-603 may be lost due to a fire in this area. Since redundant valve FCV-602 remains available, safe shutdown is not affected.

4.2.12 HVAC

A fire in this area may affect E-102 and S-68. Since these components are not required to be operational following a fire, safe shutdown is not affected.

4.3 Fire Area 6-B-3

4.3.1 Auxiliary Feedwater

AFW pump 2-2 may be lost for a fire in this area. Redundant AFW pump 2-3 will be available to provide AFW.

Valves LCV-110 and LCV-111 may be affected by a fire in this area. Redundant valves LCV-113 and LCV-115 will remain available to provide AFW flow to steam generators 2-3 and 2-4.

4.3.2 Chemical and Volume Control System

Level indication for boric acid storage tank 2-2 from LT-102 may be lost due to a fire in this area. Borated water from the RWST will remain available. Therefore, BAST level indication is not required.

Valve 8145 may be affected by a fire in this area. Since this valve fails in the desired closed position during hot standby and the PORVs will remain available, safe shutdown will not be affected.

A fire in this area may result in spurious closure of FCV-128. FCV-128 is desired to be open. FCV-128 can be opened from the Control Room by taking its controller to the Manual Mode of operation.

Valve FCV-110A may be affected by a fire in this area. Since this valve fails in the desired open position, safe shutdown is not affected.

A fire in this area may affect valves LCV-459 and LCV-460. Since redundant valves are available, safe shutdown is not affected.

A fire in this area may affect circuits associated with letdown flow transmitter, FT-134. Because letdown isolation valves 8149A, 8149B, and 8149C are not affected in this fire area and will remain available to isolate letdown, this diagnostic indication is not required.

4.3.3 Component Cooling Water

CCW pump and ALOP 2-3 may be lost due to a fire in this area. Redundant pumps and ALOPs 2-1 and 2-2 are available to provide CCW.

CCW valve FCV-357 may be affected by a fire in this area. Since seal injection will remain available, FCV-357 will not be required open.

A fire in this area may spuriously close FCV-355. FCV-355 can be manually operated for safe shutdown.

FCV-364 will fail open due to a fire in this area, which is the desired position for safe shutdown. In addition, redundant RHR HX 1-1 will be available to provide this safe shutdown function. Redundant valve FCV-365 will remain available for safe shutdown.

A fire in this area may affect circuits associated with CCW flow transmitters for Header C (FT-69). CCW to Header C is not credited in this fire area. Therefore, loss of these instruments will not affect safe shutdown.

4.3.4 Containment Spray

Containment spray pump outlet valve 9001B may be affected by a fire in this area. CS Pump 2-2 is not affected in this area and will remain de-energized to isolate containment spray.

A fire in this area may spuriously open valve 9003B. This valve can be manually closed.

4.3.5 Diesel Fuel Oil System

Diesel fuel oil pump 0-1 may be lost due to a fire in this area. The redundant diesel fuel oil pump 0-2 will remain available.

Valves LCV-88, LCV-89 and LCV-90 may be lost due to a fire in this area. Redundant valves LCV-85, LCV-86 and LCV-87 will remain available.

4.3.6 Emergency Power

A fire in this area may disable diesel generator 2-2. Diesel generator 2-1 and 2-3 will remain available for safe shutdown.

Diesel generator 2-3 backup control circuit may be lost due to a fire in this area. The normal control circuit will remain available.

All power supplies on the "H" Bus may be lost due to a fire in this area. Redundant power supplies on the "G" and "F" buses will remain available.
A fire in this area may disable dc panel SD21 backup battery charger ED221. Normal battery charger ED21 will remain available.

A fire in this area may disable dc panel SD22 backup battery charger ED221. Normal battery charger ED22 will remain available.

A fire in this area may affect vital UPS IY23 and IY24 and vital instrument ac distribution panels PY23 and PY24. Redundant UPS IY21 and IY22, and corresponding panels PY21 and PY22, will remain available.

A fire in this area may result in a loss power supplies associated with PY27N and PY26. Loss of power to PY27N and PY26 results in spurious closure of FCV-128 when in the Automatic Mode. FCV-128 can be opened by placing the controller in the Control Room to the Manual Mode.

4.3.7 Main Steam System

A fire in this area may result in the loss of the following components: LT-517, LT-518, LT-527, LT-528, LT-537, LT-538, LT-547, LT-548, PT-516, PT-526, PT-536 and PT-546. Since redundant trains of instrumentation exist for all four steam generators, safe shutdown is not affected.

Valve PCV-20 may be affected by a fire in this area. This valve fails in the desired, closed position for hot standby. Redundant dump valves PCV-19 and PCV-21 will remain available for safe shutdown.

Valve PCV-22 may be affected by a fire in this area. Redundant dump valves PCV-19 and PCV-21 will remain available for safe shutdown.

A fire in this area may spuriously close FCV-37 and affect FCV-95. Safe shutdown will not be affected since AFW pump 2-3 will remain available to provide AFW to the steam generators.

Valves FCV-762 and FCV-763 may spuriously open due to a fire in this area. Valves FCV-157 and FCV-246 can be shut to provide steam generator blowdown in place of FCV-762 and FCV-160 and FCV-244 can perform the same function for FCV-763.

A fire in this area may affect FCV-43 and FCV-44. These valves can be manually shut to ensure safe shutdown.

4.3.8 Reactor Coolant System

A fire in this area may affect LT-461, NE-52, TE-413A, TE-413B, PT-403 and PT-405. These instruments have redundant components: LT-459, LT-460, LT-406, NE-51, NE-31, NE-32, TE-423A, TE-423B, TE-433A, TE-433B, TE-443A, TE-443B and PT-406 available for safe shutdown.

A fire in this area may affect valve 8000C or cause PCV-456 to fail closed. PCV-456 is required closed during hot standby. PCV-455C will remain available for pressure reduction. Therefore, safe shutdown is not affected.

A fire in this area may prevent reactor coolant pumps 2-2 and 2-4 from being tripped. Safe shutdown is not affected if these RCPs continuously run. CCW to thermal barrier heat exchanger or seal injection will remain available for RCP seal cooling.

Pressurizer heater groups 2-1, 2-2, 2-3, and 2-4 may be lost due to a fire in this area. Manual actions can be taken to de-energize heater group 2-1 and switch heater group 2-3 to the vital power source. Therefore, safe shutdown is not affected.

4.3.9 Residual Heat Removal System

RHR pump 2-2, valve FCV-641B and outlet valve 8700B may be lost for a fire in this area. The redundant train (RHR PP 2-1 and valves 8700A and FCV-641A) will be available to provide the RHR function.

Valve 8702 may be affected by a fire in this area. This valve is closed with its power removed during normal operations; therefore it will remain closed. This valve can be manually opened for RHR operations.

4.3.10 Safety Injection System

SI pump 2-2 may spuriously operate for a fire in this area. Local manual action may be required to defeat this spurious operation.

Valve 8808C may be affected by a fire in this area. This valve can be manually closed to provide accumulator isolation.

A fire in this area may affect valve 8982B. Power to the valve is administratively removed by maintaining a toggle switch in the Control Room in the open position. The valve is normally closed, and spurious opening is not expected to occur. Therefore, safe shutdown is not affected.

A fire in this area may affect RWST Level Transmitter LT-920. Spurious operation of equipment that may divert the RWST inventory is not affected in this fire area. Therefore, loss of this instrument will not affect safe shutdown.

4.3.11 Auxiliary Saltwater System

Valves FCV-495 and FCV-496 may be affected by a fire in this area. FCV-601 will remain closed to provide ASW system integrity.

4.3.12 HVAC

One train of HVAC components (E-46, S-46, FCV-5046 and S-67) may be lost due to a fire in this area. S-67 is not required for a fire in this area. A redundant train of HVAC components (S-45, E-45 and FCV-5045) will remain available to provide the HVAC function.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3 hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Loss of safe shutdown functions in an area does not adversely affect safe shutdown.

- Automatic smoke detection in inverter and dc switchgear rooms.

- Manual fire fighting equipment is available for use.

The existing fire protection feature provides an acceptable level of safety equivalent to that provided by Section III.G.

6.0 REFERENCES

6.1 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.2 Drawing No. 515570
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065127, Fire Protection Information Report, Unit 2
6.5 NECS File: 131.95, FHARE: 15, HVAC Ducts Wrapped with Pyrocrete
6.6 NECS File: 131.95, FHARE: 26, Non-rated Barriers
6.7 Response to Q.21 of PG&E letter dated November 13, 1978
6.8 DCN DCO-EE-35151, Provide Smoke Detection in Battery Rooms
6.9 DCN DC2-EE-16569 Rev. 0, Feeder Circuits for PT-406
6.10 Deleted
6.11 AR A0211784 AE 08, NES Fire Protection's Evaluation of Exposed Structural Steel Anchor Bolts
6.12 Calculation 134-DC, Electrical Appendix R Analysis
6.13 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.14 NECS File: 131.95, FHARE 134, "Non-rated Structural Gap Seals in Fire Barriers"
6.15 NECS File: 131.95, FHARE 152, Evaluation of Fire Dampers in 480V Switchgear and Battery Rooms
6.16 NECS File: 131.95, FHARE 100, Block Walls Structurally Modified with Columns, Beams and Steel Plates

FIRE AREA 6-B-4

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Southwest side of the Unit 2 Auxiliary Building, El. 115 ft.

1.2 Description

Unit 2 reactor trip switchgear and rod programmer occupies this fire area.

1.3 Boundaries

South:

- 3-hour rated barrier separates this area from Area 3-CC and Zone 3-AA.

North:

- 3-hour rated barrier separates this area from Area 6-A-4 and Zone S-5.
- Unrated structural gap seal to Fire Area 6-A-4. (Ref. 6.11)
- A 3-hour rated door communicates to Area 6-A-4.
- A duct penetration with no fire damper penetrates to Zone S-5. (Ref. 6.5)

East:

- 3-hour rated barrier separates this area from Zones 3-AA, S-2, and S-5.

West:

- 3-hour rated barrier separates this area from Area 6-B-3.
- A 3-hour rated door communicates to Area 6-B-3.
- Two ducts without fire dampers penetrate to Area 6-B-3. (Ducts are protected within 6-B-3 with dampers provided at the registers.) (Ref. 6.6)

Floor/Ceiling:

- 3-hour rated barriers separate this area from Area 5-B-4 below and Areas 7B and 7D above.

2.0 COMBUSTIBLES

2.1 Floor Area: 1,222 ft^2

2.2 In situ Combustible Materials

- Cable insulation
- Lube Oil
- Paper
- PVC
- Rubber
- Plastic
- Misc. combustibles

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection

3.2 Suppression

- CO_2 hose stations
- Hose stations
- Portable fire extinguishers

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Auxiliary Feedwater System

Valves LCV-110 and LCV-111 may be affected by a fire in this area. These valves can be manually operated to ensure safe shutdown.

4.2 Chemical and Volume Control System

A fire in this area may affect valves 8145 and 8148. Valves 8107, 8108 and HCV-142 will remain available to prevent uncontrolled pressure reduction and valve 8145 can be manually operated to provide auxiliary spray.

A fire in this area may result in spurious closure of FCV-128. FCV-128 is desired to be open. FCV-128 can be opened from the Control Room by taking its controller to the Manual Mode of operation.

A fire in this area may affect circuits associated with letdown flow transmitter, FT-134. Because letdown isolation valves LCV-459, LCV-460, 8149A, 8149B, and 8149C are not affected in this fire are and will remain available to isolate letdown, this diagnostic indication is not required.

4.3 Emergency Power

A fire in this area may result in a loss power supplies associated with PY27N and PY26. Loss of power to PY27N and PY26 results in spurious closure of FCV-128 when in the Automatic Mode. FCV-128 can be opened by placing the controller in the Control Room to the Manual Mode.

4.4 Main Steam System

A fire in this area may affect FCV-95, and prevent operation of AFW Pump 2-1. Redundant AFW Pump 2-2 will remain available to provide AFW flow to steam generators 2-1 and 2-2.

4.5 Reactor Coolant System

A fire in this area may spuriously open the reactor vessel vent valves 8078A, 8078B, 8078C and 8078D. Valves 8078A and 8078B are in series, likewise for 8078C and 8078D. Manual operator action can be taken to fail the valves closed.

Valves PCV-455C and PCV-456 may be lost due to a fire in this area. Redundant blocking valves 8000B and 8000C will remain available to isolate the PORV lines and prevent uncontrolled pressure reduction.

RCS pressure indication, PT-405 may be lost due to a fire in this area. Redundant components PT-406 and PT-403 will remain available.

Pressurizer heater groups 2-1 through 2-4 may be affected by a fire in this area. These heater groups can be manually de-energized to ensure safe shutdown.

A fire in this area may result in the loss of the following components: TE-443A, TE-443B, TE-433A and TE-433B. Safe shutdown is not affected because redundant components exist.

4.6 Residual Heat Removal System

RHR pump 2-2 may be lost due to fire in this area. Redundant RHR pump 2-1 will remain available.

4.7 Safety Injection System

A fire in this area may affect valve 8982B. Power to the valve is administratively removed by maintaining a toggle switch in the Control Room in the open position. The valve is normally closed, and spurious opening is not expected to occur. Therefore, safe shutdown is not affected.

A fire in this area may prevent the valves 8805A and 8805B from auto opening on low VCT level. However, these valves can be opened from the Control Room using its control switch.

4.8 HVAC

S-46 and E-46 may be lost due to a fire in this area. Redundant components S-45 and E-45 will remain available to provide the HVAC function.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- The loss of safe shutdown functions located in this area will not affect safe shutdown capability.
- Automatic smoke detection is provided.
- Manual fire fighting equipment is provided.
- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These

references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

The existing fire protection features provide an acceptable level of safety equivalent to that provided by Section III.G.2.

6.0 REFERENCES

6.1 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.2 Drawing No. 515570
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065127, Fire Protection Information Report, Unit 2
6.5 NECS File: 131.95, FHARE: 27, Undampered Duct Penetration in Concrete Lined Shafts
6.6 NECS File: 131.95, FHARE: 15, HVAC Duct Wrapped in Pyrocrete
6.7 Appendix 3 for GP M-10 Unit 2 Fire Protection of Safe Shutdown Equipment
6.8 Deleted
6.9 Calculation 134-DC, Electrical Appendix R Analysis
6.10 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.11 NECS File: 131.95, FHARE 134, “Non-rated Structural Gap Seals in Fire Barriers”

FIRE AREA 6-B-5

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Southwest corner of the Auxiliary Building, El. 115 ft.

1.2 Description

Unit 2 Electrical Area, 6-B-5 is just west of the "F" Bus battery inverter and dc switchgear room, Area 6-B-1. Raceway for safe shutdown functions are routed through this fire area.

1.3 Boundaries

North:

- A 3-hour rated barrier to Fire Zone S-1.
- A 3-hour rated door communicates to Area 6-A-5 and is provided with a 2-hour rated blockout above the door. (Ref. 6.9)

South:

- 3-hour rated barrier separates this area from Fire Zone 19-A.

East:

- 3-hour rated barrier separates this area from Area 6-B-1.
- A 3-hour rated door communicates to Area 6-B-1.
- Three protected ducts without fire dampers penetrate to Area 6-B-1. Dampers are provided at the registers. (Refs. 6.7, 6.12 and 6.17)

West:

- 3-hour rated barrier separates this area from Zones 19-A, S-1, and 14-A.
- Two protected ducts without fire dampers penetrate to Zone 19-A. (Refs. 6.7, 6.12 and 6.17)
- A protected duct penetration without a fire damper penetrates to Zone S-1. (Refs. 6.7, 6.12 and 6.17)
- 3-hour rated door communicates to Zone S-1.

Floor/Ceiling:

- 3-hour rated barrier: Floor: To Fire Area 5-B-4.
  Ceiling: To Fire Area 7-B.
- Two ducts with no fire damper penetrate to Area 5-B-4 below. (Refs. 6.8 and 6.17)
- Nonrated equipment hatches communicate to Area 5-B-4 below, and Zone 7-B above. (Ref. 6.17) The nonrated hatch to Zone 7-B contains HVAC duct penetrants. (Ref. 6.14 and 6.17)
- Two duct penetrations with 3-hour rated damper to 7B above.

Protective Enclosure:

- 1-hour rated fire resistive covering for several HVAC ducts. (Refs. 6.7, 6.12 and 6.17)

2.0 COMBUSTIBLES

2.1 Floor Area: 724 ft^2

2.2 In situ Combustible Materials

- Rubber
- Cable insulation
- Miscellaneous
- Paper
- Plastic

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection

3.2 Suppression

- CO_2 hose stations
- Hose stations
- Portable fire extinguishers

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Auxiliary Feedwater System

A fire in this are may prevent the operation of LCV-110, LCV-111, LCV-113 and LCV-115. Redundant valves LCV-106 and LCV-107 will remain available to provide AFW flow into the Steam Generators 2-1 and 2-2 using AFW Pump 2-1.

4.2 Chemical and Volume Control System

Valves 8146 and 8147 may be affected by a fire in this area. These valves fail open, which provides a charging flowpath through the regenerative heat exchanger. Also the PORVs will remain available for pressure reduction. Therefore, safe shutdown can be achieved.

Valves LCV-459 and LCV-460 may be affected by a fire in this area. Redundant valves 8149A, 8149B and 8149C will remain available to isolate letdown.

A fire in this area may result in spurious closure of FCV-128. FCV-128 is desired to be open. FCV-128 can be opened from the Hot Shutdown Panel Room by taking its controller to the Manual Mode of operation.

A fire in this are may affect circuits associated with charging pump header pressure transmitter, PT-142. Charging pumps will remain available for safe shutdown in this fire area. Loss of charging pumps header flow and pressure indication will not affect safe shutdown.

4.3 Component Cooling Water

A fire in this area may affect valves FCV-355 and FCV-356, FCV-430 and FCV-431. Valves FCV-355, FCV-430 and FCV-431 can be manually operated to their safe shutdown position.

A fire in this area may affect circuits associated with CCW flow transmitter for Header C (FT-69). CCW flow to Header C is not credited for safe shutdown in this area. Therefore, loss of this instrument will not affect safe shutdown.

A fire in this area may affect circuits associated with the differential pressure transmitters for CCW Hx 2-1 (PT-5) and CCW Hx 2-2 (PT-6). CCW flow to either header, the heat exchanger discharge valves FCV-430 and FCV-431 will need to be manually aligned due to fire damage to their cables. Therefore, loss of these instruments will not affect safe shutdown.

4.4 Containment Spray

A fire in this area may spuriously open valve 9001B. Since CS pump 2-2 is not affected by a fire in this area, safe shutdown will not be affected.

4.5 Emergency Power

A fire in this area may disable diesel generator 2-3 circuits. Offsite power is not affected in this area and would remain available. In addition, diesel generators 2 1 and 2-2 will remain available for safe shutdown.

A fire in this area may result in a loss power supplies associated with PY27N and PY26. Loss of power to PY27N and PY26 results in spurious closure of FCV-128 when in the Automatic Mode. FCV-128 can be opened by placing the controller at the Hot Shutdown Panel in the Manual Mode.

4.6 Main Steam System

A fire in this area may spuriously open FCV-248 and FCV-250. FCV-761 and FCV-760 will remain available to isolate steam generator blowdown. Therefore, safe shutdown is not affected.

4.7 Makeup System

Condensate storage tank level indication may be lost due to a fire in this area. Water from the raw water storage reservoir will be available through FCV-436 and FCV-437. Operator action would be required to locally open normally closed manual valves prior to CST depletion.

4.8 Reactor Coolant System

A fire in this area may affect source range flux monitor NE-51. Redundant indicators NE-31, NE-32, and NE-52 will remain available.

Pressurizer heater group 2-4 may be affected by a fire in this area. This heater group can be manually de-energized to ensure safe shutdown. Pressurizer heater group 2-3 may be affected by a fire in this area but will de-energize and not affect safe shutdown.

Control of all four reactor coolant pumps may be affected by a fire in this area. Safe shutdown is not affected if the RCPs continue to run. CCW to the thermal barrier heat exchanger or seal injection will remain available for RCP seal cooling.

4.9 Safety Injection System

Accumulator isolation valve 8808C may be affected by a fire in this area. This valve can be manually closed to ensure safe shutdown.

4.10 Auxiliary Saltwater System

Valves FCV-495 and FCV-496 may be lost due to a fire in this area. Redundant valve FCV-601 will remain closed to provide ASW system integrity.
A fire in this area may spuriously close FCV-602 and FCV-603. These valves can be manually opened to ensure safe shutdown. A deviation was approved that credited the low combustible loading, automatic smoke detection, and the manual action.

4.11 HVAC

A fire in this area in this area may affect E-45, S-46 and S-45. Since S-46 of the opposite train may be affected, operator action may be necessary to install portable fans. (Ref. 6.13)

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3 hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Loss of the safe shutdown functions in this area will not affect safe shutdown due to redundant equipment and/or measures taken to mitigate the effects of fire.

- Area wide smoke detection is provided in this area.

- Manual fire fighting equipment is available.

- Low fire severity.

The existing fire protection features provide an acceptable level of safety equivalent to that provided by Section III.G.2.

6.0 REFERENCES

6.1 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.2 Drawing No. 515570
6.3 DCN - DC2-EE-10913 provides isolators on RPM tach-packs
6.4 SSER 31, April 1985
6.5 Calculation M-824, Combustible Loading
6.6 Drawing 065127, Fire Protection Information Report, Unit 2
6.7 NECS File: 131.95, FHARE: 15, HVAC Ducts Wrapped in Pyrocrete
6.8 NECS File: 131.95, FHARE: 73, Undampered Ducts
6.9 NECS File: 131.95, FHARE: 118, Appendix R Fire Area Boundary Plaster Barriers
6.10 Deleted in Revision 13
6.11 Appendix 3 for EP M-10 Unit 2 Fire Protection of Safe Shutdown Equipment
6.12 PG&E letter to NRC dated 12/6/84, Appendix R Deviation Request
6.13 Calculations M-911 and M-912
6.14 NECS File: 131.95, FHARE: 126, HVAC Ducts through Modified Unrated Hatch
6.15 Calculation 134-DC, Electrical Appendix R Analysis
6.16 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.17 NECS File: 131 .95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression

FIRE AREA 7-B

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This area is located directly under the control room at El. 127 ft in the Auxiliary Building.

1.2 Description

Fire Area 7-B, Unit 2 cable spreading room, is directly under the Unit 2 control room and south of the Unit 1 cable spreading room. No storage sign is posted at the west wall near the equipment hatch area.

1.3 Boundaries

South:

- 3-hour rated barrier separates this area from Fire Zone 19-A and Area 3-CC.

North:

- 3-hour rated barrier separates this area from Area 7-A and Zone S-1. In addition, localized sections of structural steel for blockwalls were not provided with 3-hour rated fireproofing. (Ref. 6.21)
- Unrated structural gap seals to Fire Area 7-A. (Refs. 6.19 and 6.22).
- Two 3-hour rated doors communicate to Area 7-A.
- Lesser-rated Unistrut seals to Fire Area 7-A. (Refs. 6.20 and 6.22)

East:

- 3-hour rated barrier separates this area from Area 7-D and Zones 3-AA, S-5.
- A non-rated duct penetrant to Zone S-5. (Refs. 6.15 and 6.22)
- Two 1-1/2-hour rated doors communicate to Area 7-D. (Refs. 6.8 and 6.22)
- A ventilation duct with a 3-hour rated fire damper communicates to Zone S-5. (Ref. 6.14)

West:

- 3-hour rated barrier separates this area from Fire Zones 14-A, 19-A and S-1.
- A 1-1/2-hour rated fire damper communicates to Zone S-1. (Ref. 6.22)
- A 3-hour rated door communicates to Zone S-1.

Floor/Ceiling:

- 3-hour rated barrier: Floor: To Fire Areas 6-B-5, 6-B-4, 6-B-3, 6-B-2, and 6-B-1.
  Ceiling: To Fire Zones 8C, 8-D, 8-F, and Fire Area 8-H.
- Two ducts with 3-hour rated damper to 6-B-5 below.
- Nonrated equipment steel hatch with HVAC duct penetrants to Area 6-B-5 below. (Refs. 6.13 and 6.22)
- Unrated penetrations to Zones 8-C and 8-D above. (Ref. 6.18 and 6.22)

2.0 COMBUSTIBLES

2.1 Floor Area: 3,612 ft^2

2.2 In situ Combustible Materials

- Cable Insulation
- Misc. combustible
- Plastics
- Polyethylene
- Resin
- Paper
- PVC
- Wood (fir)

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Moderate

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection.
- Heat detection.

3.2 Suppression

- Total flooding CO_2 system actuated by heat detection (it also protects Area 7-D).
- Portable fire extinguishers.
- Hose stations.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Auxiliary Feedwater

A fire in this area may affect Auxiliary Feedwater Supply valves LCV-106, 107, 108, 109, 110, 111, 113 and 115. Manual actions will enable valves LCV-106, 107, 108 and 109 to be controlled from the hot shutdown panel. Valves LCV-110, 111, 113 and 115 can be manually operated.

The ability to operate AFW pumps 2-2 and 2-3 from the control room may be lost due to a fire in this area. Manual actions can be taken to operate these pumps from the 4kV switchgear or the hot shutdown panel. (Ref. 6.10)

A fire in this area may affect FCV-37, FCV-38 and FCV-95. These valves are associated with AFW pump 2-1. AFW pump 2-1 is not necessary since AFW pumps 2-2 and 2-3 will remain available.

Condensate storage tank level indication, LT-40 may be affected by a fire in this area. Valves FCV-436 and FCV-437 can be manually opened in order to supply water from the raw water storage reservoir.

4.2 Chemical and Volume Control System

A fire in this area may affect valves 8801A, 8801B, 8803A, and 8803B. RCS flow through the charging injection flow path can be secured by manual operation of (either 8801A or 8801B) and (either 8803A or 8803B). Prior to initiation of auxiliary spray, charging injection flow path will need to be isolated.

A fire in this area may affect valves 8107, 8108, 8145, 8148, FCV-128, 8146, 8147 and HCV-142. Operation of HCV-142 will remain available from the hot shutdown panel to isolate auxiliary spray flowpath. FCV-128 can be opened at

the Hot Shutdown Panel by taking its controller to the Manual Mode of operation. Charging flow to the RCS will remain available through the seal injection flowpath. Repairs and operator action can be taken to use the auxiliary spray flow path and isolate diversion flowpaths for RCS pressure reduction. Valve 8145 can be operated from the dedicated shutdown panel.

A fire in this area may spuriously open 8166, 8167 and fail HCV-123 closed. Only one of these valves is required closed to provide excess letdown isolation. Since HCV-123 fails closed, safe shutdown is not affected.

A fire in this area may affect the ability to operate valves LCV-459, LCV-460, 8149A, 8149B and 8149C from the control room. Valves 8149A, 8149B, and 8149C can be operated from the hot shutdown panel.

The ability to operate charging pumps 2-1, 2-2 and 2-3 from the Control Room may be lost due to a fire in this area. Either charging pumps 2-1 and 2-2 can be started at the 4kV switchgear or the hot shutdown panel to provide charging flow. Manual action can be taken to isolate Charging Pump 2-3 by manual action at the 4kv switchgear SHG. (Ref. 6.10)

A fire in this area may spuriously close valves 8105 and 8106. Since the charging pumps will be taking suction from the RWST, these valves are not required open.

A fire in this area may result in the loss of boric acid storage tank 2-2 and 2-1 level indication from LT-102 and LT-106, respectively. Borated water from the RWST will be available. Therefore, BAST level indication will not be required.

The ability to operate boric acid transfer pumps 2-1 and 2-2 from the Control Room may be lost due to a fire in this area. However, either pump can be operated from the hot shutdown panel to provide boric acid flow. The charging pumps will be available to provide RCS makeup and borated water from the RWST.

A fire in this area may fail HCV-104 and HCV-105 closed. Since these valves fail in the desired position, safe shutdown is not affected.

Valves FCV-110A and 8104 may be affected by a fire in this area. Manual actions can be taken to enable valve 8104 to be operated from the hot shutdown panel.

A fire in this area may spuriously open valves FCV-110B and FCV-111B. These valves can be manually closed to ensure safe shutdown.

A fire in this area may affect valves LCV-112B, LCV-112C, 8805A and 8805B. All of these valves can be manually operated to ensure safe shutdown.

A fire in this area may affect charging pump header flow transmitter, FT-128, and pressure transmitter, PT-142. Alternative shutdown from the hot shutdown panel is credited in this area, and these instruments are not credited.

A fire in this area may affect letdown flow transmitter, FT-134. Alternative shutdown from the hot shutdown panel is credited in this area, and this flow transmitter is not required. Letdown is isolated at the hot shutdown panel.

A fire in this area may affect VCT level transmitter LT-112. Alternative shutdown from the hot shutdown panel is credited in this area, and this level transmitter is not required.

4.3 Component Cooling Water

A fire in this area may cause FCV-356, FCV-357 and FCV-750 to spuriously close and fail to provide component cooling water to the reactor coolant pump thermal barriers if seal injection is not available. Control of HCV-142 and FCV-128 to provide seal injection for RCP seal cooling will be available at the hot shutdown panel. Therefore, safe shutdown is not compromised.

The ability to operate CCW pumps 2-1, 2-2 and 2-3 from the Control Room may be lost due to a fire in this area. Manual actions will enable any of the CCW pumps to be started from the 4kV switchgear or the hot shutdown panel. (Ref. 6.10)

A fire in this area may affect valves FCV-430 and FCV-431. Either of these valves can be manually operated in order to provide a CCW flowpath.

Valves FCV-364 and FCV-365 may be affected by a fire in this area. Either valve can be manually opened in order to ensure RHR operation.

A fire in this area may spuriously close FCV-355. This valve can be manually opened and the RCPs can be tripped if seal injection is not available.

A fire in this area may affect CCW flow transmitters for Header A (FT-68), Header B (FT-65), and Header C (FT-69). These instruments are credited to indicate a loss of CCW flow. Availability of these instruments is not credited for safe shutdown.

A fire in this area may affect differential pressure transmitters for CCW Hx 2-1 (PT-5) and CCW Hx 2-2 (PT-6). These instruments are credited to indicate a loss of CCW flow. Availability of these instruments is not credited for safe shutdown.

4.4 Containment Spray

A fire in this area may spuriously start containment spray pumps 2-1 and 2-2 or may spuriously open the discharge valves 9001A and 9001B. Operator action can be taken to trip CS pumps 2-1 and 2-2. Therefore, safe shutdown will not be affected.

4.5 Emergency Power

A fire in this area may disable remote control and auto transfer of diesel generator 2-1. The diesel can be manually started and loaded at the diesel generator local panel and at the 4kV switchgear room. (Ref. 6.11)

A fire in this area may disable remote control and auto transfer of diesel generator 2-2. The diesel can be manually started and loaded at the diesel generator local panel and at the 4kV switchgear room. (Ref. 6.11)

A fire in this area may disable remote control and auto transfer of diesel generator 2-3. The diesel can be manually started and loaded at the diesel generator local panel and at the 4kV switchgear room. (Ref. 6.11)

A fire in this area may spuriously trip the 480 volt feeder breakers. These breakers can be manually closed.

A fire in this area may cause loss of power supplies associated with PY27N. Redundant power supply PY26 remains available.

4.6 Main Steam System

A fire in this area may spuriously open the main steam isolation valves (FCV-41, 42, 43, and 44) and their bypasses (FCV-22, 23, 24, and 25). These valves can be manually closed.

A fire in this area may spuriously open the steam generator inboard isolation valves (FCV-760, 761, 762, and 763) and the outboard isolation valves (FCV-151, 154, 157, 160, 244, 246, 248, and 250). Operator action can be taken to close the valves and isolate SG blowdown.

Steam generator pressure indication in the control room and hot shutdown panel may be lost due to a fire in this area. Steam generator pressure for steam generators 2-1, 2-2, 2-3, 2-4 can be read off of PI-518, PI-528, PI-538 and PI-548, respectively.

A fire in this area may result in the loss of steam generator level instruments LT-517, 518, 519, 527, 528, 529, 537, 538, 539, 547, 548 and 549. Steam

generator level indication will remain available from LT-516, 526, 536 and 546 at the dedicated shutdown panel.

A fire in this area may prevent ten percent dump valves (PCV-19, 20, 21 and 22) from opening. These valves are required closed for hot standby and can be manually opened for cooldown. To mitigate spurious operation of these valves, control air is isolated and bled off to allow manual operation of the valve handwheel.

4.7 Reactor Coolant System

Reactor coolant system pressure indication from PT-403 and PT-405 may be lost due to a fire in this area. This indication can be monitored using PT-406 at the dedicated shutdown panel.

A fire in this area may affect PORVs PCV-456, PCV-474 and PCV-455C and blocking valves 8000A, 8000B and 8000C. The above PORVs can be closed from the hot shutdown panel in order to prevent uncontrolled pressure reduction. Therefore, safe shutdown is not affected. Auxiliary spray is credited for RCS pressure reduction.

If RCP seal cooling is not returned within 8 minutes, then Westinghouse recommends that seal injection and CCW to the thermal barrier heat exchangers be isolated and allow the RCP seals to cool through natural circulation. Seal injection could be isolated by closing manual valves 8382A and 8382B to the RCP seal injection filters 2-2 and 2-1 and closing RCP seal return filter inlet isolation valve 8396A (located in the filter gallery in Fire Zone 3-X). In addition, FCV-357 can be manually closed to isolate the RCP thermal barrier CCW return flowpath. With the seal injection flowpath isolated, RCS makeup would need to be directed through the charging injection flowpath by locally opening 8801A and 8803A using their handwheel after opening their power supply breakers.

A fire in this area may spuriously operate pressurizer heater groups 2-1, 2-2, 2-3 and 2-4. These heater groups can be manually de-energized to ensure safe shutdown.

A fire in this area may affect PCV-455A and PCV-455B. If these valves fail in the desired, closed position, safe shutdown is not affected. RCPs can also be tripped to mitigate spurious operation of the pressurizer spray valves.

A fire in this area may prevent reactor coolant pumps 2-1, 2-2, 2-3 and 2-4 from being secured. Manual actions at the 12kV switchgear may be necessary to secure the reactor coolant pumps.

A fire in this area may affect all RCP seal cooling sources (seal injection and CCW to the RCP Thermal Barrier Heat Exchanger). To prevent thermal shock of

the RCP seals, seal injection and CCW to the RCP TBHX can be isolated by operation of valves 8382A, 8382B, 8396A and FCV-357. The charging injection flowpath will be credited for RCS makeup.

Source range monitors NE-31 and NE-32 may be lost due to a fire in this area. NE-51 and NE-52 will be available to provide source range indication at the hot shutdown panel.

Pressurizer level indication from LT-459, LT-460 and LT-461 may be lost due to a fire in this area. LT-406 will remain available to provide level indication at the dedicated shutdown panel.

A fire in this area may affect reactor vessel head vent valves 8078A, 8078B, 8078C and 8078D. Operator action can be taken to fail the valves closed. Safe shutdown is not affected.

Hot and cold leg temperature instrumentation in the control room may be lost due to a fire in this area. TE-423A and TE-423B can be read at the dedicated shutdown panel.

4.8 Residual Heat Removal System

Valves 8701 and 8702 are closed with their power removed during normal operations and will not spuriously open. Also, these valves can be manually opened for RHR operations.

A fire in this area may spuriously close 8700A and 8700B. These valves can be manually operated to ensure safe shutdown.

RHR pumps 2-1 and 2-2 may be affected by a fire in this area. Either RHR pump may be started from the 4kV switchgear room to provide RHR flow.

A fire in this area may affect FCV-641A and FCV-641B or cause spurious operation of the valves. During the transition to cold shutdown conditions, prior to starting the RHR Pump, the respective recirc valve can be manually operated.

4.9 Safety Injection System

A fire in this area may affect valves 8982A, 8982B, 9003A and 9003B may spuriously open due to a fire in this area. Power to 8982A and 8982B is administratively removed by maintaining a toggle switch in the Control Room in the open position. These valves are normally closed, and spurious opening is not expected to occur. However, an operator action can be taken to open the power breakers to further preclude spurious opening of 8982A and 8982B. Valves 9003A and 9003B can be manually operated in order to defeat any spurious signals.

Accumulator isolation valves 8808A, 8808B, 8808C and 8808D may be affected by a fire in this area. These valves can be manually closed which is the desired position for safe shutdown.

SI pumps 2-1 and 2-2 may spuriously operate due to a fire in this area. Local manual action may be required to defeat this spurious operation.
A fire in this area may spuriously open valve 8804A. This valve can be manually closed to ensure safe shutdown.

A fire in this area may affect RWST Level Transmitter LT-920. Alternative shutdown capability is credited in this fire area, and this transmitter is not credited for safe shutdown.

4.10 Auxiliary Saltwater System

The ability to operate ASW pumps 2-1 and 2-2 from the control room may be lost due to a fire in this area. Manual actions will enable both pumps to be operated from the hot shutdown panel or the 4kV switchgear.

A fire in this area may affect valves FCV-495 and FCV-496. ASW system integrity is unaffected by a fire in this area since FCV-601 will remain closed.

A fire in this area may spuriously close valves FCV-602 and FCV-603. These valves can be manually opened to ensure safe shutdown.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Smoke and heat detection are provided.

- Total flooding CO_2 system is provided.

- No storage area near hatch.

The fire protection features provided in this area provide an acceptable level of fire safety equivalent to that provided by Section III.G.

6.0 REFERENCES

6.1 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.2 Drawing No. 515572
6.3 DCN DC2-EE-12694 - provides isolators Contact on DG
6.4 DCN DC2-EE-12670 - provides disconnect switch at HSD panel
6.5 Calculation M-824, Combustible Loading
6.6 Drawing 065127, Fire Protection Information Report, Unit 2
6.7 SSER 31, April 1985
6.8 DCPP Unit 2 Report of 10 CFR 50, Appendix R Review (Rev. 0)
6.9 File 131.91 Memo from S. Lynch to P. Hypnar dated 12/08/83, Re: Current Transformer Protection
6.10 DCNs DC2-EE-48591, DC2-EE-48593, and DC2-EE-48594 Provide Transfer Switches at the 4kV Switchgear and Mode Selector Switches at the Hot Shutdown Panel
6.11 DCN DC1-EE-46132, Provides Local Control Capability for the Diesel Generators
6.12 DCN DC2-EE-48607, DG 2-2 Starting Circuit Power Supply Transfer Switch
6.13 NECS File: 131.95, FHARE: 126; HVAC Ducts through Modified Unrated Hatches
6.14 NECS File: 131.95, FHARE:80, Fire Dampers Installed at Variance with Manufacturer's Instructions
6.15 NECS File: 131.95, FHARE 139, HVAC Duct Without a Rated Seal in Appendix R Barrier
6.16 Calculation 134-DC, Electrical Appendix R Analysis
6.17 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.18 NECS File: 131.95, FHARE 140, Unrated Penetrations through Unit 2 Control Room Floor (Barrier 458)
6.19 NECS File: 131.95, FHARE 134, "Non-rated Structural Gap Seals in Fire Barriers"
6.20 NECS File: 131.95, FHARE 147, "Evaluation of Lesser Rated Unistrut Configurations in 128' Cable Spreading Room."
6.21 NECS File: 131.95, FHARE 104, "Fireproofing on Structural Steel for Block Walls."
6.22 NECS File: 131.95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area Wide Detection/Suppression

FIRE AREA 8-H

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This area is located in the southwest corner of the Unit 2 Auxiliary Building at El. 140 ft.

1.2 Description

Area 8-H, Unit 2 Safeguards room, houses Unit 2 solid state protection cabinets. Automatic reactor trip, SIS, containment/isolation and other safeguard signals are generated from these cabinets.

1.3 Boundaries

North:

- 1-hour rated barrier separates this area from Zone 8-F. (Ref. 6.6)
- A duct penetration with no fire damper. (Ref. 6.9)

South:

- 3-hour rated barrier separates this area from Area 34.

East:

- 3-hour rated barrier separates this area from Zone 8-D.
- A 3-hour rated door communicates to Zone 8-D.
- A duct penetration with no fire damper (the duct is protected within 8-H.) with a 3-hour rated fire damper at the outlet of the protected duct work. (Ref. 6.8)

West:

- 3-hour rated barrier separates this area from Fire Zone 19-D (Turbine Building).

Floor/Ceiling:

- 3-hour rated barrier: Floor: To Fire Area 7-B.
  Ceiling: To outside

2.0 COMBUSTIBLES

2.1 Floor Area: 225 ft^2

2.2 In situ Combustible Materials

- Cable insulation

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection

3.2 Suppression

- Portable fire extinguishers
- Hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Auxiliary Feedwater

AFW pumps 2-2 and 2-3 may be lost due to a fire in this area. Redundant pump 2-1 will be available to provide AFW.

4.2 Chemical and Volume Control System

Valves 8107 and 8108 may be affected by a fire in this area. Redundant valves HCV-142 or 8145 and 8148 can be closed to isolate auxiliary spray. 8145 will also fail close if operator action is taken to close SG blowdown valves. RCP seal injection will remain available to provide a charging flowpath to the reactor. The PORVs will remain available for RCS pressure reduction. Since these valves have redundant components available, safe shutdown will not be affected.

A fire in this area may result in the loss of 8149A, 8149B and 8149C. Redundant valves LCV-459 and LCV-460 will remain available to isolate letdown isolation.

Valves LCV-112B, LCV-112C, 8805A and 8805B may be affected by a fire in this area. The running charging pumps can be tripped from the control room to prevent cavitation. A pump can be restarted after the RWST is aligned and the VCT is isolated. Since one pair of valves must be closed (i.e., LCV-112B, 112C) if the other pair is open (8805A, 8805B), safe shutdown is not affected since both pairs of valves can be manually positioned.

4.3 Component Cooling Water

The ability to operate CCW pumps 2-1, 2-2 and 2-3 from the control room may be lost due to a fire in this area. Manual actions will enable these pumps to be operated from the hot shutdown panel or the 4kV switchgear.

A fire in this area may spuriously close valves FCV-356, FCV-357 and FCV-750. Since seal injection will be available, these valves are not required open and their position will not affect safe shutdown.

Valve FCV-355 may spuriously close due to a fire in this area. FCV-355 can be manually operated for safe shutdown.

4.4 Containment Spray

A fire in this area may affect containment spray pumps 2-1 and 2-2 or valves 9001A and 9001B. Operator action can be taken to trip the CS pumps. Therefore, safe shutdown is not affected.

4.5 Emergency Power

A fire in this area may disable the diesel generator 2-1 automatic transfer circuit. Manual control will remain available in the control room to transfer and load the diesel generator.

A fire in this area may disable the diesel generator 2-2 automatic transfer circuit. Manual control will remain available in the control room to transfer and load the diesel generator.

A fire in this area may disable the diesel generator 2-3 automatic transfer circuit. Manual control will remain available in the control room to transfer and load the diesel generator.

4.6 Main Steam System

A fire in this area may affect valves FCV-151, 154, 157, 160, 244, 246, 248, 250, 760, 761, 762 and 763. Operator for action can be taken to fail the SGBD valves closed and isolate the flowpath. Therefore, safe shutdown is not affected.

A fire in this area may affect valves FCV-41, 42, 43 and 44. These valves can be manually closed to ensure safe shutdown.

A fire in this area may prevent the 10% dump valves PCV-19, PCV-20, PCV-21 and PCV-22 from opening. These valves are required closed while in hot standby and can be manually opened for decay heat removal.

4.7 Reactor Coolant System

Operator action to close SGBD valves will also fail pressurizer PORV PCV-456 closed. Redundant valve PCV-455C will remain available to RCS pressure reduction.

4.8 Safety Injection System

Valves 8801A, 8801B, 8803A and 8803B may be affected by a fire in this area. A charging flowpath to the reactor will remain available through RCP seal injection. Additionally the PORVs will remain available for pressure reduction.

A fire in this area may prevent the operation of or cause the spurious operation of valves 8808A, 8808B, 8808C and 8808D. These valves can be manually closed to ensure safe shutdown.

SI pumps 2-1 and 2-2 may spuriously operate due to a fire in this area. Local manual action can be taken to defeat this spurious operation.

4.9 Auxiliary Saltwater System

The ability to operate ASW pumps 2-1 and 2-2 from the control room may be lost due to a fire in this area. Manual actions will enable both ASW pumps to be operated from the hot shutdown panel or the 4kV switchgear.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

The safe shutdown functions located in this area are not required once the reactor is tripped.

- Smoke detection is provided.

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

The existing fire protection features provide a level of safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.2 Drawing No. 515571
6.3 SSER 23, April 1984
6.4 Calculation M-824, Combustible loading
6.5 Drawing 065127, Fire Protection Information Report, Unit 2
6.6 NECS File: 131.95, FHARE 75, 1-hour Rated Barrier
6.7 NECS File: 131.95, FHARE: 15, HVAC Ducts Wrapped in Pyrocrete
6.8 NECS File: 131.95, FHARE: 80, Fire Dampers Installed at Variance with Manufacturers Instructions
6.9 NECS File: 131.95, FHARE 129, Duct penetrations through common walls associated with fire zones 8-A, 8-D, 8-E, 8-F, 8-G, and 8-H
6.10 Calculation 134-DC, Electrical Appendix R Analysis
6.11 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis

FIRE AREA 9

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Unit 2 containment building El. 91 ft through 140 ft - Containment annulus area.

1.2 Description

Fire Area 9 is divided into three fire zones:

- 9-A Containment penetration area
- 9-B Reactor coolant pump area
- 9-C Control rod drive area

Fire Zone 9-A is the annular region within containment between El. 91 ft and the operating deck at El. 140 ft. The annular region is bounded by the containment wall and the shield wall separating 9-A from 9-B.

Fire Zone 9-B is a cylindrical shaped region in the central part of containment. It is separated from Zone 9-A by the shield wall and from 9-C by the concrete operating deck.

Fire Zone 9-C is comprised of the reactor cavity and the area above the reactor from El. 140 ft and above. The outer wall of this zone is the containment wall.

1.3 Boundaries

NOTE: ^{NC} designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

1.3.1 Fire Zone 9-A

- 3-hour rated containment barrier (outer wall).
- A nonrated reinforced concrete shield wall separates this zone from Zone 9-B.
- Nonrated openings and steel grating to 9-C.
- A nonrated reinforced concrete shield ceiling separates this zone from 9-C.
- Containment penetrations consisting of 5 ft schedule 80 pipe sleeves are in the area. The electrical conductors pass through a steel header plate and are encased in fire retardant epoxy. The space between the header plates is pressurized with nitrogen.

I.3.2 Fire Zone 9-B

- A nonrated reinforced concrete shield wall separates this zone from Zone 9-A.
- Nonrated reinforced concrete operating deck separates this zone from Zone 9-C.
- Nonrated openings, hatches, piping and ventilation penetrations are present.

1.3.3 Fire Zone 9-C

- 3-hour rated containment wall. [NC]
- Nonrated reinforced concrete separates this zone from Zones 9-A and 9-B. There are also nonrated openings into 9-B.
- Nonrated equipment and personnel hatches communicate through the containment wall. (Ref. 6.9)

2.0 COMBUSTIBLES (for entire area)

2.1 Floor Area: 26,551 ft^2

2.2 In situ Combustible Materials

- Oil (in RCPs Cranes, fan cooler motors)
- Grease (in valve operators, cranes, fan cooler motors)
- Cable
- Carbon Filters
- Neoprene
- Rubber
- PVC
- Plastic
- Hepa filters
- Cloth

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles

- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Fire Zone 9-A

3.1.1 Detection

- Smoke detection

3.1.2 Suppression

- Hose stations

3.2 Fire Zone 9-B

3.2.1 Detection

- Smoke detection above each RCP.

3.2.2 Suppression

- Wet pipe automatic sprinklers over each RCP with remote annunciating flow alarm.
- Hose stations

3.3 Fire Zone 9-C

3.3.1 Detection

- Flame detection on operating deck.

3.3.2 Suppression

- Hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Zone 9-A

4.1.1 Chemical and Volume Control System

Pressurizer auxiliary spray valves 8145 and 8148 may be affected by a fire in this area. Redundant valves 8107, 8108 or HCV-142 will remain available to prevent uncontrolled pressure reduction. A cold shutdown repair will allow manual initiation of auxiliary spray. (Ref. 6.10) In addition, the circuits associated with valves 8145 and 8148 are contained in dedicated conduits.

A fire in this area may result in spurious closure of FCV-128. FCV-128 is desired to be open. FCV-128 can be opened from the Control Room by taking its controller to the Manual Mode of operation.

Valves 8146 and 8147 may be affected by a fire in this area. An available seal injection flowpath will provide the required charging function. These valves can be manually closed in order to initiate auxiliary spray following a fire inside containment.

Valves 8149A, 8149B, 8149C, LCV-459 and LCV-460 may be affected by a fire in this area. Operator action can be taken to fail valves 8149A, 8149B and 8149C closed. Therefore, isolation of letdown will not be affected.

CVCS valves 8166, 8167 and HCV-123 may be affected by a fire in this area. To make sure HCV-123 fails closed, remove instrument power. Excess letdown will remain isolated and safe shutdown is not affected.

4.1.2 Emergency Power

A fire in this area may cause loss of power supplies associated with PY27N. Redundant power supply PY26 remains available.

4.1.3 Main Steam System

Main steam system valves FCV-760, FCV-761, FCV-762 and FCV-763 may be affected by a fire in this area. The following redundant valves will remain available to isolate steam generator blowdown lines: FCV-151, FCV-250, FCV-154, FCV-248, FCV-157, FCV-246, FCV-160 and FCV-244. Therefore, safe shutdown is not affected.

A fire in this area may affect steam generator level for all four loops. Only one steam generator is necessary for safe shutdown. Therefore, steam generator

level indication for SG 2-4, from LT-547 will remain available because it has been provided with a 1-hour fire wrap. (Refs. 6.11 and 6.12)

4.1.4 Reactor Coolant System

RCS valves 8000A, 8000B, 8000C and PZR PORVs PCV-455C, PCV-456 and PCV-474 may be affected by a fire in this area. Valves 8000A, 8000B and 8000C are required closed if the PZR PORVs are open during hot standby to prevent uncontrolled pressure reduction. Since PCV-455C, PCV-456 and PCV-457 fail closed and their circuits are located in dedicated conduits, and administrative controls are provided to ensure hot short sources are not possible, uncontrolled pressure reduction will not occur. A 1-hour fire wrap is provided on junction box BJX263 and K1986 and penetration boxes BTX12E, BTX19E and BTX26E to ensure the integrity of the circuits for the subject valves. Auxiliary spray remains available for depressurization.

RCS reactor vessel head vent valves 8078A, 8078B, 8078C and 8078D may be affected by a fire in this area. Operator action can be taken to fail the valves closed. Therefore, safe shutdown is not affected.

Pressurizer level transmitters LT-406, LT-459, LT-460 and LT-461 may be affected by a fire in this area. Only one of the four level transmitters is required for safe shutdown. Since the LT-406 circuitry is separated from the LT-459 circuitry by 20 ft with no intervening combustibles, either one of these level transmitters will be available for safe shutdown.

Source range monitors NE-31, NE-32, NE-51 and NE-52 may be affected by a fire in this area. Since NE-31 and NE-32 are separated by more than 20 ft with no intervening combustibles, one of these channels will remain available to provide neutron flux indication in the event of a fire. Therefore, safe shutdown will not be affected.

RCS pressure transmitters PT-405 and PT-406 may be affected by a fire in this area. PT-403 will remain available to provide RCS pressure indication.

A fire in this area may fail PCV-455A and PCV-455B closed. Since these valves fail in the desired, closed position, safe shutdown is not affected. RCPs can also be tripped to mitigate spurious operation of the pressurizer spray valves.

Temperature indication on TE-413A, TE-413B, TE-423A, TE-423B, TE-433A, TE-433B, TE-443A and TE-443B may be affected by a fire. Due to the presence of 1-hour fire wraps, temperature indication on steam generator loops 3 and 4 will remain operational in the event of a fire. (Ref. 6.12)

4.1.5 Residual Heat Removal System

RHR valves 8701 and 8702 may be affected by a fire in this area. These valves are normally closed with power removed and will not spuriously operate. These valves can be manually operated to their safe shutdown position.

4.1.6 Safety Injection System

SI valves 8808A, 8808B, 8808C and 8808D may be affected by a fire in this area. These valves can be manually closed for RCS pressure reduction.

4.2 Fire Zone 9-B

4.2.1 Chemical and Volume Control System

CVCS valves LCV-459 and LCV-460 may be affected by a fire in this area. Valves 8149A, 8149B, 8149C remain available to provide letdown isolation.

4.2.2 Emergency Power

A fire in this area may cause loss of power supplies associated with PY27N. Redundant power supply PY26 remains available.

4.2.3 Main Steam System

Main steam system valves FCV-760, FCV-761, FCV-762 and FCV-763 may be affected by a fire in this area. The following redundant valves will remain available to isolate steam generator blowdown lines: FCV-151, FCV-250, FCV-154, FCV-248, FCV-157, FCV-246, FCV-160 and FCV-244. Therefore, safe shutdown is not affected.

4.2.4 Reactor Coolant System

RCS valves 8000A, 8000B, 8000C and PZR PORVs PCV-455C, PCV-456 and PCV-474 may be affected by a fire in this area. Valves 8000A, 8000B and 8000C are required closed if the PZR PORV are open during hot standby to prevent uncontrolled pressure reduction. Since PCV-455C, PCV-456 and PCV-474 fail closed in the event of a fire, uncontrolled pressure reduction will not occur. Auxiliary spray will remain available to provide pressure reduction capabilities. Therefore, safe shutdown is not affected.

The reactor vessel head vents 8078A, 8078B, 8078C and 8078D may be affected by a fire in this area. It would take two independent spurious signals to provide a path for the flow of reactor coolant which is not a credible scenario. If

this were to occur, the charging pumps would be able to keep up with RCS inventory loss.

A fire in this zone may affect instrument sensing lines for LT-459, LT-460, LT-461, LT-406, and PT-406. This instrument is either shielded by the pressurizer vessel or protected by a heat shield. No electrical circuitry for this instrument exists in this fire zone. Therefore, safe shutdown is not affected.

Source range monitors NE-31, NE-32, NE-51 and NE-52 may be affected by a fire in this area. Since NE-31 and NE-32 are separated by more than 20 ft with no intervening combustibles, one of these channels will be available to provide neutron flux indication. Therefore, safe shutdown will not be affected.
The following instrumentation for hot leg and cold leg temperatures: TE-413A, TE-413B, TE-423A, TE-423B, TE-433A, TE-433B, TE-443A and TE-433B may be affected by a fire in this area. TE-413A and TE-413B, and TE-423A and TE-423B, are separated by over 20 ft from TE-433A and TE-433B, and TE-4/43A and TE-443B, with no intervening combustibles. Therefore, safe shutdown will not be affected.

4.2.5 Residual Heat Removal System

RHR valve 8702 may be affected by a fire in this area. 8702 is normally closed with its power removed during normal operations and will not spuriously operate. This valve can be manually operated to its safe shutdown position.

4.3 Fire Zone 9-C

4.3.1 Reactor Coolant System

RCS valves 8000A, 8000B, 8000C and PZR PORVs PCV-455C, PCV-456 and PCV-474 may be affected by a fire in this area. Valves 8000A, 8000B and 8000C are required closed if the PZR PORV are open during hot standby to prevent uncontrolled pressure reduction. Since PCV-455C, PCV-456 and PCV-474 fail closed in the event of a fire, uncontrolled pressure reduction will not occur. Therefore, safe shutdown is not affected. Auxiliary spray will remain available for RCS pressure reduction.

Source range monitors NE-31, NE-32, NE-51 and NE-52 may be affected by a fire in this area. Since NE-31 and NE-32 are separated by more than 20 ft with no intervening combustibles, one of these channels will be available to provide neutron flux indication. Therefore, safe shutdown will not be affected. The reactor vessel head vents 8078A, 8078B, 8078C and 8078D may be affected by a fire in this area. Operator action can be taken to fail the valves closed. Therefore, safe shutdown is not affected.

5.0 CONCLUSIONS

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3 hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.
- Safe shutdown equipment utilized for safe plant shutdown are not adversely effected by a fire in this area due to spatial separation and barriers provided.
- Manual fire fighting equipment is provided for this area.
- Automatic wet pipe sprinklers are provided over each RCP.
- Smoke detection is provided for Zone 9-A and above each RCP in Zone 9-B.
- Flame detection is provided on the operating deck of Zone 9-C.

A deviation from the requirements of 10 CFR 50, Appendix R, Section III.G.2 was requested in the report on 10 CFR 50, Appendix R Review because a noncombustible radiant energy shield between redundant shutdown divisions was not provided when separation was less than 20 ft. A 1-hour rated fire barrier was provided and SSER concluded that the modifications brought the area into compliance and that no deviation was required. An RCP lube oil collection system is provided for the RCPs in Zone 9-B. A deviation from the requirements of 10 CFR 50, Appendix R, Section III.O was requested because the oil holding tank's are not large enough to hold the contents of the entire lube oil system inventory for the four RCPs. The existing system is designed to hold the oil for one RCP plus some margin. (Ref. 6.16)

This deviation was granted in SSER 31.

6.0 REFERENCES

6.1 Drawing No. 515577 and 515578
6.2 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.3 DCN D2-EA-22612, provide 1-hour barrier for boxes and conduits
6.4 Calculation M-824, Combustible Loading
6.5 Drawing 065127, Fire protection Information Report, Unit 2
6.6 Deleted in Revision 13.

6.7 SSER 31, April 1985
6.8 Procedure EP-M10, Fire Protection of Safe Shutdown Equipment
6.9 NECS File: 131.95, FHARE: 94, Containment Personnel Airlock Doors
6.10 NECS File: 131.95, FHARE: 101, Separation of Pressurizer PORV and Auxiliary Spray Valve Circuits in the Containment Annular Area
6.11 NECS File: 131.95, FHARE: 105, Nonrated Mechanical Panels in Containment
6.12 DCP A-48568, Containment Fire Wrap Modifications
6.13 Calculation 134-DC, Electrical Appendix R Analysis
6.14 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.15 NECS File: 131 .95, FHARE: 97, Containment Electrical Penetrations
6.16 NECS File: 131.95, FHARE: 115, Reactor Coolant Pump Lube Oil Flashpoint Temperature

FIRE AREA 20

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Unit 2 southeast corner of the Turbine Building at El. 76 ft and 85 ft.

1.2 Description

This area includes the 12kV switchgear room at El. 85 ft and the 12kV cable spreading room beneath, at El. 76 ft. The cable spreading room is accessed by open stairwells communicating between the two elevations of this area.

1.3 Boundaries

North:

85' Elevation
- A 3-hour rated barrier to Fire Zone 19-A (TB-7). (Ref. 6.13)
- A 3-hour rated door to Fire Zone 19-A.

76' Elevation (Ref. 6.29)
- Unrated conduit penetration seals (Ref 6.28).

South:

85' Elevation
- A 2-hour rated barrier to the exterior (Fire Area 29). (Refs. 6.8 and 6.24)
- A 2-hour rated barrier to Fire Zone S-7 (TB-13). (Ref. 21)
- A 3-hour rated roll up door to the exterior (Fire Area 29).
- Unrated penetration to the exterior (Fire Area 29). (Ref. 6.16)
- Unsealed Bus duct penetrations to Fire Area 29. (Ref. 6.6)

76' Elevation (Ref. 6.29)
- Unrated conduit penetration seals (Ref 6.28).

East:

85' Elevation
- A 2-hour rated barrier to the exterior (Fire Area 29). (Ref. 6.24)
- A 3-hour rated roll up door in front of a 1-1/2 hour equivalent rated door to the exterior.
- A 3-hour rated roll up door over wall louvers to the exterior (Fire Area 29). (Refs. 6.8 and 6.17)

- Unsealed Bus duct penetrations to Fire Area 29. (Ref. 6.6)

76' Elevation (Ref. 6.29)
- Unrated conduit penetration seals (Ref. 6.28).

West:

85' Elevation
- A 3-hour rated barrier to Fire Area 22-C. (Ref. 6.24)
- A 2-hour rated barrier to Fire Zone S-7 (TB-13). (Ref. 6.21)
- Unrated small diameter penetration to Area 22C. (Ref. 6.16)
- A 3-hour rated door to Fire Area 22-C.
- A 3-hour rated roll-up door to Fire Area 22-C.
- A 3-hour rated fire damper to Fire Area 22-C.
- Lesser rated penetration seal to Fire Area 22-C. (Ref. 6.25)

76' Elevation (Ref. 6.29)
- Unrated conduit penetration seals (Ref. 6.28).

Floor/Ceiling:

- 3-hour rated barriers with the following exception:

  - A 2-hour rated enclosed stairwell with a nonrated ceiling and a 1-1/2-hour rated door communicates to Fire Zone 23-E (TB-7). (Ref. 6.10)
  - Lesser rated penetration seal to Fire Zone 23-E. (Ref. 6.25)

- Unprotected structural steel supporting the ceiling of the 85-ft elevation. (Ref. 6.9)

  - A 3-hour rated concrete equipment plug to Fire Zone 23-B (TB-11) above, on unprotected steel supports with unsealed gaps. (Refs. 6.9 and 6.11)

Fire Resistive Enclosures:

- Ten vertical conduit banks, routed to Fire Zone 23-A, 23-B and 23-C (Fire Areas TB-10, TB-11 and TB-12 respectively) are enclosed in this area on El. 85 ft, with a 2-hour rated fire barrier. Those on El. 76 ft are also protected either with the rated enclosure or by being located in embedded conduits. (Refs. 6.11, 6.14, 6.15, 6.18, 6.19, 6.23, 6.26, and 6.27.)

- 3-hour fire resistive covering is provided for all the structural steel on El. 76 ft. (Refs. 6.1 and 6.9)

2.0 COMBUSTIBLES

2.1 Floor Area: 4,095 ft^2 (El. 76 ft), 6,160 ft^2 (El. 85 ft)

2.2 In situ Combustible Materials

- Cable insulation
- PVC
- Fiberglass

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low (El. 76 ft)
- Low (El. 85 ft)

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection at both elevations.

3.2 Suppression

- Portable fire extinguishers.
- CO_2 hose stations.
- Hose stations available in vicinity.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Auxiliary Feedwater System

A fire in this area may affect AFW Pumps 2-2 and 2-3 and level control valves LCV-110, LCV-111, LCV-113, and LCV-115. Redundant AFW Pump 2-1 and LCV-106, LCV-107, LCV-108, and LCV-109 will remain available for safe shutdown.

4.2 Emergency Power

A fire in this area may disable the diesel generator 2-2 automatic transfer circuit. Manual control will remain available in the control room to transfer and load the diesel generator.

The circuits associated with diesel generators 2-1 and 2-3 are protected with a 2-hour fire rated enclosure and will be available for safe shutdown.

A fire in this area may disable startup transformer 2-2. Manual action may be credited to locally trip startup transformer breakers and manually start DG 2-1. Onsite power will remain available from diesel generators 2-1, 2-2 and 2-3.

A fire in this area may cause loss of power supplies associated with PY27N. Redundant power supply PY26 remains available.

4.3 Reactor Coolant System

Control of reactor coolant pumps may be lost due to a fire in this area. Safe shutdown will not be affected if the RCPs continuously run. CCW to the thermal barrier heat exchanger or seal injection will remain available for RCP seal cooling.

4.4 Other Systems

A fire in this area may affect safe shutdown equipment on Buses "F", "G" and "H". The banks are separated by a fire rated enclosure with a minimum fire rating of 2 hours in both the switchgear and cable spreading rooms. The unprotected panels and conduits at El. 76 ft have been evaluated and will not affect safe shutdown. (Refs. 6.5, 6.16, 6.17, 6.18, 6.20, 6.23, and 6.26)

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Safe shutdown circuitry utilized in safe plant shutdown is not adversely affected due to the fire barriers provided (min. 2-hour enclosure on "F", "G" and "H" Buses) and the spatial separation provided. (Refs. 6.5, 6.14, 6.15, 6.18, 6.19, 6.20, and 6.23)

- Smoke detection provided in both elevations.

- Portable fire extinguishers and CO_2 hose stations are available within the area and fire hose stations are nearby.

The existing fire protection features provide an acceptable level of safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 DCN DCI-EA-36409 Structural Steel Fire Rated Covering
6.2 Drawing Number 515573, 515574
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065127, Fire Protection Information Report, Unit 2
6.5 NECS File: 131.95, FHARE: 18, Conduits Not Enclosed in 2 Hour Enclosures
6.6 NECS File: 131.95, FHARE: 20, Unsealed Bus Duct Penetration
6.7 Not used
6.8 SSER 8, November 1978
6.9 PLC Report: Structural Steel Analysis for Diablo Canyon Rev. 2 (7/8/86)
6.10 NECS File: 131.95, FHARE: 4, Stairwell Nonrated Ceiling
6.11 NECS File: 131.95, FHARE: 14, Concrete Equipment Hatches
6.12 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.13 NECS File: 131.95, FHARE: 82 Dow Corning Penetration Seal Through Concrete Block Wall
6.14 NECS File: 131.95, FHARE: 45, 3-M Fire Wrap Repair of Pyrocrete Enclosures
6.15 PG&E Design Change Notice DC2-EA-050070, Unit 2 ThermoLag Replacement

6.16 NECS File: 131.95, FHARE 123, Unsealed penetrations with fusible link chain penetrants through fire barriers
6.17 Question 25, PG&E letter to NRC dated 8/3/78
6.18 "Fire Endurance Test of Pyrocrete Box Fire Protective Envelopes," Test Report by Omega Point Laboratories, October 18, 1996
6.19 PG&E Design Change Notice DC2-EC-050339, Unit 2, "Provide Pyrocrete Fire Barriers"
6.20 NECS File: 131.95, FHARE 138, Drain Holes in Pyrocrete Panels in Fire Area 10 and 20
6.21 NECS File: 131.95, FHARE 122. Staircase S-7 Fire Area Boundary
6.22 Calculation 134-DC, Electrical Appendix R Analysis
6.23 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.24 NECS File: 131.95, FHARE 133, Seismic/Construction Gaps in the 12kV Switchgear Rooms
6.25 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.26 NECS File: 131.95, FHARE 145, Pyrocrete Enclosure Thickness
6.27 PG&E Design Change AT-MM AR A0666894, Relocation of Drain Holes in Pyrocrete Panels
6.28 NECS File: 131.95, FHARE 151, Evaluation of Fire Area Boundaries for the 76' Elevation of Fire Areas 10 and 20.
6.29 NECS File: 131.95, FHARE 154, Removal of Below Grade 12-kV Cable Spreading Room Barriers from the Fire Protection Program

FIRE AREA 22-C

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Unit 2 Turbine Building, corridor outside diesel generator rooms, El. 85 ft.

1.2 Description

Fire Area 22-C is the corridor at El. 85 ft in the Unit 2 Turbine Building that separates the diesel generator rooms; Zones 22-A-1 (TB-8), 22-B-1 (TB-9) and 22-C-1 from the 12-kV switchgear room (Area 20) and stairway Zone S-7 (TB-13).

1.3 Boundaries

NOTE: ^{NC} designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- A 3-hour rated barrier to Fire Zone 19-A (TB-7).
- A 3-hour rated double door to Fire Zone 19-A.

South:

- A 3-hour rated barrier to the exterior (Fire Zone 29).
- A 3-hour rated double door to the exterior (Fire Area 29).

East:

- A 3-hour rated barrier to Fire Area 20 and Fire Zone S-7 (TB-13). (Ref. 6.20)
- A 3-hour rated door to Fire Area 20.
- A 3-hour rated roll-up door to Fire Area 20.
- A duct penetration with a 3-hour rated fire damper to Area 20.
- A 1-1/2-hour rated door and non-rated seismic gaps to Fire Zone S-7 (TB-7). (Refs. 6.5 and 6.19)
- A lesser rated penetration seal to Area 20. (Ref. 6.23)

West:

- A 3-hour rated barrier to Fire Zones: (Ref. 6.22)

  - 22-A-1 (TB-8)

- 22-B-1 (TB-9)
- 22-C-1 (TB-17)
- 22-B-2 (TB-9)

- Unsealed penetration to Zone 22-A-1.
- Unrated small diameter penetrant to each Zone 22-A-1, 22-B-1, 22-C-1. (Ref. 6.16)
- Unsealed penetration to Zone 22-A-1.
- Unrated structural gap seal to Zone 22-C-1. (Ref. 6.22)
- A 3-hour rated roll-up door and personnel door to Zones 22-A-1 and 22-C-1.
- A 3-hour rated roll-up door to Zone 22-B-1.
- A 3-hour rated door to Zone 22-B-2.

Floor:

- Concrete on grade. NC

Ceiling:

- 3-hour rated barrier to Fire Zones 23-A (TB-10) and 23-B (TB-11) and 23-C-1 (TB-13) above.
- A duct penetration without a fire damper to Fire Zone 23-C-1 (TB-3). (Refs. 6.5 and 6.10)

2.0 COMBUSTIBLES

2.1 Floor Area: 459 ft^2

2.2 In situ Combustible Materials

- Cable insulation
- Clothing/Rags
- Rubber
- Plastic

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles

- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

None

3.2 Suppression

- Automatic wet pipe sprinklers with remote annunciation.
- Portable fire extinguishers
- Fire hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Emergency Power System

A fire in this area may affect diesel fuel oil transfer pumps 0-1 and 0-2. The circuits for diesel fuel oil transfer pumps are enclosed in fire barriers. SSER 31 justifies this deviation. Offsite power will be available for safe shutdown in the event diesel fuel oil circuits are damaged by a fire. Therefore, safe shutdown is not affected.

A fire in this area may affect day tank level control valves LCV-85, 86, 87, 88 and 89, and 90. The circuits for these valves are enclosed in fire barriers and the deviation mentioned above also applies to these valves. Offsite power will be available for safe shutdown in the event diesel fuel oil circuits are damaged by a fire.

Diesel generator 2-1 circuits located in this area and the emergency stop switch are enclosed in fire barriers. Offsite power will be available for safe shutdown in the event diesel fuel oil circuits are damaged by a fire. The configuration in this area will provide an acceptable level of fire safety equivalent to that provided by Section III.G.2 of Appendix R. (Refs. 6.7, 6.11, 6.12, 6.14, 6.15, and 6.18)

Diesel generator 2-2 circuits located in this area and the emergency stop switch are enclosed in fire barriers. The configuration in this area will provide an

acceptable level of fire safety equivalent to that provided by Section III.G.2 of Appendix R. Offsite power will be available for safe shutdown in the event diesel fuel oil circuits are damaged by a fire. (Refs. 6.7, 6.11, 6.12, 6.14, 6.15, and 6.18)

All diesel generator 2-3 circuits located in this area are enclosed in a fire barrier. Offsite power will be available for safe shutdown in the event diesel fuel oil circuits are damaged by a fire. Therefore, diesel generator 2-3 will remain available for safe shutdown. (Refs. 6.13 and 6.15)

The switches and circuits associated with the CO_2 suppression system manual actuation system for the Unit 2 diesel generator room and circuits may be affected by a fire in this area. The cables for the switches are mineral insulated with a fire rating of 2 hours to preclude inadvertent actuation of the CO_2 suppression system and automatic closure of the rollup door in the diesel generator room. Offsite power will be available for safe shutdown in the event diesel fuel oil circuits are damaged by a fire.

A fire in this area may cause loss of power supplies associated with PY27N. Redundant power supply PY26 remains available.

5.0 CONCLUSION

This area does not meet the requirements of 10 CFR 50, Appendix R, Section III.G.2, because of the lack of an area wide fire detection system.

- A deviation from 10 CFR 50, Appendix R, Section III.G.2 was requested, and granted in SSER 31.

The following features adequately mitigate the effects of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Isolators for diesel generator speed indication circuitry have been provided.

- An automatic wet pipe sprinkler system and manual fire fighting equipment is provided for this area.

- Although not required, fire barriers are provided for conduits containing diesel generator field circuits.

The existing fire protection for this area provides an acceptable level of safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 Drawing Number 515573
6.2 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065127, Fire protection Information Report, Unit 2
6.5 SSER 31, April 1985
6.6 DCN DC2-EE-10913 - Provide Isolator
6.7 DCN DC2-EE-22613 - Provide 1 Hour barrier
6.8 Deleted
6.9 Architectural Drawing Number 502989
6.10 NECS File: 131.95, FHARE: 33, Undampered Ventilation Duct Penetrations
6.11 DCP A-48449, Provides 3-Hour Fire Rated Barrier for Unit 2 Diesel Generator Circuitry
6.12 DC2-EA-48386, Modify Thermo-Lag Fire Protection Enclosure for Diesel Generator Switch Boxes
6.13 DC2-EA-44405, Sixth Diesel Generator Design
6.14 NCR DCO-91-EN-N027
6.15 PG&E Design Change Notice DC2-EA-050070, Unit 2 ThermoLag Replacement
6.16 NECS File: 131.95, FHARE 123, Unsealed penetrations with fusible link chain penetrants through fire barriers
6.17 Calculation 134-DC, Electrical Appendix R Analysis
6.18 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.19 NECS File: 131.95, FHARE 122, Staircase S-7 and S-6 - Fire Area Boundary
6.20 NECS File: 131.95, FHARE 133, Seismic/Construction Gaps in the 12kV Switchgear Rooms
6.21 Deleted
6.22 NECS File: 131.95, FHARE 30, Unrated Gaps in Appendix R Barriers in the Turbine Building
6.23 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers

FIRE AREA 24-D

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

South end of Unit 2 Turbine Building at El. 119 ft between the 4kV switchgear room and the fan room for the 4kV switchgear and cable spreading rooms.

1.2 Description

This is the excitation switchgear room at El. 119 ft. Duct work passes through this fire area. There is no safe shutdown equipment installed in this fire area. However, ventilation ducts providing cooling into safety-related 4kV switchgear required for safe shutdown passes through this area.

1.3 Boundaries

North:

- A 3-hour rated barrier to Fire Zone 23-E (TB-7).
- Unrated structural gap seal to Fire Zone 23-E (TB-7). (Ref. 6.18)

Note: Structural steel modifications for the block walls were deemed acceptable with no fireproofing. (Ref. 6.11)

- A 1-1/2-hour rated door to Fire Zone 23-E. (Ref. 6.8)

South:

- A 2-hour rated barrier to the exterior (Fire Area 29).
- A 2-hour rated barrier to Fire Zone S-7 (TB-13). (Ref. 6.14)
- A vent with a 1-1/2-hour rated fire damper to the exterior.

East:

- A 3-hour rated barrier to Fire Zones 24-A (TB-10), 24-B (TB-11) and 24-C (TB-12).
- Unrated structural gap seals to Fire Zones 24-A (TB-10), 24-B (TB-11), and 24-C (TB-12). (Ref. 6.18)
- Three 1-1/2-hour rated doors, one to each of the following fire zones: 24-A (TB-10), 24-B (TB-11),and 24-C (TB-12) with pyrocrete blockouts above doors. (Ref. 6.21)
- Three 1-1/2 rated fire dampers, one to each of the following fire zones: 24-A (TB-10), 24-B (TB-11), and 24-C (TB-12).

West:

- A 2-hour rated barrier to Fire Zone 24-E (TB-13). (Ref. 6.17)
- Three duct penetrations without fire dampers to Fire Zone 24-E (TB-13). (Ref. 6.7)
- Lesser rated penetration seal to Fire Zone 24-E (TB-13). (Ref. 6.20)
- 2-hour rated barrier to Fire Zone S-7 (TB-13). (Ref. 6.14)
- A 1-1/2-hour rated door to Fire Zone S-7 (TB-13).
- A duct penetration without a damper to Fire Zone S-7 (TB-13). (Ref. 6.7)

Ceiling:

- 3-hour rated barrier to Fire Zone 19-D. (Ref. 6.19)
- 3-hour rated equipment hatch penetrates to Zone 19-D. The hatch is supported by unprotected steel structures. (Refs. 6.6 and 6.10)

Floor:

- 3-hour rated barrier to Fire Zones 23-A (TB-10), 23-B (TB-11) and 23-C (TB-12).
- 3-hour rated equipment hatch penetrates to Fire Zone 23-B (TB-11). The hatch is supported by unprotected steel structures. (Refs. 6.6 and 6.10)
- A duct penetration without a damper to Zone 23-A (TB-10). (Refs. 6.7 and 6.13)

Protective Enclosure:

- There is ductwork near the ceiling of this area which communicates from the east wall to the west wall and is provided with a 1-hour rated enclosure. (Ref. 6.5)

  - Two ducts from Zone 24-E
  - One duct from Zone S-7

2.0 COMBUSTIBLES

2.1 Floor Area: 1,054 ft^2

2.2 In situ Combustible Materials

- Cable insulation
- Rubber
- Paper
- PVC

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection is provided.

3.2 Suppression

- CO_2 hose station
- Fire hose station
- Portable fire extinguishers

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Emergency Power System

A fire in this area may disable diesel generators 2-1, 2-2 and 2-3 automatic transfer circuit or may spuriously close the auxiliary transformer 22 circuit breakers. Offsite power is not affected in this area and will remain available for safe shutdown. In addition, manual action will enable the diesel to either be locally loaded or loaded from the control room.

4.2 HVAC

HVAC fan S-68 may be lost due to a fire in this area. No action is required for loss of HVAC in the 4kV switchgear room. (Ref. 6.12)

Ducts for the three redundant 4kV switchgear rooms are located in this fire area. An alternate cooling air flow path is available through the associated cable spreading room for each switchgear room.

5.0 CONCLUSIONS

The following features adequately mitigate the consequences of the design basis fire and assure the ability to achieve safe shutdown.

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.
- Manual fire fighting equipment is provided.
- Local smoke detection is provided.
- Loss of the safe shutdown circuitry in this area does not affect the ability to transfer to the emergency diesel generators.

This area meets the requirements of 10 CFR 50, Appendix R, Section III.G and no exemptions or deviations have been requested.

6.0 REFERENCES

6.1 Drawing Number 515575
6.2 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065127, Fire Protection Information Report, Unit 2
6.5 NECS File: 131.95, FHARE: 15, HVAC Ducts Wrapped with Pyrocrete
6.6 NECS File: 131.95, FHARE: 14, Concrete Equipment Hatches
6.7 NECS File: 131.95, FHARE: 33, Undampered Ventilation Duct Penetrations
6.8 NECS File: 131.95, FHARE: 70, Lesser Rated Door from 24-D to 23-E
6.9 Deleted
6.10 PLC Report: Structural Steel Analysis for Diablo Canyon (Rev. 2) (07/08/86)

6.11 NECS File: 131.95, FHARE: 106, Block Walls Modified in the 4kV Switchgear Area
6.12 Calculations, M-911 and M-912
6.13 NECS File: 131.95, FHARE: 136, Unrated HVAC Duct Penetrations
6.14 NECS File: 131.95, FHARE: 122, Staircase S-7, Fire Area Boundary
6.15 Calculation 134-DC, Electrical Appendix R Analysis
6.16 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.17 NECS File: 131.95, FHARE 118, Appendix R Fire Area Plaster Barriers.
6.18 NECS File: 131.95, FHARE 134, "Non-rated Structural Gap Seals in Fire Barriers"
6.19 NECS File: 131.95, FHARE 30, Unrated Gaps in Appendix R Barriers in the Turbine Building
6.20 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.21 DCN DC2-EA-24390, Provide 3-Hour Rated Double Doors and Plaster Block Out

FIRE AREA 29

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Yard area surrounding the Unit 2 Building including the main transformer area.

1.2 Description

This fire area is the open yard area surrounding the Unit 2 power plant building at El. 85 ft. The fire area includes the transformer area located south of the containment, the fire area also includes the area south and south east of the Turbine Building. Three main transformers and a spare main transformer are a minimum of 50 ft from the Turbine Building. The two auxiliary transformers are approximately 30 ft away, and the startup transformer and its spare are about 15 ft away. Spilled oil will drain away from the turbine and containment buildings due to the pavement grade. The pipe chase outside containment is approximately 40 ft away from one of the nearest transformers.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

Containment

- 3-hour rated barrier. [NC]

Turbine building

- Non-rated wall to Fire Area 23-C-1, [NC] El. 104 ft
- 2-hour rated barrier except for doors and ventilation openings fitted with class "A" labeled devices to Fire Area 20. (Ref. 6.9)
- Nonrated walls and louvers to common exhaust plenum for diesel generator fire zones 22-A-2 (Fire Area TB-8), [NC] 22-B-2 (TB-9) [NC] and 22-C-2 [NC] at El. 85 ft and El. 104 ft. (Ref. 6.12).
- 2-hour rated gypsum board shaft type fire barrier interior walls at El. 107 ft and 119 ft. (Ref. 6.13)
- Unsealed bus duct penetrations to Fire Area 20. (Ref. 6.10)
- Unrated penetration to Fire Area 20. (Ref. 6.11)
- 2-hour rated barrier to Fire Zone S-7 (El. 85 ft, 104 ft, and 119 ft)
- Non-rated barrier with roll-up door to Fire Zone 19-A. [NC] (El. 85 ft)

- Non-rated barrier with louvers to Fire Zone 19-A NC (El. 119 ft and 140 ft)
- Non-rated barrier and door to Fire Zone 19-A NC (El. 104 ft)
- 2-hour rated barrier with a duct penetration with 1-1/2-hour rated damper to Area 24-D (El. 119 ft)

South:

- Outside nonrated area

East:

- Outside nonrated area

West:

Turbine building

- Unsealed bus duct penetrations to Fire Area 20. (Ref. 6.10)
- 2-hour rated concrete barrier except for doors and ventilation openings fitted with class "A" labeled devices to Fire Area 20. (Ref. 6.9)
- Nonrated walls, roll up doors and louvers to Fire Zone 19-A NC (El. 85 ft, 104 ft, and 119 ft) Fire Area TB-7 and 19-D NC (El. 140 ft).
- Nonrated walls and louvers to Fire Zone 19-C NC (TB-7).
- 2-hour rated gypsum board shaft type fire barrier interior walls at El. 107 ft and 119 ft. (Ref. 6.13)
- A nonrated ISO phase bus penetrations and a louver with a fire damper to Fire Zone 23-E NC (El. 119 ft).

2.0 COMBUSTIBLES

2.1 Floor Area: 16,092 ft^2

2.2 In situ Combustible Materials

- Transformer oil contained in the main transformer
- Cable
- Plastic
- Wood
- Paper
- Rubber

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- High

3.0 FIRE PROTECTION

3.1 Detection

None

3.2 Suppression

- The three main transformers, two auxiliary transformers and the startup transformer are provided with automatic spray systems with remote annunciation.
- Hose station
- Yard hydrants with fully equipped hose houses
- Portable fire extinguishers

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Auxiliary Feedwater

Control of AFW valves LCV-106, LCV-107, LCV-110 and LCV-111 from the control room and hot shutdown panel may be lost due to a fire in this area. Valves LCV-108, LCV-109, LCV-113 and LCV-115 will be available to provide AFW supply to SGs 2-3 and 2-4. The main feedwater pumps are tripped in the control room.

4.2 Emergency Power

A fire in this area may cause loss of power supplies associated with PY27N. Redundant power supply PY26 remains available.

4.3 Main Steam System

Steam Generator Pressure instrumentation PT-514, PT-515, PT-516, PT-524, PT-525, and PT-526 may be lost due to a fire in this area. Steam generator pressure indication from PT-534, PT-535, PT-536, PT-544, PT-545 and PT-546 will remain available for steam generators SG 2-3 and SG 2-4.

Valves FCV-24, FCV-25, FCV-41 and FCV-42 may be affected by a fire in this area. These valves have fusible links which, melt and cause them to fail closed. (Ref. 6.6)

A fire in this area may affect 10 percent dump valves PCV-19 and PCV-20. These valves fail closed, which is the required position for safe shutdown. For spurious operation protection, fail PCV-19 and PCV-20 closed with actions in the fire area. Redundant valves PCV-21 and PCV-22 will remain available for cooldown.

4.4 Main Feedwater System

A fire in this area may affect main feedwater valves FCV-1510, FCV-1520, FCV-510, and FCV-520. The main feedwater pumps can be tripped from the control room to stop feedwater flow through these valves.

4.5 Reactor Coolant System

Source range monitor NE-51 may be lost due to a fire in this area. Redundant components NE-31, NE-32 and NE-52 will be available to provide necessary indications to the operator.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown.

- The redundant trains of safe shutdown functions located in this fire area are unaffected by fire in this area due to spatial separation and barriers provided.

- Automatic water spray systems operate to control a fire involving the transformer area.

- The grade of the transformer area is sloped to divert spilled oil away from the turbine and containment building.

- Many exposed walls of adjacent fire areas/zones are at least 2-hour rated with penetrations sealed commensurate with the hazard.

This area complies with the requirements of 10 CFR 50, Appendix R, Section III.G and no exemptions have been requested.

6.0 REFERENCES

6.1 Drawing Number 515573
6.2 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.3 Calculation Number M-671 - Fire Protection/Fire Barriers (Turbine building)
6.4 Calculation M-824, Combustible Loading Calculation
6.5 Drawing 065127, Fire Protection Information Report, Unit 2
6.6 Response to Q.31 of PG&E letter dated August 3, 1978
6.7 Calculation 134-DC, Electrical Appendix R Analysis
6.8 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.9 NECS File: 131.95, FHARE 133, Seismic/Construction Gaps in the 12kV Switchgear Rooms
6.10 NECS File: 131.95, FHARE 20, Unsealed Bus Duct Penetrations
6.11 NECS File: 131.95 FHARE 123, Unsealed Penetrations with Fusible Link Chain Penetrants Through Fire Barriers
6.12 SSER - 31
6.13 Question 27, PG&E Letter to NRC Dated 11/13/78

FIRE AREAS 30-A-3 and 30-A-4

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Both fire areas are in the Intake Structure (El. -2 ft).

1.2 Description

These areas consist of the ASW pump vaults inside the Intake Structure, surrounded by Fire Area IS-1 (Zone 30-A-5).

1.3 Boundaries

1.3.1 Fire Area 30-A-3

Northeast and Northwest:

- 3-hour rated wall and non-rated penetration seals to Fire Zone 30-A-5. (Ref. 6.7)

Southeast:

- 3-hour rated wall Fire Area 30-A-4.

Southwest

- 3-hour rated wall with a nonrated steel watertight door to Fire Zone 30-A-5. (Ref. 6.11)

Ceiling:

- Penetrated by a ventilation stack without a fire damper. (Ref. 6.11)
- 3-hour rated concrete hatch to the exterior. (Ref. 6.8)

1.3.2 Fire Area 30-A-4

Northeast and Southeast:

- 3-hour rated wall and non-rated penetration seals to Fire Zone 30-A-5. (Ref. 6.7)

Northwest:

- 3-hour rated wall Fire Area 30-A-3.

Southwest

- 3-hour rated wall with a nonrated steel watertight door to Fire Zone 30-A-5. (Ref. 6.11)

Ceiling:

- Penetrated by a ventilation stack without a fire damper. (Ref. 6.11)
- 3-hour rated concrete hatch to the exterior. (Ref. 6.8)

2.0 COMBUSTIBLES (typical for each fire area)

2.1 Floor Area: 126 ft^2

2.2 In situ Combustible Materials

- Lubricating oil
- Rubber
- Cable Insulation
- PVC

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- None
- Smoke detector outside of the entry to these areas in Fire Zone 30-A-5.

3.2 Suppression

- Portable fire extinguishers available in adjacent fire area. Hose stations in the vicinity.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Area 30-A-3

4.1.1 Auxiliary Saltwater System

ASW valve FCV-496 may be affected by a fire in this area. Redundant valves FCV-495 and FCV-601 will remain available to provide an ASW cooling flowpath and ASW system integrity.

ASW pumps 2-1 and 2-2 may be lost due to a fire in this area. ASW pump 2-2 can be locally started to provide ASW flow.

4.1.2 HVAC

HVAC fan E-104 may be lost affected by a fire in this area. Redundant HVAC fan E-102 will be available to provide necessary HVAC support.

4.2 Fire Area 30-A-4

4.2.1 Auxiliary Saltwater System

ASW pumps 2-1 and 2-2 may be affected by a fire in this area. ASW pump 2-1 can be locally started to provide ASW flow.

ASW valve FCV-495 may be affected by a fire in this area. Redundant valves FCV-496 and FCV-601 will remain available to provide an ASW cooling flowpath and ASW system integrity.

4.2.2 HVAC

HVAC fan E-102 may be lost due to a fire in this area. Redundant HVAC fan E-104 will be available to provide necessary HVAC support.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown.

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Low Fire Severity.

- 3-hour rated walls except for nonrated steel watertight doors and non-rated penetration seals.

- Steel watertight doors would be able to confine smoke and hot gases to one side of the barrier. (Refs. 6.6 and 6.11)

- Smoke detection is available immediately outside the entrance of the areas.

- Manual fire protection equipment is available in the immediate vicinity.

In these areas existing fire protection will provide an acceptable level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section IIIG.2.

6.0 REFERENCES

6.1 Drawing Number 515580
6.2 DCPP Unit 2 Review of 10/CFR/50, Appendix R (Rev. 2)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065127, Fire Protection Information Report, Unit 2
6.5 SSER 31, April 1985
6.6 Response to Q.7 of PG&E letter dated February 6, 1978
6.7 FHARE 114, Non-Rated Penetration Seals in the ASW Pump Room Barriers
6.8 FHARE 14, Concrete Equipment Hatches
6.9 Calculation 134-DC, Electrical Appendix R Analysis
6.10 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.11 NECS File: 131.95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression.

FIRE AREA AB-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This fire zone is in the Auxiliary Building at El. 54 ft, 64 ft and 73 ft on the south side adjacent to containment and is called the Unit 2 Boron Injection Tank (BIT) room.

1.2 Description

Fire Zone 3-D-3 constitutes the corridor that separates the RHR pump rooms from each other at the 54-ft and 64-ft elevation. The Boron injection tank (which has been taken out of service) occupies this zone. Floor at 64 ft is metal grating.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

El. 54 ft

North:

- 3-hour rated barrier to Fire Zone 3C. [NC]

South:

- 3-hour rated barrier to containment. [NC]

East:

- 3-hour rated barrier to Fire Area 3-D-2.

West:

- 3-hour rated barrier to Fire Area 3-D-1.

Floor:

- 3-hour rated barrier to below grade. [NC]

El. 64 ft

North:

- 3-hour rated barrier with an opening to Zone 3-C. [NC]

South:

- 3-hour rated barrier to containment. [NC]

East:

- 3-hour rated barrier to Fire Area 3-D-2.
- A 1-1/2-hour rated door to Fire Area 3-D-2. (Ref. 6.6)
- Two duct penetrations without fire dampers communicate to Fire Area 3-D-2. (Ref. 6.6)
- A 3 hour equivalent rated double door with a monorail cutout that has water spray protection communicates to Fire Area 3-D-2. (Refs. 6.9 and 6.14)
- A 2-hour plaster block-out panel communicates to Fire Area 3-D-2. (Ref. 6.9)

West:

- 3-hour rated barrier to Fire Area 3-D-1.
- A 1-1/2-hour rated door to Fire Area 3-D-1. (Ref. 6.6)
- A duct penetration without a fire damper communicates to Fire Area 3-D-1. (Ref. 6.6)
- A 3-hour-equivalent rated double door with a monorail cutout that has water spray protection communicates to Fire Area 3-D-1. (Refs. 6.9 and 6.14)
- A 2-hour rated plaster block-out panel communicates to Fire Area 3-D-1. (Ref. 6.9)

Ceiling

- 3-hour rated to 3-I-1.

El. 73 ft

South:

- 3-hour rated barrier to containment. [NC]

North:

- 3-hour rated barrier to Fire Areas 3-D-1, 3-D-2 and 3-I-1.
- Lesser rated penetrations to Fire Areas 3-D-1 and 3-D-2. (Ref. 6.12)
- 3-hour rated door to Fire Area 3-I-1.
- A duct penetration without damper to Fire Area 3-I-1. (Ref. 6.6)

East:

- 3-hour rated barrier to Fire Zone 3-G and below grade. [NC]
- Two duct penetrations without dampers to Fire Area 3-G. (Ref. 6.7)

West:

- 3-hour rated barrier to below grade. [NC]

Ceiling:

- 3-hour rated to Fire Area 3-CC.
- Lesser rated penetrations to Fire Area 3-CC. (Ref. 6.12)

Floor:

- 3-hour rated barrier to Fire Areas 3-D-1 and 3-D-2.

2.0 COMBUSTIBLES

2.1 Floor Area: 583 ft^2

2.2 In situ Combustible Materials

- Oil
- Grease
- Cable
- Plastic

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants

- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- None

3.2 Suppression

- Portable fire extinguishers
- Fire hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Residual Heat Removal System

A fire in this area may affect AC control cables for RHR Pumps 2-1 and 2-2 recirculation valves, FCV-641A and FCV-641B Prior to starting either RHR Pump 2-1 or 2-2 from the control room, locally open its respective recirc valve (FCV-641A or FCV-641B) after opening its associated power supply breaker (52-2G-29 or 52-2H-15) located in SPG and SPH.

4.2 Safety Injection System

SI valves 8803A and 8803B may be affected by a fire in this area. Alternate charging paths through the regenerative heat exchanger and the RCP seals will be available. Redundant valves 8801A and 8801B can be closed to isolate the charging injection flowpath if auxiliary spray is used for pressure reduction.

5.0 CONCLUSION

The following features will adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown.

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Portable fire extinguishers and fire hose stations are available.

- Low Fire Severity.

- Redundant safe shutdown functions are located outside this zone.

The existing fire protection provides an acceptable level of fire safety equivalent to that provided by Section III.G.2.

6.0 REFERENCES

6.1 Drawing 515566, 515567
6.2 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065127, Fire Protection Information Report, Unit 2
6.5 SSER 23, June 84
6.6 SSER 31, April 1985
6.7 NECS File: 131.95, FHARE: 67, Undampered Duct Penetrations
6.8 Deleted
6.9 NECS File: 131.95, FHARE 50, Plaster Block-out Panels in 3-Hour Barriers
6.10 Calculation 134-DC, Electrical Appendix R Analysis
6.11 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.12 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.13 PG&E Letter DCL-84-185 to NRC Dated 5/16/84
6.14 NECS File: 131.95, FHARE 159, Unrated Doors Protected by Local Automatic Sprinklers

FIRE AREA AB-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fire Zone 3-G is located on the southeast side of the Auxiliary Building at El. 73 ft.

1.2 Description

This fire zone contains the Unit 2 containment spray pumps 2-1 and 2-2, the spray additive tank and a nonvital motor control center.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- 3-hour rated barriers to Fire Areas 3-D-2 and 3-I-2
- 3-hour rated barrier to Fire Zone S-4.
- A nonrated barrier with openings to Fire Zone 3-C. [NC]
- A duct penetration without a damper to Fire Area 3-I-2. (Ref. 6.5)

South:

- 3-hour rated barrier to Fire Zone S-4 and to below grade. [NC]

East:

- 3-hour rated barrier to Fire Zone S-4 and to below grade. [NC]
- A nonrated barrier to Fire Zone 3-A. [NC]
- A nonrated door to Fire Zone 3-A. [NC]

West:

- 3-hour rated barrier to areas 3-D-2, 3-I-2 and Zones 3-D-3, [NC] S-4.
- A 1-1/2-hour rated door to Fire Zone S-4.
- An open doorway with a security gate communicates to Fire Area 3-I-2. (Ref. 6.5)
- A duct penetration without a damper to Fire Area 3-I-2. (Ref. 6.5)

- Two duct penetrations without dampers communicate with Fire Zone 3-D-3. [NC] (Ref. 6.6)

Floor/Ceiling:

- 3-hour rated barrier to Fire Area 3-CC.

2.0 COMBUSTIBLES

2.1 Floor Area: 2,870 ft^2

2.2 In situ Combustible Materials

- Cable
- Charcoal
- Clothing/Rags
- Miscellaneous
- Rubber
- Grease
- Lubricating oil

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection

3.2 Suppression

- Portable fire extinguishers
- Fire hose station

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Chemical and Volume Control System

Charging pump 2-3 may be lost due to a fire in this area. Charging pumps 2-1 and 2-2 will remain available to provide charging flow.

5.0 CONCLUSION

The following features will adequately mitigate the consequences of a design basis fire and assure the capability to achieve safe shutdown.

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Low Fire Severity.

- Smoke detection.

- Fire protection equipment is provided.

- Redundant safe shutdown functions are outside this zone.

The existing fire protection provides an acceptable level of fire safety equivalent to that provided by Section III.G.

6.0 REFERENCES

6.1 Drawing Number 515567
6.2 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev 2)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065127, Fire Protection Information Report, Unit 2
6.5 SSER 31, April 1985
6.6 NECS File: 131.95, FHARE: 67, Undampered Duct Penetrations
6.7 Calculation 134-DC, Electrical Appendix R Analysis
6.8 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis

FIRE AREA AB-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

These zones are in the southwest corner of the 75-ft elevation of the Auxiliary Building. The zones are side by side with 3-K-2 between 3-K-1 on the west and 3-K-3 to the east.

1.2 Description

These zones contain the component cooling water (CCW) pumps. Zone 3-K-1 contains CCW Pump 2-1. Zone 3-K-2 contains CCW Pump 2-2. Zone 3-K-3 contains CCW Pump 2-3. Zones 3-K-1 and 3-K-2 are similar in size, but Zone 3-K-3 is larger.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

1.3.1 Fire Zone 3-K-1

North:

- Open to Fire Zone 3-C (See Note 1). (Ref. 6.3)

South:

- 3-hour rated barrier to below grade. [NC]

East:

- 1-hour rated barrier to Fire Zone 3-K-2. (Ref. 6.6)
- A duct penetration without a damper to Fire Zone 3-K-2. (Ref. 6.3)

West:

- 3-hour rated barrier to below grade. [NC]

Floor/Ceiling:

- 3-hour rated barriers: Floor: To Fire Zone 3-C.
  Ceiling: To Fire Area 4-B.

1.3.2 Fire Zone 3-K-2

North:

- Open to Fire Zone 3-C (See Note). (Ref. 6.3)

South:

- 3-hour rated barrier to below grade. [NC]

East:

- 1-hour rated barrier to Fire Zone 3-K-3. (Ref. 6.6)
- Two duct penetrations without fire dampers communicate to Fire Zone 3-K-3. (Ref. 6.3)

West:

- 1-hour rated barrier to Fire Zone 3-K-1. (Ref. 6.6)
- A duct penetration without a fire damper communicates to Fire Zone 3-K-1. (Ref. 6.3)

Floor/Ceiling:

- Duct penetration with a 3-hour rated damper prevents communication to Fire Zone 3-C below.
- 3-hour rated barriers: Floor: To Fire Zone 3-C.
  Ceiling: To Fire Areas 4-B and 4-B-1.

1.3.3 Fire Zone 3-K-3

North:

- Open to Fire Zone 3-C (See Note 1). (Ref. 6.3)
- 3-hour rated barrier and door to Fire Area 3-I-1.

South:

- 3-hour rated barrier to below grade. NC

East:

- 3-hour rated barrier to below grade. NC
- 3-hour rated barrier to Fire Area 3-D-1.
- 3-hour rated barrier to Fire Area 3-I-1.

West:

- 3-hour rated barrier to below grade. NC
- 1-hour rated barrier to Fire Zone 3-K-2. (Ref. 6.6)
- Two duct penetrations without dampers communicate to Fire Zone 3-K-2.

Floor/Ceiling:

- 3-hour rated barriers: Floor: To Fire Zone 3-C.
  Ceiling: To Fire Areas 4-B, 4-B-1, and 4-B-2.

(Note: For all three zones the openings North to 3-C are provided with an approximately 4-inch-high curb to prevent oil spillage from communicating between zones.)

- Lesser rated penetration seals to Fire Area 3-CC. (Ref. 6.11)

2.0 COMBUSTIBLES

<u>2.1 Fire Zones 3-K-1 and 3-K-2</u>

<u>2.1.1 Floor Area</u>: 405 ft^2

<u>2.1.2 In situ Combustible Materials</u>

- Lubricating oil
- Cable insulation

<u>2.1.3 Transient Combustible Materials</u>

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.1.4 Fire Severity

- Low (3-K-1)
- Low (3-K-2)

2.2 Fire Zone 3-K-3

2.2.1 Floor Area: 781 ft^2

2.2.2 In situ Combustible Materials

- Lubricating oil
- Cable insulation
- Rubber

2.2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

Zone 3-K-1: Smoke detection provided.

Zone 3-K-2: Smoke detection provided.

Zone 3-K-3: Smoke detection provided.

3.2 Suppression

Zone 3-K-1:

- Wet pipe automatic sprinkler system with remote annunciation.
- Fire hose stations.
- Portable fire extinguishers.

Zone 3-K-2:

- Wet pipe automatic sprinkler system with remote annunciation.
- Fire hose stations.
- Portable fire extinguishers.

Zone 3-K-3:

- Partial wet pipe automatic sprinkler system with remote annunciation is provided for the pump room and the pipe chase but not for the ante room.
- Fire hose station.
- Portable fire extinguishers.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Zone 3-K-1

4.1.1 Component Cooling Water

CCW pump 2-1 and ALOP 2-1 may be lost due to a fire in this area. Redundant CCW pumps 2-2 and 2-3 as well as ALOPs 2-2 and 2-3 will remain available to provide CCW. A deviation has been granted which justifies that even without full area detection and suppression, the existing configuration provides a level of fire safety that is equivalent to the criteria outlined in Section III.G.2 of 10 CFR 50, Appendix R. (Ref. 6.3)

4.2 Fire Zone 3-K-2

4.2.1 Chemical and Volume Control System

Circuitry for charging pumps 2-1, 2-2 and 2-3 as well as ALOPs 2-1 and 2-2 may be damaged due to a fire in this area. Charging Pump 2-3 will remain available for safe shutdown. Charging pumps 2-1 and 2-2 can be tripped by opening their respective breaker control DC knife switch.

4.2.2 Component Cooling Water

CCW pumps 2-1 and 2-2 and associated ALOPs may be lost due to a fire in this area. CCW pump 2-3 and ALOP 2-3 will remain available to provide CCW. A deviation has been granted which justifies that even without full area detection and suppression, the existing configuration provides a level of fire safety that is equivalent to the criteria outlined in Section III.G.2 of 10 CFR 50, Appendix R. (Ref. 6.3)

4.2.3 Residual Heat Removal System

A fire in this area may affect an AC control cable for RHR Pp 2-1 recirc valve FCV-641A and result in loss of control of the valve. Redundant recirc valve FCV-641B will remain available for cold shutdown functions using RHR Pump 2-2.

4.2.4 Safety Injection System

SI valves 8803A and 8803B may be affected by a fire in this area. Alternate charging paths through the regenerative heat exchanger or through the RCP seals will remain available. Redundant valves 8801A and 8801B can be closed to isolate the charging injection flowpath if auxiliary spray is used for pressure reduction.

4.3 Fire Zone 3-K-3

4.3.1 Chemical and Volume Control System

Circuitry for charging pumps 2-1, 2-2 and ALOPs 2-1 and 2-2 may be affected by a fire in this area. Charging Pump 2-3 will remain available for safe shutdown. Charging pumps 2-1 and 2-2 can be tripped by opening their respective breaker control DC knife switch.

4.3.2 Component Cooling Water

CCW pump 2-3 and ALOP 2-3 may be lost due to a fire in this area. Redundant CCW pumps 2-1 and 2-2 and associated ALOPs will remain available to provide CCW. A deviation has been granted which justifies that even without full area detection and suppression, the existing configuration provides a level of fire safety that is equivalent to the criteria outlined in Section III.G.2 of 10 CFR 50, Appendix R. (Ref. 6.3)

4.3.3 Emergency Power

A fire in this area may cause loss of power supplies associated with PY27N. Redundant power supply PY26 remains available.

4.3.4 Residual Heat Removal System

A fire in this area may affect RHR Pump Recirc Valve FCV-641B and redundant recirculation valves, FCV-641A and FCV-641B. Prior to starting either RHR Pump 2-1 or 2-2 from the control room, locally open its respective recirc valve (FCV-641A or FCV-641B) after opening its associated power supply breaker (52-2G-29 or 52-2H-15) located in SPG and SPH.

4.3.5 Safety Injection System

SI valves 8803A and 8803B may be affected by a fire in this area. Alternate charging paths through the regenerative heat exchanger or through the RCP seals will remain available. Redundant valves 8801A and 8801B can be closed to isolate the charging injection flowpath if auxiliary spray is used for pressure reduction.

5.0 CONCLUSION

The following feature will adequately mitigate consequences of a design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Smoke detection in each zone.

- Manual suppression equipment is available.

- Automatic sprinkler system.
- Low Fire Severity.
- Dispersal of hot gases and smoke.

The existing fire protection provides an acceptable level of fire safety equivalent to that provided by Section III.G.

6.0 REFERENCES

6.1 Drawing No. 515567
6.2 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.3 SSER 31, April 1985
6.4 Calculation M-824, Combustible Loading
6.5 Drawing 065127, Fire Protection Information Report, Unit 2
6.6 NECS File: 131.95, FHARE: 37, Rating of Barriers Between CCW Pump Rooms
6.7 SSER 23, June 1984
6.8 Appendix 3 For EP M-10 Unit 2 Fire Protection of Safe Shutdown Equipment
6.9 Calculation 134-DC, Electrical Appendix R Analysis
6.10 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.11 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers

FIRE AREA AB-1

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fire Zone 3-T-2 is located in the south end of the Unit 2 Fuel Handling Building at El. 100 ft. This zone is adjacent to the southeast wall of the Auxiliary Building.

1.2 Description

This zone contains AFW pump 2-2 and 2-3 and is actually in the Fuel Handling Building and is called the Unit 2 Auxiliary Feedwater Motor Driven Pump Room.

1.3 Boundaries

North:

- 3-hour rated barrier to Fire Zone S-4.

South:

- 3-hour rated barrier to Fire Zone 3-U.
- A 1-1/2-hour rated double door to Fire Zone 3-U.

East:

- 1-hour rated barrier to Fire Zone 3-T-1. (Ref. 6.5)
- A 3-hour rated door to Fire Zone 3-T-1.
- A 1-1/2-hour rated fire damper to Fire Zone 3-T-1. (Ref. 6.5)
- A duct penetration without a damper to Fire Zone 3-T-1. (Ref. 6.2)
- Lesser rated penetration seals to Zone 3-T-1. (Ref. 6.10)

West:

- 3-hour rated barrier to Fire Zone 3-CC.
- Lesser rated penetration seals to Fire Zone 3-CC. (Ref. 6.10)
- A 1-1/2-hour rated door to Fire Zone 3-CC. (Ref. 6.5)

Floor/Ceiling:

- 3-hour rated barrier: Floor: To Fire Zone S-4.
  Ceiling: To Fire Zone 3-W.
- Ventilation opening communicates with Fire Zone 3-W above. (Ref. 6.6)

2.0 COMBUSTIBLES

2.1 Floor Area: 400 ft^2

2.2 In situ Combustible Materials

- Lubricants
- Cable insulation
- Clothing/Rags
- Wood (fir)

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detectors

3.2 Suppression

- Wet pipe automatic sprinkler system with remote annunciation.
- Portable fire extinguishers.
- Fire hose stations.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Auxiliary Feedwater

AFW pumps 2-2 and 2-3 may be lost due to a fire in this area. AFW pump 2-1 will remain available to provide AFW.

5.0 CONCLUSION

The following features will adequately mitigate the consequences of a design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3 hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Portable fire extinguishers and hose stations.

- Redundant safe shutdown function located outside of this zone.

- Low Fire Severity.

- Automatic wet pipe sprinkler system.

- Smoke detection provided.

The existing fire protection features provide a level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 Drawing No. 515569
6.2 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065127, Fire Protection Information Report, Unit 2
6.5 SSER 31, April 1985
6.6 NECS File: 131.95, FHARE 9, Ventilation Opening Above AFW Pump RM
6.7 NECS File: 131.95, FHARE 10, Undampered Ventilation Opening in the Unit 2 Auxiliary Feedwater Pump Rooms
6.8 Calculation 134-DC, Electrical Appendix R Analysis
6.9 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.10 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers

FIRE AREA FB-2

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This zone is located at the east end of the Unit 2 Fuel Handling Building at El. 104 ft.

1.2 Description

This zone consists of the Fuel Handling Building corridor.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- A 3-hour rated barrier to Fire Zone 3-W. [NC]
- A 3-hour fire rated barrier separates this zone from Zone 3-T-1 except for a 1-1/2-hour-equivalent rated double door in a 2-hour rated plaster barrier. (Refs. 6.8 and 6.12)
- Lesser rated penetration seals to Zone 3-T-1. (Ref. 6.13)

South:

- A 3-hour barrier to Zone 3-V-3. [NC]
- A duct penetration without a fire damper penetrates from Zones 3-V-2 [NC] and 3-V-3 [NC]. (Ref. 6.4)
- A 3-hour rated barrier separates this zone from Zone 3-V-2. [NC]
- A 3-hour rated barrier to Zone S-10.
- A 1-1/2 hour equivalent rated door to zone S-10.

East:

- A 3-hour barrier to below grade [NC] and to Fire Area 3-T-1.

West:

- A 3-hour rated barrier separates this zone from Zone 3-U. [NC]
- An opening communicates to Zone 3-U. (Ref. 6.7)
- A nonrated door communicates to Zone 3-V-2. [NC]

- A 3-hour rated barrier communicates to staircases S-10 and S-11.
- A 1-1/2 hour equivalent rated door communicates to staircase S-11.
- A 3-hour rated barrier separates this zone from Zone 3-W, NC 3-V-2 NC and 3-V-3. NC
- A duct penetration without a damper to Fire Zone 3-V-3. NC (Ref. 6.4)

Floor:

- 3-hour rated barrier to 3-V-3. NC

Ceiling:

- 3-hour rated barrier to 3-W NC and 3-V-4. NC
- A vent opening to 3-W. NC
- Two vent openings to 3-V-4. NC

2.0 COMBUSTIBLES

2.1 Floor Area: 2,089 ft^2

2.2 In situ Combustible Materials

- Bulk Cable
- Lube Oil

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- None

3.2 Suppression

- Wet pipe sprinklers.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Make-up System

Condensate storage tank level indication from LT-40 may be lost due to a fire in this area. Water from the raw water storage reservoir will remain available through FCV-436 an FCV-437.

4.2 Safety Injection System

A fire in this area may affect RWST Level Transmitter LT-920. There are no cables affected in this area that may result in diverting the RWST inventory. Therefore, loss of this instrument will not affect safe shutdown.

5.0 CONCLUSION

The following features mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- A trained fire brigade is on-site at all times and is responsible for fire suppression responsibilities.

- Area wide fire suppression is provided.

The existing fire protection for this area meets the requirements of 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 Drawing No. 515577.
6.2 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.3 Calculation M-824, Combustible Loading
6.4 FHARE 40, Undampered Ventilation Ducts
6.5 Deleted in Revision 14.

6.6 Deleted
6.7 PG&E Letter to the NRC, Question No. 5, 11/13/78
6.8 NECS File: 131.95, FHARE 125, Lesser Rated Plaster Blockouts and Penetration Seal Configurations
6.9 Drawing 065127, Fire Protection Information Report, Unit 2
6.10 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.11 Calculation 134-DC, Electrical Appendix R Analysis
6.12 NECS File: 131.95, FHARE 118, Appendix R Fire Area Plaster Barriers
6.13 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers

FIRE AREA TB-7

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Main condenser, feedwater, and condensate equipment area, Unit 2 Turbine Building, El. 85 ft through 119 ft.

1.2 Description

This fire zone comprises the bulk of the Unit 2 Turbine Building at El. 85 ft, 104 ft, and 119 ft.

1.3 Boundaries

NOTE: NC designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

1.3.1 El. 85 ft

North:

- 3-hour rated barriers separate this zone from Zones 14-A NC and 16, NC Areas 5-B-4 and 4-B.
- A 3-hour rated roll up door communicates to Zone 16. NC
- Two 1-1/2-hour rated double door communicates to Zone 16. NC
- A 3-hour rated door communicates to Zone 16. NC
- A duct penetration with a 3-hour rated fire damper to Area 19-E. NC
- A duct penetration without a fire damper penetrates to Area 19-E. NC (Ref. 6.11)
- A 1-1/2-hour rated door communicates to Zone 14-A. NC
- A 3-hour rated barrier to Fire Zone 19-E. NC (Ref. 6.22)
- A nonrated barrier to Fire Zone 19-C. NC

South:

- 3-hour rated barriers separate this zone from Zones 22-C-1 and 22-C-2. (Ref. 6.20), and Areas 20, 22-C, and 19-E. NC (Refs. 6.12 and 6.22)
- A 3-hour rated double door communicates to Area 22-C and 19-C. NC
- A 3-hour rated door communicates to Area 20.
- A non-rated barrier with 3-hour rated double door to Zone 19-C.
- A non-rated barrier with rollup door to the exterior. NC

East:

- 3-hour rated barriers separate this zone from Zone 3-CC and Fire Area 4-B.
- 3-hour rated roll-up door to Area 4-B.
- Unrated small diameter penetration to Area 4-B. (Ref. 6.15)
- Nonrated barrier to Zone 19-C. NC
- A 3-hour rated barrier to Zone S-1.
- A 3-hour rated barrier with door to Zone 19-E. NC
- A penetration to Fire Area 3-CC. (Ref. 6.9)
- Lesser rated penetration seals to Fire Area 3-CC. (Ref. 6.21)
- 3-hour rated double doors communicate to Zone 19-C. NC
- Nonrated barrier separates this zone from part of the exterior. NC (Area 29).
- A 3-hour rated double door communicates to Zone 3-CC.
- 3-hour rated doors communicate to Zone 19-C. NC
- A ventilation penetration without a fire damper to Zone 19-C. NC
- Nonrated roll-up door communicates to Area 29. NC
- Four nonrated louvers to Area 29. NC
- Three 1-1/2-hour rated dampers to Zone 3-CC.
- A 3-hour rated barrier with a 3-hour and 1-1/2-hour double door to Fire Zone 16. NC

West:

- Nonrated barriers separate this zone from the exterior (Area 29) NC Fire Zone 19-C, NC and the buttress area. NC
- Nonrated roll up door communicates to the buttress area. NC
- A nonhour rated roll-up door communicates to the exterior. NC (Area 29).
- A 3-hour rated barrier with 3-hour door to Zone 19-E. NC

Floor: Reinforced concrete on grade. NC

1.3.2 El. 104 ft

North:

- 3-hour rated barriers separate this zone from Zones 16 NC and 14-A NC and Areas 18, 5-B-4, and 6-B-5.
- An opening communicates to Zone 14-A.
- 3-hour rated door communicate to Area 18.
- Two 3-hour rated roll-up doors communicate to Zone 16. NC

South:

- 3-hour rated barriers separate this zone from Zones 24-E, [NC] 23-A, 23-E, [NC] 22-C-2 and Area 20.
- 3-hour rated barrier separates this zone from Zone 22-C-2. (Ref. 6.20)
- 3-hour rated doors communicate to Zones 24-E and 23-E. [NC]
- Nonrated barrier with door to the exterior. [NC]

East:

- 3-hour rated barrier to Fire Area 18.
- 3-hour rated barriers separate this zone from Zone 3-CC.
- Nonrated barrier separates this zone from the exterior. [NC]
- Two nonrated louvers communicate to the exterior. [NC]
- A 3-hour rated door communicates to Zone 3-CC.
- Nonrated penetration seal between Zone 19-A [NC] and 3-CC. (Ref. 6.10)

West:

- A nonrated barrier separates this zone from the exterior. [NC]
- Two nonrated doors communicate to the buttress area. [NC]

<u>1.3.3 El. 119 ft</u>

North:

- 3-hour rated barriers separate this zone from Zones 14-A, [NC] 16 [NC] and 19-B [NC] and Areas 18, 6-B-5, and 7-B.
- Two 3-hour rated roll up doors communicate to Zone 16. [NC]
- A 3-hour rated double door communicates to Zone 16. [NC]
- 3-hour equivalent rated door communicate to Zone 19-B. [NC]
- A 3-hour rated fire damper to Zone 19-B. [NC]
- 3-hour rated fire damper to Area 18.
- Nonrated pipe penetration to Area 18. (Ref. 6.16)
- The non-rated gap assemblies in the fire barriers to Area 18 were deemed acceptable. (Ref. 6.19).

South:

- 3-hour rated barriers separate this zone from Zones 23-E, [NC] 24-E, S-6 and Fire Zone 25. (Ref. 6.20)

- Nonrated isophase bus phase penetration communicates to Zone 23-E. NC
- 3-hour rated double doors communicate to Zones 25 and 24-E.
- Nonrated barrier and louver to the exterior. NC

East:

- 3-hour rated barriers separate this Zone from Zone 3-CC, and Areas 6-B-5 and 7-B.
- Nonrated barriers separate this zone from the exterior (Area 29). NC
- A 3-hour equivalent rated door and blowout panels, both protected with a directional water spray system (Ref. 6.7 and 6.23) communicates to Area 3-CC.
- Three nonrated louvers to the exterior. NC
- Nonrated penetration for the main steam line penetration to Fire Area 3-CC. (Ref. 6.10)
- Two protected ducts without dampers to Fire Area 6-B-5. (Ref. 6.8)
- Duct penetration with 3-hour rated damper to Zone 19-B. NC

West:

- 3-hour rated barrier to Fire Area 18.
- A nonrated barrier separates this zone from the exterior (Fire Area 29). NC
- Lesser rated penetration seals to Fire Area 19-A. NC (Ref. 6.21)

Ceiling: 3-hour rated barrier to 19-D. NC

2.0 COMBUSTIBLES

2.1 Floor Area: 30,191 ft^2 (El. 85 ft)
31,966 ft^2 (El. 104 ft)
31,216 ft^2 (El. 119 ft)

2.2 In situ Combustible Materials

Elevation:	85 ft	104 ft	119 ft
	• Cable	• Cable	• Cable
	• Hydrogen	• Alcohol	• Rubber
	• Acetylene	• Rubber	• Lube Oil
	• Rubber	• Lube Oil	• Clothing/Rags
	• Lube Oil	• Clothing/Rags	• Paper
	• Clothing/Rags	• Paper	• Plastic
	• Paper	• Plastic	• PVC
	• Plastic	• PVC	• Wood (fir)

- PVC
- Wood (fir)
- Miscellaneous (RP)
- Wood

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low (El. 85 ft)
- Low (El. 104 ft)
- Low (El. 119 ft)

3.0 FIRE PROTECTION

3.1 Detection

None

3.2 Suppression

- Automatic wet pipe sprinklers with remote annunciation area wide
- Deluge water spray systems for hydrogen seal oil unit and feedwater pump turbines
- Portable fire extinguishers
- Hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Auxiliary Feedwater

A fire in this area may affect AFW pump 2-3. AFW pumps 2-1 and 2-2 will remain available.

A fire in this area may affect valves LCV-113 and LCV-115. Redundant valves LCV-106, LCV-107, LCV-108, and LCV-109 will remain available for AFW flow from AFW Pump 2-1, and LCV-110 and LCV-111 will remain available for AFW flow from AFW Pump 2-2.

4.2 Component Cooling Water

CCW valves FCV-430 and FCV-431 may be affected by a fire in this area. FCV-431 can be manually operated to ensure safe shutdown.

A fire in this area may affect the circuits associated with the CCW flow transmitter on Header C (FT-69). This instrument is credited to indicate a loss of CCW flow. Loss of this indication will not affect flow to CCW Header C. Therefore, loss of this indicator will not affect safe shutdown.

A fire in this area may affect circuits associated with CCW flow transmitters for Header A (FT-68) and Header B (FT-65). A fire in this area may also affect circuits associated with the differential pressure transmitters for CCW Hx 2-1 (PT-5) and CCW Hx 2-2 (PT-6). CCW pumps are not affected in this area, and CCW valves FCV-430 and FCV-431 can be manually operated. Therefore, loss of these instruments will not affect safe shutdown.

4.3 Emergency Power System

A fire in this area may disable diesel generator 2-3. Offsite power is not affected in this area and will remain available for safe shutdown. In addition, diesel generators 2-1 and 2-2 will remain available for safe shutdown.

A fire in this area may cause loss of power supplies associated with PY27N. Redundant power supply PY26 remains available (also applies to fire zone 19-B).

4.4 Auxiliary Saltwater System

A fire in this area may spuriously close valves FCV-602 and FCV-603. FCV-603 can be manually opened to provide cooling to CCW heat exchanger 2-2.

4.5 HVAC

S-45 and E-45 may be lost due to a fire in this area. Redundant HVAC equipment S-46 and E-46 will be available to provide necessary HVAC support.

4.6 Containment Spray

Containment spray pump 2-2 may spuriously operate due to a fire in this area. However, the corresponding discharge valve 9001B will not open. Therefore, the spurious containment spray pump operation has no impact on safe shutdown.

5.0 CONCLUSION

The following features adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.
- Area wide automatic wet pipe sprinkler coverage.
- AFW trains 2-1 and 2-2 are independent of this zone and remain available.
- Isolators are provided to preclude the effects of hot shorts in the DG RPM indicator circuits.
- Substantial fire zone boundaries are provided to confine the fire to this zone.
- Manual fire fighting equipment is available.

The existing fire protection features provide a level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.2 Drawing No. 515573, 515574, 525575
6.3 DCN DC2-EE-10913 - Provides Isolators on DG Tach-Pack
6.4 DCN DC2-EA-22612 - 3 Hour Fire Rated Barriers
6.5 Calculation M-824, Combustible Loading
6.6 Drawing 065127, Fire Protection Information Report, Unit 2
6.7 DCN DC2-EE-26465 - Provide Water Spray System in Blowout Area
6.8 SSER 31, April 1985
6.9 NECS File: 131.95, FHARE: 12, Winch Cable Penetrations for Post-LOCA Sampling Room Shield Wall
6.10 NECS File: 131.95, FHARE: 13, Unique Blockout Penetration Seal Through Barrier Between The Unit 2 Turbine/Containment Penetration Areas
6.11 NECS File: 131.95, FHARE: 58, Undampered Ventilation Duct Penetrations
6.12 NECS File: 131.95, FHARE: 82, Dow Corning Penetration Seal Through Concrete Block Wall
6.13 Deleted in Revision 14.
6.14 PG&E Design Change Notice DC2-EA-050070, Unit 2 ThermoLag Replacement
6.15 NECS File: 131.95, FHARE 123, Unsealed penetrations with fusible link chain penetrants through fire barriers
6.16 NECS File: 131.95, FHARE 131, Non-rated Pipe Penetrations in the Clean and Dirty Lube Oil Room and Unit 1 and Unit 2 Turbine Lube Oil Reservoir Rooms
6.17 Calculation 134-DC, Electrical Appendix R Analysis
6.18 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.19 NECS File: 131.95, FHARE 135, “Gaps in Appendix A Fire Rated Boundaries”
6.20 NECS File: 131.95, FHARE 30, Unrated Gaps in Appendix R Barriers in the Turbine Building
6.21 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.22 NECS File: 131.95, FHARE 120, CCW Heat Exchanger Rooms Fire Area Boundaries
6.23 NECS File: 131.95, FHARE 159, Unrated Doors Protected by Local Automatic Sprinklers.

FIRE AREA TB-7

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Unit 2 Turbine Deck, El. 140 ft.

1.2 Description

This fire zone comprises the Unit 2 Turbine Operating Deck at El. 140 ft.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- There is no boundary separating Fire Zone 19-D from 14-D.

South:

- A nonrated barrier separates this zone from Area 29. [NC]

East:

- A nonrated barrier separates this zone from Area 34. [NC]
- A nonrated roll up door communicates to Area 34. [NC]
- A 3-hour rated barrier separates this zone from Area 8-H.
- A 3-hour rated barrier separates this zone from Area 8-F.
- A 3-hour rated barrier separates this zone from Area S-1.
- A 3-hour rated door communicates to Area S-1.

West:

- A nonrated barrier separates this zone from Area 29. [NC]

Floor:

- A 3-hour rated floor to Zones 19-A, [NC] 23-E, [NC] 24-E, 25, [NC] 19-B, [NC] 16, [NC] 17, [NC] 24-A, 24-B, 24-C, 24-D (Ref. 6.9), and 18.
- Ventilation exhaust openings with 3-hour rated fire dampers from Zones 24-A, 24-B, and 24-C.

- A 3-hour rated equipment hatch penetrates to Fire Area 24-D. (Ref. 6.4)
- A 3-hour rated equipment hatch penetrates to Fire Zone 18. (Ref. 6.4)
- An open equipment hatch communicates to the 85-ft elevation of Zone 16. NC
- Open stairwells to Zones S-6, S-7, 19-A and 23-E.
- Unsealed blockout openings communicate to Zone 18. (Ref. 6.8)
- Nonrated vent and exhaust openings to Fire Zone 19-A. NC

Ceiling:

- Nonrated ceiling to the exterior. NC
- An open ventilation exhaust vent along the center ridge of the roof. NC

2.0 COMBUSTIBLES

2.1 Floor Area: 52,547 ft^2

2.2 In situ Combustible Materials

- Bulk Cable
- Hydrogen
- Alcohol
- Rubber
- Lube Oil
- Clothing/Rags
- Paper
- Plastic
- PVC
- Wood (Fir)

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Heat detection for Turbine Bearing No. 10

3.2 Suppression

- Water Deluge for all Turbine Bearings except No. 10
- Local CO_2 System for Bearing No. 10
- Portable fire extinguishers
- Hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Emergency Power System

A fire in this area may disable diesel generator 2-3. Offsite power is not affected in this fire area and will remain available for safe shutdown. In addition, diesel generators 2-1 and 2-2 will remain available for safe shutdown.

4.2 HVAC

One train of HVAC equipment (E-45 and S-45) may be lost due to a fire in this area. A redundant train of HVAC components (E-46 and S-46) will remain available.

4.3 Containment Spray

Containment spray pump 2-2 may spuriously operate due to a fire in this area. However, the corresponding discharge valve 9001B will not open. Therefore, the spurious containment spray pump operation has no impact on safe shutdown.

5.0 CONCLUSION

The following features mitigate the consequences of the design basis fire and ensure the capability to achieve safe shutdown:

- A trained fire brigade is on-site at all times and is responsible for fire suppression responsibilities.

- Local (partial) fire detection is provided.
- Local (partial) fire suppression is provided.
- Manual fire suppression equipment is available.
- Redundant components are available or manual actions can be taken to achieve safe shutdown.

The existing fire protection for this area meets the level of safety required by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 Drawing No. 515576
6.2 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 1)
6.3 Calculation No. M-824, Combustible Loading
6.4 FHARE 14, Concrete Equipment Hatches
6.5 Drawing 065127, Fire Protection Information Report, Unit 2
6.6 Calculation 134-DC, Electrical Appendix R Analysis
6.7 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.8 NECS File: 131.95, FHARE 3, Valve Operator Shafts Through Barrier
6.9 NECS File: 131.95, FHARE 30, Unrated Gaps in Appendix R Barriers in the Turbine Building

FIRE AREA TB-7

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fire Zone 19-E is part of Fire Area TB-7 and is located in the northeast corner of the Unit 2 Turbine Building at El. 85 ft. (Ref. 6.12)

1.2 Description

Fire Zone 19-E is the component cooling water (CCW) heat exchanger room. This area is completely separated from the rest of the Turbine Building by 3 hour barriers constructed of reinforced concrete walls, concrete block walls, and fire rated covering (on the Turbine Building side only). (Ref. 6.12)

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- 3-hour rated unidirectional fire barrier to Fire Zone 19-A (TB-7). [NC] (Ref. 6.12)
- 3-hour rated door to Fire Zone 19-A. [NC]

South:

- 3-hour rated barrier to Fire Zone 19-A (TB-7). [NC] (Ref. 6.12)

East:

- 3-hour rated barrier to Fire Area 4-B.
- 3-hour rated barrier to Fire Zone 19-A (TB-7). [NC] (Ref. 6.12)
- 3-hour rated fire damper to Fire Zone 19-A. [NC]
- A 2-hour rated fire barrier encloses a HVAC duct, without fire dampers, which passes from Fire Zone 19-A (TB-7) [NC] through the ceiling and through the east wall to Fire Area 4-B, and contains an unrated penetration seal. (Ref. 6.10)

West:

- 3-hour rated unidirectional pyrocrete barrier Fire Zone 19-A (TB-7). [NC] (Ref. 6.12)

- 3-hour rated Fire Door to Fire Zone 19-A. NC
- 3-hour rated fire damper to Fire Zone 19-A. NC

Floor/Ceiling:

- 3-hour rated barriers except for the following:

A nonrated steel hatch that connects Fire Area 19-E to the 104-ft elevation of Fire Zone 19-A.

Protective Enclosure:

- A reinforced concrete missile shield separates the redundant heat exchangers and extends approximately 2.5 ft beyond the ends and above the tops of the heat exchangers.

2.0 COMBUSTIBLES

2.1 Floor Area: 1,899 ft^2

2.2 In situ Combustible Materials

- Cable insulation
- Plastics
- Oil
- Miscellaneous
- Rubber
- Clothing/Rags
- PVC
- Wood (fir)

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic

- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection is provided except under the alcove area (south side). (Ref. 6.8)

3.2 Suppression

- Automatic wet pipe sprinkler protection, with remote annunciation, is provided except under the alcove area (South side). (Ref. 6.8)
- Portable fire extinguishers
- Fire hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Component Cooling Water

CCW valves FCV-430 and FCV-431 may be lost due to a fire in this area. Since one of these valves is normally open and would remain open in the event of a fire, CCW flow would still be available.

A fire in this area may affect circuits associated with CCW flow transmitters for Header A (FT-68), Header B (FT-65), and Header C (FT-69). These instruments are credited to indicate a loss of CCW flow. Therefore, loss of these instruments will not affect safe shutdown.

A fire in this area may affect differential pressure transmitters for CCW Hx 2-1 (PT-5) and CCW Hx 2-2 (PT-6). Loss of these instruments will not affect safe shutdown.

4.2 Auxiliary Saltwater System

Valves FCV-602 and FCV-603 may be affected by a fire in this area. These valves can be manually opened to provide ASW to the CCW heat exchangers.

5.0 CONCLUSION

This fire area does not meet the requirements of Appendix R, Section III.G.2.(c) in that a 1-hour enclosure is not provided around one train of redundant safe shutdown equipment.

A deviation was requested and granted as stated in SSER 31.

The following fire protection features will adequately mitigate the consequences of the design basis fire and will assure the capability to achieve safe shutdown:

- Deviations to requirements for 3 hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.
- Wet pipe automatic sprinkler system.
- Fire hose stations and portable fire extinguishers.
- Smoke detection is provided.
- Failure of ASW valve circuits could result in loss of ASW cooling to CCW heat exchangers but manual action can be taken to restore it.
- Failure of CCW valves circuits, due to fire, will result in the motor operated valves failing as is with one valve open and one valve closed, providing adequate CCW cooling for safe shutdown.

The fire protection in this area provides an acceptable level of fire safety equivalent to that provided by Section III.G.

6.0 REFERENCES

6.1 Drawing No. 515573
6.2 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065127, Fire Protection Information Report, Unit 2
6.5 SSER 31, April 1985
6.6 Not used
6.7 Memorandum from G.A. Tidrick/C.E. Ward to P.R. Hypnar dated May 3, 1983, Re: CCW system, files 140.061 and 131.91

6.8 NECS File: 131.95, FHARE: 51, Lack of Area Wide Detection and Suppression
6.9 Procedure: EP M-10 Emergency Procedure Fire Protection of Safe Shutdown Equipment
6.10 NECS File: 131.95, FHARE: 58, Undampered Ventilation Duct Penetrations
6.11 Not used
6.12 FHARE 120, CCW Heat Exchanger Room Boundary Walls
6.13 Calculation 134-DC, Electrical Appendix R Analysis
6.14 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis

FIRE AREA TB-7

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Isophase bus duct, area Unit 2 Turbine Building, El. 104 ft.

1.2 Description

This fire zone is part of Fire Area TB-7 and occupies the elevations from 104 ft through 140 ft. An enclosed stairwell on the north wall provides access to Area 20 below and a stair along the south wall provides access to Zone 24-A.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- 3-hour rated barrier separates this zone from Zone 19-A. [NC]
- A 3-hour rated door communicates to Zone 19-A. [NC]
- A nonrated isophase bus penetration communicates to Zone 19-A. [NC]
- 2-hour rated barrier separates Zone 23-E from Area 20 except for:
    - A 1-1/2-hour rated door communicates to Area 20.
    - Nonrated ceiling slab for stairwell communicating to Area 20. (Ref. 6.5)
    - Lesser rated penetration seal from Zone 23-E to Area 20. (Ref. 6.14)

South:

- 3-hour rated barrier separates this zone from Zones 23-A, 24-A, and Area 24-D with the following exceptions:
    - A 1-1/2-hour rated door communicates to Zone 23-A.
    - A 1-1/2-hour rated door communicates to Area 24-D. (Ref. 6.16)
    - A 1-1/2-hour rated door communicates to Zone 24-A.
    - Unrated structural gap seals to Fire Zones 23-A, 24-A, and 24-D. (Ref. 6.13)
    - Structural steel modifications for the block walls (at El. 119 ft) were deemed acceptable with no fireproofing. (Ref. 6.7)

East:

- 2-hour rated (plaster) barrier separates this zone from Area 29. NC
- A nonrated isophase bus penetration communicates to Area 29. NC

West:

- 2-hour rated barrier separates this zone from Zone 24-E, EL. 119 ft. (Ref. 6.11).
- Lesser rated penetration seals to Zone 24-E, EL. 119 ft. (Ref. 6.14)
- 2-hour rated barrier separates this zone from Zone 23-A. (Ref. 6.12)
- A 1-1/2-hour rated door communicates to Zone 23-A.
- A duct penetration without a fire damper penetrates to Zone 24-E. (Ref. 6.6)

Floor/Ceiling:

- 3-hour rated barrier separates this zone from Area 20 below.
- 3-hour rated barrier separates this zone from Zone 19-D NC above.
- Open vertical communication through the stairwell to Zone 19-D NC above.

2.0 COMBUSTIBLES

2.1 Floor Area: 1,920 ft^2

2.2 In situ Combustible Materials

- Cable Insulation
- Rubber
- Plastic
- Wood (fir)

2.3 Transient Combustible Materials

- No storage area

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- None

3.2 Suppression

- CO_2 hose station
- Portable fire extinguishers
- Fire hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Emergency System

A fire in this area may disable the diesel generators 2-1, 2-2 and 2-3 automatic transfer circuits or may spuriously close the auxiliary transformer 2-2 circuit breaker. Offsite power is not affected in this area and will remain available for safe shutdown. In addition, manual actions can be taken to enable the diesels to be manually loaded or loaded from the control room.

5.0 CONCLUSION

The following features will adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Safe plant shutdown will not be adversely impacted if safe shutdown functions located in this zone are lost.

- Substantial zone boundary construction.

- Low fire severity.

- Manual fire fighting equipment is provided for this zone.

The existing fire protection features provide an acceptable level of safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.2 Drawing No. 515574, 515575
6.3 Calculation M-824, Combustible Loading

6.4 Drawing 065127, Fire Protection Information Report, Unit 2
6.5 NECS File: 131.95, FHARE: 4, Stairwell Nonrated Ceiling
6.6 NECS File: 131.95, FHARE: 33, Undampered Ventilation Duct Penetrations
6.7 NECS File: 131.95, FHARE: 106, Block Walls Modified in the 4kV Switchgear Area
6.8 NECS File: 131.95, FHARE: 119, Plaster Barriers Credited for Appendix A to BTP (APCSB) 9.5-1
6.9 Calculation 134-DC, Electrical Appendix R Analysis
6.10 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.11 NECS File: 131.95, FHARE 118, Appendix R Fire Area Plaster Barriers
6.12 NECS File: 131.95, FHARE 119, Appendix A to BTP (APCSB) 9.5-1, Plaster Barriers
6.13 NECS File: 131.95, FHARE 134, "Non-rated Structural Gap Seals In Fire Barriers"
6.14 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.15 NECS File: 131.95, FHARE 50, Lesser Rated Plaster
6.16 NECS File: 131.95, FHARE 70, Lesser Rated Doors

FIRE AREA TB-7

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fire Zone S-6 is a stairway, in the southern end of the Unit 2 Turbine Building that goes from the 119-ft elevation to the 140-ft main turbine deck.

1 .2 Description

This stairway is between the east and west sides of the Turbine Building. It runs from El. 119 ft to the turbine deck with access through a fire rated door, except where it opens onto the turbine deck.

1.3 Boundaries

El. 119ft

North:

- 3-hour rated fire barrier to Fire Zone 19-A (TB-7).

South:

- 2-hour rated barrier to Fire Zone 25 (TB-13). (Ref. 6. 7)

East:

- 2-hour rated barrier to Fire Zone 24-E (TB-13). (Ref. 6.6)

West:

- 2-hour rated barrier to Fire Zone 25 (TB-13). (Ref 6.7)
- A 1-1/2 hour door communicates to Fire Zone 25.

Floor:

- 3-hour rated barrier concrete slab.

El. 140ft

The stairway is open to Fire Zone 19-D.

2.0 COMBUSTIBLES

2.1 Floor Area: 120ft^2

2.2 In situ Combustible Materials

- Cable insulation
- Plastics
- Rubber

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.1D4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

None

3.2 Suppression

- Manual suppression capability is available from other areas.

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Electrical Power

A fire in this area may disable diesel generator 2-3. Offsite power may be available to provide power to the F bus. In addition, diesel generators 2-1 and 2-2 will remain available for safe shutdown.

5.0 CONCLUSION

- Manual suppression capability is provided in the adjacent zones.
- Substantial barriers, also electrical and mechanical penetrations sealed commensurate with barrier rating.
- Low fire severity.
- Loss of the safe shutdown functions in this fire zone does not affect safe shutdown of the plant as the redundant train is independent and remains available.

The existing fire protection for the area provides an acceptable level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section Ill. G.

6.0 REFERENCES

6.1 Drawing No. 515575, 515576

6.2 Calculation M-824, Combustible Loading

6.3 Drawing 065127, Fire Protection Information Report, Unit 2

6.4 Calculation 134-DC, Electrical Appendix R Analysis

6.5 Calculation M-928 10 CFR 50 Appendix R Safe Shutdown Analysis

6.6 NECS File: 131.95 FHARE 119 Plaster Barriers Credited for Appendix A to BTP (APCSB) 9.5-1

6.7 NECS File: 131 .95 FHARE 122, Staircase S-7 and S-6- Fire Area Boundary

FIRE AREAS TB-8, TB-9, TB-17

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Southwest corner of Unit 2 Turbine Building; consists of the diesel generator rooms (El. 85 ft) and the diesel generator air intakes (El. 85 ft and 107 ft).

1.2 Description

Fire Areas TB-8, TB-9 and TB-17 and are divided into Fire Zones 22-A-1, 22-A-2, 22-B-1, 22-B-2, 22-C-1 and 22-C-2 to differentiate between the generator rooms and the ventilation intake and exhaust rooms.

Fire Zones 22-A-1, 22-B-1 and 22-C-1 contain diesel generators 2-1, 2-2 and 2-3 respectively. These areas are located side by side with 22-C-1 (TB-17) on the north side of 22-A-1 (TB-8) and 22-B-1 (TB-9) on the south side of 22-A-1 (TB-8). Fire Zones 22-A-1, 22-B-1 and 22-C-1 are provided with curbs at all door openings to contain any oil leakage. Several 4-inch floor drains are provided underneath the day tanks in each diesel generator room. A common 4-inch pitched header, which is a minimum of 3-1/2-ft below the drain openings, connects the drains from each room with the turbine building sump.

The diesel generator intake rooms (Fire Zones 22-A-2 (TB-8), 22-B-2 (TB-9) and 22-C-2 (TB-17)) communicate air between El. 85 ft, 107 ft, and the exterior (Fire Area 29) area. The area south of Zone 22-B-1 above El. 107 ft is separated by walls and Zones 22-A-2, 22-B-2 and 22-C-2, becomes an open common exhaust plenum below El. 107 ft.

Due to the similarities of these three fire areas they are evaluated together.

1.3 Boundaries

NOTE: ^{NC} designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

1.3.1 El. 85 ft

1.3.1.1 Fire Zones 22-A-1, 22-B-1, 22-C-1

North:

- 3-hour rated barrier from:
    - Zone 22-A-1 to Zone 22-C-1. (Ref. 6.13)
    - Zone 22-B-1 to Zone 22-A-1. (Ref. 6.13)
    - Zone 22-C-1 to Zone 19-A.

South:

- 3-hour rated barrier from:
    - Zone 22-A-1 to 22-B-1. (Ref. 6.13)
    - Zone 22-B-1 to 22-B-2. (Ref. 6.13)
    - Zone 22-C-1 to 22-A-1. (Ref. 6.13)
- A 3-hour rated door from Zone 22-B-1 to 22-B-2

East:

- 3-hour rated barriers to Area 22-C. (Ref. 6.13)
- A 3-hour rated roll-up door, one from each zone to Area 22-C.
- An unsealed penetration from Zone 22-A-1 to Area 22-C. (Ref. 6.13)
- Unrated small diameter penetrations one from each zone to Area 22-C. (Ref. 6.11)
- Unrated vertical gap seal from 22-C-1 to 22-C. (Ref. 6.8)
- A 3-hour rated door from Zone 22-A-1 to Area 22-C and from Zone 22-C-1 to Area 22-C.
- Unsealed Penetration from Zone 22-A-1 to Fire Area 22-C. (Ref. 6.8)

West:

- 3-hour rated barrier
- Two 3-hour rated roll-up doors
- A drive shaft penetration

All of the above exist between each of the following:

- Zone 22-A-1 to Zone 22-A-2
- Zone 22-B-1 to Zone 22-B-2
- Zone 22-C-1 to Zone 22-C-2

Floor/Ceiling:

- Floor: Reinforced concrete on grade. [NC]
- Ceiling: 3-hour rated except for Diesel Exhaust Stacks. (Ref. 6.8)
- Openings from Common Exhaust Plenum to Zones 22-A-2, 22-B-2 and 22-C-2 on El. 107 ft. (Ref. 6.8)

1.3.1.2 Fire Zones 22-A-2, 22-B-2, and 22-C-2 (Radiator Rooms)

North:

- 3-hour rated barrier from Zone 22-A-2 to Zone 22-C-2.
- 3-hour rated barrier from Zone 22-B-2 to Zone 22-A-2 and Zone 22-B-1. (Ref. 6.13)
- 3-hour rated barrier from Zone 22-C-2 to Zone 19-A. (Ref. 6.13)
- A 3-hour rated door from Zone 22-B-2 to Zone 22-A-2.
- A 3-hour rated door from Zone 22-A-2 to Zone 22-C-2. (Ref. 6.13)
- A 3-hour rated door from Zone 22-B-2 to Zone 22-B-1.

South:

- 3-hour rated barrier from Zone 22-A-2 to Zone 22-B-2. (Ref. 6.13)
- 3-hour rated barrier from Zone 22-C-2 to Zone 22-A-2. (Ref. 6.13)
- 3-hour rated door from Zone 22-A-2 to Zone 22-B-2.
- Nonrated barrier to the exterior (Area 29) [NC] from 22-B-2. (Ref. 6.18)
- 3-hour door to the radiator exhaust plenum.
- 3-hour rated door from Zone 22-C-2 to Zone 22-A-2.

East:

- 3-hour rated barrier.
- Two 3-hour rated roll up doors.
- A drive shaft penetration.

All of the above exist between each of the following:

- Zone 22-A-2 to Zone 22-A-1
- Zone 22-B-2 to Zone 22-B-1
- Zone 22-C-2 to Zone 22-C-1

- A 3-hour rated barrier exists between 22-B-2 and 22-C. (Ref. 6.13)
- A 3-hour rated door from Zone 22-B-2 to 22-C.

West:

- Nonrated barrier to the exterior (Fire Area 29). (Ref. 6.18) NC

Floor/Ceiling:

- Floor: Reinforced concrete on grade. NC

1.3.2 El. 104 ft

Fire Areas 22-A-2, 22-B-2, and 22-C-2

North:

- 3-hour rated barrier from Zone 22-C-2 to Zone 24-E with non-rated features and Zone 19A. (Ref. 6.13)
- 3-hour rated barrier from Zone 22-A-2 to Zone 22-C-2. (Ref. 6.13)
- 5-inch deep cutout and a void in barrier from Zone 22-A-2 to Zone 22-C-2. (Ref. 6.13)
- A 3-hour rated door from Zone 22-C-2 to Zone 24-E.
- 3-hour rated barrier from Zone 22-B-2 to Zone 22-A-2. (Ref. 6.13)
- Lesser rated penetration seals form Zone 22-B-2 to Zone 22-A-2. (Ref. 6.17)

South:

- Nonrated barriers to the exterior. (Ref. 6.18)
- A 3-hour rated barrier from Zone 22-A-2 to Zone 22-B-2. (Ref. 6.13)
- Lesser rated penetration seals form Zone 22-A-2 to Zone 22-B-2. (Ref. 6.17)
- A 3-hour rated barrier from Zone 22-C-2 to Zone 22-A-2. (Ref. 6.13)
- 5-inch deep cutout and a void in barrier from Zone 22-C-2 to Zone 22-A-2. (Ref. 6.13)

East:

- 3-hour rated barrier from Zone 22-A-2 to Zone 22-C-2. (Ref. 6.13)
- Lesser rated penetration seals form Zone 22-A-2 to Zone 22-C-2. (Ref. 6.17)
- 3-hour rated barrier from Zone 22-B-2 to Zone 22-A-2. (Ref. 6.13)
- 3-hour rated barrier from Zone 22-C-2 to Zones 23-C-1, 23-A, and 23-B. (Ref. 6.13)

West:

- 3-hour rated barrier from:

  - Zone 22-A-2 to Zone 22-B-2. (Ref. 6.13)
  - Zone 22-B-2 to Zone 24-E.
  - Zone 22-C-2 to Zone 22-A-2. (Ref. 6.13)
    Non Rated barriers to the exterior. (Refs. 6.8 and 6.18)

- Lesser rated penetration seals form Zone 22-A-2 to Zone 22-C-2. (Ref. 6.17)

- 3-hour rated doors from:

  - 24-E to 22-C-2
  - 22-C-2 to 22-A-2
  - 22-A-2 to 22-B-2

Floor/Ceiling:

- Floor:

  - 3-hour rated barriers to Zones 22-A-1, 22-B-1, and 22-C-1.
  - Floor openings to 22-B-2. (Ref. 6.8)

- Ceiling: 3-hour rated barrier to Zone 25. (Ref. 6.13)

2.0 COMBUSTIBLES

2.1 Floor Area: 770 ft^2 (22-A-1, 22-B-1, 22-C-1)
1383 ft^2 (22-A-2) (Ref. 6.11)
1532 ft^2 (22-B-2) (Ref. 6.11)
1658 ft^2 (22-C-2) (Ref. 6.11)

2.2 In situ Combustible Materials

- Lube oil
- Diesel fuel
- Cable insulation
- Clothing/Rags
- Polyethylene
- Plastic
- Paper
- Rubber

2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.4 Fire Severity

- Moderate (22-A-1, 22-B-1, 22-C-1)
- Low (22-A-2, 22-B-2, 22-C-2)

3.0 FIRE PROTECTION

3.1 Detection

- Heat detection which:

  (1) Releases west doors
  (2) Releases east door
  (3) Activates CO_2 system

3.2 Suppression

- Total flooding CO_2
- Portable fire extinguishers
- Fire hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Zones 22-A-1 and 22-A-2

4.1.1 Diesel Fuel Oil System

Diesel fuel oil pump 0-2 may be lost due to a fire in this area. Redundant pump 0-1 will remain available.

Valves LCV-86 and LCV-89 may be lost due to a fire in this area. Day tank level control will be maintained by LCV-88 and LCV-90. In addition, offsite power is not affected in this area and will remain available for safe shutdown.

4.1.2 Emergency Power

A fire in this area may disable diesel generator 2-1. Offsite power is not affected in this area and will remain available for safe shutdown. In addition, diesel generators 2-2 and 2-3 will remain available for safe shutdown.

A fire in this area may cause loss of power supplies associated with PY27N. Redundant power supply PY26 remains available.

4.2 Fire Zones 22-B-1 and 22-B-2

4.2.1 Diesel Fuel Oil System

Diesel fuel oil pumps 0-1 and 0-2 may be affected by a fire in this area. Offsite power is not affected in this area and will remain available for safe shutdown. In addition,, diesel fuel oil transfer pump 0-1 will remain available for diesels 2-1 and 2-3 and diesel fuel oil pump 0-2 will remain available for diesels 2-1, 2-2 and 2-3.

A fire in this area may result in the loss of LCV-85 and LCV-88. Offsite power is not affected in this area and will remain available for safe shutdown. In addition, day tank level control will be maintained by LCV-86 and LCV-87.

4.2.2 Emergency Power

Diesel generator 2-2 may be lost due to a fire in this area. Offsite power is not affected in this area and will remain available for safe shutdown. In addition, diesel generators 2-1 and 2-3 will remain available for safe shutdown.

4.3 Fire Zones 22-C-1 and 22-C-2

4.3.1 Diesel Fuel Oil System

A fire in this area may disable diesel fuel oil pumps 0-1 and 0-2. Offsite power is not affected in this area and will remain available for safe shutdown.

A fire in this area may disable day tank level control valves LCV-87 and LCV-90 for diesel generator 2-3. Offsite power is not affected in this area and will remain available for safe shutdown. In addition, redundant valves LCV-85, LCV-88, LCV-86, and LCV-89 will remain available to supply diesel to diesel generators 2-1 and 2-2.

4.3.2 Emergency Power

Diesel generator 2-3 may be lost due to a fire in this area. Offsite power is not affected in this fire area and will remain available. In addition, diesel generators 2-1 and 2-2 will remain available for safe shutdown.

4.3.3 HVAC

A fire in this area may cause one train of HVAC equipment to be lost (S-67). Loss of 4kV switchgear room HVAC S-67 will not affect safe shutdown.

5.0 CONCLUSION

The following fire protection features will adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- A total flooding CO_2 suppression system is provided for the diesel generator rooms.

- Manual fire fighting equipment is available.

- Low fire severity.

- The fire hazard is minimal in the ventilation intake and exhaust rooms. Smoke and hot gases would either be vented outside through the louvers in the exterior wall or confined within the area by the fire rated perimeter construction until the fire brigade arrives.

- The drainage system described in Section 1.2 does not contain fire traps. A commitment to provide fire traps was accepted by the NRC in SSER 8. This commitment was then withdrawn and the existing floor drainage system was justified and found to be acceptable. (Ref. 6.19)

The existing fire protection for the areas provides an acceptable level of safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 Drawing No. 515573
6.2 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065127, Fire Protection Information Report, Unit 2
6.5 SSER 23, June 1984
6.6 SSER 31, April 1985
6.7 Deleted
6.8 NECS File: 131.95, FHARE: 103, Fire Barrier Configurations in the Emergency Diesel Generator Rooms
6.9 DCP M-44405, Sixth Diesel Generator Design
6.10 Deleted
6.11 NECS File: 131.95, FHARE 123, Unsealed Penetrations with Fusible Link Chain Penetrants Through Fire Barriers
6.12 DCP H-50117, Diesel Generator Air Flow Improvement Modification, Units 1 and 2
6.13 NECS File: 131.95, FHARE 30, Unrated Gaps in Appendix R Barriers in the Turbine Building
6.14 Calculation 134-DC, Electrical Appendix R Analysis
6.15 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.16 Deleted
6.17 NECS File: 131.95, FHARE 109, Acceptance Criteria for Penetration Seals in Selected Barriers

6.18 NECS File: 131 .95, FHARE 157, Unprotected Fire Rated Assemblies and Lack of Area-Wide Detection/Suppression

6.19 NECS File: 131.95, FHARE 29, Fire Trap for Diesel Generator Rooms

6.20 NCES File: 131 .95, FHARE 33, Undampered Ventilation Duct Penetrations

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fire Area TB-10 is in the southeast corner of the Unit 2 Turbine Building and consists of Fire Zone 23-A, at El. 107 ft, and Fire Zone 24-A, at El. 119 ft.

1.2 Description

Fire Area TB-10 consists of the 4kV F Bus cable spreading room (at 107 ft), Fire Zone 23-A, and the 4kV F Bus switch gear room (at 119 ft), Fire Zone 24-A, in the Turbine Building. At least two of the three vitalities are required for safe shutdown.

1.3 Boundaries

1.3.1 Fire Zone 23-A (El. 107 ft)

North:

- 3-hour rated barrier to Fire Zone 19-A.
- 2-hour rated barrier to Fire Zone 23-E (TB-7). (Ref. 6.14)
- A 1-1/2-hour rated door to Fire Zone 23-E.

South:

- 2-hour plaster barrier above 3-hour door to Zone 23-B. (Ref. 6.21)
- 2-hour rated barrier to Fire Zone 23-B (TB-11). (Ref. 6.5)
- Unrated structural gap seals to Fire Zone 23-B. (Ref. 6.18)
- Two 3-hour rated doors to Fire Zone 23-B.
- A 1-1/2-hour rated door to Fire Zone 23-B. (Ref. 6.22)

East:

- 2-hour rated barrier to Fire Zone 23-E. (Ref. 6.21)
- 2-hour rated barrier to the exterior (Area 29).
- 1-1/2-hour rated door to Fire Zone 23-E.

West:

- 3-hour rated barrier to Fire Zones 24-E (Ref. 6.17) and 22-C-2. (Ref. 6.19)
- Lesser rated penetration seal to Fire Zone 24-E. (Ref. 6.20)

- 1-hour rated unidirectional barrier to Fire Zone 24-E (TB-13) (above) (1-hour from Zone 23-A to Zone 24-E).
- A 1-1/2-hour rated door to Fire Area 24-E.

Floor/Ceiling:

Floor: To Fire Areas 20 and 22-C. (Ref. 6.23)

Ceiling: To Fire Area 24-D and Zones 24-A and 24-E.

- 3-hour rated concrete slab on unprotected steel. (Ref. 6.8)
- A ventilation duct without a fire damper communicates with Fire Area 24-D (above). (Refs. 6.9 and 6.13)
- A vent opening to Fire Zone 24-A above.
- A ventilation duct with a 3-hour rated fire damper communicates to Fire Zone 24-E (TB-13) (above). (Ref. 6.6)

<u>1.3.2 Fire Zone 24-A (El. 119 ft)</u>

North:

- 3-hour rated barrier to Fire Zone 23-E (TB-7).
- Unrated structural gap seals to Fire Zone 23-E (TB-7). (Ref. 6.18)
- A 1-1/2-hour rated door to Fire Zone 23-E.

South:

- 2-hour rated barrier to Fire Zone 24-B (TB-11). (Ref. 6.5 and 6.23)
- Unrated structural gap seals to Fire Zone 24-B (TB-11). (Ref. 6.18)
- A 1-1/2-hour rated door to Fire Zone 24-B.

East:

- 2-hour rated barrier to the exterior (Area 29).

West:

- 3-hour rated barrier to Fire Area 24-D.
- Unrated structural gap seals to Fire Area 24-D. (Ref. 6.18)
- A 1-1/2-hour rated double door to Fire Area 24-D. (Ref. 6.10)
- 2-hour rated blockout around the door. (Ref. 6.10 and 6.24)
- A 1-1/2-hour rated damper to Fire Area 24-D. (Ref. 6.5)

Floor:

- 3-hour rated concrete slab to Fire Zone 23-A.
- A vent opening to Fire Zone 23-A below.

Ceiling:

- A vent opening with a 3-hour rated fire damper to Zone 19-D (TB-7).
- 3-hour rated barrier to Fire Area 19-D.

Protective Enclosure:

- All corner gaps are sealed.
- Structural steel has fire resistive coverings.

(Note: Some structural steel modifications for the block walls (at El. 119 ft) were deemed acceptable with no fireproofing. (Ref. 6.11))

2.0 COMBUSTIBLES

2.1 Fire Zone 23-A (Elevation 107 ft)

2.1.1 Floor Area: 1,463 ft^2

2.1.2 In situ Combustible Materials

- Cable insulation
- Rubber
- Plastic

2.1.3 Transient Combustible Loading

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.1.4 Fire Severity

- Low

2.2 Fire Zone 24-A (El. 119 ft)

2.2.1 Floor Area: 855 ft^2

2.2.2 In situ Combustible Materials

- Rubber
- Plastic

2.2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection is provided in Fire Zones 23-A and 24-A.

3.2 Suppression

- Portable fire extinguishers
- CO_2 hose stations
- Fire hose stations

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Zones 23-A and 24-A

4.1.1 Auxiliary Feedwater

AFW pump 2-3 may be lost for a fire in this area. Redundant pump 2-1 will be available to provide AFW to steam generators 2-3 and 2-4.

AFW valves LCV-113 and LCV-115 may be affected by a fire in this area. Redundant valves LCV-108 and LCV-109 will remain available to provide AFW flow to steam generators 2-3 and 2-4 from AFW Pump 2-1.

4.1.2 Chemical and Volume Control System

CVCS valve 8107 may be affected by a fire in this area. CVCS valves 8108, HCV-142, or 8145 and 8148 remain available to isolate auxiliary spray, two other charging flowpaths are available and the PORVs can be used for pressure reduction. Therefore, safe shutdown is not affected.

Charging pump and ALOP 2-1 may be lost due to a fire in this area. Redundant charging pumps 2-2, 2-3 and ALOP 2-2 will remain available to provide charging flow.

Boric acid transfer pump 2-1 may be lost due to a fire in this area. Redundant boric acid pump 2-2 will be available for this function.

CVCS valve LCV-112B may be affected by a fire in this area. Valve 8805B remains available to provide water from the RWST to the charging pump suction. The VCT can be isolated by closing LCV-112C.

A fire in this area may result in the loss of boric acid storage tank 2-1 level indication from LT-106. Borated water from the RWST will be available. Therefore, BAST level is not required.

4.1.3 Component Cooling Water

CCW pump and ALOP 2-1 may be lost due to a fire in this area. CCW pumps and ALOPs 2-2 and 2-3 will remain available to provide CCW.

CCW valve FCV-430 may be affected by a fire in this area making heat exchanger 2-1 unavailable for CCW cooling. Redundant valve FCV-431 will remain available making CCW heat exchanger 2-2 available. Thus no manual actions are required.

4.1.4 Emergency Power

The diesel generator 2-1 backup control circuit may be lost due to a fire in this area. The normal control circuit will remain available.

Diesel generator 2-3 may be lost due to a fire in this area. Diesel generators 2-1 and 2-2 will remain available for safe shutdown.

A fire in this area may disable startup transformer 2-2. Onsite power will remain available from diesel generators 2-1 and 2-2.

All power supplies on the "F" Bus may be lost due to a fire in this area. Redundant power supplies from the "G" and "H" Buses will be available.

A fire in this area may disable dc panel SD23 backup battery charger ED231. Normal battery charger ED232 will remain available.

A fire in this area may cause loss of power supplies associated with PY27N. Redundant power supply PY26 remains available.

4.1.5 Main Steam System

A fire in this area may result in the loss of LT-516, LT-526, LT-529, LT-536, LT-539, LT-546, PT-514, PT-524, PT-534 and PT-544. Safe shutdown will not be affected since redundant instrumentation exists for all four steam generators.

Main steam system valve PCV-19 may fail due to a fire in this area. Since this valve fails in its desired position, safe shutdown can still be achieved. A redundant dump valve will remain available for cooldown purposes.

4.1.6 Makeup System

The level transmitter for the condensate storage tank, LT-40 may be lost due to a fire in this area. Feedwater will remain available through FCV-436 from the raw water storage reservoir.

4.1.7 Reactor Coolant System

The following instrumentation may be lost due to a fire in this area: LT-406, LT-459, NE-31, NE-51, PT-406, PT-403, TE-413A, TE-413B, TE-423A, TE-423B. Redundant instrumentation will be available to provide necessary indications to the operator.

RCS valve 8000A may be affected by a fire in this area. This valve fails "as is" (open). PCV-474 will remain closed to prevent uncontrolled pressure reduction through the PORV path.

4.1.8 Safety Injection System

SI valves 8801A, 8803A and 8805A may be lost due to a fire in this area. Valves 8801B and 8803B can be opened to provide a charging injection flow path in the event that 8801A and 8803A fail closed. Valve 8805B can be opened instead of valve 8805A to provide RWST water to the charging pumps. Since these valves have redundant components, safe shutdown is not affected.

SI valve 8808A may be affected by a fire in this area. Valve 8808A can be manually closed in order to provide accumulator isolation during RCS pressure reduction.

SI pump 2-1 may spuriously operate due to a fire in this area. Local manual action can be taken to defeat this spurious operation.

4.1.9 Auxiliary Saltwater System

Circuitry for ASW pumps 2-1 and 2-2 may be damaged by a fire in this area. ASW pump 2-2 can be started locally to provide ASW flow.

A fire in this area may affect valve FCV-602. This valve fails open which is the desired safe shutdown position.

4.1.10 HVAC

HVAC equipment E-104, E-45, S-45, FCV-5045 and S-69 may be lost due to a fire in this area. E-104 and S-69 are not be necessary during a fire in this area. S-45, E-45 and FCV-5045 have redundant components S-46, E-46 and FCV-5046 that will remain available to provide necessary HVAC support to the 480 volt switchgear.

5.0 CONCLUSION

The consequences of a design basis fire will be mitigated by the following fire protection features and assure the ability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining

adequate separation between redundant components to assure safe shutdown.

- Smoke detection is provided in Fire Zones 23-A and 24-A.

- Portable fire extinguishers, CO_2 hose stations and fire hose stations are available.

- Redundant safe shutdown capability is located outside of this fire area.

In this fire area, existing fire protection features provide an acceptable level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 Drawing Nos. 515573, 515574, 515575, 515576
6.2 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.3 Calculation M-824, Combustible Loading
6.4 Drawing 065127, Fire Protection Information Report, Unit 2
6.5 SSER 8, November 1978
6.6 DCN DC2-EH-16047, Provide 3-hour rated Dampers to Area 24-E
6.7 Not used
6.8 PLC Report: Structural Steel Analysis for Diablo Canyon (Rev. 2) (7/8/86)
6.9 NECS File: 131.95, FHARE: 33, Undampered Ventilation Duct Penetrations
6.10 DCN DC2-EA-24390, Provide 3-hour rated Double Door and Plaster Blockout
6.11 NECS File: 131.95, FHARE: 106, Block Walls Modified in the 4kV Switchgear Area
6.12 AR A0211784 AE 08, NES Fire Protection's Evaluation of Exposed Structural Steel Anchor Bolts
6.13 NECS File: 131.95, FHARE: 136, Unrated HVAC Duct Penetrations
6.14 NECS File: 131.95, FHARE: 119, Plaster Barriers Credited for Appendix A to BTP (APCSB) 9.5-1
6.15 Calculation 134-DC, Electrical Appendix R Analysis
6.16 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.17 NECS File: 131.95, FHARE: 118, Appendix R Fire Area Plaster Barriers
6.18 NECS File: 131.95, FHARE: 134, "Non-rated Structural Gap Seals in Fire Barriers"
6.19 NECS File: 131.95, FHARE: 30, Unrated Gaps in Appendix R Barriers in the Turbine Building
6.20 NECS File: 131.95, FHARE: 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.21 NECS File: 131.95, FHARE: 50, Lesser Rated Plaster Barriers

6.22 Question 27, PG&E Letter to NRC Dated 11/13/78
6.23 NECS File: 131 .95, FHARE 20 , Bus Duct Penetrations
6.24 NECS File: 131 .95, FHARE 146, Gaps in Unistruts and Support Members through Pyrocrete Barriers

FIRE AREA TB-11

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fire Area TB-11 is in the southeast corner of the Unit 2 Turbine Building and consists of Zones 23-B, and 24-B at El. 107 ft and 119 ft respectively.

1.2 Description

Fire Zones 23-B and 24-B are in Fire Area TB-11 and contain the 4kV "G" Bus Cable Spreading Room at El. l04 ft and the 4kV "G" Bus switchgear room at El. 119 ft, respectively. At least two of the three vitalities are required for safe shutdown.

1.3 Boundaries

1.3.1 Fire Zone 23-B (El. 107 ft)

North:

- 2-hour rated barrier separates this zone from Zone 23-A. (Refs. 6.6 and 6.16)
- Unrated structural gap seals to Fire Zone 23-A. (Ref. 6.14)
- A l-l/2-hour rated door communicates to Zone 23-A. (Ref. 6.16)
- One 3-hour rated doors communicate to Zone 23-A.

South:

- 2-hour rated barrier separates this zone from Zone 23-C. (Refs. 6.6 and 6.16)
- Unrated structural gap seals to Fire Zone 23-C. (Ref. 6.14)
- One 3-hour rated door communicates to Zone 23-C.1
- Two 1-1/2-hour rated doors communicate to Zone 23-C. (Ref. 6.16)

East:

- 2-hour rated barrier separates this zone from the exterior (Area 29). (Ref. 6.16)

West:

- 3-hour rated barrier separates this zone from Zones 22-C-2 and 23-C-1. (Ref. 6.15)
- 2-hour rated barrier to Fire Zone 23-C. (Ref. 6.16)

Floor/Ceiling:

- 3-hour rated barrier separates this zone from Zones 24-B and 24-D above and Areas 20 and 22-C below. (Ref. 6.17)
- A ventilation opening without a fire damper communicates to Zone 24-B, above.
- A duct penetration with a 3-hour rated fire damper communicates with Fire Zone 24-E, above. (Ref. 6.3)
- 3-hour rated concrete hatches communicate through the floor and ceiling of this zone, on unprotected steel. (Ref. 6.8 and 6.18)

<u>1.3.2 Fire Zone 24-B (El. 119 ft)</u>

North:

- 2-hour rated barrier separates this zone from Zone 24-A. (Ref. 6.6 and 6.17)
- Unrated structural gap seals to Fire Zone 24-A. (Ref. 6.14)
- A 1-1/2-hour rated door communicates to Zone 24-A.

South:

- 2-hour rated barrier separates this Zone from Zone 24-C. (Ref. 6.6 and 6.17)
- Unrated structural gap seals to Fire Zone 24-C. (Ref. 6.14)
- A 1-1/2-hour rated door communicates to Zone 24-C.

East:

- 2-hour rated barrier separates this zone from the exterior (Area 29).

West:

- 3-hour rated barrier separates this zone from Area 24-D.
- Unrated structural gap seals to Fire Area 24-D. (Ref. 6.14)
- A ventilation duct with a 1-1/2-hour rated fire damper communicates to Area 24-D. (Ref. 6.6)
- A 1-1/2-hour rated double door communicates to Area 24-D. (Ref. 6.9)
- A 2-hour rated blockout around the door to Fire Area 24-D. (Ref. 6.9 and 6.19)

Floor/Ceiling:

- 3-hour rated barrier separates this zone from l9-D (above), and 23-B (below).
- A vent opening without a fire damper communicates to Zone 23-B.
- A vent opening with a 3-hour rated damper communicates to Zone 19-D.

Protective Enclosure:

- All corner gaps are sealed.
- Structural steel has a fire barrier coating.

(Note: Some structural steel modifications for the block walls (at El. 119 ft) were deemed acceptable with no fireproofing. (Ref. 6.10))

2.0 COMBUSTIBLES

2.1 Fire Zone 23-B

2.1.1 Floor Area: 1,473 ft^2

2.1.2 In situ Combustible Materials

- Cable Insulation
- Rubber
- Plastic

2.1.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.1.4 Fire Severity

- Low

2.2 Fire Zone 24-B

2.2.1 Floor Area: 855 ft^2

2.2.2 In situ Combustible Materials

- Cable insulation
- Rubber
- Plastic

2.2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- Smoke detection is provided in Zones 23-B and 24-B.

3.2 Suppression

- CO_2 hose station
- Hose station
- Portable fire extinguisher

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Zones 23-B and 24-B

4.1.1 Auxiliary Feedwater

A fire in this area may affect LCV-106, LCV-107, LCV-108 and LCV-109. Redundant valves LCV-110 and LCV-111 will remain available to provide AFW flow to steam generators 2-1 and 2-2 from AFW Pump 2-2.

4.1.2 Chemical and Volume Control System

Valve 8108 may be lost due to a fire in this area. Valve 8107 can be closed to isolate auxiliary spray, one other charging flowpath is available and the PORVs can be used for pressure reduction. Since this valve has redundant components, safe shutdown is not affected.

A fire in this area may affect valve 8104. Safe shutdown is not affected because FCV-110A and manual valve 8471 will remain available to provide a boric acid flowpath to the charging pumps.

Valves 8146, 8147 and 8148 may be affected by a fire in this area. Redundant valve 8107 will be available to isolate auxiliary spray. Alternate charging flow paths exist and the PORVs will be available for pressure reduction. Since redundant components are available, safe shutdown is not affected.

Charging pumps 2-2 and 2-3 and ALOP 2-2 may be affected by a fire in this area. Redundant charging pump 2-1 and ALOP 2-1 will remain available for safe shutdown.

Boric acid transfer pump 2-2 may be lost due to a fire in this area. Redundant boric acid transfer pump 2-1 will remain available.

HCV-142 may be affected by a fire in this area. Since redundant components will be available, safe shutdown is not affected.

A fire in this area may result in spurious closure of FCV-128. FCV-128 is desired to be open. FCV-128 can be opened from the Control Room by taking its controller to the Manual Mode of operation.

A fire in this area may affect LCV-112C. Redundant valve 8805A will be available to provide water to the charging pump suction. The VCT may be isolated by a closure of LCV-112B.

A fire in this area may affect valves LCV-459 and LCV-460. Redundant valves 8149A, 8149B, and 8149C will be available to isolate letdown.

4.1.3 Component Cooling Water

CCW pump and ALOP 2-2 may be lost due to a fire in this area. Redundant CCW pumps and ALOPs 2-1 and 2-3 will be available to provide CCW.

A fire in this area may affect FCV-431. Redundant valve FCV-430 will enable the use of the other CCW train.

Valve FCV-365 may be affected by a fire in this area. Since this valve fails in the desired, open position and redundant valve FCV-364 will remain available, safe shutdown is not affected.

4.1.4 Containment Spray

A fire in this area may spuriously energize containment spray pump 2-1. However, the pump discharge valve, 9001A will remain closed and the pump will run on recirculation.

4.1.5 Diesel Fuel Oil System

Diesel fuel oil pump 0-2 may be lost due to a fire in this area. Redundant diesel fuel oil pump 0-1 will remain available.

A fire in this area may affect valves LCV-85, LCV-86 and LCV-87. Redundant valves LCV-88, LCV-89 and LCV-90 will provide day tank level control for all diesels.

4.1.6 Emergency Power

Diesel generator 2-1 may be lost due to a fire in this area. Diesel generators 2-2 and 2-3 will remain available for safe shutdown.

A fire in this area may disable the diesel generator 2-2 backup control circuit. The normal control circuit will remain available.

A fire in this area may disable startup transformer 2-2. Onsite power will remain available from diesel generators 2-2 and 2-3.

All power supplies on the "G" Bus may be lost due to a fire in this area. The redundant power supplies for "F" and "H" buses will be available.

A fire in this area may result in a loss power supplies associated with PY27N and PY26. Loss of power to PY27N and PY26 results in spurious closure of FCV-128 when in the Automatic Mode. FCV-128 can be opened by placing the controller in the Control Room to the Manual Mode.

4.1.7 Main Steam System

A fire in this area may result in the loss of the following components: LT-519, LT-549, PT-515, PT-525, PT-535 and PT-545. Safe shutdown is not affected since redundant trains of instrumentation exist for all four steam generators.

PCV-21 may be affected by a fire in this area. Since this valve fails in the desired closed position, safe shutdown is not affected. Redundant dump valves will remain available for cooldown purposes.

A fire in this area may affect FCV-95. This valve is not necessary since two other AFW pumps 2-2 and 2-3 will remain available.

Valves FCV-41 and FCV-42 may be affected by a fire in this area. These valves can be manually closed to ensure safe shutdown.

4.1.8 Reactor Coolant System

A fire in this area may result in the loss of LT-460, NE-32, TE-433A, TE-433B, TE-443A and TE-443B. Redundant components for safe shutdown will be available.

A fire in this area may affect valves 8000B and PCV-455C. 8000B fails "as is" (open) and PCV-455C fails closed. Since PCV-455C fails closed, uncontrolled pressure reduction will not occur. A redundant PORV is available for pressure reduction.

Control of reactor coolant pumps 2-1, 2-2, 2-3 and 2-4 may be lost due to a fire in this area. Safe shutdown is not affected if the RCPs continuously run.

Pressurizer heater groups 2-3 and 2-4 may be affected by a fire in this area. Manual actions can be taken to de-energize heater group 2-4 and switch heater group 2-3 to the vital power supply. Therefore, safe shutdown is not affected.

4.1.9 Residual Heat Removal System

RHR pump 2-1 may be lost due to a fire in this area. Redundant pump 2-2 will be available to provide the RHR function.

Valve 8701 may be affected by a fire in this area. This valve can be manually opened for RHR operations.

A fire in this area may result in loss of control of FCV-641A. Since the redundant train is available (RHR Pp 2-2 and FCV-641B), this will not affect safe shutdown.

4.1.10 Safety Injection System

A fire in this area may result in the loss of valves 8801B, 8803B and 8805B. Redundant valves 8801A, 8803A and 8805A will remain available for safe shutdown.

Valves 8808B and 8808D may be affected by a fire in this area. These valves can be manually closed to ensure safe shutdown.

4.1.11 Auxiliary Saltwater System

Circuits for ASW pumps 2-1 and 2-2 may be damaged by a fire in this area. ASW pump 2-1 can be started locally to provide ASW flow.

A fire in this area may affect valve FCV-603. Since this valve fails in the desired, open position, safe shutdown is not affected.

4.1.12 HVAC

One train of required HVAC equipment, E-102 and S-68 may be lost due to a fire in this area. Neither of these components will be necessary because redundant HVAC equipment will be available to provide necessary HVAC support.

5.0 CONCLUSION

The following fire protection features mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Loss of the safe shutdown functions in these zones does not affect safe shutdown of the plant as the redundant train is located outside of the fire area will remain available.

- Smoke detection is provided in Zones 23-B and 24-B.

- Manual fire fighting equipment is available for use.

In this fire area, existing fire protection features provide an acceptable level of fire safety equivalent to that provided by 10 CFR 50, Appendix R, Section III. G.

6.0 REFERENCES

6.1 DCPP Unit 2 Review of 10 CFR 50, Appendix R (Rev. 2)
6.2 Drawing No. 515574, 515575,
6.3 DCN DC2-EA-l6047 Provides 3 Hr. Rated Damper
6.4 Drawing 065127, Fire Protection Information Report, Unit 2
6.5 Calculation M-824, Combustible Loading
6.6 SSER 8, November 1978
6.7 Deleted
6.8 PLC Report: Structural Steel Analysis for Diablo Canyon (Rev. 2) (7/8/86)
6.9 DCN DC2-EA-24390 Provide 3-hour rated double door and 2-hour rated plaster blockout
6.10 NECS File: 131.95, FHARE 106, Block Walls Modified in the 4kV Switchgear Area
6.11 AR A0211784 AE 08, NES Fire Protection’s Evaluation of Exposed Structural Steel Anchor Bolts
6.12 Calculation 134-DC, Electrical Appendix R Analysis
6.13 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.14 NECS File: 131.95, FHARE: 134, “Non-rated Structural Gap Seals in Fire Barriers”
6.15 NECS File: 131.95, FHARE: 30, Unrated Gaps in Appendix R Barriers in the Turbine Building
6.16 Question 27, PG&E Letter to NRC Dated 11/13/78
6.17 NECS File: 131 .95, FHARE 20, Bus Duct Penetrations
6.18 NECS File: 131 .95, FHARE 14, Concrete Equipment Hatches
6.19 NECS File: 131 .95, FHARE 146, Gaps in Unistruts and Support Members through Pyrocrete Barriers

FIRE AREA TB-12

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

Fire Area TB-12 is in the southeast corner of the Unit 2 Turbine Building and consists of Zones 23-C (4kV H Bus Cable Spreading Room) at El. 107 ft, and Zone 24-C (4kV H Bus Switchgear Room) at El. 119 ft.

1.2 Description

Fire Zones 23-C and 24-C are in Fire Area TB-12 and contain the 4kV "H" Bus Cable Spreading Room at El. 107 ft and the 4kV "H" Bus Switchgear room at El. 119 ft respectively. At least two of the three vital divisions are required for safe shutdown.

1.3 Boundaries

1.3.1 Fire Zone 23-C (El. 107 ft)

North:

- 2-hour rated barrier separates this zone from Zone 23-B. (Refs. 6.6 and 6.17)
- Unrated structural gap seals to Fire Zone 23-B. (Ref. 6.15)
- Two 1-1/2-hour rated doors communicating to Zone 23-B. (Ref. 6.17)

South:

- 2-hour rated barrier to the exterior (Area 29 and Fire Zone S-7).
- A 2-hour rated barrier separates this zone from Fire Zone S-7 (TB-13). (Ref. 6.7)
- Duct penetration with a 3-hour rated damper to the exterior (Area 29). (Ref. 6.17)

East:

- 2-hour rated barrier to the exterior (Area 29) and Zone 23-B. (Ref. 6.17)

West:

- 2-hour rated barrier separates this zone from Zones S-7 and 23-C-1. (Ref. 6.7)
- 2-hour rated barrier separates this zone from Fire Zone 23-C-1. (Ref. 6.8)

- A 1-1/2-hour rated door communicates to Zone S-7.
- A duct penetration with a fire damper communicates to Zone S-7. (Ref. 6.3)
- Lesser rated penetration seals to Zone S-7 and 23-C-1. (Ref. 6.16)

Floor/Ceiling:

Ceiling:

- 3-hour rated barrier
- A ventilation opening to Fire Zone 24-C, above

Floor:

- 3-hour rated barrier on unprotected steel. (Ref. 6.9)

<u>1.3.2. Fire Zone 24-C (El. 119 ft)</u>

North:

- 2-hour rated barrier separates this zone from Zone 24-B. (Ref. 6.18)
- Unrated structural gap seals to Fire Zone 24-B. (Ref. 6.15)
- A 1-1/2-hour rated door communicates to Zone 24-B. (Ref. 6.6)

South:

- 2-hour rated barrier separates this zone from the exterior (Area 29).

East:

- 2-hour rated barrier separates this zone from the exterior (Area 29).

West:

- 3-hour rated barrier separates this zone from Area 24-D.
- Unrated structural gap seals to Fire Area 24-D. (Ref. 6.15)
- A 1-1/2-hour rated double door communicates to Area 24-D. (Ref. 6.10)
- A ventilation duct with a 1-1/2-hour rated fire damper communicates to Area 24-D. (Ref. 6.6)
- A 2-hour rated blockout around the door. (Ref. 6.10 and 6.19)

Ceiling:

- 3-hour rated barrier to Fire Zone 19-D.
- A ventilation opening with a 3-hour rated damper to the main turbine deck.

Floor:

- 3-hour rated barrier.
- A ventilation opening to Zone 23-C below.

Protective Enclosure:

- All corner gaps are sealed.
- Structural steel has fire resistive coatings.

(Note: Some Structural steel modifications for the block walls (at El. 119 ft) were deemed acceptable with no fireproofing. (Ref. 6.11))

2.0 COMBUSTIBLES

2.1 Fire Zone 23-C

2.1.1 Floor Area: 1,224 ft^2

2.1.2 In situ Combustible Materials

- Cable insulation
- Plastics

2.1.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.1.4 Fire Severity

- Low

2.2 Fire Zone 24-C

2.2.1 Floor Area: 958 ft^2

2.2.2 In situ Combustible Materials

- Cable insulation
- Plastics
- Rubber

2.2.3 Transient Combustible Materials

Transient combustible materials are strictly controlled in accordance with procedure OM8.ID4 and Engineering Calculation M-824. Below is a listing of reasonably expected transient combustible materials:

- Clothing/Rags
- Lubricants
- Miscellaneous Class A & B combustibles
- Solvents
- Wood
- Plastic
- Paper

2.2.4 Fire Severity

- Low

3.0 FIRE PROTECTION

3.1 Detection

- 3.A.1 Zone 23-C Smoke detection for cable trays only
- 3.A.2 Zone 24-C Smoke detection area wide
- Smoke detection area wide

3.2 Suppression

- CO_2 hose station
- Hose station
- Portable fire extinguisher

4.0 SAFE SHUTDOWN FUNCTIONS

4.1 Fire Zones 23-C and 24-C

4.1.1 Auxiliary Feedwater

AFW pump 2-2 may be lost due to a fire in this area. Redundant AFW pumps 2-1 and 2-3 will be available to provide AFW.

A fire in this area may affect valves LCV-110 and LCV-111. Redundant valves LCV-106, LCV-107, LCV-108 and LCV-109 will remain available to provide AFW flow from AFW Pump 2-1, and LCV-113 and LCV-115 will remain available to provide AFW flow from AFW pump 2-3.

4.1.2 Chemical and Volume Control System

Boric acid storage tank 2-2 level indication from LT-102 may be lost due to a fire in this area. Borated water from the RWST will remain available. Therefore, BAST level indication is not required.

Pressurizer auxiliary spray valve 8145 may be affected by a fire in this area. This valve fails closed to isolate auxiliary spray during hot standby. The PORVs can be used for pressure reduction so valve 8145 will not be necessary.

A fire in this area may affect valve FCV-110A. This valve fails in the desired, open position. Valve 8104 will remain available to provide boric acid transfer.

4.1.3 Component Cooling Water

CCW pump 2-3 and ALOP 2-3 may be lost due to a fire in this area. Redundant pumps and ALOPs 2-1 and 2-2 will be available to provide CCW.

A fire in this area may affect valve FCV-364. Since this valve fails in the desired, open position safe shutdown is not affected.

4.1.4 Containment Spray

Containment spray pump 2-2 may spuriously operate due to a fire in this area. However, the corresponding discharge valve 9001B will not open. Therefore, the spurious containment spray pump operation has no impact on safe shutdown.

4.1.5 Diesel Fuel Oil System

Diesel fuel oil pump 0-1 may be lost due to a fire in this area. The redundant diesel fuel oil pump 0-2 remains available.

Valves LCV-88, LCV-89 and LCV-90 may be affected by a fire in this area. Redundant valves LCV-85, LCV-86 and LCV-87 will be available for day tank level control.

4.1.6 Emergency Power

Diesel generator 2-2 may be lost due to a fire in this area. Diesel generators 2-1 and 2-3 will remain available for safe shutdown.

A fire in this area may disable the diesel generator 2-3 backup control circuit. The normal control circuit will remain available.

A fire in this area may disable startup transformer 2-2. Onsite power will remain available from diesel generators 2-1 and 2-3.

All power supplies on the "H" Bus may lose power due to a fire in this area. Redundant power supplies on the "G" and "F" Buses will be available.

A fire in this area may disable dc panel SD21 and SD22 backup battery charger ED221. Normal battery ED21 and ED22 will remain available.

A fire in this area may cause loss of power supplies associated with PY27N. Redundant power supply PY26 remains available.

4.1.7 Main Steam System

A fire in this area may result in the loss of the following instrumentation: LT-518, LT-528, LT-538, LT-548, PT-526 and PT-536. Since redundant instrumentation exists for all four steam generators, safe shutdown is not affected.

PCV-20 may be affected by a fire in this area. This valve fails in the desired, closed position, safe shutdown will not be affected. Redundant dump valves will remain available for cooldown purposes.

A fire in this area may affect valves FCV-43 and FCV-44. These valves can be manually operated to ensure safe shutdown.

4.1.8 Reactor Coolant System

A fire in this area may result in the loss of LT-461, NE-52 and PT-403. Safe shutdown will not be affected since redundant components will be available.

A fire in this area may affect PZR PORV and blocking valve PCV-456 and 8000C. PCV-456 fails closed which prevents uncontrolled pressure reduction. Since redundant PORV PCV-455C will remain available for pressure reduction, safe shutdown will not be affected.

Control of reactor coolant pumps 2-1, 2-2, 2-3 and 2-4 may be lost due to a fire in this area. Safe shutdown is not affected if the RCPs continuously run.

Pressurizer heater groups 2-1 and 2-2 may be affected by a fire in this area. Manual actions can be taken to de-energize heater group 2-1 and switch heater group 2-2 to the vital power supply. Therefore, safe shutdown is not affected.

4.1.9 Residual Heat Removal System

RHR pump 2-2 may be lost for a fire in this area. The redundant RHR pump 2-1 will be available to provide the RHR function.

Valve 8702 may be affected by a fire in this area. This valve can be manually opened for RHR operations.

A fire in this area may result in loss of control of FCV-641B. Since the redundant train is available (RHR Pp 2-1 and FCV-641A), this will not affect safe shutdown.

4.1.10 Safety Injection System

SI pump 2-2 may spuriously operate due to a fire in this area. Local manual action may be required to defeat this spurious operation.

Accumulator isolation valve 8808C may be affected by a fire in this area. This valve can be manually closed.

4.1.11 Auxiliary Saltwater System

A fire in this area may affect valves FCV-495 and FCV-496. FCV-601 will remain closed to provide ASW system integrity.

4.1.12 HVAC

A fire in this area may result in the loss of one train of HVAC components (E-46, S-46, FCV-5046 and S-67). S-67 is not necessary for a fire in this area. The HVAC function will be supplied by a redundant train of components (S-45, E-45 and FCV-5045).

5.0 CONCLUSION

The following fire protection features will adequately mitigate the consequences of the design basis fire and assure the capability to achieve safe shutdown:

- Deviations to requirements for 3-hour boundaries have been documented in the referenced Appendix R exemptions and engineering evaluations. These references verify that the subject boundaries are capable of maintaining adequate separation between redundant components to assure safe shutdown.

- Smoke detection is provided in Zone 23-C and 24-C.

- Manual fire fighting equipment is available for use.

- Loss of the safe shutdown functions in these zones does not affect safe shutdown of the plant as the redundant train is independent and remains available.

In this fire area, existing fire protection features provide an acceptable level of fire safety equivalent to that provided by l0 CFR 50, Appendix R, Section III.G.

6.0 REFERENCES

6.1 DCPP Unit 2 Review of l0 CFR 50, Appendix R (Rev. 2)
6.2 Drawing No. 515574, 5l5575
6.3 DCN DC2-EA-16047 - Provides 3 Hr. Rated Barrier
6.4 Drawing 065127, Fire Protection Information Report, Unit 2
6.5 Calculation M-824, Combustible Loading
6.6 SSER 8, November 1978
6.7 NECS File: 131.95, FHARE: 122: Staircase S-7, Fire Area Boundary
6.8 NECS File: 131.95, FHARE: 118, Appendix R Fire Area Plaster Barriers
6.9 PLC Report: Structural steel analysis for Diablo Canyon (Rev. 2) (7/8/86)
6.10 DCN DC2 - EA - 24390, Provide 3-hour rated double door and 2-hour rated plaster wall
6.11 NECS File: 131.95, FHARE: 106, Block Walls Modified in the 4kV Switchgear Area

6.12 AR A0211784 AE 08, NES Fire Protection's Evaluation of Exposed Structural Steel Anchor Bolts
6.13 Calculation 134-DC, Electrical Appendix R Analysis
6.14 Calculation M-928, 10 CFR 50, Appendix R, Safe Shutdown Analysis
6.15 NECS File: 131.95, FHARE: 134, "Non-rated Structural Gap Seals in Fire Barriers"
6.16 NECS File: 131.95, FHARE: 109, Acceptance Criteria for Penetration Seals in Selected Barriers
6.17 Question 27, PG&E Letter to NRC Dated 11/13/78
6.18 NECS File: 131 .95, FHARE 20, Bus Duct Penetrations
6.19 NECS File: 131.95, FHARE 146, Gaps in Unistruts and Support Members through Pyrocrete Barriers

FIRE AREA TB-13

1.0 PHYSICAL CHARACTERISTICS

1.1 Location

This zone is the corridor outside the 4kV cable spreading rooms at El. 107 ft at the south end of the Unit 2 Turbine Building.

1.2 Description

Fire Zone 23-C-1 is the corridor between the Fire Zones 23-B and 23-C, and Stairway S-7 to the east and Fire Zone 22-C-2 on the west. The corridor contains "H" Bus safe shutdown circuitry.

1.3 Boundaries

NOTE: [NC] designates a fire rated assembly that is not credited for compliance to 10 CFR 50 Appendix R or to Appendix A to BTP APCSB 9.5-1.

North:

- 2-hour rated barrier to Fire Zone 23-B (TB-11).
- 3-hour rated door to Fire Zone 23-B.

South:

- Nonrated barrier to the exterior (Area 29). [NC]

East:

- 2-hour rated barrier to Fire Zones S-7, 23-B, and 23-C. (Ref. 6.10)
- 2-hour rated barrier to Fire Zone 23-C (TB-12). (Ref. 6.13)
- A duct penetration without a fire damper communicates to Fire Zone S-7 (TB-13). (Ref. 6.8)
- A 1-1/2-hour rated door to Fire Zone S-7 (TB-13).
- Lesser rated penetration seals to Fire Zones S-7 and 23-C. (Ref. 6.14)
- The south end of the east wall does not abut with the south wall. But the configuration is such that the rating is maintained to S-7.

West:

- 3-hour rated barrier to Fire Zone 22-C-2. (Ref. 6.9)
- A duct penetration without a fire damper communicates to Fire Zone 22-C-2.