NEXTera ENERGY POINT BEACH

August 24, 2016

NRC 2016-0039
10 CFR 50.48
10 CFR 50.71(e)

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Point Beach Nuclear Plant, Units 1 and 2
Dockets 50-266 and 50-301
Renewed License Nos. DPR-24 and DPR-27

Transmittal of Fire Protection Evaluation Report, Revisions 16 and 17

In accordance with the requirements of 10 CFR 50.48, 10 CFR 50.71(e), and Generic Letter 88-12, "Removal of Fire Protection Requirements from Technical Specifications," NextEra Energy Point Beach, LLC (NextEra) is submitting Revisions 16 and 17 to the Fire Protection Evaluation Report (FPER) for Point Beach Nuclear Plant.

Enclosure 1 provides a listing of the changes to the FPER. Enclosure 2 contains Revision 17 of the FPER.

This letter contains no new Regulatory Commitments and no revisions to existing Regulatory Commitments.

If you have any questions or require additional information, please contact Bryan Woyak at 920/755-7599.

Sincerely,

NextEra Energy Point Beach, LLC

Bryan Woyak
Licensing Manager

Enclosure

cc: Administrator, Region III, USNRC
Project Manager, Point Beach Nuclear Plant, USNRC
Resident Inspector, Point Beach Nuclear Plant, USNRC

ENCLOSURE 1

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

SUMMARY OF CHANGES TO FIRE PROTECTION EVALUATION REPORT, REVISIONS 16 and 17

The following changes were incorporated into Revision 16 of the Point Beach Nuclear Plant (PBNP) Fire Protection Evaluation Report (FPER):

- Sections 2.1 and 5.2 (pages 17 and 49) were revised to more clearly describe the use of safe shutdown analysis tools. The change was completed according to EN-AA-202-1004, via Fire Protection Evaluation Report, Change Request 2015-FPER-04.

The following changes were incorporated into Revision 17 of the Point Beach Nuclear Plant (PBNP) Fire Protection Evaluation Report (FPER):

- Sections 6.2 (pages 142 and 143) was revised due to the installation of a new 400 gallon diesel oil tank for the diesel driven fire pump. The change was completed according to EN-AA-202-1004, via Fire Protection Evaluation Report, Change Request 2015-FPER-05.

ENCLOSURE 2

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

FIRE PROTECTION EVALUATION REPORT, REVISION 17
ISSUED JANUARY 2016

174 pages follow

FPER

FIRE PROTECTION EVALUATION REPORT

DOCUMENT TYPE: Administrative

REVISION: 17

EFFECTIVE DATE: January 11, 2016

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PROCEDURE OWNER (title): Group Head

OWNER GROUP: Engineering

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1.0 INTRODUCTION

The Fire Protection Evaluation Report (FPER) documents and describes the Fire Protection Program for Point Beach Nuclear Plant (PBNP). The purpose of the Fire Protection Program is to provide assurance, through defense-in-depth design, that a fire will not prevent the performance of necessary safe shutdown functions or significantly increase the risk of radioactive release to the environment during a postulated fire. The FPER serves as PBNP's fire plan as described in 10 CFR 50.48 and additionally documents PBNP's compliance with Criterion 3 of Appendix A of 10 CFR 50, which states:

> Criterion 3 – Fire Protection
>
> 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. Firefighting systems shall be designed to assure that their rupture or inadvertent operation does not significantly impair the safety capability of these structures, systems, and components.

The FPER is incorporated into the FSAR by reference consistent with the guidance of NRC Generic Letter 86-10 (Implementation of Fire Protection Requirements), and encompasses the current fire protection commitments affecting the Fire Protection Program. FPER revisions are conducted in accordance with the requirements of PBNP license condition 4.F to ensure the retention of Fire Protection Program commitments. Revisions to this document are subject to the conditions and limitations of 10 CFR 50.12 (Specific Exemptions), 10 CFR 50.59 (Changes, Tests, and Experiments), and 50.71(e) (Maintenance of Records, Making of Reports – Updated FSAR).

The FPER also provides the method of controlling changes to the program or existing fire protection features in accordance with the Quality Assurance Topical Report.

1.1 SYSTEM DESIGN AND OPERATION OVERVIEW

Point Beach Nuclear Plant is designed on the basis of limiting the use of combustible materials in construction and of using fire-resistant materials to the extent possible. Plant fire prevention is enhanced by structural and component designs that minimize the exposure of combustible materials and controls unavoidable exposed combustible materials. Plant fire control is enhanced by providing appropriately sized, fixed and/or portable fire fighting equipment.

1.2 DEFINITIONS

Alternative or Alternate Shutdown: Shutdown for those areas where a diverse system is used in lieu of the preferred system because redundant components of the preferred system do not meet the separation criteria of Section III.G.2 of Appendix R. Alternative Shutdown is governed by Sections III.G.3 and III.L of Appendix R and generally involves one or both of the following conditions:

a) Key shutdown activities are controlled/conducted outside of the Control Room (e.g., from alternate shutdown locations), or
b) Plant systems are utilized in a manner that is diverse from their intended design function.

Alternative Shutdown is often referred to as Alternate Shutdown outside of the Appendix R document.

Alternate Shutdown Area: Plant area that requires the use of alternate shutdown capability to achieve safe shutdown performance goals.

Approved: Tested and accepted for a specific purpose or application by a nationally recognized testing laboratory.

Associated Circuits by Common Enclosure: Circuits (safe shutdown and non-safe shutdown related) that share a common enclosure with safe shutdown circuits or equipment. Enclosures include panels, junction boxes and raceways (conduit and cable trays).

Associated Circuits by Common Power Supply: Circuits (safe shutdown and non-safe shutdown related) that share a common power supply with safe shutdown circuits or equipment. Power supplies include those provided for motive power, control power or instrument power.

Associated Circuits by Spurious Operation: Circuits associated with equipment whose spurious operation could adversely affect safe shutdown capability.

Associated Circuits of Concern: Circuits (safe shutdown and non-safe shutdown related) associated by common power supply, common enclosure and/or spurious operation that meet the following conditions:

a) Have physical separation less than that required by Section III.G.2 of Appendix R, and

b) Have the potential to impair safe shutdown capability through one or more of the following mechanisms:
   - Causing the loss of a safe shutdown power supply due to lack of coordinated circuit protection,
   - Inducing a spurious operation that adversely affects safe shutdown capability, and
   - Sharing an enclosure with a safe shutdown circuit without adequate electrical protection or without protection against fire propagation from one fire area to another.

Automatic: Self-acting, operating by its own mechanism when actuated by some impersonal influence such as a change in current, pressure, temperature, or mechanical configuration.

Boundary: Physical outer limits of a fire area/zone, which usually constitutes walls, floor and ceiling but is not necessarily a fire barrier.

Cable Failures: Fire-induced damage to a cable or circuit involving one or more of the following electrical faults:

a) Short-circuit - An individual conductor that comes into electrical contact with another electrical conductor.

b) Short to Ground - An individual conductor that comes into electrical contact with a grounded conducting device, such as a cable tray, conduit, or metal housing.

c) Hot Short - An energized conductor that comes into electrical contact with another conductor, thereby energizing the affected conductor.

d) Open Circuit - An individual conductor that loses electrical continuity.

Cold Shutdown: The reactor is in the cold shutdown condition when the reactor has a shutdown margin of at least 1 percent $\Delta k/k$ and reactor coolant temperature is $\leq 200°$ F.

Cold Shutdown Equipment: Safe shutdown equipment employed to make the transition of the reactor from a hot standby or hot shutdown mode to cold shutdown and/or maintain cold shutdown conditions thereafter.

Combustible: Any material that will normally burn or sustain the combustion process whether or not it exhibits flame.

Cooldown: The transitional period when the reactor is being cooled down from hot standby to cold shutdown.

Electrical Penetration: Penetration of a fire area/zone boundary, which contains cables, cable trays or conduits.

Enclosure: An identifiable housing such as a cubicle, compartment, terminal box, panel, or enclosed raceway used for electrical equipment or cables.

Exposure Fire: A fire in a given area that involves either in situ or transient combustibles and is external to any structures, systems or components located in or adjacent to that same area. The effects of such fire (e.g., smoke, heat or ignition) can adversely affect those structures, systems or components important to safety.

FPEE: Fire Protection Engineering Evaluations. Engineering evaluations performed in accordance with the guidance of NRC Generic Letter 86-10.

FPTE: Fire Protection Technical Evaluations. Technical evaluations performed to document the technical basis or results of various Fire Protection issues.

Factory Mutual (FM): The Factory Mutual Corporation, which conducts research and development in the field of property loss and provides a testing laboratory for the approval of fire protection equipment.

Fire Area: Area sufficiently bounded to withstand the hazards associated with the area and, as necessary, to protect equipment within the area from a fire outside the area.

Fire Barrier: Components of construction (walls, floors and their supports, including beams, joists, columns, penetration seals or closures, fire doors and fire dampers) that are rated by approving laboratories in hours of resistance to fire and are used to prevent the spread of fire.

Fire Brigade: The team of plant personnel assigned to fire fighting and trained in the manual fighting of fires in accordance with an established training program.

Fire Detection: Devices designed to respond to heat or products of combustion from fire and signal an alarm.

Fire Door: A door and frame assembly installed to provide resistance to the spread of fire through an opening in a fire barrier. The door and frame assembly is listed, classified or approved for such use by a recognized testing laboratory.

Fire Rating: The fire resistance endurance period of a fire barrier or component as determined by a standard fire test (refers to NFPA 251).

Fire Safe Shutdown: The process by, which operations are performed to achieve the safe shutdown performance goals of Appendix R, Section III.L.2 in the event of a fire in any plant area. ("Safe shutdown" and "fire safe shutdown" are used interchangeably in this document. Fire safe shutdown is not related to Design Basis Accident safe shutdown.) Also see definition for "Safe Shutdown."

Fire Stop: A feature of construction that prevents fire propagation along the length of cables or prevents spreading of fire to nearby combustibles within a given fire area or fire zone.

Fire Suppression: The capability to apply fire-extinguishing agents in order to control and extinguish fires. Manual fire suppression refers to equipment such as fixed hose stations, portable extinguishers or special agents that are manually applied to fires. Automatic fire suppression refers to fixed systems, which automatically respond to fires and apply extinguishing agents such as automatic sprinklers, Halon 1301, CO_2, dry chemical or foam systems.

Fire Wrap: Non-load bearing partition type envelope system installed around electrical components and cabling that are rated by test laboratories in hours of fire resistance and are used to maintain safe shutdown functions free of fire damage.

Fire Zone: The subdivisions of a fire area.

High/Low Pressure Interface Components: Valves, which:

a) Form a boundary of the reactor coolant system or isolate the reactor coolant system from low-pressure systems, and

b) Have the potential of causing uncontrolled depressurization and/or loss of primary coolant as a result of fire-induced failures.

Hot Shutdown Equipment: Safe shutdown equipment employed to achieve and maintain hot standby conditions.

Hot Standby: The reactor is in the hot standby condition when the reactor is subcritical, by an amount equal to the margin as specified in Technical Specification 15.3.10 [ITS 3.1.1] and Tavg is ≥ 540°F.

Isolation Device: A device in an electrical circuit, which prevents malfunctions in one section of the circuit from causing unacceptable effects in other sections of the circuit or other circuits (e.g., open contacts, fuses, switches, instrument isolation modules). Devices credited as providing electrical isolation for an Appendix R fire do not need to meet Class 1E qualification criteria unless required by other design considerations, i.e., the device also functions as a Class 1E isolator to meet electrical separation and independence criteria.

Intervening Combustible: In-situ combustible materials, such as grouped electrical cables routed in an open raceway, which are located between redundant trains of safe shutdown equipment or cabling.

Local Control: Control activities at control stations outside the Control Room.

Manual Action/Manual Operation: Physical manipulation (human powered) or visual observation of a component (i.e., an action or operation that requires no power source, support components or electrical circuits/cables), including specific Control Room actions to overcome fire-induced failures.

Mechanical Penetration: A penetration of a fire area/zone boundary, which contains mechanical equipment such as pipes, steel, ventilation ducts or access hatches.

Noncombustible Material:

a) A material, which, in the form it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat; or

b) Material having a structural base of noncombustible material, as defined in a., above, with a surfacing not over 1/8-inch thick that has a flame spread rating not higher than 50 when measured using ASTM E-84 Test, "Surface Burning Characteristics of Building Materials."

NFPA: National Fire Protection Association

Penetration Seal: Filling of a barrier penetration with materials, which have been installed in a configuration that provides a fire resistance rating as supported by a fire test.

Performance Goals: A set of functional criteria, which ensures the plant will achieve a hot standby condition, and subsequently be cooled down to and maintained in a cold shutdown condition.

Post-Fire: The time following identification of a fire.

Pre-Fire: The time prior to initiation of a fire.

Raceway: A channel that is designed and used expressly for supporting or enclosing wires, cable or bus bars. Raceways consist primarily of, but are not restricted to, cable trays and conduit.

Radiant Energy (Heat) Shield: A noncombustible or fire resistive barrier installed to provide separation protection of redundant cables, equipment and associated non-safety circuits within containment.

Safe Shutdown: The condition in, which the reactor is at zero power with k_{eff} less than 0.99, the core decay heat being removed at a controlled rate sufficient to prevent core or reactor coolant system (RCS) thermal design limits from being exceeded, and components and systems necessary to maintain these conditions are operating within their design limits. Safe shutdown can further be broken down into hot standby and cold shutdown based on the conditions of the reactor and RCS.

Safe Shutdown Area: An area completely enclosed by ASTM rated fire barriers, or a configuration, which can be considered to provide separation equivalent to rated fire barriers, which contains systems, equipment or components necessary to achieve and maintain safe shutdown.

Safe Shutdown Circuit: An electrical circuit (including its associated circuits of concern), which if damaged by a fire, can prevent a safe shutdown component from performing its safe shutdown function. A cable in the circuit, which is exposed to a fire, is assumed to fail as defined under Cable Failures.

Safe Shutdown Equipment: Equipment required to achieve and maintain safe shutdown. This includes equipment whose active function is required to support safe shutdown, as well as equipment whose spurious operation could adversely affect safe shutdown. A list of safe shutdown equipment is provided in the Safe Shutdown Equipment List (SSEL) included in Appendix A of the SSAR.

Safe Shutdown System: A plant system or a portion thereof that is used to achieve and maintain Fire Safe Shutdown performance goals.

Sprinkler System: A network of piping connected to a reliable water supply that will distribute water throughout the area protected and will discharge water through sprinkler heads in sufficient quantity either to extinguish the fire or to prevent its spread. The system, usually activated by heat, includes a control valve and a device for actuating an alarm when the system is in operation.

Spurious Operation: The undesired operation of plant equipment, which adversely affects safe shutdown capability, caused by circuit failures (undesired energization or de-energized) resulting from fire damage.

Standpipe and Hose Systems: A fixed piping system with hose outlets, hose and nozzles connected to a reliable water supply to provide effective fire hose streams to specific areas inside a building.

Transient Fire Loads: Combustible material, which is not permanently installed.

Underwriters Laboratory (UL): Is an independent testing organization for public safety. It maintains and operates laboratories for the examination and testing of devices, systems, and materials to determine their relation to life, fire casualty, hazards, and crime prevention.

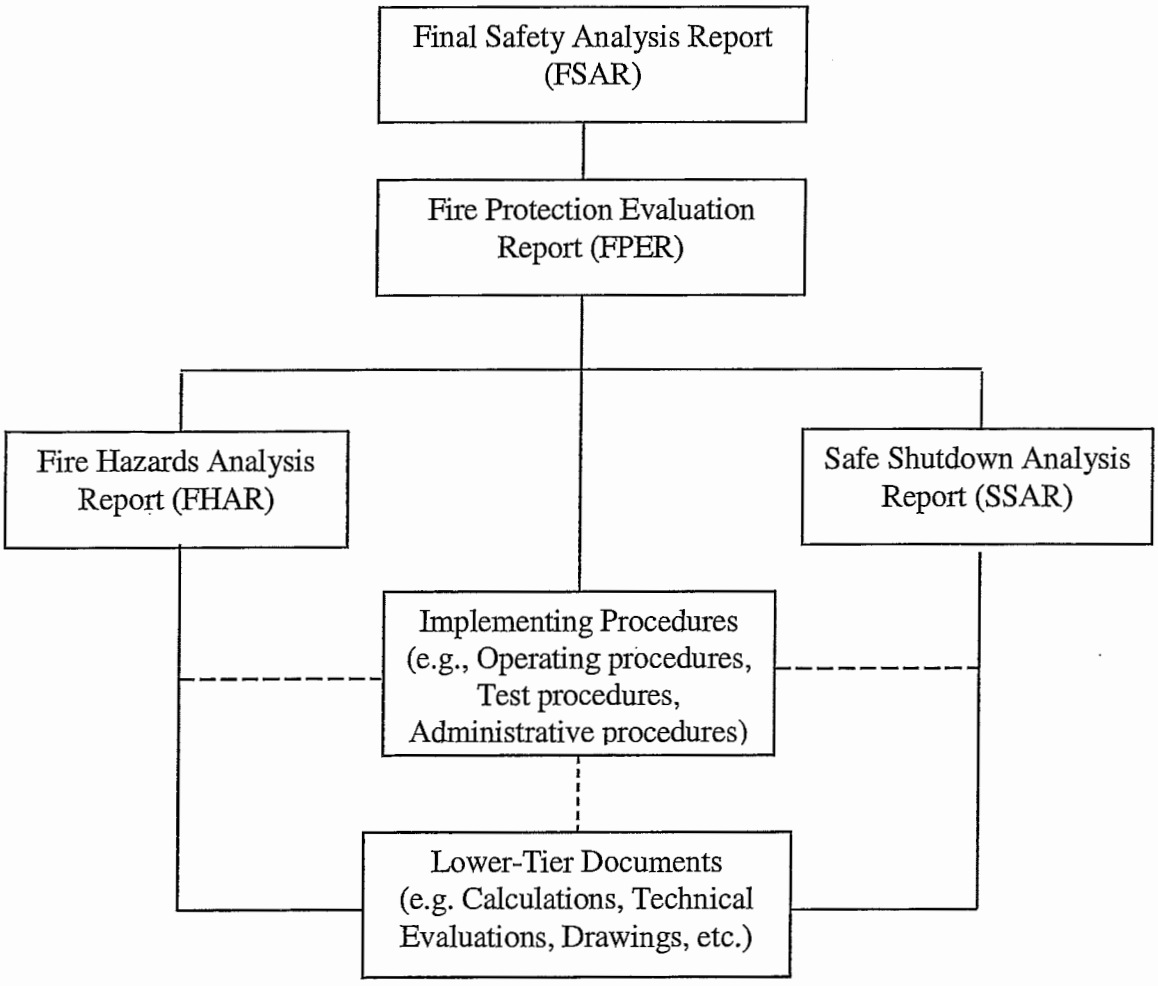
Unrecoverable Condition: A point in the sequence of an event where no reasonable action is available to recover plant conditions consistent with defined performance goals. Temporary deviation from performance goals is acceptable provided plant conditions can be restored prior to exceeding fuel cladding integrity or reactor coolant system pressure boundary integrity.

Water Spray System: A fixed pipe system connected to a reliable source of fire protection water supply and equipped with open head water spray nozzles for specific water discharge and distribution over the surface area to be protected.

2.0 DISCUSSION

2.1 PBNP FIRE PROTECTION PROGRAM DOCUMENTS

The following figure illustrates the upper-tier PBNP Fire Protection Program documents and their overall hierarchy for the PBNP Fire Protection Program. A brief description of each document follows that characterizes the purpose, level of detail, or other attributes helpful in defining the PBNP Fire Protection Program.



Final Safety Analysis Report (FSAR)

The FSAR is the highest level PBNP licensing basis document. The FSAR references the PBNP Fire Protection Evaluation Report (FPER) as the program description and licensing basis for the PBNP Fire Protection Program. The FPER is the "umbrella" document that describes the PBNP program requirements, including the commitments to 10 CFR 50.48, Branch Technical Position (BTP) APCSB 9.5-1 Appendix A and the applicable requirements of 10 CFR 50 Appendix R.

Fire Protection Evaluation Report (FPER)

The FPER is a summary-level document that describes the PBNP Fire Protection Program and how the program requirements are implemented. In certain cases, program requirements are explicitly described in the FPER, such as the fire protection operability action and surveillance requirements that were relocated from the Technical Specifications to the FPER. For the purpose of performing safety evaluations in accordance with 10 CFR 50.59, the FPER is considered a licensing basis document.

The FPER is organized the same as BTP CMEB 9.5-1, the NRC review guidance contained in the most recent revision of the Standard Review Plan. The FPER content is tailored for PBNP to reflect that the plant is licensed to an earlier version of the BTP and to the applicable requirements of 10 CFR 50 Appendix R. The FPER also has additional sections that address key attributes of the program that are not directly related to the regulatory guidance in BTP CMEB 9.5-1.

The FPER addresses both the earlier NRC requirements related to protecting the plant against fire hazards and the Appendix R safe shutdown regulations. It is intended that the FPER provide summary-level information regarding these general areas and that the next lower level of upper-tier documents provide more detailed but still summary-level information. As a result, the FPER refers to the SSAR and FHAR for supporting details related to the methodology, compliance approach, and results of supporting analysis.

Fire Hazards Analysis Report (FHAR)

The Fire Hazards Analysis Report (FHAR) provides plant as-built information characterizing the fire hazards and fire protection features on a zone-by-zone basis. The FHAR is consistent with the information submitted in 1977 that is part of the basis for the PBNP Safety Evaluation Reports (SERs) and their supplements referenced in License Condition 4.F and described in the FSAR and FPER.

The FHAR provides documentation links to various lower-tier documents such as the plant fire protection area drawings, system P&IDs, and applicable engineering evaluations. Regulatory commitments relating to specific plant areas appearing in PBNP SERs, etc. are identified in the applicable fire zone to assist PBNP personnel in identifying the impact of proposed changes on the Program. In addition, if Fire Protection Engineering Evaluations ("Generic Letter (GL) 86-10 evaluations") are applicable to a specific fire zone, they are referenced in the fire zone write-up. Proposed changes to a fire zone are evaluated in accordance with 10 CFR 50.59 as part of the modification process. Changes required to the FHAR are identified as part of the modification. The FHAR is updated to reflect changes to the plant.

Safe Shutdown Analysis Report (SSAR)

The Safe Shutdown Analysis Report (SSAR) is the upper-tier document that describes the analysis methodology, approach, key assumptions, and results, as supported by lower-tier information (e.g. analysis databases, design calculations, area evaluations, operator action feasibility studies, etc.).

The SSAR provides documentation links to the supporting lower-tier documents where the actual analysis and supporting documents reside. The SSAR is divided into five major sections:

- Introduction
- Safe Shutdown Systems and Components
- Safe Shutdown Circuit Analysis
- Safe Shutdown Equipment and Cable Locations
- Fire Area Analysis

A subset of this document is repeated in the FPER for the purpose of addressing key regulatory positions and the PBNP compliance approach. The FPER summary of the SSAR is more general and does not reference lower-tier documents.

Implementing Procedures

Post-fire shutdown procedures are provided to ensure operators have sufficient guidance and instruction to safely shutdown the plant in the event of fire. The procedures implement the shutdown methods that are supported by the safe shutdown analysis. Post-fire safe shutdown procedures are discussed in more detail in Section 5 of the SSAR.

Lower Tier Safe Shutdown Documentation

- ***Highlighted P&IDs and Single Line Diagrams***

  Highlighted P&IDs and Single Line Drawings provide a pictorial representation of flowpaths and boundary components that are relied upon to ensure the Appendix R performance goals are satisfied. The information on the P&IDs is arranged to indicate flow boundaries, equipment used for isolation, and process monitoring instrumentation. Separate P&ID sets are provided for Hot Standby and Cold Shutdown for each unit. Single line diagrams are highlighted to indicate alignment of power to support all potential safe shutdown scenarios. They identify the required safe shutdown power feeds to safe shutdown components.

- **Safe Shutdown Logic Diagrams and Safe Shutdown Equipment List**

  Safe Shutdown System and Component Logic Diagrams (SLD, CLDs) and an associated Equipment List (SSEL) identify the inter-relationship of essential plant systems and components required to achieve and maintain hot and cold shutdown in accordance with Appendix R requirements. The SLD provides a "big picture" overview and shows the relationships between the essential systems. Safe Shutdown CLDs provide the detailed component requirements for each of the systems described on the SLD. The logic diagrams are discussed in greater detail in Section 2 of the SSAR and are included as Appendix B to the SSAR.

- ***Fire Protection Engineering and Technical Evaluations***

  Fire Protection Engineering and Technical Evaluations (FPEEs and FPTEs) document various positions and analyses in support of the PBNP fire protection program. FPEEs typically address the impact of a non-conforming item on the defense-in-depth elements of the fire protection program, including impact on safe shutdown capability. FPTEs typically address the method and/or adequacy of PBNP's compliance with a fire protection program requirement.

- ***Safe Shutdown Calculations***

  There are many calculations that address various aspects of the safe shutdown analysis at PBNP. These calculations are controlled in accordance with the appropriate PBNP calculation procedures.

- ***Safe Shutdown Analysis Management System***

  The Safe Shutdown Analysis Management System (SSAMS) software is a relational database initially developed using Microsoft Access. SSAMS functions as the primary analysis tool and repository for data associated with the PBNP Appendix R safe shutdown analysis. Data includes information relating to equipment, cables, raceways, Fire Zones, Fire Areas, and compliance strategies. The database manages and controls the interrelationships that exist between the various data elements. These relationships may represent physical attributes (e.g., cables associated with a piece of equipment) or developed relationships (e.g., compliance strategies to ensure necessary shutdown functions).

2.2 DEFENSE-IN-DEPTH

The purpose of the fire protection program at PBNP is to provide assurance, through a defense-in-depth approach, that a single fire does not impair the safe operation or the safe shutdown capability of the plant and will not significantly increase the risk of radioactive release to the environment.

Defense-in-depth is implemented using a philosophy that starts with and emphasizes a strong fire prevention program to reduce or eliminate the potential for fires occurring at PBNP. In the event there is a breakdown of the prevention program, fire protection features have been incorporated into the plant design to ensure fires are detected early and contained to an area where they will not jeopardize the plant's safe operation or shutdown capability.

Preventive maintenance and administrative control programs exist to monitor and maintain these fire protection features to ensure they remain available. Alternative measures are taken to compensate for these features when they have been removed from service. This defense-in-depth fire protection program consists of a number of plant features, which together form the overall program. The program consists of both programmatic and plant fire protection equipment and systems. It also includes a fire protection safe shutdown analysis performed and maintained to demonstrate the plant's safe shutdown capability in the event of a fire in accordance with 10 CFR 50 Appendix R.

The fire protection program incorporates the following concepts:

- fire prevention,
- protection,
- detection,
- suppression,
- containment, and
- separation.

Fire prevention is the first priority of the fire protection program. Through employee education and training, housekeeping guidelines, control of ignition sources, and fire hazard control, an effort is made to minimize the probability of a fire event. In addition, periodic recorded tours are conducted to monitor the effort and initiate corrective action where needed.

Fire protection features have been strategically incorporated into the plant design to control and limit fire damage in the unlikely event a fire does occur. These fire protection features include fire detection, automatic and manual fire suppression systems and fire barriers or spatial separation.

Detection is provided in appropriate plant areas. Early detection of a fire and subsequent response will limit the spread of fire and resultant damage to equipment. Detection is provided by fixed systems and use of fire watches in instances where suppression systems may be out of service.

Suppression capability is provided as the next level of defense in depth. Suppression systems including Halon 1301, water, and dry chemical are provided to control and extinguish unwanted fires that may occur. Included in suppression is the complement of manual fire fighting devices such as fire extinguishers and fire hose stations that are provided for use by a trained plant fire brigade.

Containment is provided to ensure that unmitigated fires will not spread to involve secondary areas or equipment. Containment typically consists of fire barriers of an adequate fire-resistive rating to confine the potential fire exposure to a predetermined area.

Separation of critical components is used to ensure that a single fire event cannot affect both components. The separation can be by physical distance or by barriers similar to fire-resistive walls.

All the fire protection features used for the above-listed concepts are based on the sound fire protection engineering application of guidelines available in insurance and industry standards, building codes, and acceptable test data, including the National Fire Protection Association standards. Experienced and qualified fire protection engineers ensure adequate fire protection is achieved for particular plant conditions by applying the applicable guidance from the pertinent codes and standards. Existing fire protection systems at the plant have been determined by qualified fire protection engineers to provide adequate protection against fire and meet the intent of the applicable codes and standards.

The objectives of the fire protection systems are to provide:

- Automatic fire protection for known hazardous areas where it is practical to do so,
- Adequate warning of fire in hazardous areas where automatic protection is not feasible,
- Adequate manually-actuated fire protection systems for the entire plant and yard areas (e.g., hose stations, hydrants, etc.) and
- Assurance that the maintenance of train integrity of safety-related systems.

This assures that the capability for safe shutdown of the reactors during and after a fire event.

PBNP also maintains Fire Protection Operating Conditions through the FPER, FSAR and license to ensure important fire protection systems are operable during plant operations.

2.3 LICENSING BASIS OF THE FIRE PROTECTION EVALUATION REPORT

NextEra Energy-Point Beach [hereafter referred to as 'the licensee'] is allowed to operate Point Beach Nuclear Plant, Units 1 and 2 subject to the conditions and requirements incorporated in the Facility Operating Licenses DPR-24 and DPR-27, respectively. The NRC licenses are issued pursuant with Section 104b of the Atomic Energy Act and 10 CFR Part 50. The licensee must operate Point Beach in accordance with and subject to the additional conditions specified in plant Technical Specifications contained in Appendices A and B of the license. In addition, Amendment 39 to License No. DPR-24 and Amendment 44 to License No. DPR-27, dated August 2, 1979 required the licensee to complete fire protection modifications listed in the NRC's Fire Protection Safety Evaluation Report (FPSER) and supplements to the FPSER. In addition, these amendments required the licensee implement and maintain the administrative controls identified in these FPSERs and supplements.

2.3.1 Regulatory Documents

2.3.1.1 Title 10 Of The Code Of Federal Regulations Part 50

10 CFR 50.48 requires each operating nuclear plant to have a fire protection plan that satisfies Criterion 3 of Appendix A to Part 50. This Fire Protection Evaluation Report has been developed for PBNP to satisfy this requirement.

The fire protection plan must describe the overall fire protection program for the facility, identify the various positions within the licensee's organization that are responsible for the program, state the authorities that are delegated to each of these positions to implement those responsibilities, and outline the plans for fire protection, fire detection and suppression capability, and limitation of fire damage. The plan must also describe specific features necessary to implement the program, such as administrative controls and personnel requirements for fire prevention and manual fire suppression activities, automatic and manually operated fire detection and suppression systems, and the means to limit fire damage to structures, systems, or components important to safety so that the capability to safely shutdown the plant is ensured. The fire protection plan and each change to the plan shall be retained until the NRC terminates the license and shall retain each superseded revision of the procedures for three years from the date it was superseded.

The Fire Protection Evaluation Report (FPER) and plant fire protection implementing procedures satisfy these requirements.

Appendix R to 10 CFR Part 50, which went into effect February 17, 1981, established the fire protection features required to satisfy Criterion 3 of Appendix A to 10 CFR Part 50 with respect to certain generic fire protection issues for nuclear power plants. The fire protection features described in Appendix R (except for the requirements of Sections III.G, III.J and III.O) are not applicable to nuclear plants licensed to operate prior to January 1, 1979, if those fire protection features had already been proposed or implemented by the licensee and accepted by the NRC staff as satisfying the provisions of Appendix A to BTP APCSB 9.5-1 and reflected in NRC Fire Protection Safety Evaluation Reports (FPSERs) issued prior to the effective date of the Appendix R rule (February 17, 1981) or prior to issuance of Appendix A to BTP APCSB 9.5-1 (August 1976).

Appendix R sets forth the regulatory fire protection requirements for safe shutdown of nuclear power plants docketed prior to January 1979. The NRC formally issued Appendix R with Generic Letter 81-12, which required all licensees to reassess their facilities with respect to safe shutdown capability (Section III.G), emergency lighting (Section III.J), and reactor coolant pump lube oil collection (Section III.O).

PBNP Units 1 and 2 were licensed to operate prior to January 1, 1979. Therefore, only sections pertaining to the plant's safe shutdown capability and Sections III.G, III.J, and III.O of Appendix R are applicable to PBNP. The fire protection features in Appendix R were proposed or implemented by the licensee and accepted by the NRC staff as satisfying the provisions of Appendix A to Branch Technical Position BTP APCSB 9.5-1 in NRC Fire Protection Safety Evaluation Reports (FPSERs). The PBNP FPSER was issued by the NRC on August 2, 1979. The FPSER is supplemented by docketed correspondence as detailed in Section 10.0. The approved fire protection features are summarized in this document and are described in the FHAR. PBNP subsequently committed to Section III.L of 10 CFR 50 Appendix R to provide alternate safe shutdown capability.

2.3.1.2 Branch Technical Position - APCSB 9.5-1 And Appendix A

Branch Technical Position (BTP) APCSB 9.5-1, "Guidelines for Fire Protection for Nuclear Power Plants Docketed Prior to July 1, 1976," was issued by the NRC in May 1976. It established the basic NRC fire protection guidance for nuclear power plants. Appendix A thereto, which was issued in September 1976, listed the requirements applicable to plants docketed prior to July 1, 1976. Clarifications and guidance with respect to permissible alternatives to satisfy these guidelines were provided in four other NRC documents.

- "Supplementary Guidance on Information Needed for Fire Protection Evaluation," dated October 21, 1976.
- "Sample Technical Specifications," dated May 12, 1977.
- "Nuclear Plant Fire Protection Functional Responsibilities, Administrative Control and Quality Assurance," dated June 14, 1977.
- "Manpower Requirements for Operating Reactors," dated May 11, 1978.

These documents and licensee responses to these documents set forth the original regulatory fire protection basis for PBNP. The fire protection features and proposed modifications to meet the Appendix A guidelines were first documented in the PBNP Fire Protection Review. Some of the positions submitted were accepted by the NRC others were not and were superseded by alternative measures. The final approved positions were incorporated into the NRC Fire Protection Safety Evaluation Reports.

2.3.1.3 Point Beach Nuclear Plant Fire Protection Review

PBNP was requested to submit a comparison of the plant fire protection program with respect to the guidelines in Appendix A to BTP 9.5-1. This was done in a document entitled, "Point Beach Nuclear Plant Fire Protection Review," (FPR) and was submitted to the NRC in June 1977. The FPR contained the original basic combustible loading evaluation for many of the fire zones at PBNP. The FPR also contained the original fire hazards analysis for the plant and comparison to Appendix A to BTP 9.5-1 fire protection guidelines, proposed modifications and justification for the adequacy of the fire protection program in each fire zone. Much of this information was accepted by the NRC and remains valid for design requirements (i.e. commitments to design and maintain fire protection systems in accordance with specific commercial fire protection codes and standards). The disposition of individual items is discussed in Section 2.3.1.9. The FPR has been retained as a reference document for these reasons, however, the FPER has superseded the FPR as the controlling document that describes the PBNP fire protection program, which satisfies the intent of the Facility Operating License Condition 4.F.

2.3.1.4 Codes And Standards

Commercial fire protection codes and standards (e.g., NFPA, UL, FM) are applicable to a significant portion of the fire protection program. Although Appendix R to 10 CFR Part 50 specifies a level of fire protection required to demonstrate the plant's safe shutdown capability for fire areas containing safe shutdown equipment, the commercial fire protection codes and standards specify the administrative, design, and manufacturing standards to be followed to achieve the level of fire protection required for property protection and NRC guidelines in Appendix A to BTP 9.5-1.

The NRC required the licensee to identify the level of compliance to specific NFPA codes and standards identified in the Appendix A to BTP 9.5-1 guidelines. The NFPA codes used and credited in the PBNP fire protection design were referenced in the FPR in response to Appendix A to BTP 9.5-1. These fire protection codes and standards form part of the design basis for the fire protection program and systems implemented at PBNP.

The specific codes and standards that apply can be found in the PBNP Fire Protection Design Basis Document (DBD) or original FPR. In general, PBNP uses and complies with these NFPA codes and standards whenever possible. However, knowing that the NFPA codes are consensus standards developed for commercial industry and not specifically for application in nuclear power plants, PBNP uses the NFPA codes as guidelines in the design and maintenance of plant fire protection programs and systems and attempts to meet the overall objectives of these standards as they apply in a nuclear power plant. Where deviations exist to significant code requirements in fire protection systems and/or features required for safe shutdown, an engineering analysis and justification is developed to demonstrate that an equivalent level of protection is achieved.

2.3.1.5 NRC Fire Protection Safety Evaluation Reports

The NRC Fire Protection Safety Evaluation Report (FPSER) was issued August 2, 1979 for PBNP. The FPSER is supplemented by docketed correspondence as detailed in Section 10.0. These safety evaluation reports were issued to document NRC acceptance of specific features in the PBNP fire protection program described in licensee submittals dated November 1, 1976, June 20, 1977, November 7, 1977, January 13, 1978, February 1, 1978, February 14, 1978, March 15, 1978, September 22, 1978, December 29, 1978, September 26, 1979, December 20, 1979, June 23, 1980, October 13, 1980, February 7, 1986, and February 29, 1988, which addressed plant compliance with Appendix A to BTP 9.5-1 fire protection guidelines.

2.3.1.6 Fire Protection Safe Shutdown Capability

The Safe Shutdown Analysis Report (SSAR) documents PBNP's Safe Shutdown capability, including Alternate Shutdown capability. See Section 2.1 for a description of the SSAR.

2.3.1.7 Generic Letter 86-10

Generic Letter 86-10, "Implementation of Fire Protection Requirements," was issued by the NRC to become effective in April 1986. This letter is a supplement to Appendix R and provides NRC interpretations of Appendix R requirements. Also, this letter accepts performance of technical evaluations under specific conditions as an alternative to requesting an exemption from the requirements of Appendix R. Conformance to the requirements of Generic Letter 86-10 is necessary to ensure the adequacy of the fire protection program and to ensure continued compliance with the technical requirements of Appendix R.

2.3.1.8 Summary Of Regulatory Commitments

Amendment 39 to Facility Operating License No. DPR-24 and Amendment 44 to Facility Operating License No. DPR-27, dated August 2, 1979 required that the fire protection modifications listed in the FPSER and supplements to the FPSER be completed. These modifications are identified in paragraphs 3.1.1 through 3.1.33 of the FPSER. Some of these modifications where later renegotiated and alternative solutions implemented. The summary of commitments through 1986 are described in the Fire Protection Commitments punchlist and the Fire Hazards Analysis Commitment list included in Tab III of Section 10.0, "References." Regulatory commitments pertaining to a specific fire protection feature are discussed in the appropriate section in the FPER or in the specific Fire Zone in the Fire Hazard Analysis Report (FHAR) under the section on "Regulatory Commitments."

The PBNP Summary of Commitments is a document, which lists NRC requests, licensee proposals and the action taken to resolve each item (see Tab III of Section 10.0). Many fire protection items were evaluated in more than one submitted document and in response to different regulatory requirements. Thus, not all proposed resolutions were accepted by the NRC, and many commitments were superseded by subsequent proposals.

In addition to completing the proposed plant fire protection modifications, the licensee is required to implement and maintain the administrative controls identified in section 6 of the FPSER dated August 2, 1979.

2.3.1.9 Revising Plant Fire Protection License Conditions

In 1995, the licensee requested and received a license amendment that allows the evaluation and change of the approved fire protection program without prior approval of the Commission only if those changes would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire. The licensee proposed this change in accordance with the guidance in NRC Generic Letters 86-10 and 88-12 to remove Section 15.3.14, "Fire Protection System," from the Technical Specifications and to relocate these requirements into the FPER. The NRC approved fire protection program is incorporated into the FSAR by reference, with the FPER being the controlling document for the fire protection program.

Changes to the fire protection program licensing basis can be made without prior NRC approval if those changes would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire. Because the FPER is incorporated into the FSAR by reference, such changes are subject to the requirements of 10 CFR 50.59, as directed in Generic Letter 86-10.

2.3.2 Fire Protection Technical Specifications

Wisconsin Electric Power Company applied for amendments to Facility Operating Licenses DPR-24 and DPR-27 for Point Beach Nuclear Plant, Units 1 and 2 to remove fire protection requirements from the Technical Specifications and incorporate them in PBNP's Final Safety Analysis Report and Fire Protection Evaluation Report (FPER).

The following sections of the FPER provide the technical specifications for:

- The PBNP Fire Protection Program, regarding Fire Brigade Staffing and Training requirements, (FPER Section 3.1.4.2 and 3.1.4.3)
- Limiting Conditions for Operation and Surveillance requirements associated with the plant fire protection systems, (FPER Sections 8.1 and 8.2)
- Reporting requirements should degradation of fire protection systems or components occur rendering the system(s) inoperable, (FPER Section 8.1.5)

These sections provide the operational conditions, remedial actions and test requirements for plant fire detection systems, fire suppression systems, fire barriers, and fire brigade staffing necessary to maintain nuclear safety and safe shutdown capability in accordance with 10 CFR 50 Appendix R.

Plant Technical Specification 5.4.1 requires that the fire protection program be implemented and maintained using approved plant procedures.

2.3.3 Final Safety Analysis Report (FSAR)

The PBNP Final Safety Analysis Report (FSAR) describes PBNP's safety analysis in support of the licensee's application for operating the facility. It discusses the design and safety objectives to be used in operation of the plant.

The FSAR identifies the FPER as the controlling document for the fire protection program.

2.4 ESTABLISHMENT AND USE OF FIRE AREAS/ZONES

Fire areas are plant areas bounded by fire rated barriers or a configuration that provides separation equivalent to rated fire barriers. Fire areas may also be bounded by spatial separation in the case of separate structures. Fire area boundaries may contain penetration seals, which have been determined to provide a fire resistance equivalent to the rating of the fire barrier. Fire area boundaries may also contain openings, which have been determined to provide separation commensurate with the hazard posed. A fire area shall have sufficient fire protection capability to withstand the hazards associated with the area and the fire protection capabilities must be evaluated.

This definition of fire areas for PBNP is consistent with the NRC definition of "Fire Area" in Generic Letter 86-10 as follows:

> "...The term 'Fire Area' as used in Appendix R means an area sufficiently bounded to withstand the hazards associated with the area from a fire outside the area. In order to meet the regulation, Fire Area boundaries need not be completely sealed floor-to-ceiling, wall-to-wall boundaries. However, all unsealed openings should be identified and considered in evaluating the effectiveness of the overall barrier. Where Fire Area boundaries are not wall-to-wall, floor-to-ceiling boundaries with all penetrations sealed to the fire rating required of the boundaries, licensees must perform an evaluation to assess the adequacy of fire boundaries in their plants to determine if the boundaries will withstand the hazards associated with the area and protect important equipment within the area from a fire outside the area. This analysis must be performed by at least a fire protection engineer and, if required, a system engineer..."

PBNP fire areas have been subdivided into fire zones, which, generally, are determined by room boundaries. Fire zones in the Auxiliary and Control Building are bounded in most cases by concrete walls, which are considered to provide resistance to the spread of fire, but are not necessarily fire rated by definition. Each fire zone containing systems, equipment or components necessary for safe shutdown is documented in the FHAR.

2.5 PROGRAM/CONFIGURATION CONTROL

Plant physical or programmatic changes that impact the PBNP fire protection features, fire protection commitments to the NRC, or insurance carrier requirements may result in the necessity to revise the FPER, FHAR and/or SSAR.

The procedure for initiating an FPER, FHAR or SSAR change request shall be made in accordance with procedure NP 5.2.11, Fire Protection Program Documentation. This procedure defines the procedural controls for maintaining these documents, which include:

- Specifies periodic updates,
- Changes are evaluated per the requirements of the 10 CFR 50.59 process, and
- Changes are evaluated per the requirements of the Facility Operating License Condition 4.F.

Lower tier documents supporting the Fire Protection Program are procedurally controlled by the requirements defined for that particular type of document.

3.0 FIRE PROTECTION PROGRAM REQUIREMENTS

3.1 FIRE PROTECTION PROGRAM

3.1.1 Fire Protection Organization

The Site Vice President is responsible for the overall administration of PBNP, including the fire protection program. The Site Vice President has charged the Plant Manager with the administration of the PBNP fire protection program. The fire protection organization and responsibilities are detailed in NP 1.9.14, Fire Protection Organization.

Qualifications of individuals in the fire protection organization are administratively controlled to ensure qualification of the individual commensurate with the position being held and the activities being performed.

3.1.2 Administrative Controls

PBNP procedures and policies are incorporated into the fire protection program in order to minimize the probability of a fire to occur and to ensure that systems and equipment are available and operable to quickly control and extinguish fires, which may occur.

Administrative procedures to control ignition sources, transient combustible material, penetration of fire barriers, housekeeping, etc., are provided to define guidelines for maintaining the plant free from fires and to minimize the impact of a fire should it occur.

Fire emergency plans, fire attack plans and fire emergency response guidelines are provided to ensure that forethought and planning will lead to efficient response to a fire emergency.

Testing, surveillance and maintenance procedures are provided to ensure that fire protection equipment is operable and ready to be used.

Testing, surveillance and maintenance procedures are provided to ensure that Appendix R Safe Shutdown Equipment will be available to perform its intended safe shutdown function.

3.1.2.1 Ignition Control

Administrative procedures are maintained to ensure positive control of welding, torch cutting, grinding, and open flame or spark producing operations, which are performed outside of designated hot work areas. This procedure is based on National Fire Protection Association standards and sound industrial loss prevention practices.

Ignition control permits are issued to ensure plant operating supervision is aware of hot work being conducted in the plant and to ensure proper precautions are taken to minimize the probability of a fire event.

3.1.2.2 Transient Combustible Control

An administrative procedure is maintained to provide guidelines for the appropriate handling and use of transient combustible material within the plant. This procedure is based on the guidance of National Fire Protection Association standards, evaluation of the level of hazard, and an evaluation of the level of protection in specific areas. This is done for both in-situ and transient combustible loading.

The procedure addresses the storage and handling of combustible materials associated with plant operation and maintenance, flammable and combustible liquids, wood, and plastic (including temporary storage). The procedure also addresses exposure to safe shutdown equipment. A permit system is in place for areas, which contain active safe shutdown equipment. The procedure is coordinated by the fire protection coordinator who also conducts weekly housekeeping tours in accordance with established procedures to ensure that the control of transient combustibles is effective in minimizing the exposure to safe shutdown equipment and preventing fires.

3.1.2.3 Intervening Combustibles

Procedural controls ensure that sensitive safe shutdown areas requiring horizontal separation remain free of intervening combustibles. These sensitive areas are typically governed by exemptions from the requirements of 10 CFR 50, Appendix R or Generic Letter 86-10 evaluations. The conditions of these documents require that these areas be maintained free of intervening combustibles between redundant safe shutdown circuits and/or equipment (e.g., combustible materials routed or present between redundant safe shutdown circuits and/or equipment).

3.1.2.4 Housekeeping

Administrative procedures are maintained to delineate housekeeping policies and practices and to outline the housekeeping responsibilities for maintaining the plant clean, orderly and safe from fire and/or personnel hazards. These procedures address the policies and practices that each individual worker is expected to follow in order to maintain the plant clean and orderly. This is done to promote personnel safety and minimize fire hazards.

3.1.2.5 Leaks And Spills Of Flammable Or Combustible Liquids

To aid operating personnel in the management of non-radiological spills, including spills of flammable/combustible liquids, administrative procedures have been established. These procedural guidelines provide guidance for response to an unplanned discharge, whether from a fire or environmental standpoint.

3.1.2.6 Penetrating Barriers

Administrative procedures are maintained to establish a method of administering the work performed on fire barriers to ensure penetrations are protected by approved methods and that the fire rating of barriers, doors, dampers, and penetration seals is maintained. These procedures also provide for the removal and replacement of specific covered cable trays in the Cable Spreading Room and Turbine Driven Auxiliary Feedwater Pump Room (Auxiliary Feedwater Pump Room) credited in PBNP exemptions to 10 CFR 50 Appendix R.

A permit system is used to ensure that fire barrier work is approved before it is started, that the control room is aware of degraded barriers, that barriers are either temporarily sealed or provided with an appropriate fire watch, and that the barrier is ultimately restored to a permanent arrangement.

3.1.2.7 Fire Protection Features Impairment Control

Appendix R fire protection equipment and fire barriers shall be maintained operable to the maximum extent possible. Procedural controls define the compensatory measures and fire watch duties when fire protection systems (e.g., fire doors, barriers, electrical raceway barriers, fire detection, and fire suppression systems, etc) and Appendix R safe shutdown systems or components are taken out of service. Refer to Section 9.0 for specific operability requirements and associated compensatory measures.

3.1.2.8 Plant Inspection Program

Administrative procedures provide a means to ensure the identification and correction of material deficiencies, industrial safety hazards, cleanliness and housekeeping deficiencies, and radiological protection deficiencies. The plant manager is responsible for the effectiveness of this procedure. Implementation of this program provides for regular plant tours conducted by management.

3.1.3 Training

3.1.3.1 General Employee

All employees, including contractors, with general plant access receive fire protection program related training on an annual basis. This training covers the administrative controls and fire emergency response guidelines.

3.1.3.2 Supervision

As appropriate, supervisors, including contractors, receive more comprehensive training concerning the requirements of plant administrative procedures. This additional training helps to ensure that the activities of each work group follow the procedures affecting the fire protection program.

3.1.3.3 Fire Watches

3.1.3.3.1 Hot Work

All employees who are designated to serve as fire watches for hot work activities covered under the ignition control procedure are trained in the areas of what to look for, how to respond, and the actual hands-on use of portable fire extinguishers. Fire watch responsibilities are described in administrative procedures.

3.1.3.3.2 Compensatory Actions

All employees who are designated to serve as fire watches for degraded fire protection systems/components, compensatory actions, or fire watch tours are adequately trained in general employee training to identify basic potential fire hazards and how to respond if they find adverse conditions or a fire. Fire watch responsibilities are described in administrative procedures.

3.1.4 Fire Brigade

3.1.4.1 Organization

The fire brigade is staffed, trained and equipped for fire fighting activities in accordance with Appendix A to BTP APCSB 9.5-1 Section B.5 and guidelines in NRC letter dated July 14, 1977, entitled, "Nuclear Plant Fire Protection Functional Responsibilities, Administration Controls and Quality Assurance." Additional support in the event of a fire is provided by the Two Creek Volunteer Fire Department.

3.1.4.2 Staffing

A site fire brigade of at least five members shall be maintained onsite at all times. The fire brigade consists of plant operations personnel. The five member fire brigade does not include the Shift Manager and the 3 members of the minimum shift crew necessary for safe shutdown of the plant and personnel required for other essential functions during a fire emergency. Fire brigade responsibilities and duties are outlined in administrative procedures. These duties are reviewed and discussed during training sessions and drills. A list of qualified fire brigade members is maintained by the PBNP Fire Protection Coordinator on a computer database.

This shift crew may be less than the minimum requirements for a period of time not to exceed 2 hours in order to accommodate unexpected absence of personnel, provided immediate action is taken to restore the shift makeup to within the minimum requirements.

The Two Creeks Volunteer Fire Department (TCVFD) will provide support in the event of a fire at the plant. Their response is considered in the overall fire protection program and they are included in the "Fire Protection Organization."

3.1.4.3 Training

Each member of the fire brigade is required to complete an established amount of classroom instruction and hands-on practical training in accordance with the Fire Protection Manual. The Fire Protection Manual identifies the methods and types of training for both initial and re-qualification training. Continuing training is conducted over a 2-year cycle. Training records are maintained by the PBNP Fire Protection Coordinator and Training Department.

Plant training is provided for TCVFD, which includes training in plant operational precautions during fire emergencies (e.g., radiation protection, security access requirements and special hazards at a nuclear power plant).

3.1.4.3.1 Initial Qualification

Initial qualification training is an in-depth review of manual fire fighting philosophy and tactics, fire protection equipment surveillance tests, and plant systems and equipment. This training also provides more intense practical and hands-on fire fighting experience.

3.1.4.3.2 Re-qualification

Re-qualification training is conducted on a 2-year cycle. This includes review of fire emergency plans, fire attack plans, administrative procedures, quarterly fire drills, quarterly fire brigade meetings, and annual practical hands-on fire fighting experience.

3.1.4.4 Fire Brigade Equipment

The fire brigade is provided with sufficient equipment to perform manual fire suppression operations, as required. Full personal protective gear, including self-contained breathing apparatus with reserve breathing air, is provided. Fire fighting equipment is located throughout the plant to facilitate brigade use and response. Portable smoke removal equipment is available for use by the fire brigade, if necessary.

Portable radios are used for primary communications between the brigade and the control room in fire emergencies.

3.1.4.4.1 Self-contained Breathing Apparatus (SCBA)

Units are provided at the plant to meet the needs of the fire brigade and emergency plan response. The total number of units and charged spare cylinders that are available ensures ample breathing air capacity. Additional units are provided for training purposes.

3.1.4.4.2 Turnout Gear

Approved coats, helmets, boots, and gloves are provided in a variety of sizes to ensure personal protection of each fire brigade member while fighting structural fires. This equipment is located at the fire brigade ready station and at two other locations in the plant to ensure accessibility at all times.

3.1.4.4.3 Fire Hose and Nozzles

Fire Hose - The significant details for fire hose types used at PBNP are discussed in FPTE 013, PBNP Fire Hose Details. Specific commitments to fire hose types, their location, and use may be found in the Fire Hazards Analysis Report.

Fire Hose Nozzles - All fire fighting nozzles are listed for fire fighting use. Each is capable of shutting off the flow of water. Nozzles are capable of straight stream or fog patterns. In areas where energized electrical equipment is located in the principal area of coverage, only the fog pattern nozzles are used. Nozzles vary from 1 to 2-1/2 inches.

PBNP has specific commitments regarding the type and location of interior fire hose stations and electrically rated fire hose nozzles in the August 1979 fire Protection SER (in Section 10.0).

3.1.4.4.4 Smoke Ejectors

There are two mechanical smoke ejectors provided to remove smoke from a fire area. Both smoke ejectors are electric; the power source for one unit is 120VAC through an extension cord, the other unit is battery powered.

In addition, a fixed smoke exhaust system is provided for the cable spreading room, control room, and computer area. The fire brigade is trained in hoseline ventilation techniques. Fixed ventilation systems can also be used under some conditions to ventilate areas.

3.1.4.4.5 Emergency Lighting

Fixed units are located along the normal access paths and near safe shutdown equipment in accordance with 10 CFR 50 Appendix R Section III.J.

In addition, eight hour battery backed portable lanterns are available at several locations in the plant for use by plant operators and the fire brigade. These units are identified for emergency use only. The units are periodically inspected.

3.1.4.4.6 Miscellaneous Equipment

Other equipment available for fire brigade use includes: FM communication radios, axes, pike poles, foam and foam eductors, spanner wrenches, and other minor available tools.

3.1.4.5 Pre-Fire Planning

3.1.4.5.1 Fire Emergency Plans (FEPs)

The Fire Protection Manual provides a reference document with the appropriate information so that the fire brigade may conduct a safe and effective attack on a fire in a particular plant area.

The location of the general plant area covered by the plan is provided by common name and elevation. Guidelines for fire attack are provided to enhance the attack and provide an awareness of the safety of individual fire fighters. Fire, radiological, electrical, and physical hazards are listed for each plan area. Adjacent hazards or areas of easy fire extension are listed as exposures. Communications are listed as to the acceptability of FM radio transmissions and location of public paging stations. Access and egress to areas are indicated to ensure prompt fire brigade response and to point out possible escape routes. Ventilation methods and precautions are provided. Installed fire suppression systems located in the plan area are indicated, along with available fire suppression equipment located nearby. The general plan includes notes on construction details to aid in determining the possibility of fire spread or collapse of structures.

General electrical equipment in the areas are listed. However, the controls to deenergize and isolate equipment is not included in the FEPs. This information is available to plant operations from other controlled document sources readily available to plant operators.

3.1.4.5.2 Fire Attack Plans (FAPs)

The Fire Protection Manual provides guidance to the fire brigade for attacking the various classes of fire or combinations of fires that can occur at the plant.

Basic information is provided that is most useful as a training aid, but is available for ready reference by the fire brigade as needed.

Handling fires involving PCB-containing equipment is specifically addressed in order to minimize the spread of contamination and to minimize exposure to fire brigade members.

3.2 FIRE HAZARDS ANALYSIS REQUIREMENTS

A fire hazard analysis was performed to demonstrate that the plant will maintain the ability to safely shutdown in the event of a fire. The analysis considers potential in situ fire hazards, determines the consequences of fire in any plant location; and specifies fire detection, fire suppression and compartmentalization requirements. Refer to Section 7.0 for a more detailed discussion of the Fire Hazards Analysis Report (FHAR).

3.3 FIRE SUPPRESSION SYSTEM DESIGN BASIS

In general, total reliance is not placed on a single fire suppression system. Automatic sprinkler and water spray protection is provided in many areas of the plant. Automatic total flooding Halon 1301 suppression systems are provided for plant areas where other fire suppression agents could damage sensitive equipment. Automatic dry chemical extinguishing systems are provided for the plant turbine generator bearings and for the gas turbine generator exhaust bearings. Manual fire suppression equipment, including hose stations and portable fire extinguishers, are located throughout the plant to be used for the manual application of fire suppression agents.

The two fire pumps are redundant, full capacity pumps with independent power supplies and controls. The two fire pumps are separated by a partial height partition.

A single break in a section of the 10-inch yard fire main will not interrupt the fire protection capability. The yard fire main and distribution piping system are installed such that the subsystems are fed from two runouts that connect to the yard main. Thus, the single failure criteria is satisfied.

A loss of electrical power to the Fire Protection System does not degrade system operation. The wet pipe sprinkler and deluge systems do not rely on electrical signals for their operation. The Halon systems have been designed with redundancy in detection, initiation and actuation mechanisms to provide a single active failure-proof system.

The loss of instrument air does not affect the wet pipe sprinkler and deluge systems. The deluge systems are actuated via pneumatic signals. An air reservoir, isolated from the air supply by a check valve, allows normal system actuation if instrument air is lost.

The original plant design did not require the operation of the Fire Protection System after a severe natural phenomena occurring on a frequency less than once in 10 years, or man-created events, except lightning. Lightning arrestors are installed in accordance with the Wisconsin Administrative code and with applicable portions of NFPA 78.

Portions of the Fire Protection System required to protect areas in and around safety related equipment are largely located in Seismic Category I structures, or buried below grade. Lightning is not considered a source of fire in or near safety-related areas.

Flooding caused by the inadvertent operation of automatic fire suppression systems will not degrade safety-related equipment as evaluated in FPTE-002. Drains in these areas are capable of passing the expected flows as a result of system actuation and manual hose application.

In areas where the application of hose streams present the potential for flooding, drains are adequately sized to pass the expected flow. The use of pedestals, curbs and other barriers provides added margin for the protection of redundant safety systems from the effects of water runoff.

Components of the water type fire suppression systems are located in a manner that will not result in the loss of safety-related systems or components. This was evaluated as part of the analysis for flooding due to non-Category I pipe failure. Based on the flooding analysis, a postulated piping failure will not incapacitate redundant safety-related systems, which are necessary for safe plant shutdown.

3.4 ALTERNATIVE SHUTDOWN DETERMINATION

The safe shutdown analysis was performed to consider the potential fire damage to the plant shutdown capability and to demonstrate that the plant can achieve safe shutdown in accordance with the requirements of 10 CFR 50.48 and 10 CFR 50 Appendix R for a fire in any location of the plant. Refer to Section 5.2 for safe shutdown capability evaluation and for alternative shutdown capability.

The following areas have been identified as alternative shutdown areas:

- Control Room,
- Cable Spreading Room,
- Computer and Instrument Rack Room,
- 4160 V Vital Switchgear Room,
- Monitor Tank Room (C-59 area) and Primary Auxiliary Building. 26' Central Area, and
- Component Cooling Water Heat Exchanger and Boric Acid Tank Room (Auxiliary Building. 44' Central Area).

4.0 FIRE PROTECTION QUALITY ASSURANCE PROGRAM

The Quality Assurance Topical Report (QATR), assures that the requirements for design, procurement, installation, testing, and administrative controls for the Fire Protection Program (FPP) in areas of the plant, which contain or expose equipment, components, or cabling necessary to achieve safe shutdown of both units in accordance with the requirements of 10 CFR 50, Appendix R are satisfied. The quality assurance provisions for fire protection apply to activities performed since the QATR commitments delineated in the S. Burstein (WE) to E. Case (NRC) response letter dated February 1, 1978 and August 1979 Fire Protection SER (included in Section 10.0).

The QATR is under the management control of the Quality Assurance (QA) organization. This control consists of (1) formulating and/or verifying that the fire protection QATR incorporates applicable requirements and is acceptable to the management responsible for fire protection and (2) verifying the effectiveness of the QATR for fire protection through reviews, surveillance, and audits.

Performance of other QATR functions for meeting the FPP requirements may be performed by personnel outside of the QA organization. The QATR for fire protection is part of the overall QATR. The QATR criteria apply to those items within the scope of the FPP, as described in Quality Assurance Program.

PBNP meets the fire protection QATR criteria of Appendix A to BTP 9.5-1 by implementing those portions of the QATR under 10 CFR Part 50 Appendix B that apply to fire protection.

4.1 DESIGN CONTROL AND PROCUREMENT DOCUMENT CONTROL

Measures are established to assure that:

a. Design and procurement document changes, including field changes and design deviations are subject to the same level of controls, reviews, and approvals that were applicable to the original document.

b. Quality standards are specified in the design documents, such as appropriate fire protection codes and standards, and deviations and changes from these quality standards are controlled.

c. New designs and all plant modifications, including fire protection systems, are reviewed by qualified personnel to assure inclusion of appropriate fire protection requirements. These reviews include items such as:

    1) Design reviews to verify adequacy of wiring isolation and cable separation criteria.

    2) Design reviews to verify appropriate requirements for room isolation (sealing penetrations, floors, and other fire barriers).

d. A review and concurrence of the adequacy of fire protection requirements and quality requirements stated in procurement documents are performed and documented by qualified personnel. The reviews determine that fire protection requirements and quality requirements are correctly stated, inspected, and controlled; that there are adequate acceptance and rejection criteria; and that the procurement document has been prepared, reviewed, and approved in accordance with QATR requirements.

These measures are established through administrative procedures that govern modification request design control and engineering change requests. Each modification and design must be screened for its impact on fire protection and Appendix R safe shutdown using the Design Input Checklist and, as applicable, the Fire Protection Conformance Checklist (FPCC) form PBF 2060 series, which is described in design guide DG-F01.

Fire protection of structures, equipment and property at PBNP for Appendix R must satisfy the requirements of the Wisconsin Administrative Code, OSHA, and the insurance carrier. These requirements are normally satisfied through compliance with NFPA standards. Where literal compliance with NFPA standards cannot be achieved, Fire Protection engineers have evaluated the fire protection features installed and have determined that protection equivalent to NFPA standards is provided.

4.2 INSTRUCTIONS, PROCEDURES AND DRAWINGS

Inspections, tests, administrative controls, fire drills, and training that govern the FPP are prescribed by documented instructions, procedures, or drawings and are accomplished in accordance with these documents. The following provisions are included:

a. Indoctrination and training programs for fire prevention and fire fighting are implemented in accordance with documented procedures.

b. Activities such as design, installation, inspection, testing, maintenance, and modification of fire protection systems are prescribed and accomplished in accordance with documented instructions, procedures, and drawings.

c. Instructions and procedures for design installation, inspection, testing, maintenance, modification, and administrative controls are reviewed to assure that the fire protection requirements, such as precautions, control of ignition sources and combustibles, provisions for backup fire protection of the activity requiring the disabling of the fire protection system, and restriction on material substitution unless specifically permitted by design and confirmed by design review are properly included.

d. The installation or application of penetration seals, fire wraps, and fire breaks is performed by trained personnel using approved procedures.

4.3 CONTROL OF PURCHASED MATERIAL, EQUIPMENT AND SERVICES

Measures are established to assure that purchased material, equipment and services conform to the procurement documents. These measures include:

a. Provisions, as appropriate, for source evaluation and selection, objective evidence of quality furnished by the contractor, inspections at suppliers, or receiving inspections.

b. Source or receiving inspection, as a minimum, for those items whose quality cannot be verified after installation.

4.4 INSPECTION

A program for inspection of activities affecting fire protection is established and implemented by or for the organization performing the activity to verify conformance to documented installation drawings and test procedures for accomplishing activities. This program includes:

a. Procedures, which ensure inspections of installation, maintenance, and modification of fire protection systems to assure conformance to design and installation requirements. Required inspections will be specified by established procedures.

b. Procedures, which ensure the inspection of penetration seals, fire wraps, and fire breaks to verify that the installation activity is completed satisfactorily. Required inspections will be specified by established procedures.

c. Validation of safe shutdown cable routing to verify conformance with design requirements. (Controlled and evaluated through the Fire Protection Conformance Checklist, Cable and Raceway Data System, and the Safe Shutdown Analysis Report).

d. Procedures, which ensure that appropriate room isolation methods (sealing penetrations, floors, and other fire barriers) are, employed during construction and maintenance activities to satisfy fire protection program requirements.

e. Measures to assure that inspection personnel are independent from the individuals performing the activity being inspected.

f. [Deleted]

g. [Deleted]

h. Procedures, which ensure periodic inspection of materials subject to degradation such as fire breaks, seals, and fire wraps to assure that these items have not deteriorated or been damaged.

4.5 TEST AND TEST CONTROL

A test program is established and implemented to ensure that testing is performed and verified by inspection and audit to demonstrate conformance with design and system readiness requirements. The tests are performed in accordance with written test procedures; test results are properly evaluated and acted on. The test program includes the following:

a. Installation Testing - Following construction, modification, repair, or replacement, sufficient testing is performed to demonstrate that fire protection systems will perform satisfactorily in service and that design criteria are met. Written test procedures for installation tests incorporate the requirements and acceptance limits contained in applicable design documents.

b. Periodic Testing - The schedules and methods for periodic testing are developed and documented. Fire protection systems and equipment are tested periodically to assure that the equipment will function properly and continue to meet the design criteria (see applicable PC and TS 70 Series procedures, and PT-FP series procedures).

c. Periodic observations and/or audits by Nuclear Oversight will be conducted to verify fire protection systems are tested as required either by direct observation and/or review of completed test documentation. These observations and audits are conducted on a sample of the fire protection system testing.

d. Test results are documented, evaluated, and their acceptability determined by a qualified responsible individual or group.

e. Refer to Section 9.0 for a discussion of testing, inspection, and maintenance of Appendix R Safe Shutdown Equipment.

4.6 INSPECTION, TEST AND OPERATING STATUS

Measures are established to provide for the identification of items that have satisfactorily passed required tests and inspections. These measures include provisions for identification by means of tags, labels, or similar temporary markings to indicate completion of required inspections and tests, and operating status.

4.7 NONCONFORMING ITEMS

Measures are established to control items that do not conform to specified requirements to prevent inadvertent use of installation. Non-conformances are identified in accordance with the requirements of the Corrective Action Program. These measures include provisions to assure that:

a. Nonconforming, inoperative, or malfunctioning fire protection systems are appropriately tagged or labeled.

b. The identification, documentation, segregation, review disposition, and notification to the affected organization of nonconforming materials, parts, components, or services are procedurally controlled.

c. Documentation identifies the nonconforming item, describes the nonconformance and the disposition of the nonconforming item, and includes signature approval of the disposition.

d. Provisions are established identifying those individuals or groups delegated the responsibility and authority for the disposition and approval of nonconforming items.

4.8 CORRECTIVE ACTION

Measures are established to ensure that conditions adverse to fire protection such as failures, malfunctions, deficiencies, deviations, defective components, uncontrolled combustible material and non-conformances are promptly identified, reported, and corrected as required by the Corrective Action Program. These measures assure that:

a. Procedures are established for evaluation of conditions adverse to fire protection (such as nonconformance, failures, malfunctions, deficiencies, deviations, and defective material and equipment) to determine the necessary corrective action.

b. In the case of significant or repetitive conditions adverse to fire protection, including fire incidents, the cause of the conditions is determined and analyzed and prompt corrective actions are taken to preclude recurrence. The cause of the condition and the corrective action taken are promptly reported to cognizant levels of management for review and assessment.

4.9 RECORDS

Records are prepared and maintained to furnish evidence that the criteria enumerated above are being met for activities affecting the Fire Protection Program. Administrative procedures are maintained, which ensure that Fire Protection Program records are appropriately addressed. The following provisions are included:

a. Records are identifiable and retrievable and should demonstrate conformance to fire protection requirements. The records should include results of inspections, tests, reviews, and audits; nonconformance and corrective action reports; construction, maintenance, and modification records; and certified manufacturers' data.

b. Record retention requirements are established.

4.10 AUDITS

Audits are conducted in accordance with the Quality Assurance Topical Report.

5.0 GENERAL PLANT FIRE PROTECTION GUIDELINES

5.1 BUILDING DESIGN

General plant construction provides for significant compartmentalization with most walls of concrete construction. The configuration will greatly impede the spread of fire throughout any of the structures. The plant has been segregated into fire zones and fire areas for evaluation purposes. The location of plant fire barriers, fire zones and fire areas are shown on drawings PBC-218 Sheets 1-27. Fire zones containing shutdown equipment at PBNP consist mostly of reinforced concrete construction as described in the fire zone fire and hazard evaluations.

5.1.1 Plant Layout Separation

Redundant safe shutdown related equipment, components, and systems are provided with adequate spatial separation or are separated by fire resistant barriers as described in the technical evaluations and in the safe shutdown analysis according to the separation requirements prescribed in 10 CFR 50, Appendix R, Section III.G. Where this separation could not be provided, an alternative method of protection was provided and an exemption was requested to the specific requirements in Section III.G.

5.1.2 Fire Barriers

Walls, floors, and ceilings enclosing fire areas utilize fire resistant construction with a minimum concrete thickness of ten inches. Using the 1977 edition of the Pre-stressed Concrete Institute (PCI) publication, "Design for Fire Resistance," it has been estimated that for the worst case condition using siliceous aggregate, 6.2 inches of concrete would be required for a 3-hour fire rating. Therefore, plant barriers with a minimum thickness of 10 inches are considered to provide an equivalent 3-hour fire rating.

The construction of hollow concrete block walls has been evaluated in accordance with accepted standard designs such as UL fire resistance ratings to ensure the protection provided is appropriate for the area protected. Other special cases (e.g., metal wall panels with fire resistant coatings) have been evaluated to ensure the fire resistance provided is commensurate with the boundary of the area protected. Underwriters' Laboratories, Inc. listed fire doors and dampers have been installed to protect barrier door and duct openings commensurate with the boundary protection for the area. Doors and dampers receive periodic surveillance to ensure operability. Special cases, such as door openings protected with spray nozzles or solid steel ventilation ducts penetrating fire barriers, have been evaluated to determine the equivalent fire resistance rating as described in specific fire zone hazard evaluations.

5.1.3 Openings in Fire Barriers

5.1.3.1 Fire Dampers

Fire dampers in rated barriers are rated commensurate with the fire resistance rating of the barrier. Solid steel ventilation ducts without fire dampers that penetrate the fire barriers are evaluated to determine the equivalent fire resistance rating. Fire dampers receive periodic surveillance to ensure operability.

5.1.3.2 Fire Doors

Fire Doors in barrier walls, including frame and installation hardware, are rated commensurate with the fire resistance rating of the barrier. Only labeled or listed doors are used. Where listed doors are not available for specific applications engineering evaluations have been performed. Entranceways in fire barriers without doors that are protected by spray curtains are discussed in Section 5.1.11.

5.1.3.3 Fire Barrier Penetration Seals

Fire penetration seals are provided for the appropriate mechanical and electrical fire barrier penetrations in credited fire barriers. Penetration seals are installed in accordance with approved seal designs by a qualified installer. The seal designs have been tested and are qualified to provide a fire resistance rating commensurate with the barrier in, which they are installed.

5.1.3.4 Internal Conduit Fire Seals

Conduits that penetrate fire barriers have been conservatively provided with internal seals, either at the wall or at the first available access point of the conduit. Small conduits that are provided for items such as lighting circuits and are embedded in the concrete construction are not considered to be paths for the spread of fire and have not been sealed. In general, sealing conduits internally is not considered to be necessary as this is not a viable path for the spread of fire across barriers. This position is supported by general fire protection practice and available test data. Internal seals can serve as a means of preventing the spread of products of combustion where conduits terminate with an open end (i.e., not at a fitting or piece of equipment).

The general installation criteria for installing internal conduit seals at PBNP includes:

1. Conduits of two (2) inch diameter or larger that terminate within an area shall be sealed at the first available fitting after penetrating the fire barrier. The seal shall consist of a noncombustible material such as "Kaowool" ceramic fiber, hand packed into the conduit or fitting to close any void space between the cable and the inner wall of the conduit. A conduit thus sealed shall then have the fitting cover put in place and painted, receive a penetration number and be entered into the penetration seal list and drawings as is currently done with silicone seals. Conduits less than two (2) inches in diameter, which terminate less than one (1) foot from the fire barrier shall be sealed in the same manner.

2. Conduits less than two (2) inches in diameter, which terminate one (1) foot or more from the fire barrier need not be sealed.

3. Conduits that run through a fire area but do not terminate in that area need not be sealed in that area.

In order to maintain control and uniformity for the installation of new conduit seals, this criteria is included in the plant administrative procedures, which control fire barrier penetrations.

Rooms protected with a Halon suppression system shall have conduits sealed as described above. In addition, conduits less than 2 inches in diameter, which terminate open shall also be sealed as described above. Due to the physical properties of Halon it is doubtful that appreciable leakage or agent dilution would occur through small diameter open conduits or through a conduit penetration other than large diameter, open conduits near floor level. Therefore, this is considered a conservative approach that will minimize the probability that total Halon leakage from the room will result in a dilution of the extinguishing agent concentration due to modifications, which involve additional conduit penetrations of the room boundaries.

5.1.3.5 Ventilation System Penetrations

Penetration openings for ventilation systems in Appendix R boundary walls are protected by fire dampers that exhibit a rating that is commensurate to the fire rating of the wall in, which they are installed. Where fire dampers are not provided, an engineering evaluation has been performed to demonstrate the capability of the penetration to withstand the effects of the fire hazard posed per the guidance of Generic Letter 86-10.

5.1.3.6 Equipment Hatches

Floor plugs for equipment hatches in credited barriers are considered to be part of the fire barrier. They are identified by warning signs indicating that plug removal requires a permit.

5.1.3.7 Access Test Ports through Fire Barriers

Access test ports through fire barriers are provided for general testing and maintenance activities. The test ports are filled with mineral wool and capped when not in use. When in use they are treated as temporary fire penetration seals.

5.1.4 Structural Steel Fire Proofing

Original plant construction provided for concrete enclosure of most structural steel located below the 46' elevation of the PAB and inside the containment structures. Protection of exposed structural steel in other plant areas is provided by sprayed on fire proofing material, where the exposed steel is integral to the construction of an Appendix R credited fire barrier and has been determined to be susceptible to the effects of fire in the area.

5.1.5 Spatial Separation

Redundant safe shutdown related equipment, components and systems are provided with adequate spatial separation or are separated by fire resistant barriers as described in the safe shutdown analysis according to the separation requirements of 10 CFR 50, Appendix R, Section III.G. Fire areas are bounded by 3-hour rated fire barriers, spatial separation, or other configurations considered to provide separation equivalent to fire rated barriers or adequate for the hazard in accordance with GL 86-10. Because of the heightened threat of fire posed by transient combustibles, certain sensitive areas have been identified, within which the storage of transient combustibles is excluded. Safe Shutdown areas, which are required to be maintained free of intervening combustibles, are controlled to prevent the installation of in-situ combustible materials.

5.1.6 Personnel Access and Egress Routes

Plant access and egress routes are maintained free of obstacles to ensure escape routes, access routes for fire fighting, or access to areas containing equipment necessary for safe shutdown are available during a fire event. Fire exits are clearly marked. Availability of these routes is maintained by periodic tours and design controls.

Enclosed stairwells are enclosed with 2-hour rated walls and self-closing Class B fire doors. Elevator hoistways are constructed similar to stairwells except the sliding elevator doors are 1-1/2 hour rated. In addition, a number of open stairwells are provided throughout the plant. These stairwells open and closed, are designed and located to serve as functional personnel traffic routes, escape routes and access routes for fire fighting.

5.1.7 Construction Materials

Interior walls and structural components are noncombustible steel, concrete, concrete unit masonry, gypsum board, and metal studs. Thermal insulation, where used, is noncombustible glass fiber. Insulated panel walls where used are composed of a noncombustible core with asbestos cement facings. Radiation shielding consists primarily of concrete, concrete unit masonry and lead. Soundproofing, where utilized, is incorporated within noncombustible and insulating materials.

Interior finishes such as gypsum plaster, ceramic tile and acoustical ceiling materials are noncombustible. Epoxy coatings, alkyd and latex paints are used.

Typically building roofs consist of standard multi-ply, built-up roof designs. These designs employ several layers of saturated felts/fabrics, or mats between, which are alternate layers of bitumen. The roof design is built-up on a non-combustible steel or concrete deck. Roofing materials and designs installed at Point Beach comply with the pertinent Building Code-of-Record and insurance requirements.

Suspended ceilings and their supports are of noncombustible construction. Acoustical board lay-in units for the exposed systems and acoustical tile for the concealed systems are noncombustible mineral fiber with a flame spread rating of 25 or less. By design, concealed spaces are devoid of combustibles.

5.1.8 Indoor Transformers

Transformers located inside buildings are air cooled or insulated and cooled with a noncombustible fluid and contain no flammable oil.

5.1.9 Outdoor Transformers

The main unit auxiliary and station auxiliary transformers are oil cooled and are greater than 50 feet from the Containments, Control Building and the Auxiliary Building.

The Unit 1 main and unit auxiliary transformers, located near the south wall of the Turbine Building, are protected by automatic deluge systems. The Turbine Building wall in this area is a combination of masonry construction with a 3-hour fire resistant rating and steel panel siding protected by water sprays. The Unit 2 main and unit auxiliary transformers, located near the west wall of the Turbine Building, are protected by automatic deluge systems. The Turbine Building wall in this area is masonry construction with a 3-hour fire resistance rating. The high voltage station auxiliary transformers, located in the switchyard, are not protected. The low voltage station auxiliary transformers, located west of the Primary Auxiliary Building, are protected by automatic deluge systems.

5.1.10 Floor Drains, Curbs and Dikes

Floor drains in areas containing sprinkler and deluge systems are capable of passing the expected flows occurring due to system actuation and manual hose application. No flooding of safety-related equipment will occur when these systems are operating during a fire event. Drains in other areas are adequate to pass the expected flow from hose lines except there are no drains in the control room, cable spreading room, and electrical switchgear room. The cable spreading room and electrical switchgear room are protected by Halon 1301 suppression system. In the control room, chemical and carbon dioxide extinguishers are the primary means of fire suppression.

The use of pedestals, curbs and other barriers provides added margin for the protection of safety systems from the effects of firewater runoff.

In the areas where the Halon 1301 suppression system are installed there are no drains or the drains are sealed or the system is sized to compensate for the loss of suppression agent.

Floor drains from areas housing equipment that contains significant quantities of oil are routed to retention sumps to prevent oil from being released to the environment. This also prevents the spreading of a potential oil fire to other equipment areas through the floor drainage system.

The floor drains in areas that may contain radioactivity are routed to the Auxiliary Building sumps that are pumped to the waste holdup tank. This liquid is processed by the liquid radwaste system. Discharge from the liquid radwaste system is monitored.

5.1.11 Water Curtains

The use of water curtains provides a method of utilizing active systems in order to compensate for and enhance the effectiveness of unqualified physical fire barriers. The use of water curtains at PBNP has been limited to three locations as follows:

- The Unit 1 Turbine Building south wall is protected by an open-head deluge water spray to compensate for not having a barrier with sufficient rating to withstand the effects of an adjacent transformer fire,

- Closed-head water spray nozzles supplied by a wet-pipe sprinkler system protect doorless openings at the 8' elevation of the Primary Auxiliary Building in designated fire barriers and

- Closed head water spray nozzles supplied by a preaction sprinkler system protect the northeast corner of the Gas Turbine Building from exposure of a Station Auxiliary Transformer fire.

5.1.12 Reactor Coolant Pump Oil Collection System

A reactor coolant pump lube oil collection system is installed on each Reactor Coolant Pump in accordance with the requirements of 10 CFR 50, Appendix R Section III.O. The system is designed, engineered and installed so that failure will not lead to fire during normal or design basis accident conditions and there is reasonable assurance that it will withstand a safe shutdown earthquake.

The major potential for oil leakage occurs during normal operation from non-pressurized sites. This leakage can run down the pump shaft, exit the shaft housing, and ignite upon contact with the hot reactor coolant pump body. At PBNP, openings in the pump shaft housing are closed so that the housing provides an approximate 20-gallon capacity oil sump. The housing has been fitted with an overflow pipe so that additional oil leakage will overflow onto the oil deflector cone. The deflector cone prevents oil from coming in contact with the hot reactor coolant pump body. A leak-off tray on the deflector cone will collect oil leakage, with drain piping to a collecting tank. Spilled oil is then diverted and collected away from potential ignition sources. This system provides suitable oil collection from non-pressurized leakage sites.

The oil lift pump is normally operated for a period of less than three minutes during unit start-up. During this period the reactor coolant pump and piping are cold and containment integrity has not been established. The 175-gallon oil reservoir is equipped with both high and low level alarms. A major leak in the pressurized system would rapidly decrease the level in the oil reservoir, which would result in a low-level alarm. This would necessitate immediate shutdown, repair and cleanup before the pump could be restarted and system heat-up begun. This type of event would not present a fire hazard because there would be no hot surfaces to collect and ignite the oil and because of the timely response from operations and maintenance personnel.

This system is typically not pressurized, therefore leakage from the high-pressure system would be in the form of dripping oil. The oil collection system provides suitable collection capability for this condition.

During the less than 3 minutes of lift pump operation, some quantity of oil could be sprayed out of a small leak in the high pressure system. The quantity of oil spilled would have to be small to avoid low level annunciation; however, this could be a potential fire hazard. An enclosure is provided around the oil lift pump and piping, oil cooler oil piping is equipped with flange covers, and an oil cooler drip pan is provided to contain oil leakage from high pressure sources.

Another potential hazard is introduced by RCP cubicle ventilation systems. Post-1974 RCP designs included a fan connected to the RCP to provide additional cooling. These fans have been found to blow in the direction of the oil collection pans potentially spraying oil mist in the cubicle and preventing oil from collecting in the pans.

PBNP uses an older Pre-1974 RCP design that does not require an additional fan unit. The rotor on the motor is designed to provide cooling for the motor as it spins. This design does not introduce the potential fire hazard experienced with post-1974 RCP designs.

Each RCP is provided with a dedicated collection tank with capacity to hold the entire inventory of the RCP lube oil system. Each tank is equipped with a flame arrestor.

The general arrangement of the reactor coolant pump lube oil collection system is shown on Figure 5.1.12-1. The protective components of this oil collection system collect oil leakage from pressurized and non-pressurized sources and drain it away from hot potential ignition sources. This system meets the intent of Appendix R.

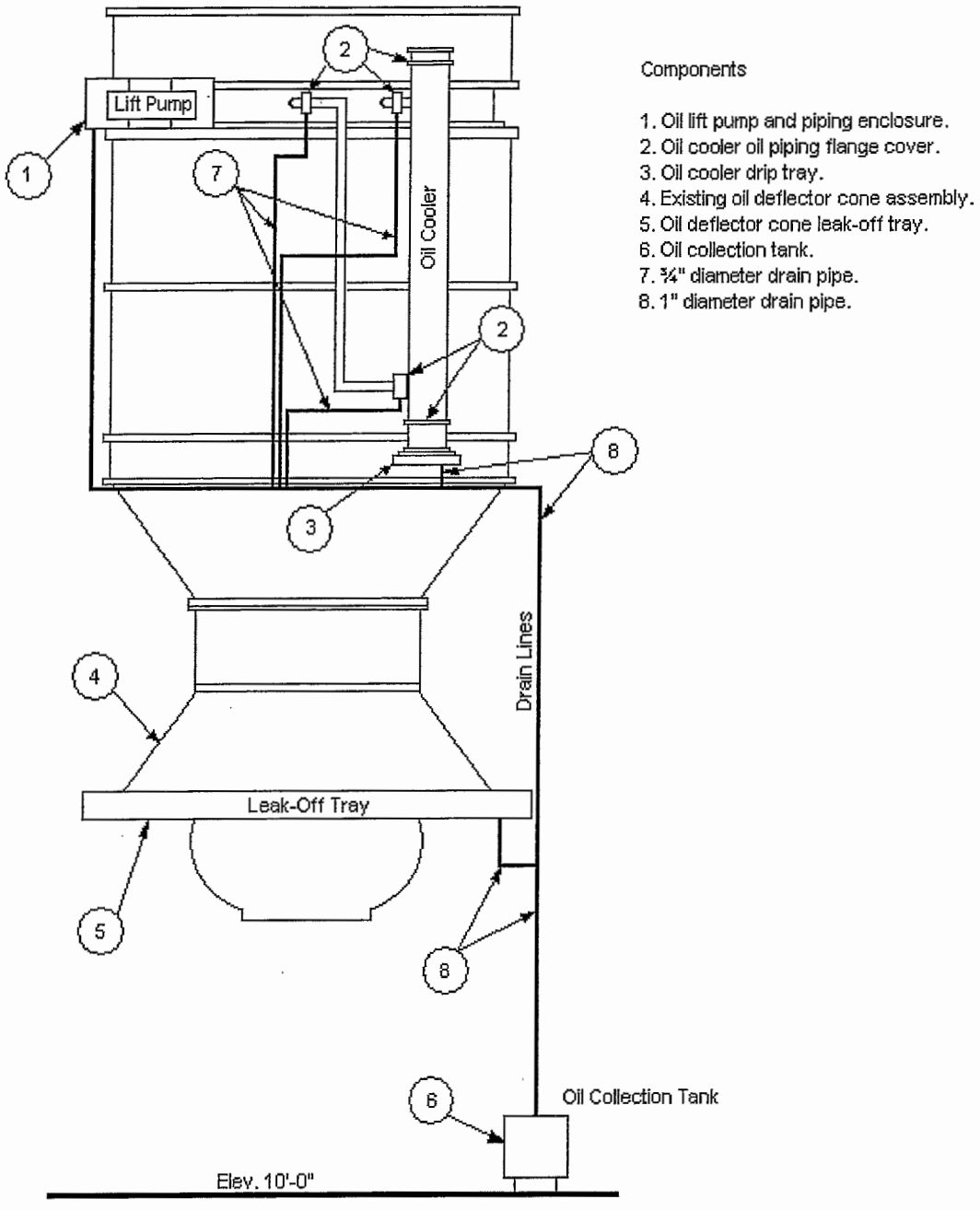


Figure 5.1.12-1
RCP Oil Collection System

5.2 SAFE SHUTDOWN CAPABILITY

The principal concern of 10 CFR 50 Appendix R is safe plant shutdown in the event of a fire. To address this concern, PBNP has been evaluated and fire protection features provided to ensure that systems, equipment and components necessary for safe plant shutdown will be available in the event of a fire according to the requirements of Appendix R.

An Appendix R safe shutdown component and circuit database is used to evaluate and demonstrate continued compliance with Appendix R requirements and commitments as well as to address and incorporate the effects of future plant modifications. This database contains plant specific data related to the location of safe shutdown components and cable routings. The database (SSAMS – Safe Shutdown Analysis Management System) effectively demonstrates compliance with 10 CFR 50 Appendix R.

The analysis provides a listing of safe shutdown components identified by fire area as delineated in the FHAR for each safe shutdown fire area/fire zone and it identifies those safe shutdown systems whose function could be affected assuming conservatively that all cables in that fire area are damaged by the fire. The analysis lists equipment located in each fire area and includes qualifiers for modifications that can affect the alternate actions associated with the equipment, which have been implemented to preserve the capability of the safe shutdown systems to function. The analysis demonstrates that a fire occurring in any fire area, which contains cable or equipment associated with safe shutdown will not result in the loss of safe shutdown capability in accordance with the requirements of 10 CFR 50 Appendix R.

FPER Section 5.2 describes PBNP's Appendix R safe shutdown capability and method of addressing the requirements established in Sections III.G, III.J, III.L and III.O of Appendix R. These sections of Appendix R deal with separation criteria of structures, systems and components credited for safe shutdown in the event of a fire (Sections III.G and III.L); emergency lighting for operator access and manual plant control (Section III.J); and oil collection systems for reactor coolant pumps (RCP) (Section III.O).

5.2.1 Safe Shutdown Requirements

5.2.1.1 Purpose and Scope

The Code of Federal Regulations, 10 CFR 50.48 and 10 CFR 50, Appendix R, requires that plant equipment, which is necessary for safe shutdown, be adequately protected from a fire event in any plant location. The Safe Shutdown Analysis Report (SSAR) describes PBNP's Appendix R safe shutdown capability and method of addressing the requirements of Sections III.G, III.J, III.L and III.O, of Appendix R. Demonstration of compliance with Appendix R is a continuing process. As plant modifications are performed, the post-fire safe shutdown capability must be ensured. The SSAR reflects the current safe shutdown capability. This section contains a summary of the SSAR.

Figure 5.2.1-1 shows the basic steps associated with the PBNP Appendix R safe shutdown analysis. These steps include the following:

- **Safe Shutdown Systems and Equipment** – Selection of the systems, equipment, and their necessary inter-relationships for ensuring the Appendix R performance goals can be satisfied following a fire.
- **Safe Shutdown Circuit Analysis –** Identification of circuits, including associated circuits, that could adversely affect the operation of safe shutdown equipment.
- **Safe Shutdown Equipment and Cable Locations –** Identification of the physical location of safe shutdown equipment and their associated cables.
- **Fire Area Analysis –** Analysis of each fire area to ensure compliance with Appendix R separation requirements or Appendix R exemptions. This includes the identification of protection schemes and mitigating strategies for safe shutdown equipment impacted by a fire in each Fire Area.

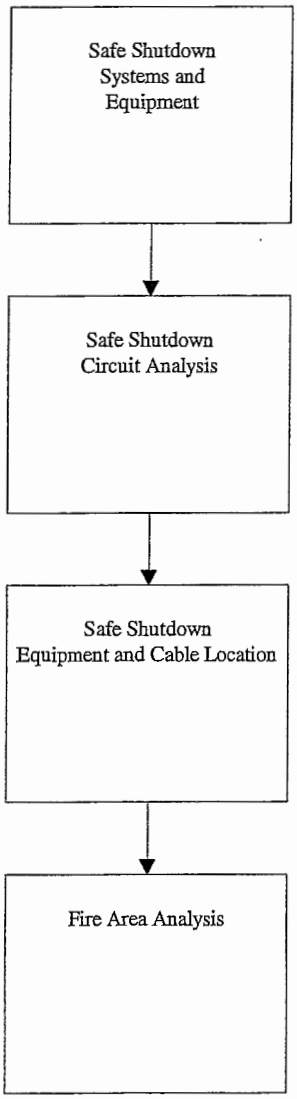


Figure 5.2.1-1
PBNP Safe Shutdown Analysis Process (Simplified)

5.2.1.2 Assumptions

The following assumptions are associated with the major tasks involved in demonstrating compliance with the safe shutdown requirements in Appendix R.

5.2.1.2.1 Systems and Equipment

a. The units are operating at 100% power upon the occurrence of a fire.

b. The reactors are tripped either manually or automatically.

c. A loss of offsite power is assumed to occur concurrent with the fire, unless the effects of offsite power remaining available could be more severe than a loss of offsite power (e.g., power remaining available to the main feedwater pumps or reactor coolant pumps). No credit is taken for offsite power as a motive power source.

d. No additional single failures are considered other than the loss of offsite power and those directly attributable to the fire.

e. All equipment required for post-fire safe shutdown is assumed to be in service and fully operable.

f. All required mechanical components (valves, etc.) are assumed operable and free of damage due to fire.

g. A loss of Instrument Air is assumed to occur at the onset of a fire if the loss of air could place a safe shutdown component in its undesired position. Instrument Air is assumed available if its availability could assist in placing a component in its undesired position.

5.2.1.2.2 Circuit Analysis Criteria and Assumptions

a. Components are assumed to initially be in their normal operating position.

b. All relay, position switch, and control switch contacts in control circuits are assumed to be in the position that corresponds to the normal Plant operating condition of that device unless specifically stated otherwise.

c. Test switches in control circuits are assumed to be in their normal Plant operating position.

d. Automatic logic interlocks and permissives from other circuits (i.e., interposing contacts in control circuits) must be considered in the circuit analysis. Two options exist for analyzing the effects of these circuits:

- The contacts can be assumed to be in a permissive position (worst case position), or
- The circuits associated with the interlock or permissive can be analyzed and included in the safe shutdown cable selection for the component of concern.

e. Fire damage is assumed to render a cable and electrical components nonfunctional with regard to ensuring proper circuit operation. The insulation and external jacket material of electrical cables are susceptible to fire damage, as are the materials of electrical components. Damage may assume several forms including deformation, loss of structure, loss of function, cracking, and ignition. The relationship between exposure of electrical cables and components to fire conditions, the failure mode, and the time to failure may vary with the configuration and cable/component type. To accommodate these uncertainties in a consistent and conservative manner, it is assumed that the functional integrity of electrical cables and components is lost when they are exposed to a postulated fire in a fire area, except where protected by a fire rated barrier within the fire area (or radiant energy shield within containment).

5.2.1.2.3 Fire Area Analysis Assumptions

In addition to the assumptions listed in Section 5.2.1.2, the following assumptions are also applied to the Fire Area Analysis.

a. Off-site power is assumed lost at the onset of the fire. However, off-site power is assumed available for those cases where availability of off-site power could adversely impact post-fire safe shutdown [The loss of off-site power assumption may only be waived if a detailed analysis demonstrates that: (1) fire damage will not affect the continuity of off-site power and (2) the area of concern is not an alternative shutdown area.]

b. Independent failures (e.g., failures that are not a direct consequence of fire damage) of systems, equipment, instrumentation, controls or power supplies, do not occur before, during or following the fire.

c. The "worst case" fire-induced plant transient shall consider the following for a fire in any single fire area:

- One spurious actuation or signal at a time,
- The loss of all automatic functions (signal, logic) from the circuits located in the fire area in conjunction with one worst case spurious actuation or signal, and
- Spurious actuation of the redundant valves in any one high/low pressure interface line when the valves or associated circuits are located in the same fire area.

d. Instruments exposed to a fire (e.g., RTDs, thermocouples, pressure transmitters, flow transmitters, and mechanically linked remote/local indications) are assumed to suffer damage that results in failure of the instruments. The instrument fluid boundary associated with these devices is, however, assumed to remain intact.

e. Instrument sensing lines for level, pressure, and flow transmitters that are exposed to a fire are considered to have the potential of causing erratic or unreliable indication, unless a fire hazards analysis demonstrates that this failure is not credible.

f. Instrument circuits that operate at low signal levels (4-20 mA, 10-50 mA, 0-1 V, 1-5 V, etc.) and are enclosed in a grounded metal shield are not considered to be susceptible to hot shorts from other adjacent instrument or control circuits external to the shield. External circuits are assumed to short to ground via the shield and do not have the potential of creating a signal of proper polarity and amplitude to simulate a valid instrument signal. Instrument circuits are, however, assumed to be susceptible to short circuits (from conductors within the shield), open circuits and shorts-to-ground.

g. Credible circuit failures include:

- Open circuits, shorts-to-ground, and short circuits
- One hot short/short circuit per affected component or multiple hot shorts/short circuits for high/low pressure interface components.

h. Two types of cable hot short conditions are considered to be of sufficiently low likelihood that they are not assumed credible, except for analysis involving high/low pressure interface components. These hot shorts are:

- 3-phase ac power circuit cable-to-cable proper phase sequence fault, and
- 2-wire ungrounded dc circuit cable-to-cable proper polarity faults.

i. Isolation and transfer switches (alternate power or control capability) are assumed to be in their normal position at the beginning of a fire and are operated as follows:

- Non-alternate shutdown fire areas: Transfer and isolation switches are not operated during or after the fire and should be assumed to remain in their normal position.
- Alternate shutdown fire areas: Transfer and isolation switches are assumed to be operated during the course of the fire and thus must be analyzed in both the normal and alternate/isolate positions. Circuits exposed to the fire must be assumed damaged prior to operation of the switch.

j. No additional single failures are considered other than the loss of offsite power and those directly attributable to the fire.

k. Piping, heat exchangers and tanks that are exposed to a fire are assumed to be unaffected in their ability to function as pressure boundaries or as safe shutdown components. Brazed and soldered lines are assumed to be damaged in the event of a fire. For valves, the fire damage is limited to power-assisted operators such as motors, air operators, hydraulic or solenoid operators.

5.2.1.3 10 CFR 50 Appendix R Requirements

A fire could affect safe shutdown systems and impact safety while the loss of function of systems used to mitigate the consequences of a design basis accident under post-fire conditions does not necessarily impact public safety. Therefore, the need to limit fire damage to safe shutdown systems is greater than the need to limit damage to those systems necessary to mitigate the consequences of a design basis accident. Levels of protection have been defined by 10 CFR 50 Appendix R according to the safety function of the structure, system or component. These levels of fire damage limits are:

- **Hot Standby** – One train of equipment necessary to achieve and maintain hot standby from the control room or emergency control station(s) shall remain free of fire damage from a single fire, including an exposure fire.

- **Cold Shutdown** – Both trains of equipment needed to achieve and maintain cold shutdown may be damaged by a single fire, including an exposure fire. However, damage shall be limited to the extent that at least one train can be repaired or otherwise made operable within 72 hours using onsite capability. When alternate shutdown capability is provided, damage shall be limited so that the systems can be made operable and cold shutdown can be achieved within 72 hours.

- **Design Basis Accidents** – Both trains of equipment necessary for mitigation of the consequences following a design basis accident may be damaged by a single exposure fire event.

5.2.1.3.1 Section III.G, Separation Criteria for Safe Shutdown Capability

Section III.G.1 Limits of Fire Damage

Appendix R, Section III.G describes the fire protection features required for structures, systems and components considered important to safe shutdown in the event of a fire in the plant. The fire protection features provided are to be capable of limiting fire damage so that:

One train of systems necessary to achieve and maintain hot standby conditions from either the control room or emergency control station(s) is free of fire damage (Section III.G.1.a); and
Systems necessary to achieve and maintain cold shutdown from either the control room or emergency control station(s) can be repaired within 72 hours (Section III.G.1.b).

Section III.G.2 Separation Criteria

Appendix R, Section III.G.2 describes the separation requirements for cables and equipment within the same fire area including associated non-safety circuits that could prevent operation or cause maloperation due to hot shorts, open circuits or shorts to ground, of redundant trains of systems necessary to achieve and maintain hot standby conditions. One of the following means of separation must be provided to ensure one of the redundant trains is free of fire damage:

- **Cables and Equipment Outside of Containment**

  a. Separation of cables and equipment and associated non-safety circuits of redundant trains by a fire barrier having a 3-hour rating. Structural steel forming a part of or supporting such fire barriers shall be protected to provide fire resistance equivalent to that required of the barrier (Section III.G.2.a);

  b. Separation of cables and equipment and associated non-safety circuits of redundant trains by a horizontal distance of more than 20 feet with no intervening combustible or fire hazards. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area (Section III.G.2.b); or

  c. Enclosure of cable and equipment and associated non-safety circuits of one redundant train in a fire barrier having a 1-hour rating. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area (Section III.G.2.c).

- **Cables and Equipment inside Noninerted Containment**

  Inside noninerted containments, any of the separation means for outside of containment may be provided or one of the following:

  a. Separation of cables and equipment and associated non-safety circuits of redundant trains by a horizontal distance of more than 20 feet with no intervening combustibles or fire hazards (Section III.G.2.d);

  b. Installation of fire detectors and an automatic fire suppression system in the fire area; or (Section III.G.2.e); or

  c. Separation of cables and equipment and associated non-safety circuits of redundant trains by a noncombustible radiant energy shield (Section III.G.2.f).

Section III.G.3 Alternate or Dedicated Shutdown

Appendix R, Section III.G.3 describes where alternate or dedicated shutdown capability shall be provided. Alternate shutdown capability includes rerouting, relocating, or modifying existing systems. Dedicated shutdown capability includes installing new structures and systems for the function of post-fire shutdown.

Alternate or dedicated shutdown capability, including its associated circuits, independent of cables, systems, or components in the area, room, or zone under consideration is required where:

a. Systems credited for hot standby functions do not meet the separation conditions in Section III.G.2 described above, or

b. Redundant trains of systems required for hot standby located in the same fire area may be subject to damage from fire suppression activities or from the rupture or inadvertent operation of fire suppression systems.

Fire detection and a fixed fire suppression system shall be installed in those areas, rooms or zones where alternate or dedicated shutdown is required.

5.2.1.3.2 Section III.L, Alternate and Dedicated Shutdown Capability

Alternative and Dedicated Shutdown Capability (Section III.L.1)

Appendix R, Section III.L describes the safe shutdown requirements when an alternate or dedicated shutdown capability is provided, as required in Section III.G described above. The safe shutdown requirements for an alternate or dedicated shutdown capability are essentially the same as those requirements and performance goals established for normal safe shutdown using system trains in the event of a fire except the alternate or dedicated structures, systems, components, and all associated cables shall be outside the fire area in consideration. The alternate or dedicated shutdown capability shall be able to:

a. Achieve and maintain subcritical reactivity conditions in the reactor,

b. Maintain reactor coolant inventory,

c. Achieve and maintain hot standby conditions,

d. Achieve cold shutdown conditions within 72 hours, and

e. Maintain cold shutdown conditions thereafter.

During the post-fire shutdown, the reactor coolant system (RCS) process variables shall be maintained within those predicted for a loss of normal AC power, and the fission product boundary integrity shall not be affected (i.e., there shall be no fuel-clad damage, rupture of any primary coolant boundary or rupture of the containment boundary).

Performance Goals for Shutdown Functions (Section III.L.2)

a. The reactivity control function shall be capable of achieving and maintaining cold shutdown reactivity conditions.

b. The reactor coolant makeup function shall be capable of maintaining the reactor coolant level within the level indication in the pressurizer for PWRs.

c. The reactor heat removal function shall be capable of achieving and maintaining decay heat removal.

d. The process monitoring function shall be capable of providing direct readings of the process variables necessary to perform and control the above functions.

e. The supporting functions shall be capable of providing the process cooling, lubrication, etc., necessary to permit the operation of the equipment used for safe shutdown functions.

Offsite Power and Shutdown Procedures (Section III.L.3)

The shutdown capability for specific fire areas may be unique for each such area, or it may be one unique combination of systems for all such areas. In either case, the alternate shutdown capability shall be independent of the specific fire area(s) and shall accommodate post-fire conditions where offsite power is available and where offsite power is not available for 72 hours.

Procedures must be in effect to implement this alternate or dedicated shutdown capability.

Cold Shutdown Capability and On-Site Operating Shift Personnel (Section III.L.4)

If the capability to achieve and maintain cold shutdown is not available because of fire damage, the equipment and systems comprising the means to achieve and maintain the hot standby condition shall be capable of maintaining such conditions until cold shutdown can be achieved. If such equipment and systems are not capable of being powered by both onsite and offsite electric power systems because of fire damage, an independent onsite power system shall be provided.

The number of operating shift personnel, exclusive of fire brigade members, required to operate such equipment and systems shall be on site at all times.

Cold Shutdown Repairs and Repair Procedures (Section III.L.5)

Equipment and systems comprising the means to achieve and maintain cold shutdown conditions shall not be damaged by fire; or the fire damage to such equipment and systems shall be limited so that the systems can be made operable and cold shutdown achieved within 72 hours. Materials for such repairs shall be readily available onsite and procedures shall be in effect to implement such repairs. If such equipment and systems used prior to 72 hours after the fire are not capable of being powered by both onsite and offsite electric power systems because of fire damage, an independent onsite power system shall be provided. Equipment and systems used after 72 hours may be powered by offsite power only.

Seismic, Single Failure, Or Other Design Basis Accident Criteria (Section III.L.6)

Shutdown systems installed to ensure post-fire shutdown capability need not be designed to meet seismic Category I criteria, single failure criteria, or other design basis accident criteria, except where required for other reasons, e.g., because of interface with or impact on existing safety systems, or because of adverse valve actions due to fire damage.

Separation of Associated Circuits (Section III.L.7)

The safe shutdown equipment and systems for each fire area shall be known to be isolated from associated non-safety circuits in the fire area so that hot shorts, open circuits, or shorts to ground in the associated circuits will not prevent operation of the safe shutdown equipment. The separation and barriers between trays and conduits containing associated circuits of one safe shutdown division and trays and conduits containing associated circuits or safe shutdown cables from the redundant division, or the isolation of these associated circuits from the safe shutdown equipment, shall be such that a postulated fire involving associated circuits will not prevent safe shutdown.

An acceptable method of complying with this alternative would be to meet Regulatory Guide 1.75 Position 4 related to associated circuits and IEEE Standard 384-1974 (Section 4.5) where trays from redundant safety divisions are so protected that postulated fires affect trays from only one safety division.

5.2.1.3.3 Section III.J, Criteria for Emergency Lighting

Appendix R, Section III.J requires emergency lighting units with provisions for at least an 8-hour battery power supply for all access and egress routes to safe shutdown equipment and in all areas for operation of safe shutdown equipment.

5.2.1.3.4 Section III.O, Reactor Coolant Pump Oil Collection Systems

Appendix R, Section III.O describes the requirements for an oil collection system for reactor coolant pumps in containments, which are not inerted during normal operation.

Design Basis for Oil Collection System

The oil collection system shall be designed, engineered, and installed so that a failure will not lead to a fire during normal or design basis accident conditions and that there is reasonable assurance that the system will withstand the safe shutdown earthquake.

Oil Collection Design

The oil collection systems shall be capable of collecting lube oil from all potential pressurized and non-pressurized leakage sites in the reactor coolant pump lube oil systems.

Leakage shall be collected and drained to a vented, closed container that can hold the entire lube oil system inventory. A flame arrestor is required in the vent if the flash point characteristics of the oil present the hazard of fire flashback.

Leakage points to be protected must include lift pump and piping, overflow lines, lube oil cooler, oil fill and drain lines and plugs, flanged connections on oil lines, and lube oil reservoirs where such features exist on the RCPs.

The drain line shall be large enough to accommodate the largest potential oil leak.

5.2.1.4 Summary of Results

Table 5.2.1-1 presents summary level information for compliance with Appendix R Safe Shutdown requirements. Fire detection and suppression systems required to ensure compliance with Appendix R requirements and the associated NRC approved exemptions are outlined in the FHAR. The following is a description of the information contained in Table 5.2.1-1:

Fire Area: Fire Area Number -- Specific areas that have been further divided or combined for the purposes of the safe shutdown analysis (i.e., Diesel Generator Building, Turbine Driven Auxiliary Feedwater Pump Room (Formerly Auxiliary Feed Pump Room), Fire Area A01).

Area Description: Description of the Fire Area.

Fire Zones: Fire Zones that comprise the Fire Area.

Normal or Alternate Shutdown: Whether the area relies on Normal Shutdown (in accordance with Sections III.G.1 and III.G.2 of Appendix R) or Alternate Shutdown (in accordance with Sections III.G.3 & III.L of Appendix R). Areas containing no safe shutdown equipment or cables are identified.

Exemptions: Fire Areas with Appendix R exemptions are identified.

FPEEs: Fire Areas with Fire Protection Engineering Evaluations (FPEEs) are identified.

ERFBS Relied Upon (Fire Wrap): Fire Areas containing Electrical Raceway Fire Barrier Systems (ERFBS) used to ensure compliance with Sections III.G.2.a (3 hour fire wrap) or III.G.2.c (1-hour fire wrap) of Appendix R or an Appendix R exemption. Fire wrap used as a radiant energy shield in Containment (Section III.G.2.f of Appendix R) is also annotated.

Spatial Separation: Fire Areas using spatial separation without intervening combustibles or fire hazards used to ensure compliance with Sections III.G.2.b (outside Containment) or III.G.2.d (inside Containment) of Appendix R or an Appendix R exemption.

Manual Actions: Fire Areas requiring manual operator actions to ensure post-fire safe shutdown capability.

Repairs: Fire Areas requiring repairs to ensure post-fire safe shutdown capability.

Note: For a given Fire Area, there may be multiple methods of compliance. For example, certain safe shutdown functions may be free of fire damage or available from an emergency control station (Section III.G.1.a of Appendix R). Other functions may be protected with 1-hour wrap with suppression and detection (Section III.G.2.c), while others may require alternative shutdown capability (Section III.G.3 of Appendix R).

Table 5.2.1-1 Summary of Appendix R Compliance

Fire Area	Area Description	Fire Zones	Normal or Alternate Shutdown	Exemptions (See Table 5.2.6-1)	FPEEs	Fire Wrap Credited	Spatial Separation	Manual Actions	Repairs
A01-A	Auxiliary Building - 8' Elevation and Below	101, 104, 105, 106, 107, 108, 109, 110, 111, 113, 114, 115, 117, 118, 119, 131, 137, 138, 139, 140, 141, 142, 142A, 143, 144, 145, 146, 147, 148, 149, 150	Normal	Exemption 3 Exemption 12 Exemption 15	Yes	Yes	Yes	Yes	Yes
A01-B	Auxiliary Building – 26' Elevation Central Area	128, 129, 130, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199	Alternate – For Process Monitoring Instrumentation Only	Exemption 5 Exemption 12 Exemption 13 Exemption 16	Yes	None	None	Yes	Yes
A01-B/46	Auxiliary Building -46' Elevation CCW Hx Area	237	Alternate for process monitoring instrumentation only	Exemption 12 Exemption 13 Exemption 16	Yes	None	None	Yes	None
A01-CN	Auxiliary Building – 26' Elevation, North Wing	212, 213, 214, 215, 216, 217	Normal	Exemption 12	Yes	None	None	Yes	None
A01-CS	Auxiliary Building – 26' Elevation, South Wing	181, 182, 183, 184, 185, 186	Normal	Exemption 12	Yes	None	None	Yes	None
A01-D	Auxiliary Building - 44' and 66' Elevation and Facades (except Fire Zone 237)	203, 204, 205, 206, 207, 208, 208A, 209, 238, 239, 240, 241, 243, 244, 271	Normal	Exemption 12 Exemption 13	Yes	None	None	Yes	None
A01-E	Turbine Building & South Service Building	122, 123, 124, 126, 180, 218, 222, 223, 224, 231, 245, 246, 250, 251, 272, 273, 300, 301, 302, 303, 311, 316, 317, 319, 320, 322, 324, 325, 338, 360, 542, 547, 583, 584, 587, 588	Normal	None	Yes	None	None	Yes	None
A01-F	Yard Area	556, 557, 576, 577, 666, 671, 672, 673, 674, 675, 676, 677, 680, 681, 682, 683, 684, 685, 693, 694, 698, 751, 755, YARD	Normal	Exemption 19	Yes	None	None	None	None
A01-G	Unit 1 Façade	524, 525, 531, 536	Normal	None	Yes	None	Yes	Yes	None
A01-H	Unit 2 Façade	596, 597A, 600	Normal	None	Yes	None	Yes	Yes	None
A02	Containment Spray & Safety Injection Pump Room	151	Normal	Exemption 2	Yes	None	Yes	Yes	Yes

Table 5.2.1-1 Summary of Appendix R Compliance

Fire Area	Area Description	Fire Zones	Normal or Alternate Shutdown	Exemptions (See Table 5.2.6-1)	FPEEs	Fire Wrap Credited	Spatial Separation	Manual Actions	Repairs
A03	1P2C Charging Pump Room	152	Normal	None	None	None	None	Yes	None
A04	1P2B Charging Pump Room	153	Normal	None	None	None	None	None	None
A05	1P2A Charging Pump Room	154	Normal	None	None	None	None	None	None
A06	1B32 MCC Area	156	Normal	Exemption 1	Yes	None	Yes	Yes	None
A07	Chemical Drain, Laundry Tank and RCP Seal Filter Area	157, 158	Normal	None	Yes	None	None	Yes	None
A08	HVAC Equipment Room & Pipeway 1 Valve Gallery Area	155, 159	Normal	None	Yes	None	None	Yes	None
A09	Exhaust Fan Room	160	Normal – No SSD equipment or cables	None	Yes	None	None	None	None
A10	Radioactive Gas Treatment Area	167, 168	Normal	None	Yes	None	None	Yes	None
A11	Pipeway 4–Valve Gallery Area	162	Normal	None	Yes	None	None	Yes	None
A12	2P2C Charging Pump Room	163	Normal	None	None	None	None	None	None
A13	2P2B Charging Pump Room	164	Normal	None	None	None	None	None	None
A14	2P2A Charging Pump Room	165	Normal	None	None	None	None	None	None
A15	2B32 MCC Area	166	Normal	Exemption 4	Yes	None	Yes	Yes	Yes
A16	D106 – Battery Room	225	Normal	None	None	None	None	Yes	None
A17	D04 Electrical Equipment Room	226	Normal	None	None	None	None	Yes	None
A18	D03 Electrical Equipment Room	227	Normal	None	None	None	None	Yes	None
A19	D105 – Battery Room	228	Normal	None	None	None	None	Yes	None
A20	Heating Boiler Room	221	Normal – No SSD equipment or cables	None	Yes	None	None	None	None
A21	Heating Boiler Day Tank No. 1 Room	252	Normal – No SSD equipment or cables	None	None	None	None	None	None
A22	Heating Boiler Day Tank No. 2 Room	253	Normal – No SSD equipment or cables	None	None	None	None	None	None
A23N	Turbine Driven Auxiliary Feedwater Pump Room (North)	304N	Normal	Exemption 6 Exemption 18	Yes	Yes	Yes	Yes	Yes

Table 5.2.1-1 Summary of Appendix R Compliance

Fire Area	Area Description	Fire Zones	Normal or Alternate Shutdown	Exemptions (See Table 5.2.6-1)	FPEEs	Fire Wrap Credited	Spatial Separation	Manual Actions	Repairs
A23S	Turbine Driven Auxiliary Feedwater Pump Room (South)	304S	Normal	Exemption 6 Exemption 18	Yes	Yes	Yes	Yes	Yes
A24	4160V Vital Switchgear Room	305	Alternate	None	Yes	Yes	None	Yes	Yes
A25	D06 – Battery Room	306	Normal	None	Yes	None	None	Yes	None
A26	D05 – Battery Room	307	Normal	None	Yes	None	None	Yes	None
A27	G-01 – Diesel Generator Room	308	Normal	None	Yes	None	None	Yes	None
A28	G-02 – Diesel Generator Room	309	Normal	None	Yes	None	None	Yes	None
A29	Air Compressor Room	310	Normal	None	Yes	None	None	None	None
A30	Cable Spreading Room	318	Alternate	Exemption 8	Yes	None	None	Yes	Yes
A31	Control Room	326, 328, 329, 330, 331	Alternate	Exemption 9	Yes	None	None	Yes	Yes
A32	Computer Room	333, 334, 335, 336	Alternative – Process Monitoring Instrumentation Only	Exemption 17	Yes	None	None	Yes	None
A33	Control Bldg. HVAC Equip. Room	337	Normal – No SSD Equipment or Cables	None	Yes	None	None	None	None
A34	Technical Support Center	450	Normal – No SSD Equipment or Cables	None	Yes	None	None	None	None
A35	Maintenance Bldg.	430	Normal – No SSD Equipment or Cables	None	Yes	None	None	None	None
A36	Unit 1 Containment Area	501, 505, 511, 516, 520	Normal	None	Yes	Yes (Radiant Energy Shield)	Yes	Yes	None
A37	Unit 1 Façade Stairway/Elevator Area	526, 526A	Normal – No SSD Equipment or Cables	None	None	None	None	None	None
A38	Circulating Water & Service Water Pumphouse	550, 551, 552, 553, 554, 555	Normal	Exemption 14	Yes	None	Yes	None	None
A39	South Gatehouse	558	Normal – No SSD Equipment or Cables	None	None	None	None	None	None
A40	Fuel Oil Pumphouse	578, 579, 580	Normal – No SSD Equipment or Cables	None	None	None	None	None	None
A41	Flammable Liquids Storage Room	581	Normal – No SSD Equipment or Cables	None	None	None	None	None	None

Table 5.2.1-1 Summary of Appendix R Compliance

Fire Area	Area Description	Fire Zones	Normal or Alternate Shutdown	Exemptions (See Table 5.2.6-1)	FPEEs	Fire Wrap Credited	Spatial Separation	Manual Actions	Repairs
A42	Lubricating Oil Storage Room	582	Normal – No SSD Equipment or Cables	None	Yes	None	None	None	None
A43	Blowdown Evaporator Building	591	Normal – No SSD Equipment or Cables	None	Yes	None	None	None	None
A44	Gas Stripper Building	592	Normal – No SSD Equipment or Cables	None	None	None	None	None	None
A45	Unit 2 Facade Stairway Area	597	Normal – No SSD Equipment or Cables	None	None	None	None	None	None
A46	Unit 2 Containment Area	606, 608, 611, 615, 618	Normal	None	Yes	Yes (Radiant Energy Shield)	Yes	Yes	None
A47	Extension Building	620	Normal – No SSD Equipment or Cables	None	None	None	None	None	None
A48	Warehouse #1	667, 668	Normal – No SSD Equipment or Cables	None	None	None	None	None	None
A49	Well Water Pumphouse	669	Normal – No SSD Equipment or Cables	None	None	None	None	None	None
A50	Warehouse #2	691	Normal – No SSD Equipment or Cables	None	None	None	None	None	None
A51	Warehouse #3	692	Normal – No SSD Equipment or Cables	None	None	None	None	None	None
A52	North Service Bldg.	700	Normal – No SSD Equipment or Cables	None	None	None	None	None	None
A53	Sewage Treatment Plant	575	Normal – No SSD Equipment or Cables	None	None	None	None	None	None
A54	D305 - Swing Battery & D301 Charger Rooms	321, 323	Normal	None	None	None	None	None	None
A58	T-175A Fuel Tank Room	761	Normal – No SSD Equipment or Cables	None	None	None	None	None	None
A59	T-175B Fuel Tank Room	762	Normal – No SSD Equipment or Cables	None	None	None	None	None	None

Table 5.2.1-1 Summary of Appendix R Compliance

Fire Area	Area Description	Fire Zones	Normal or Alternate Shutdown	Exemptions (See Table 5.2.6-1)	FPEEs	Fire Wrap Credited	Spatial Separation	Manual Actions	Repairs
A61	P-206A & P-207A Fuel Oil Pump Room	771	Normal	None	Yes	None	None	Yes	None
A68	Train B East Duct Bank & Manholes	791, 793, 795, 799	Normal	None	Yes	None	None	Yes	Yes
A69	Manhole Z-068 West of DGB	790	Normal – No SSD Equipment or Cables	None	None	None	None	None	None
A70	Train A West Duct Bank & Manholes	792, 794, 796, 800	Normal	None	Yes	None	None	Yes	None
A71	Diesel Generator Building, Train B Area	763, 764, 770, 772, 773, 773A, 774, 775, 776, 777, 777A, 778, 780, 781, 782, 783, 784, 785, 786, 787	Normal	None	Yes	None	None	Yes	Yes

5.2.2 Safe Shutdown Systems and Equipment

5.2.2.1 Methodology

- **Functional Requirements**

In order to achieve the performance goals of Appendix R, Section III.L.2 as defined in Section 5.2.1.3.2, the following specific safe shutdown functional requirements shall be met:

- Reactor reactivity control,
- Reactor coolant make-up control,
- Reactor coolant pressure control,
- Reactor heat removal (also called Decay Heat Removal),
- Process monitoring, and
- Miscellaneous support functions.

These functional requirements are discussed in Section 5.2.2.2 and are depicted in greater detail on the Safe Shutdown Logic Diagrams in the SSAR.

- **Safe Shutdown Equipment List**

Based on the performance goals identified above, the systems or portions of system required to meet those goals are identified. This is accomplished by reviewing design, operating and licensing documents, such as:

- Piping and Instrumentation Diagrams (P&IDs),
- Single-Line Diagrams,
- Schematic Drawings,
- Design Basis Documents,
- Operating Instructions,
- Emergency Operating Procedures, and
- Abnormal Operating Procedures
- Fire Protection SERs and other NRC correspondence

Once the required systems are identified, the P&IDs are reviewed to identify components in these systems that are necessary to support the safe shutdown functional requirements. This is performed by reviewing the flow paths for the systems and identifying system boundaries. Components in the flow paths that require operation/repositioning to allow the system to function, and components, which could spuriously operate and impair safe shutdown are identified. Components for functions not involving mechanical/fluid flow paths (e.g., process monitoring and support systems) are then identified.

Based on the above, the Safe Shutdown Equipment List (SSEL) is developed and equipment attributes and data are included for each piece of safe shutdown equipment. Position information is contained in the SSEL to form the foundation for circuit analysis and Fire Area analysis, where equipment failure states and desired states are analyzed for impact on the safe shutdown performance goals.

- **Appendix R Safe Shutdown Logic Diagrams**

  The safe shutdown logic diagrams depict the systems and components necessary to achieve the Appendix R performance goals. The system-level safe shutdown logic diagram identifies systems essential for safe shutdown following an Appendix R fire. Systems identified on the system-level logic are represented on a component-level logic diagram.

5.2.2.2 Functional Requirements

Various analytical approaches can be taken to ensure that sufficient plant systems are available to perform the previously identified plant safety functions. Numerous plant systems are normally available, alone and in combination with other systems, to provide these required functions. However, the exact location and specific effects of exposure fires cannot be precisely predicted. In general, recognizing the confined nature of fires in nuclear plant environments and the inherent operational flexibility and physical diversity of systems available to achieve safe shutdown, plant fire protection features would be expected to limit the potential for fire damage to the extent that unaffected plant systems would be available to attain safe shutdown.

An extensive effort is required to identify the effects of postulated fires in all potential plant locations and on all the plant systems, which are available to support safe shutdown. As a conservative alternative to such an approach, a minimum set of plant systems (safe shutdown systems) and components was identified in response to the requirements of Appendix R. This minimum set of components can achieve and maintain safe shutdown regardless of the location of the fire, while assuming concurrent loss of off-site power. Demonstration of adequate protection of this minimum system set from the effects of postulated fires constitutes an adequate and conservative demonstration of the ability to achieve and maintain safe shutdown for the purposes of fire protection. Spurious operation of components within the systems and interfacing systems necessary to perform safe plant shutdown, are identified and addressed.

The safe shutdown systems selected for PBNP are capable of achieving and maintaining subcritical conditions in the reactor, maintaining reactor coolant inventory, achieving and maintaining hot conditions for an extended period of time, achieving Cold Shutdown conditions within 72 hours, and maintaining Cold Shutdown conditions thereafter. A detailed description of the selected systems can be found in the SSAR.

The following provides a summary level description of the functional requirements listed in Section 5.2.2.1 and the methods used to ensure they can be achieved.

- **Reactor Reactivity Control Function**

  After a reactor trip, the reactivity control function shall be capable of achieving and maintaining at least a 1% reactivity shutdown margin (ΔK/K) from zero power hot standby to cold shutdown conditions. The function shall be capable of compensating for any positive reactivity change as a result of xenon decay and decreasing reactor coolant temperature during cooldown. A safety sequence diagram, Figure 5.2.2-1, represents safe shutdown functions for reactivity control. An analysis demonstrates PBNP's ability to maintain acceptable reactivity shutdown margin. This analysis is documented in calculation N-94-022.

Initial reactivity control results from an automatic reactor protection system (RPS) trip or from operator initiation of a manual trip. The effects of fires on the RPS do not preclude the initiation of an automatic trip or control rod insertion because the system is designed to fail in the safe (scram) condition.

Following control rod insertion, hot subcritical conditions can be maintained for at least 24 hours with no addition of boron, assuming all rods are inserted into the core and the reactor trip occurs at worst case conditions (end of life and at 100% power), with xenon at steady-state level. As xenon decays, positive reactivity is added, requiring the addition of borated water from the refueling water storage tank (RWST) to maintain the required margin of shutdown reactivity. The cooldown transition from hot standby, and ultimately to cold shutdown, requires additional boration to compensate for the negative moderator temperature coefficient. The total quantity of borated water from the RWST, which must be injected into the RCS to achieve the required cold shutdown margin is less than the quantity of borated water from the same source required to maintain pressurizer level within the operating band during cooldown (RCS volume shrinkage compensation). The chemical and volume control system (CVCS) is capable of injecting this quantity of borated water into the RCS and maintaining the required shutdown reactivity margin throughout safe shutdown.

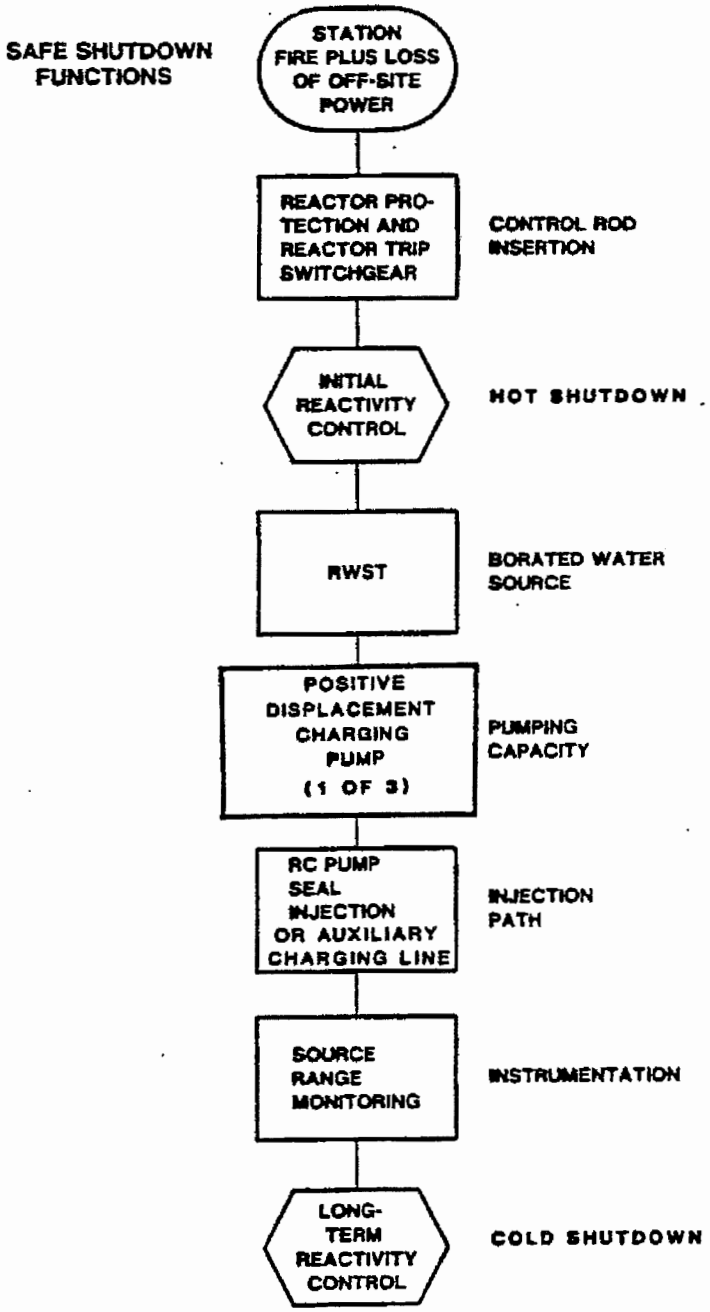


Figure 5.2.2-1
Reactivity Control

- **Reactor Coolant Make-up Control Function**

  Reactor Coolant Inventory Control is required for maintenance of RCS integrity and for reactor coolant makeup capability to compensate for Reactor Coolant System fluid losses and shrinkage during cooldown. Reactor Coolant Inventory Control is accomplished by the following actions:

  - Isolation of Normal and Excess Letdown flow paths,
  - Isolation of the Reactor Coolant System,
  - Isolation of special Safety Injection and Containment Spray flow paths,
  - Isolation of Residual Heat Removal flow paths,
  - Isolation of potential Refueling Water Storage Tank draindown to containment sump,
  - Operation of charging through the seal injection or the normal or auxiliary charging flow path, and
  - Isolation of Reactor Coolant Pump seal return flow path.

  A simplified diagram of Reactor Coolant Makeup Control is shown in Figure 5.2.2-2.

- **Reactor Coolant Pressure Control**

  Reactor Coolant Pressure Control is necessary to prevent exceeding RCS design pressure-temperature limits and to minimize void formation in the reactor. Reactor Coolant Pressure Control is accomplished by the following actions:

  - Isolating Normal and Auxiliary Spray,
  - Closing or isolating the Pressurizer Power-Operated Relief Valves (PORVs),
  - Assuring the availability of a Pressurizer Safety Valve,
  - Charging via the Normal or Auxiliary Charging flow path, and
  - Controlling/Securing the Pressurizer Heaters.

- **RCS Pressure Control for Cooldown**

  Reactor Coolant Pressure Control for Cooldown (depressurization) is necessary to prevent exceeding RCS Technical Specification and design pressure-temperature limits during the transition from Hot Standby to Cold Shutdown. Reactor Coolant Pressure Control for Cooldown is accomplished by the following actions:

  - Isolation of Safety Injection (SI) accumulators,
  - Reliance on the RHR code safety relief valves,
  - Use of the PORVs or Auxiliary Spray, and
  - Float RWST on the RCS.

A simplified diagram of Reactor Coolant Pressure Control is shown in Figure 5.2.2-3.

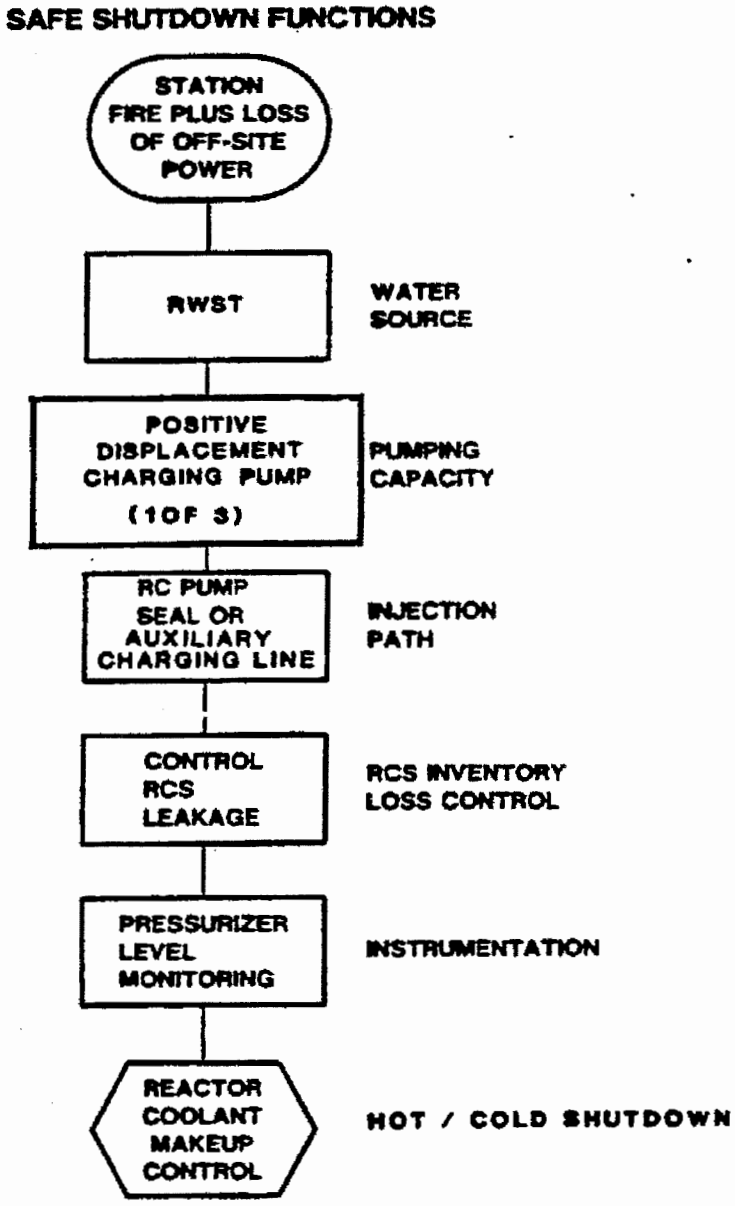


Figure 5.2.2-2
Reactor Coolant Makeup Control[1]

[1] The normal charging flow path could also be used.

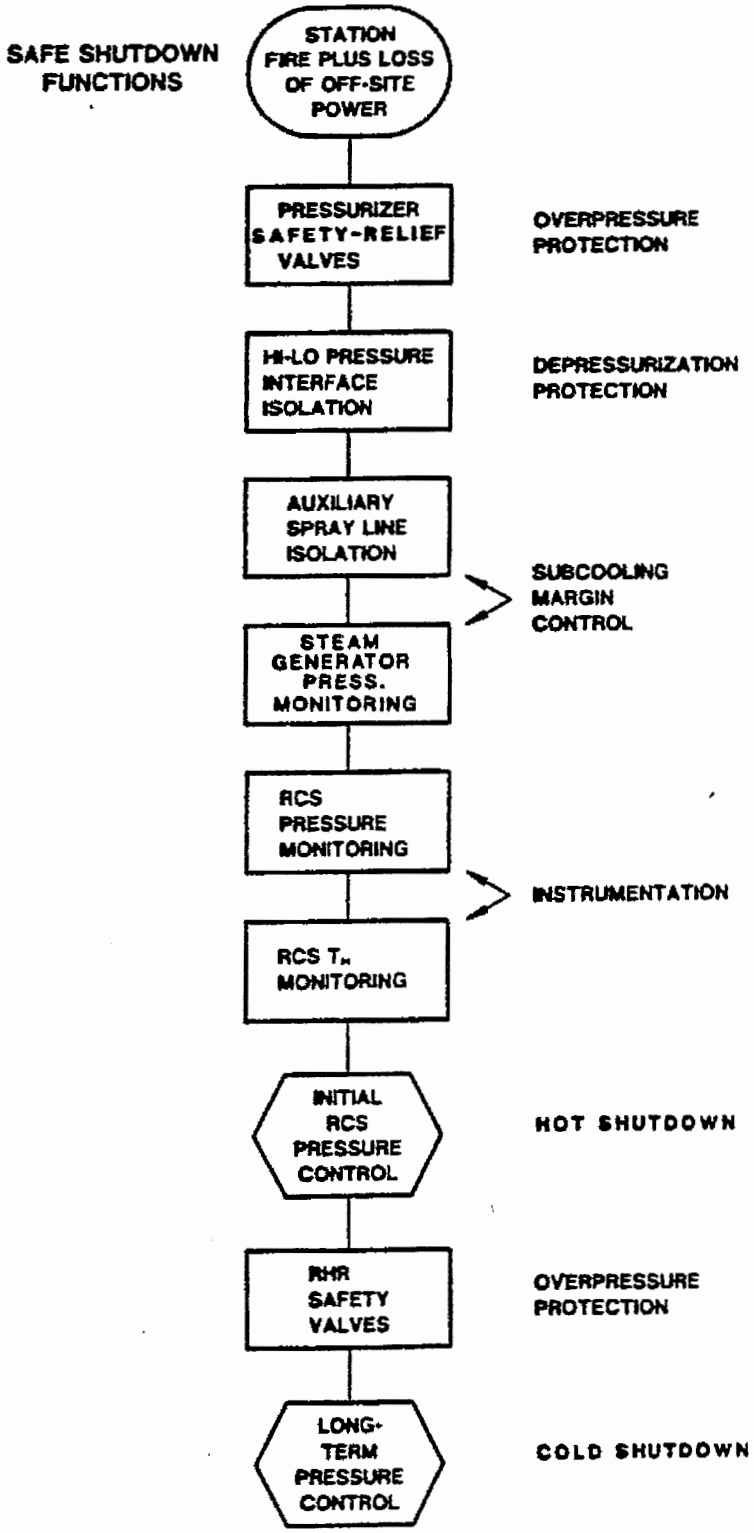


Figure 5.2.2-3
Reactor Coolant Pressure Control

- **Reactor Heat Removal Function**

  Removing both decay and sensible energy from the reactor core and primary systems is required to ensure that overall system temperatures can be maintained within acceptable limits. The decay heat removal function is accomplished by the following actions:

  - Establishing natural circulation in the Reactor Coolant System,
  - Isolating the Steam Generators at Main Steam lines and isolating the blowdown and sample lines,
  - Closing the Atmospheric Dump Valves for Hot Standby,
  - Isolating Main Feedwater,
  - Main Steam Code Safety Valves available, and
  - Establishing and controlling Auxiliary Feedwater flow to a minimum of one Steam Generators per Unit.

  Reactor heat removal has been modeled and documented in Calculation N-93-117, "Appendix R Thermal Hydraulic Analysis."

- **Reactor Heat Removal for Cooldown**

  Decay heat removal and temperature reduction are required to achieve Cold Shutdown conditions. This is achieved by the following systems:

  - Continued Operation of AFW System and Operation of the Atmospheric Steam Dump Valves,
  - Residual Heat Removal System,
  - Safety Injection System, and
  - Support Systems.

  Reactor heat removal for cooldown has been modeled and documented in calculation 97-0118, Appendix R Cooldown Capability.

  A simplified diagram of Reactor Heat Removal is shown in Figure 5.2.2-4.

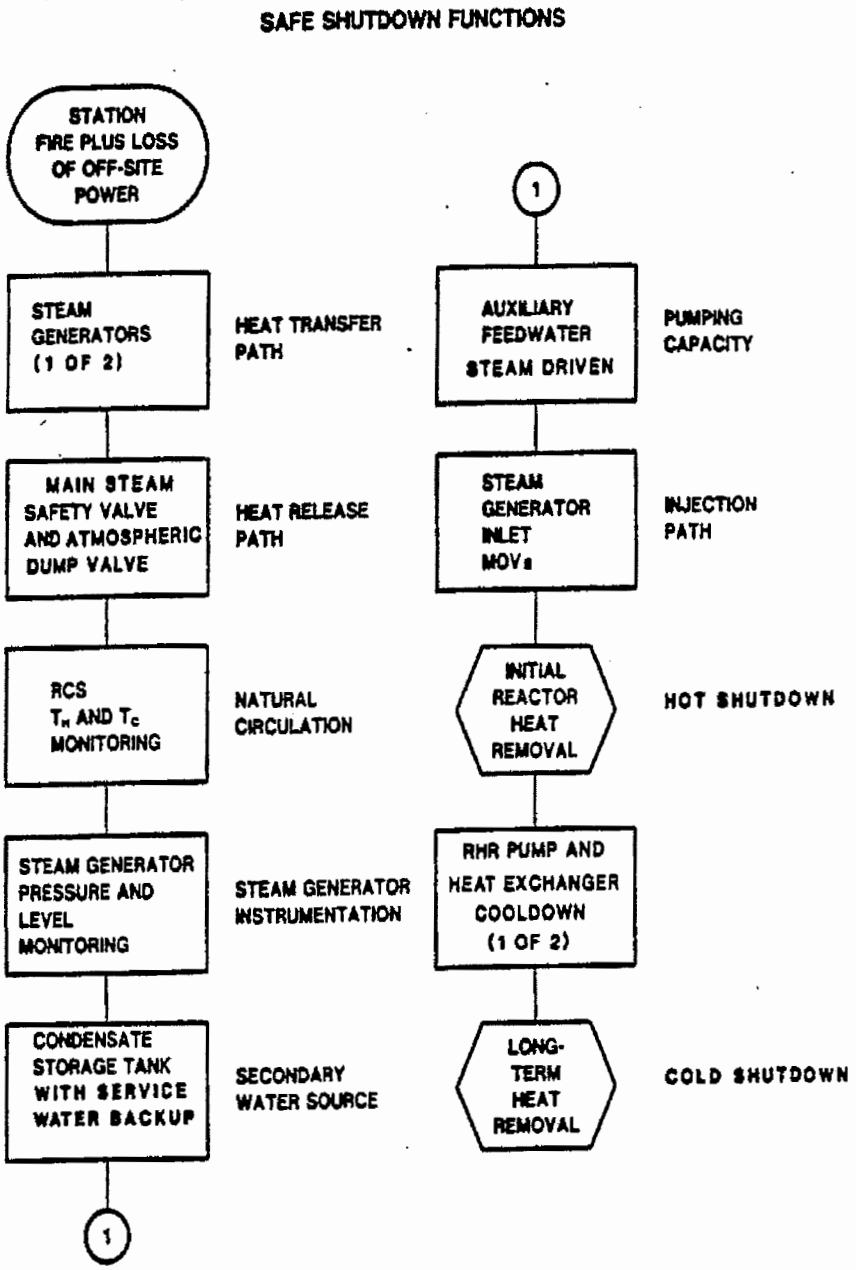


Figure 5.2.2-4
Reactor Heat Removal

- **Process Monitoring Function**

Process monitoring capability shall be available to control equipment and system alignments to ensure safe shutdown of the plant in the event of a fire. The following instruments are included in the safe shutdown analysis:

➢ **Residual Heat Removal**

The RHR pump discharge pressure and heat exchanger outlet temperature transmitters and indicators are necessary to monitor cool down rates to satisfy the Decay Heat Removal for Cooldown safe shutdown function.

➢ **Reactor Coolant System**

The following Reactor Coolant System transmitters and indicators are necessary to support the Reactivity Control, Reactor Coolant Pressure Control, and Reactor Coolant Inventory Control safe shutdown functions:

- Nuclear Instrumentation / Source Range Monitoring,
- RCS Wide Range Pressure Instrumentation,
- RCS Hot and Cold Leg Temperature Instrumentation, and
- Pressurizer Level Instrumentation.

RWST level indication is also provided to support the Reactor Coolant Inventory Control function.

➢ **Main Steam System**

The Steam Generator pressure and wide-range level transmitters and indicators are necessary to support the Decay Heat Removal safe shutdown function. Indication is necessary to ensure a heat removal rate within the required operational limits.

➢ **Auxiliary Feedwater System**

The following Auxiliary Feedwater System transmitters and indicators are necessary to support the Decay Heat Removal safe shutdown function:

- Condensate Storage Tank (CST) Level Indication, or
- Auxiliary Feedwater Pump Suction Pressure Indication.

- **Miscellaneous Supporting Functions**

  The systems and equipment used to perform the above functions may require miscellaneous supporting functions such as process cooling, lubrication, and ac/dc power. These supporting functions shall be available and capable of providing the support necessary to assure acceptable performance of the previously identified safe shutdown functions.

  The various systems required to provide support to safe shutdown equipment or systems are:

  - Component Cooling Water,
  - Service Water,
  - Emergency Power,
  - Emergency Diesel Generator Ventilation System, and
  - Fuel Oil System

Discussion of these systems is provided in the SSAR, Section 2.3.2 - "Safe Shutdown Systems."

5.2.2.3 Spurious Equipment Operation and High-Low Pressure Interface

Spurious operation of safe shutdown equipment is fully considered in the development of the Safe Shutdown Equipment List (SSEL) and logic diagrams. The normal, failure and desired positions of safe shutdown equipment contained in the SSEL and depicted on the logic diagrams, account for equipment, which, if spuriously actuated, could adversely affect safe shutdown. This includes boundary valves on required systems and equipment that is not relied upon (e.g., normal spray valves). In some cases, a valve may be required shut for one flow path and functional or open for another.

The high-low pressure system interface boundary valves are of particular concern because spurious operation of these valves could challenge low-pressure system integrity and result in an uncontrolled loss of primary system coolant, if left unmitigated. High-low pressure interface equipment are identified as valves, which:

- Form a boundary of the Reactor Coolant System or isolate the Reactor Coolant System from low-pressure systems, and
- Have the potential of causing uncontrolled depressurization and/or loss of primary coolant as a result of fire-induced failures.

The main analysis concern associated with high-low pressure interface valves is that these components are subjected to more rigorous and conservative circuit failure modes. Table 5.2.2-1 provides a listing of high-low pressure interface valves at PBNP and the associated mitigating action/protection provided.

A more detailed explanation of the spurious operation and high-low pressure interface analysis is provided in the SSAR.

Table 5.2.2-1
High-Low Pressure Interface Equipment

Equipment ID	Equipment Description	Mitigating Action-Protection
1/2CV-00200A	Normal Letdown Orifice Isolation Valve AOV	Post-fire operator action to isolate instrument air to containment, then vent air to fail the valve shut.
1/2CV-00200B	Normal Letdown Orifice Isolation Valve AOV	Post-fire operator action to isolate instrument air to containment, then vent air to fail the valve shut.
1/2CV-00200C	Normal Letdown Orifice Isolation Valve AOV	Post-fire operator action to isolate instrument air to containment, then vent air to fail the valve shut.
1/2RC-00430	Pressurizer Power Operated Relief Valve (PORV)	Post-fire operator action to isolate instrument air to containment, then vent air to fail the valve shut.
1/2RC-00431C	Pressurizer Power Operated Relief Valve (PORV)	Post-fire operator action to isolate instrument air to containment, then vent air to fail the valve shut.
1/2RC-00570A	Reactor Head Vent Valve	Power removed to valve during normal operation, in conjunction with power removed to 1/2RC-00570B.
1/2RC-00570B	Reactor Head Vent Valve	Power removed to valve during normal operation, in conjunction with power removed to 1/2RC-00570A.
1/2RC-00575A	Gas Vent to Pressure Relief Tank (PRT) Valve	Power removed to valve during normal operation, in conjunction with power removed to 1/2RC-00575B.
1/2RC-00575B	Gas Vent to Containment Standpipe Valve	Power removed to valve during normal operation, in conjunction with power removed to 1/2RC-00575A.
1/2RC-00580A	Pressurizer Vent Valve	Power removed to valve during normal operation, in conjunction with power removed to 1/2RC-00580B.
1/2RC-00580B	Pressurizer Vent Valve	Power removed to valve during normal operation, in conjunction with power removed to 1/2RC-00580A.
1/2RH-00700	Loop A RCS to RHR Suction MOV	Power removed to valve during normal operation, in conjunction with power removed from 1/2RH-00701.
1/2RH-00701	Loop A RCS to RHR Suction MOV	Power removed to valve during normal operation, in conjunction with power removed from 1/2RH-00700.

5.2.3 Safe Shutdown Circuit Analysis

5.2.3.1 Circuit Analysis

The primary circuit analysis identifies cables that could adversely affect safe shutdown due to direct impact on equipment functionality or due to spurious operation. These cables are referred to as safe shutdown cables (or circuits) throughout this report. Associated circuits, specifically those associated by common power source and common enclosure, are addressed in Section 5.2.3.2.

5.2.3.1.1 Circuit Analysis Criteria and Assumptions

The criteria and assumptions that establish the basic ground rules for circuit analysis are identified in Section 5.2.1.2.

5.2.3.1.2 Circuit Analysis Process

The circuit analysis process for each safe shutdown component includes the following basic steps:

- Prepare for the analysis by collecting drawings and design documents for the component,
- Verify equipment attributes contained in the SSEL,
- Identify the cables associated with the component to determine, which are required to support proper safe shutdown operation of the component,
- Identify the power supplies required to support proper safe shutdown operation of the component, and
- Document the results of the analysis.

5.2.3.1.3 Credible Circuit Failures

Electrical circuits exposed to a fire are considered susceptible to the following credible failure modes:

- Short Circuit - An individual conductor that comes into electrical contact with another electrical conductor.
- Short to Ground - An individual conductor that comes into electrical contact with a grounded conducting device, such as a cable tray, conduit, or metal housing.
- Hot Short - An energized conductor that comes into electrical contact with another conductor, thereby energizing the affected conductor.
- Open Circuit - An individual conductor that loses electrical continuity.

5.2.3.1.4 Designation of Safe Shutdown Cables

Using the circuit analysis criteria and assumptions listed in Section 5.2.1.2 and the general analysis guidelines listed in Section 5.2.3.1.3, and based on the cable's function in the electrical circuit, each cable is analyzed to determine the effects of a fire induced fault. Each type of credible fault is applied to each conductor in the cable to determine the possible impact of the fault on the component's ability to perform its safe shutdown function, as determined by the component's required position.

If a fire-induced failure of the cable (short circuit, hot short, open circuit, short to ground) could place the safe shutdown component in a position other than the desired safe shutdown position (both HSD and CSD), then the cable is designated a safe shutdown cable. If a fire induced failure of the cable cannot spuriously reposition or prevent the desired operation of the safe shutdown component, then the cable is not a safe shutdown cable.

5.2.3.1.5 Alternate Shutdown Considerations

If the component being analyzed has alternate power/control capability, the specific cables that are required to support alternate shutdown are uniquely identified in the Cable Information section of the SSAMS circuit analysis worksheet. Only those cables associated with the alternate position of the equipment are identified. For circuits containing transfer or isolation switches, each circuit is analyzed to confirm that circuit damage suffered prior to actuating the transfer/isolation switch cannot preclude proper operation of the equipment after the transfer is accomplished (e.g., in control circuits a redundant set of control power fuses is generally required because the normal fuses are assumed to have cleared as a result of a circuit fault prior to transfer).

5.2.3.1.6 General Guidelines and Considerations for Circuit Analysis

The guidelines, criteria and assumptions used in the circuit analysis conform to the guidance provided in NRC Generic Letters 81-12 and 86-10, and other related documents. The following general guidelines are used to perform the circuit analysis as described in Section 5.2.1.3.2 above.

a) Only manual initiation of equipment and systems is credited in the safe shutdown analysis. Therefore, circuits associated only with automatic system operation (e.g., EDG auto start, AFW auto initiation, etc.) are not identified as safe shutdown circuits unless they could prevent or override manual initiation of the equipment or system. For example, within the EDG auto start and load sequencer circuits, only the cables that can prevent the Control Room operators from manually starting the EDG are designated as safe shutdown circuits. However, circuits within the auto start circuit that could cause a spurious EDG operation (e.g., unintentional shutdown, spurious closure of the output breaker, loss of voltage control, etc.) or prevent the EDG from being manually started are considered safe shutdown circuits. This guidance is not to be construed to include operator actions that can be taken to mitigate a spurious operation, even if such actions can be taken from the Control Room. For example, circuits that could spuriously reposition a valve are identified as safe shutdown circuits even if an operator could overcome the spurious operation by manipulating a switch in the Control Room.

b) Subcomponents such as solenoids, pilot valves, relays, switches, etc., are not explicitly identified in the SSEL. Instead, the subcomponents are tied to their primary component (i.e., components listed on the SSEL) by the circuit analysis process, which links all circuits associated with subcomponents to the primary components. The subcomponents are inherently incorporated into the analysis by capturing the field cables that run to the components. Failure of subcomponents is inherently considered in the circuit analysis.

c) Panel wires that are completely contained within a panel are not explicitly listed as safe shutdown cables. These wires are inherently included in the safe shutdown analysis in the same manner as subcomponents. Panel wiring is, however, analyzed to ensure all credible circuit failures are identified.

d) Components with isolation and transfer switches are analyzed such that cables associated with the normal and alternate positions are uniquely identified:

- For non-alternate safe shutdown, isolation and transfer switches are not operated and are assumed to be in the REMOTE/NORMAL position. Only cables that can affect proper operation of the component with the switch in this position are identified as safe shutdown cables.
- For alternate shutdown scenarios, isolation and transfer switches are analyzed in both their REMOTE/NORMAL and LOCAL/ALTERNATE positions since the switches are assumed initially to be in the REMOTE/NORMAL position and are subsequently placed in the LOCAL/ALTERNATE position. Only cables that can affect proper operation of the component with the switch in the LOCAL/ALTERNATE position are identified as alternate safe shutdown cables; however, potential damage to the circuit prior to the switch being operated is considered. For example, it is assumed that control power fuses associated with the normal switch alignment are damaged prior to the switch being actuated – a redundant set of fuses is generally necessary for the circuit to work. Another example is damage to a current transformer before isolation switches are operated if the current transformer could suffer an open-circuited secondary.

e) In performing the primary circuit analysis, it is assumed that electrical coordination exists for all power supplies. Cables downstream of the coordinated protective devices are not identified as safe shutdown cables nor included in the circuit analysis. The assumed electrical coordination is confirmed by the common power supply study described in Section 5.2.3.2.

f) In conducting the electrical analysis for a component no assumptions are made about the presence or lack of motive/control power or supporting air. All functional states of the component are considered to ensure that the analysis is performed under "worst-case" Appendix R conditions.

g) For components with an Safety Injection System (SIS) input (or other Emergency Safeguards Function Actuation System (ESFAS) input), cable faults occurring between the SIS contacts and the SIS master relay associated with the SIS signal are included in the circuit analysis. However, the analysis does not include the initiating logic circuits and input circuits to the safeguards cabinets. Due to the inherent fail-safe design and myriad of logic combinations that can initiate a safety injection, the Appendix R analysis conservatively assumes that an SIS is possible for all fire areas.

h) Electrical isolation devices prevent malfunctions in one section of a circuit from causing unacceptable effects in other portions of the circuit or other circuits (e.g., open contacts, fuses, switches, instrument isolation modules). Devices credited as providing electrical isolation are identified in the circuit analysis for the affected component.

i) All circuits that are electrically connected to the circuit under analysis are dispositioned by the analysis. This approach is sometimes difficult for instrument loops that provide a signal to numerous different instrument modules. In many cases, the instrument modules are credited with providing isolation from other portions of the circuit. In these instances, the modules credited with providing isolation are identified in the circuit analysis.

5.2.3.2 Associated Circuits Analysis

Section III.G of Appendix R requires that associated circuits be accounted for in the Appendix R safe shutdown analysis. Generic Letter 81-12 and a subsequent clarification to Generic Letter 81-12 were issued, in part, to define and clarify concerns about fire-induced faults on non-safe shutdown circuits that might adversely affect the operation of safe shutdown equipment. These potential associated circuits of concern are divided into three categories:

- **Associated Circuits by Common Power Supply**: Circuits (safe shutdown and non-safe shutdown related) that share a common power supply with safe shutdown circuits or equipment. Power supplies include those provided for motive power, control power and instrument power.

- **Associated Circuits by Common Enclosure**: Circuits (safe shutdown and non-safe shutdown related) that share a common enclosure with safe shutdown circuits or equipment. Enclosures include panels, junction boxes and raceways (conduit and cable trays).

- **Spurious Operation Associated Circuits**: Circuits that are not specifically required for proper operation of safe shutdown equipment, but if subjected to a fault, could result in the spurious operation or maloperation of safe shutdown equipment.

The purpose of the associated circuits evaluation is to determine if any associated circuits of concern exist that could, as a result of fire damage, prevent achieving and maintaining safe shutdown in the event of a worst case fire at the plant. If an associated circuit meets the following definition it is classified as an associated circuit of concern:

Those circuits (safe shutdown and non-safe shutdown) associated by common power supply,

- Have physical separation less than that required by Section III.G.2 of Appendix R, and
- Have the potential to impair safe shutdown capability through one or more of the following mechanisms:

  - Causing the loss of a safe shutdown power supply due to lack of coordinated circuit protection.
  - Inducing a spurious operation that adversely affects safe shutdown capability.
  - Sharing an enclosure with a safe shutdown circuit without adequate electrical protection or without protection against fire propagation from one fire area to another.

The PBNP Appendix R safe shutdown analysis relies on proper electrical coordination and protection to eliminate both common power supply and common enclosure associated circuits as an Appendix R concern (inherent assumption in conducting the primary circuit analysis). Spurious operation associated circuits are incorporated directly into the primary circuit analysis (Section 5.2.3.2) and are dispositioned along with other safe shutdown cables in the fire area analysis (Section 5.2.5).

Key elements of the PBNP associated circuits analysis include:

- Common Power Supply Associated Circuits Evaluation (Coordination Study)

  - An evaluation of classical electrical coordination for all safe shutdown power supplies, including buses, switchgear, motor control centers, batteries, inverters, distribution panels, and control panel branch circuits
  - Disposition of common power supply associated circuits of concern

- Common Enclosure Associated Circuits Evaluation

  - An evaluation of cable and equipment fault protection and susceptibility to secondary fires [Type I common enclosure associated circuits]
  - An evaluation of cable protection against fire propagation between fire areas [Type II common enclosure associated circuits]
  - An evaluation of current transformer (CT) secondary-side faults
  - Disposition of common enclosure associated circuits of concern

- Multiple High Impedance Fault (MHIF) Evaluation

  - An evaluation of safe shutdown power supply vulnerability to MHIFs
  - Disposition of MHIFs of concern

5.2.3.2.1 Common Power Supply Associated Circuits

Circuits and cables associated by common power supply are those circuits whose fire-induced failures could cause the loss of a power source (e.g., bus, switchgear, distribution panel, Motor Control Center (MCC), branch circuit) that is necessary to support safe shutdown equipment or functions. The issue of associated circuits of concern by common power supply is primarily resolved by confirming adequate electrical coordination between a power supply's incoming breaker or fuse and its load-side breakers or fuses.

5.2.3.2.2 Common Power Supply Analysis Criteria

An electrical coordination study serves as the principal tool for confirming the absence of associated circuits of concern. The following criteria are applied to the electrical coordination study:

a. Electrical coordination is achieved when the time-current characteristics of the electrical protective devices assure that the load-side interrupting device trips prior to any upstream interrupting device over the full range of available fault current (e.g., overload to maximum short-circuit current). Protective devices shall be rated to interrupt the maximum credible fault current and the power source shall be capable of providing the necessary fault current for sufficient time to ensure proper coordination.

b. The single failure criterion is not applied to electrical protection devices. Electrical protection devices are assumed to operate in accordance with their corresponding time-current characteristics, unless their failure is directly attributable to the fire.

c. Only one electrical fault is postulated to occur at any moment in time (see Section 5.2.3.2.4 for MHIF analysis criteria). For each safe shutdown power supply load-side circuit breaker or fuse, coordination is verified against the upstream protective device(s).

d. Any load-side circuit that is defined as a SPARE is assumed isolated from external circuit cables (i.e., the circuit breaker is open and/or there are no connected field cables).

e. Protective relays and circuit breakers require periodic testing to confirm that their trip characteristics remain within acceptable tolerances to assure coordination.

5.2.3.2.3 Common Enclosure Associated Circuits

Circuits and cables associated by common enclosure are those circuits that share a common enclosure with safe shutdown circuits or equipment. Within the context of Appendix R, an enclosure may be a fire area, fire zone, cable tray, cabinet, conduit, or other such structure that contains electrical circuits. The issue of associated circuits of concern by common enclosure is primarily resolved by confirming that plant cables are adequately protected by properly sized overcurrent protective devices.

Circuits can be associated by common enclosure in the following ways:

a. Fire-induced damage to cables can create circuit faults that generate high currents. If an electrical protective device (e.g., protective relay, circuit breaker, or fuse) does not adequately protect a cable, the high fault current can lead to temperature excursions in the cable that in turn might initiate a secondary fire at somewhere along the cable. If such a secondary fire was to occur in an enclosure outside of the fire area containing the original fire, safe shutdown cables or equipment contained within the common enclosure could be damaged and potentially prevent achieving safe shutdown. This concern also applies to equipment such as switchgear and distribution panels that are not rated for the available fault current. This type of common enclosure associated circuit is designated a Type 1 Common Enclosure Associated Circuit.

b. Cable jacket fire propagation may lead to damage of safe shutdown circuits associated by common enclosure. The concern is that a fire propagating along a cable might spread beyond the affected fire area. Should this occur, safe shutdown cables in adjacent fire areas that share raceways with the ignited cables might be damaged and potentially prevent achieving safe shutdown. This type of common enclosure associated circuit is designated a Type 2 Common Enclosure Associated Circuit.

c. Current Transformers (CTs) represent a potential secondary fire risk. Open circuits on the secondary-side windings of a CT (open circuit assumed to be caused by the initiating fire) can produce momentary high voltages that are beyond the insulation rating of connected equipment. This high voltage can result in arcing that might potentially initiate a secondary fire.

5.2.3.2.4 Common Enclosure Analysis Criteria

The following criteria are applied in assessing common enclosure associated circuits:

a. Rated fire seals at fire area barriers prevent direct propagation of the fire along a cable from one fire area to another fire area. This ensures that redundant safe shutdown enclosures separated by required fire area barriers remain independent.

b. Propagation within the same fire area is reduced by fire retardant features of the cable insulation used in power, control and instrumentation circuits, and by the selected use of cable raceway fire stops. Fire propagation within the same area is also minimal for cables enclosed by conduit and covered trays. Cables enclosed within conduit are susceptible to fire damage but are not considered to contribute to the combustible loading of the area.

c. Over current devices are used to protect power and control circuits. These devices ensure that electrical faults on power and control cables are cleared before they create a fire hazard remote from the location of the fault. A cable is considered to be adequately protected by an over current protective device if the device clears the fault before the cable is heated to the ignition temperature of the cable insulation.

d. Enclosures that contain instrumentation loop cables include instrumentation racks, control panels, cable trays, conduits, and remotely located structures. Instrumentation panels are rigid metal cabinets on, which the individual instrumentation loop modules are mounted. Cable trays and conduits form the raceways in, which field cables are routed. Remotely located structures include process measurement racks that contain transmitters, controllers and/or indicators. These enclosures, along with instrumentation cable separation design criteria, provide a high level of confidence that only low energy cables could short to instrumentation cables. Short circuits on instrument signal cables involving low energy conductors are not considered to represent a secondary fire concern.

e. Creation of a secondary fire resulting from the fire-induced opening of a CT secondary-side circuit shall be considered. Resolution is provided through proper CT qualification or a fire hazards analysis to determine if a secondary fire ignition is credible.

- **Type I Common Enclosure Associated Circuits**

The goal of the Type I common enclosure study is to confirm that electrical system equipment is properly rated for available fault current and that electrical protective devices will clear faults prior to ignition temperatures being reached for downstream cables. The most efficient and straightforward approach for conducting this evaluation is to establish power supply subgroups and confirm adequate protection for the worst-case "protective device – cable" combination within each group.

For each power supply subgroup, electrical protection is reviewed against the criteria established in Section 5.2.3.2.2 following the steps below:

- Review relevant design information, including existing short circuit calculations, equipment rating characteristics, protective device setting sheets and time current curves.
- Identify worst-case "protective device – cable" combinations to bound all cases within a group. These cases are reviewed to confirm that adequate cable protection exists.
- Confirm that electrical system equipment withstand and interrupting ratings are satisfactory with respect to available short circuit current.
- For cases where adequate protection cannot be demonstrated, a common enclosure associated circuit is assumed to exist, requiring further disposition as outlined in Section 5.2.3.2.3 below.

In general, PBNP has provided cable protection in accordance with the National Electrical Code, as documented in the FSAR, Section 8.0, which states: "All cables are protected against overload in accordance with the National Electric Code." This design practice provides a high degree of assurance that adequate circuit protection is provided for cables and that secondary fires in common enclosures do not pose a risk to safe shutdown cables.

- **Type 2 Common Enclosure Associated Circuits**

Type 2 common enclosure associated circuits are concerned with fire propagation along a cable jacket that might lead to damage of safe shutdown circuits sharing a common enclosure somewhere along the cable's route. The safe shutdown circuit analysis assumes that all cables in a particular fire area are impacted by a fire in that area. Consequently the fundamental concern is that a fire will propagate from one fire area to another. Three-hour fire barriers installed in the boundary of each fire area prevent propagation of fire between fire areas, thereby eliminating Type 2 common enclosure associated circuits as a concern.

- **Current Transformers**

A special type of common enclosure issue involves current transformers. Current transformers are used throughout the electrical distribution system to monitor bus current and provide overcurrent protection. The operating characteristics of current transformers are reviewed to determine if the current transformers represent a secondary fire hazard for a shorted secondary circuit.

5.2.3.2.5 Spurious Operation Associated Circuits

Circuits associated by spurious operation are those circuits that can cause plant equipment to spuriously operate or maloperate, as a result of fire-induced faults, in a manner that defeats or adversely affects the function of safe shutdown systems or equipment. Examples include the uncontrolled opening or closing of valves, unintentional pump starts, and spurious safeguards signals that may affect the safeguard circuit interlocks associated with safe shutdown components (e.g., safety injection signal logic).

Electrically controlled equipment may be affected by fire-induced spurious operations. There are two types of power-assisted electro-mechanical devices (motor-operated and air-operated) that can be affected by fire-induced cable damage:

a. Air-operated devices are susceptible to fire-induced spurious operations if the control circuit of the actuating device could develop (as a result of fire damage) the spurious signals necessary to cause operation of the actuating device. Availability of motive power (air) is assumed to be either available or unavailable, depending on, which represents the limiting condition.

b. Motor-operated devices are susceptible to fire-induced spurious operations if the control circuit of the actuating device could develop (as a result of fire damage) the necessary control and/or power conditions in the respective electrical circuits. Electrical power loss for motor-operated valves results in the device remaining in the "as-is" condition.

Spurious equipment operations that affect safe shutdown equipment are terminated, and/or corrected in some cases, by one of the following methods:

- Isolation of motive power and, if applicable, manual repositioning of the affected component,
- Operation of a redundant component to isolate or bypass the affected component,
- Removal of control power from equipment control circuits, and
- Any appropriate combination of the above methods.

The treatment of circuits associated by spurious operation is an integral part of the safe shutdown analysis. Components whose spurious operation potentially jeopardizes safe shutdown are themselves considered to be safe shutdown components and are included in the SSEL. These spurious operation components undergo circuit analysis along with all other safe shutdown components. Ultimately, the spurious operation concern is dispositioned during the fire area analysis, as discussed in Section 5.2.5.

5.2.3.2.6 Multiple High Impedance Faults

Multiple high impedance faults (MHIFs) are a special category of common power supply associated circuits. They involve the same safe shutdown power supplies, circuits, and cables as addressed in the coordination study. A potential concern with MHIFs was raised in Generic Letter 86-10, which states in part that simultaneous high impedance faults for all associated circuits located in the fire area should be considered in evaluating safe shutdown capability. The difference between a traditional coordination study and a MHIF study is that a MHIF study is based on multiple concurrent faults in lieu of a single fault. This difference alone entirely changes the nature of the study.

- **MHIF Analysis Criteria**

  The analysis criteria for MHIFs is generally the same as those listed for the electrical coordination study in Section 5.2.3.2.1 with the following caveats:

  a. A MHIF concern exists when sustained faults on multiple load-side circuits could result in a cumulative fault current that trips the supply-side protective device before the individual faults are cleared by load-side protective devices.

  b. The sustained faults are assumed to be caused by high impedance faults that result in abnormally low fault currents. Evaluation of MHIFs considers circuits that are associated by common power supply.

  c. Analysis of MHIFs takes into consideration, which circuits are susceptible to failure based on configuration and fault current magnitude. Conservative, but reasonable assumptions are made regarding the number of circuits susceptible to the high impedance fault phenomena coincidentally.

  d. Analysis of MHIFs considers the nature of high impedance faults (arcing faults) for the voltage class under consideration as documented in industry literature.

5.2.3.3 Overcurrent Protective Device Testing

A maintenance and testing program is necessary to ensure that overcurrent protective devices will function as designed. Generic Letter 81-12 describes the attributes of an acceptable testing program as one that ensure that protective relays, switchgear breakers or molded case breakers operate in accordance with their published time-current trip characteristics, ensure that the settings have not experienced excessive drift, and ensure that molded case breakers will trip when called upon to do so.

The PBNP breaker, protective relay and fuse control program consists of periodic testing maintenance and administrative controls to ensure the reliability of protective devices for Appendix R safe shutdown components. The program includes the following elements:

- Relay and breaker testing procedures with checks performed in accordance with vendor manuals. These tests use a recent equipment functional demonstration as the baseline for determining equipment operability and calibration, since the original manufacturer's shop acceptance tests were not required or provided at the time these protective devices were purchased.
- Periodic testing of low and medium voltage power circuit breakers and protective relays.
- Breaker testing procedures for molded case circuit breakers are controlled by the Component Maintenance Program.
- Although fuses do not require testing, configuration control is maintained by the PBNP Fuse Control Program.

5.2.4 Safe Shutdown Equipment and Cable Locations

5.2.4.1 Methodology

The purpose of this section is to identify the methodology used to determine the physical location of the equipment and cables that are required to support post-fire safe shutdown. The processes for selecting systems, equipment and cables are not dependent on physical location. The systems, equipment and cable selection are performed to provide a minimum set of equipment to ensure safe shutdown, regardless of fire location. However, in order to ensure compliance with the separation criteria in Section III.G of Appendix R, the physical locations of the safe shutdown equipment and cables must be determined.

Equipment and cables are located by fire zones for ease of analysis. This provides the most accurate location for individual pieces of equipment and cables and allows the most efficient use of the computer analysis as a tool for ensuring compliance with Appendix R requirements.

The following are the key information and relationships that are established in order to assess safe shutdown capability for each fire area.

- **Fire Zone Information**: Plant fire zones are defined as sub-divisions of fire areas at PBNP. A fire area can be comprised of one or more fire zones. The Fire Hazards Analysis is performed for PBNP on a fire zone basis.
- **Fire Area Information**: Fire Areas are areas sufficiently bounded to withstand the hazards associated with the area and, as necessary, to protect equipment within the area from a fire outside the area. Fire Area Analysis (Section 5.2.5) is done primarily on a fire area basis, unless specific analyses are performed to either combine or subdivide a fire area for unique analyses (i.e., the DG Building, Turbine Driven Auxiliary Feedwater Pump Room, or Fire Area A01).
- **Fire Zone-to-Fire Area Relationship**: Since the Fire Area Analysis is performed on a fire area basis and equipment and cable locations are identified on a fire zone basis, the fire zone to fire area relationship must be understood as defined above. This relationship does not include equipment associated circuits.
- **Equipment-to-Fire Zone Relationship**: This is the fire zone location of the actual safe shutdown equipment (not its associated cables).
- **Cable-to-Raceway Relationship**: The raceways a particular cable is routed through.
- **Raceway-to-Fire Zone Relationship**: The raceway to fire zone relationship is identified to assign a physical location to the raceways containing safe shutdown cables.
- **Cable Endpoint**: Cable endpoints are the termination points of individual cables. This information must be utilized because, in certain instances, cables may terminate in an area, but may not be routed in a raceway within that area (e.g., a cable penetrates a floor in a cabinet from an area below the cabinet.
- **Cable Endpoint Location**: The fire zones, rooms or sub-fire areas where a cable terminates. This may be necessary since cable endpoints may exist in plant areas with no raceways containing the cable (i.e., a cable terminating in the Control Room coming up through the floor of the Cable Spreading Room).

The information discussed in this section is not stand-alone and represents an intermediate step between the identification of safe shutdown equipment and cables (Sections 5.2.2 and 5.2.3) and the fire area analysis (Section 5.2.5).

5.2.5 Fire Area Analysis

5.2.5.1 Methodology

This section provides the criteria and process for performing the fire area analysis. Fire area analysis is performed for each area in order to ensure compliance with the requirements of 10 CFR 50, Appendix R, Sections III.G and/or III.L or an Appendix R exemption. Fire area analysis is performed for all areas containing safe shutdown equipment or cables. The Safe Shutdown System and Component Logic Diagrams are analyzed for each area to ensure that at least one success path is available based upon the postulated equipment and/or cable losses due to a fire in that area. The impact of a loss of equipment in a particular area is documented based upon the review of the cable and equipment losses and their impact on safe shutdown success paths.

5.2.5.1.1 Appendix R Compliance Criteria

Acceptance criteria for separation of safe shutdown capability is provided in Sections III.G and III.L of 10 CFR 50, Appendix R as discussed in Section 5.2.1.3.

5.2.5.1.2 Fire Area Analysis Assumptions

The Appendix R safe shutdown analysis details the effects of fire on safe shutdown equipment and identifies methods for achieving safe shutdown. The fundamental basis for this analysis is that a single fire occurs in any plant area coincident with a loss of off-site power. All equipment normally present in the plant is assumed to be functional and may be lost only as a result of fire damage or a loss of off-site power. No other external events, accidents, or failures unrelated to the fire are assumed to occur concurrently with the postulated fire or with any subsequent activities performed to achieve cold shutdown conditions. Refer to Section 5.2.1.2 for a list of assumptions used in the safe shutdown analysis.

5.2.5.1.3 Fire Area Analysis Process

- **Fire Area Analysis Preparation**

  For each Fire Area, the following information is utilized to assess, which equipment and systems could be affected by a postulated fire:

  - Safe Shutdown Equipment located in the fire area, and
  - Safe Shutdown Cables located in the area, either due to its endpoint being located in the area or a raceway containing the cable being located in the area.

A set of safe shutdown logic diagrams is utilized to ensure that the appropriate losses and their interrelationships are appropriately assessed. Other references that are used in the fire area compliance assessment include:

- Appendix R Exemptions and docketed correspondence,
- Fire Hazards Analysis for the fire zones associated with the Fire Area-Fire Zones being analyzed,
- List of raceways that are currently fire wrapped,
- Abnormal Operating Procedures,
- Fire Protection and Fire Barrier Location Drawings, and
- Electrical Layout Drawings for raceway physical locations.

- **Fire Area Compliance Assessment**

a. All safe shutdown equipment affected by a postulated fire are identified, based upon the physical location of equipment and cables affected by a fire in the area. This equipment includes:

   - Equipment physically located in the area,
   - Equipment whose safe shutdown cables are physically located in the area, and
   - Equipment affected for another specific reason, such as instrument tubing, instrument air, or another area-specific reason.

b. Equipment that is identified as being affected by a fire in the area is crossed off on the logic diagrams to show that it is not available to perform its required function.

c. Support systems are reviewed first in order to assess the impact on the systems being supported. In addition, the impact of a particular fire on process monitoring instrumentation was reviewed prior to assessing other process system availability.

d. Using the marked-up logic diagrams and supporting information, a success path determination for all safe shutdown functions is performed. The logic(s) are reviewed to ensure that all systems that support the safety functions are addressed. The achievement of safe shutdown and the positive control of spurious operations that could adversely affect safe shutdown are considered.

e. For each safe shutdown equipment impacted by a fire in the area, the method to achieve compliance with Appendix R requirements is documented. A summary for each fire area is prepared to documents key safe shutdown information for the area.

- **Fire Protection Features**

The presence of fire protection features such as fire wrap, detection and suppression are reviewed for each applicable Fire Area when compliance strategies required these features for that Fire Area.

- **Manual Operator Actions and Equipment Repairs**

  a. Manual operator actions (required for safe shutdown) are evaluated for feasibility (e.g., physical accessibility, adequate time for the action, emergency lighting, access to or travel through the Fire Area). In addition, all motor operated valves requiring post-fire manual operator action are reviewed to determine if the valve is susceptible to the failure modes described in NRC Information Notice 92-18, Potential Loss of Remote Shutdown Capability During a Control Room Fire, for the fire area that requires the manual operator action.

  b. Required manual operator actions for each Fire Area are documented as the compliance strategy for the affected safe shutdown equipment. Any post-fire manual operator actions that may not be linked to specific fire areas (e.g., cables are excluded during the circuit analysis process where it is assumed a post-fire operator action occurs either inside or outside of the control room) are considered generically.

  c. Cold shutdown repairs are assessed to ensure that procedures are in place to implement the repair, dedicated materials are available on-site, and that adequate time and manpower are available to implement the repair. Cold shutdown equipment is defined as equipment required to make the transition from Hot Standby to Cold Shutdown but not required to maintain the plant in a stable, hot standby condition.

5.2.5.2 Safe Shutdown Scenarios

The following provides summary level information on specific safe shutdown scenarios at PBNP. Alternative Shutdown, in accordance with Section III.G.3 of 10 CFR 50, Appendix R, is relied upon for postulated fires in the following plant areas:

Fire Zone(s)	Fire Area	Description
326, 328, 329, 330, 331	A31	Control Room
318	A30	Cable Spreading Room
305	A24	4160V Vital Switchgear Room
333, 334, 335, 336	A32	Computer and Instrument Rack Room
187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199	A01-B	Monitor Tank Room (PAB 26' Elev. Central Area)
237	A01-B	CCW Heat Exchanger and Boric Acid Tank Room (PAB 44' Elev. Central Area)

The following fire areas are not considered alternative shutdown in accordance with Sections III.G.3 and III.L of Appendix R, but have complex fire scenarios that warrant additional attention.

Fire Zone(s)	Fire Area	Description
304N, 304S	A23N, A23S	Turbine Driven Auxiliary Feedwater Pump Room (North and South)
156	A06	MCC Room – 1B-32
166	A15	MCC Room – 2B-32

The discussions, provided in this section, focus on the safe shutdown scenarios, without discussing details associated with the fire protection features such as detection, suppression, and passive fire protection features. See the Fire Hazards Analysis Report for additional discussion on the traditional fire protection features and issues associated with these fire areas.

5.2.5.2.1 Control Room, Cable Spreading Room and 4160V Switchgear Room Scenarios

The equipment and cable losses associated with a fire in these areas are similar, in that redundant trains of equipment and cables for both units are located in these areas. The consequences of a postulated fire in these areas are severe and requires the use of equipment that is independent of these areas. The following is a summary level description of the equipment utilized for alternative shutdown for a fire in the Control Room (Fire Zone/Area 326/A31), Cable Spreading Room (Fire Zone/Area 318/A30), or 4160V Switchgear Room (Fire Zone/Area 305/A24):

a. The areas contain both Train A and Train B safe shutdown equipment for both units. Control and indication circuits are routed in the Control Room and Cable Spreading Room. In addition, the Cable Spreading Room contains the Train A and Train B 480V load centers for both units, as well as Train A and Train B DC distribution panels.

b. The Diesel Generator (DG) Building contains the Train B 4160V Switchgear for both Units and the 4160V Vital Switchgear Room contains the Train A 4160V switchgear for both Units. However, there are Train B control and indication circuits, which are routed into the 4160V Vital Switchgear Room to the 4160V non-vital switchgear also located in the room. Thus, there is the potential for loss of both trains of power for both units.

As discussed in Section 5.2.2, the following specific safe shutdown functional requirements shall be met.

The following discusses summary level approaches to accomplishing the safe shutdown functional requirements for a fire in either the Control Room, Cable Spreading Room, or 4160V Switchgear Room. Although there are slight variations on actions required for postulated fires in these areas, they are fundamentally the same. The major differences in the shutdown methodologies for these areas can be summarized as follows:

a. The operator action locations, particularly for de-energizing loads as part of system alignment or mitigation of spurious operation, may differ depending on the location of the fire (i.e., in order to avoid manual actions in the area where the fire is located).

b. The consequences of a postulated all consuming fire in the 4160V Switchgear Room are less severe than a fire in the Control Room or Cable Spreading, particularly since the addition of the Train B Emergency Diesel Generators and Train B 4160V Switchgear in the DG Building. The Control Room and Cable Spreading Room also contain more safe shutdown control cables than the 4160V Switchgear Room. This makes the number of potential spurious actuations in the 4160V Switchgear Room less than in the Control Room or Cable Spreading Room.

Note: The alternative shutdown process utilizing the Gas Turbine as a power source and the dedicated switchgear B-08 and B-09 was originally only relied upon for a fire in the 4160V Switchgear Room. Modifications were performed in 1997 to allow this lineup to be utilized for a Control Room and Cable Spreading Room fire. This was performed to resolve technical issues associated with the Control Room and Cable Spreading Room fire scenarios and to provide a more consistent approach for operators in post-fire shutdown strategies for these areas.

- **Reactor Reactivity Control**

Initial reactivity control occurs as a result of a reactor trip, either automatically or from initiation of a manual trip. Long term reactivity control is accomplished by adding borated water from the Refueling Water Storage Tank (RWST) using the charging pumps to ensure reactivity margin throughout safe shutdown.

For alignment of the charging system, a flow path from the RWST must be established by local manual operator action by opening the RWST to Charging Pump Suction valve and closing the Volume Control Tank (VCT) Outlet Isolation valve. Since charging to the RCP seals may be lost during a worst case scenario, seal damage may occur. If this occurs, the seal injection path must be isolated by local manual operator action. Charging is accomplished via the normal or auxiliary charging flow path by local manual operator action (which also isolates the auxiliary spray line).

- **Reactor Coolant Make-up Control**

Reactor Coolant System (RCS) makeup from the RWST using the charging pumps is accomplished as described above.

Certain reactor coolant boundary valves are susceptible to spurious opening and must be shut in order to maintain positive control of reactor coolant system inventory. The following is a summary of boundary valves and methods of ensuring that they either remain shut or can be shut in the event of spurious opening:

- Pressurizer PORVs are shut (by the isolation and venting of instrument air to containment),
- Normal letdown system isolation valves are shut (by the isolation and venting of instrument air to containment),
- Reactor coolant sample valves are shut (by the isolation and venting of instrument air to containment),
- RCS Loop A to RHR suction valves remain shut (by keeping power removed to the valves during normal operation),
- Reactor head vent and pressurizer vent valves remain shut (by keeping power removed to the valves during normal operation), and
- The excess letdown valves remain shut (by normal system alignment and circuit design features).

Other potential spurious operations that could adversely impact RCS makeup control and their mitigating actions include:

- Positive control of RCS makeup by ensuring that an Safety Injection (SI) pump does not spuriously inject into the reactor coolant (by turning off a spuriously started pump or shutting the valve flow path),
- Ensuring the RWST inventory is preserved in the event of spurious containment spray actuation (by turning off a spuriously started pump or shutting the valve flow path), and
- Ensuring the RWST inventory is preserved in the event of spurious opening of a containment sump valve (by local manual operator action).

Approximately 160 gallons per hour, per Reactor Coolant Pump (RCP), would return to the Pressurizer Relief Tank (PRT) as a result of RCP seal water return flow. The reactor coolant pump seal return lines are isolated by operator action.

- **Reactor Coolant Pressure Control**

  Reactor coolant pressure control is accomplished by mitigating potential spurious operations that could affect positive control of RCS pressure:

  - Pressurizer PORVs are shut (by the isolation and venting of instrument air to containment),
  - Auxiliary spray valves are isolated,
  - Isolating normal spray (by turning off the reactor coolant pumps), and
  - Securing the pressurizer heaters to prevent undesired pressure excursion (by local manual operator action).

  For RCS pressure control in the transition from hot standby to cold shutdown, auxiliary spray may be used by aligning valves via local manual operation and relying on the opening of the auxiliary spray valve on differential pressure. SI accumulator isolation is accomplished via local manual operator action. Following cooldown and depressurization and operation of the RHR system, the RCS is floated on the RWST to maintain system pressure by local manual operator action.

- **Reactor Heat Removal**

  The reactor heat removal function is accomplished by the following actions:

  a. Establishing and controlling auxiliary feedwater flow to the steam generators by:

     - Manually aligning steam to the Turbine Driven Auxiliary Feedwater pumps from the "B" Steam Generators by local manual operator action, and
     - Manually aligning the Turbine Driven Auxiliary Feedwater pumps to feed the "B" Steam Generators.

  b. Manually isolating the Main Steam Isolation Valves (MSIVs) by isolating and venting air locally at the valves,

  c. Closing the Steam Generator Atmospheric Dump Valves by isolating and venting air locally at the valves,

  d. Isolating the Steam Generator Blowdown lines by isolating and venting air to containment,

  e. Isolating the Steam Generator Sample lines by local manual operation, and

  f. Isolating Main Feedwater in the event of uncontrolled feeding of the Steam Generators by securing the pumps by local manual operator action.

Reactor heat removal during the cooldown phase is accomplished using Auxiliary Feedwater and local manual operation of the Steam Generator Atmospheric Dump Valves for the "B" Steam Generators. Following cooldown and depressurization, the Residual Heat Removal System is used for reactor heat removal. The RHR system flow path is aligned by local manual operation.

- **Process Monitoring**

Maintenance and control of various plant operating modes requires indication of certain plant parameters. A minimum set of instruments provides an alternate method of indication. For each unit this includes: Pressurizer level, RCS pressure, hot and cold leg temperature, Steam Generator level and pressure, and neutron flux. Essential parameter monitoring is accomplished outside of the control room at two primary locations (per unit):

a. In the Turbine Driven Auxiliary Feedwater Pump Room

- SG "B" Level Indication
- SG "B" Pressure Indication
- RCS Loop "B" T_{hot} Indication
- RCS Loop "B" T_{cold} Indication
- NIS Source Range

b. Outside Unit 1 Charging Pump Area – PAB 8′ EL

- Pressurizer Level Indication
- RCS Pressure Indication

c. Outside Unit 2 Charging Pump Area – PAB 8′ EL

- Pressurizer Level Indication
- RCS Pressure Indication

- **Miscellaneous Support Functions**

Alignment of miscellaneous support functions can be described as two major activities:

- Electrical Support (Power Alignment), and
- Mechanical Support (cooling systems, etc.)

a. Electrical Support (Power Alignment)

The following power alignment is utilized to support safe shutdown for a postulated fire in the above areas:

- Gas Turbine G-05 as the main power source.
- Power Feed through the 13.8 kV Switchgear H-01 through X-08 transformer to feed Load Centers B-08 and B-09.
- Load Centers B-08 and B-09 provide power to the following pumps via transfer switches:

  - Charging Pumps 1P-2A and 2P-2A
  - Either Service Water Pump P-32B or P-32F and P-32C or P-32E
  - Either RHR Pump 1P-10A or 1P-10B and 2P-10A or 2P-10B
  - Either CCW Pump 1P-11A or 1P-11B and 2P-11A or 2P-11B

- B-08 also feeds motor control center B-81, which can be aligned to Battery Charger D-109.
- Battery Charger D-109 charges either battery D-105 or D-106 to provide power to 125V DC panel D-03 or D-04.
- DC Distribution panel D-31 or D-41 is powered from either D-03 or D-04, respectively.
- D-31 or D-41 provides control power for the 13.8 kV switchgear, control power for B-08/B-09, indication at the C-45 control panel for control of equipment from B-08/B-09, and the alternative red instrumentation inverters DY-13/DY-14 at panel C-207.
- Inverters DY-13 or DY-14 provide power to the alternate red instrumentation at the C-205 panels.

b. Mechanical Support

Mechanical support system alignment for the alternative shutdown scenario is comprised of the following:

- Alignment of Service Water (SW) to provide a backup source of water for the Turbine Driven Auxiliary Feedwater pumps in the event of depletion of the Condensate Storage Tanks. For Cold Shutdown, SW is relied upon as the ultimate heat sink when the RHR System is being used for plant cooldown. Non-essential SW systems loads are isolated by local manual operator action, as well as alignment of SW as a source of Auxiliary Feedwater for plant cooldown,
- Alignment of the Component Cooling Water (CCW) System to the RHR System Heat Exchangers for plant cooldown. Since the CCW Pumps do not have permanent power cables installed from power transfer switch to the pumps, repairs are necessary to install power cables from the power transfer switch to the respective pump motors. Non-essential CCW system load isolation and alignment of cooling water to the RHR Heat Exchangers are accomplished by local manual operator action, and
- Appendix R loss of ventilation calculations have determined that portable ventilation may be required in the following plant areas in the event of a fire-induced loss of ventilation:

    - Computer Room
    - Vital Switchgear Room
    - Cable Spreading Room
    - Control Room
    - Turbine Driven Auxiliary Feedwater Pump Room (North and South)
    - PAB 26' Electrical Equipment Rooms

Postulated fires in the Control Room, Cable Spreading Room, Vital Switchgear, or Computer Room do not require equipment in those rooms to be provided with cooling. The alternative shutdown capability provided following a fire in these areas is independent of these areas. Therefore, room cooling is not required to be provided following fires in these areas. Only the Turbine Driven Auxiliary Feedwater Pump Room fire event requires establishment of portable ventilation, which would be accomplished by local manual operator action.

5.2.5.2.2 Computer & Instrument Rack Room, Monitor Tank Room, and CCW Heat Exchanger & Boric Acid Tank Room

Postulated fires in the Computer and Instrument Rack Room (Fire Zones/Area 335 & 336/A32), Monitor Tank Room (Fire Zone/Area 187/A01-B), and CCW Heat Exchanger and Boric Acid Tank Room (Fire Zone/Area 237/A01-B) could result in alternative shutdown, in accordance with Sections III.G.3 and III.L of Appendix R. However, the consequences of an unmitigated fire in these areas are not as severe as the Control Room, Cable Spreading Room, or 4160V Vital Switchgear Room.

The reason that the Computer and Instrument Rack Room, Monitor Tank Room, and CCW Heat Exchanger and Boric Acid Tank Room fire scenarios require alternative shutdown is that the normal process monitoring instrumentation in the Control Room could be damaged by a postulated fire, which would require the use of instrumentation outside of the Control Room for monitoring essential plant parameters. For each unit this includes: Pressurizer level, RCS pressure, hot and cold leg temperature, Steam Generator level and pressure, and neutron flux. Therefore, for a postulated fire in these areas, process variables may require monitoring outside of the Control Room. The primary locations and process variables monitored at these locations are the same as those discussed above in Section 5.2.5.2.1.

While monitoring of process variables outside of the Control Room is the only action that is considered alternative shutdown, there are other manual actions that may be required in the event of a fire in the Computer and Instrument Rack Room, Monitor Tank Room, and CCW Heat Exchanger and Boric Acid Tank Room. However, the alternative shutdown alignments that are applicable to the other alternative shutdown scenarios (such as aligning power from the Gas Turbine and utilizing dedicated switchgear B-08 and B-09) are not required.

5.2.5.2.3 Turbine Driven Auxiliary Feedwater Pump Room

- **Background**

  The Turbine Driven Auxiliary Feedwater Pump (TDAFP) Rooms (Fire Zones/Areas 304N/A23N and 304S/A23S) contain both Turbine Driven Auxiliary Feedwater Pumps, and their associated valves. In addition, the TDAFP Room contains cables associated with Train A and Train B Safe Shutdown systems for both units. Several key cables/equipment located in this area include:

  - The main power feeder cables from the Train A and Train B 4160V switchgear to their respective 4160V/480V transformer,
  - Control circuitry for the Train A (G-01/G-02) and Train B (G-03/G-04) Emergency Diesel Generators and their associated support systems such as fuel oil and ventilation,
  - Train A and Train B 125V DC circuitry for both units,
  - 120V AC instrumentation power for multiple channels, and
  - Power and control circuitry for all safe shutdown systems.

The TDAFP Room does not rely upon the alternative shutdown methodology described above in Section 5.2.5.2.1 for the Control Room, Cable Spreading Room, and 4160V Switchgear Room for the following primary reasons:

- Depending on fire location, the motor-driven AFPs may be required for a fire in the TDAFP Room. Load Centers B-08 and B-09, the alternative shutdown 480V power sources, do not have power feeds to the motor-driven AFPs.
- The alternative red instrumentation process monitoring panels 1/2C-205, as well as their associated inverters DY-13 and DY-14 are physically located in the TDAFP Room.

Instead of relying on alternative shutdown capability, safe shutdown for a fire in the TDAFP Room relies on different shutdown strategies depending on fire location. For the purpose of the safe shutdown analysis, the TDAFP Room was subdivided into two Analysis Areas, the North (Fire Area A23N and South (Fire Area A23S). The North area includes the Unit 2 Turbine Driven Auxiliary Feedwater Pump (TDAFP) cubicles. The South area includes the Unit 1 TDAFP cubicles. The analyses for this area relies on the lack of north-south fire propagation to ensure safe shutdown capability as discussed in the NRC approved Appendix R exemption for this area. A three hour rated gypsum wall was installed to further ensure that a fire within the TDAFP Room will be limited to either the north or south section of the room.

The different shutdown strategies relied upon for a postulated fire in the different areas are driven primarily by the available power sources and the impact of the fire on the Turbine Driven Auxiliary Feedwater System.

Achieving and maintaining hot standby is accomplished for both units using a single EDG by the following general system lineups:

- One EDG (G-01, G-02, G-03, or G-04) supplies power through its associated 4160V switchgear (1A05, 2A05, 1A06, 2A06) and transformer (1X-13, 2X-13, 1X-14, 2X-14) to its respective 480V load center (1B03, 2B03, 1B04, 2B04).
- Since only one 480V Load Center is receiving power, the B03-B04 cross-tie must be utilized to provide Train A and Train B power for a given unit.
- Power provided to B-03 and B-04 for a given unit ensures power to the following:

  - At least 3 Service Water Pumps (2 are sufficient to shutdown both units),
  - At least one MDAFP (which used in conjunction with a TDAFP, could be used to shutdown both units), and
  - Power to a charging pump for a given unit, and power to the opposite Unit's "B" pump via the charging pump cross-tie breakers.

The power alignments for each section of the room are described as follows:

- **North Side Fire Scenario Power Alignment**

A North Side fire could potentially result in the loss of Emergency Diesel Generators (EDGs) G-02, G-03, and G-04.

Train A Emergency Diesel Generator (G-01) is relied on for a fire in this section of the room. In addition to the loss of the EDGs, the 4160V power feeds to the 1X-14, 2X-13 and 2X-14 transformers could be lost. The power alignment for safe shutdown would be the 1A-05 bus to 1B-03 bus and then cross-tying 1B-03 bus to 1B-04 bus.

The offsite power feeds to the Unit 1 and Unit 2 4160V switchgear will not be damaged by the fire.

- **South Side Fire Scenario Power Alignment**

For a fire event in the South Half of the room, G-01 and G-02 may not be available due to fire damage. G-03 and G-04 EDGs will be available to power the 2A-06 bus. The 4160V power feeds to 1X-13 and 1X-14 transformers could also be lost. Offsite power feeds to the Unit 1 and Unit 2 4160V switchgear could be lost. The safe shutdown power alignment would be from 2A-06 to 2B-04. 2B-03 and 2B-04 could then be cross-tied to provide the necessary power for safe shutdown.

5.2.5.2.4 Unit 1 / Unit 2 MCC B32 Rooms

The Unit 1 and Unit 2 MCC B32 Rooms (Fire Areas A06 and A15, respectively) are located on the 8′ elevation of the PAB outside of the Charging Pump Rooms. Key equipment and cabling located in these areas include:

- Power and Control Cables for all 3 Charging Pumps,
- Speed Control Station for the Charging Pumps,
- Motor Control Center B-32 (Train A MCC), which powers most Train A valves and 480V loads, including the Charging Supply Valve (1/2CV-112B) from the Refueling Water Storage Tank (RWST), and the Charging Supply Valve (1/2CV-112C) from the Volume Control Tank (VCT),
- Charging Supply Valve (1/2CV-112B) from the RWST, and
- 125VDC Distribution Panels D-31 and D-41 (Unit 2 Fire Area A15 only).

The primary concern with post-fire shutdown in these areas is ensuring that a charging pump can be protected or restored in order to provide RCP seal injection flow, inventory control and boration. The short term necessity is to minimize the chances of a temporary loss of charging flow, which could potentially result in increased RCP seal leakage and RCS makeup requirements. Increased RCP seal leakage may warrant the fast speed operation of the charging pumps in order to compensate for the increased leakage. The charging pump speed control fails slow, therefore, damage local to the speed control station could fail the charging pump(s) to slow speed. Fast Speed operation of the charging pumps from the control room cannot be ensured for a fire in this area. Speed control for the credited pump(s) is available via manual action at the VFD. The VFD is free from fire damage. Therefore, ensuring continuity of charging or the ability to restore charging/RCP seal injection in a timely manner is the primary concern for a fire in these areas.

The above concerns are inter-related and were considered in the fire area assessment for these areas. Table 5.2.5.2.4-1 is a summary of the resolution for post-fire safe shutdown for these areas.

Table 5.2.5.2.4-1
Fire Area A06 and A15 – Safe Shutdown Scenario Summary

Issue-Concern	Unit 1 (FA A06) Strategy	Unit 2 (FA A15) Strategy
Power and Control Cables for all 3 Charging Pumps	Physical separation is provided to ensure that either 1P-2A and 1P-2B or 1P-2C is available. This is discussed in an NRC approved Appendix R exemption.	Physical separation is provided to ensure that either 2P-2A and 2P-2B or 2P-2C is available. This is discussed in an NRC approved Appendix R exemption.
The Speed Control Station for the Charging Pumps	The speed control station is assumed lost. No credit is taken for fast speed operation of the charging pumps.	The speed control station is assumed lost for a fire in the east side of the room. Speed control for the credited pumps is available via manual action at the VFD. The VFD is located outside of the fire area and is relied upon. The speed control station would remain available for a fire on the west side of the room and is relied upon.
Motor Control Center B-32	Assumed lost. Manual action prescribed to de-energize the MCC.	Assumed lost. Manual action prescribed to de-energize the MCC.
Charging Supply Valve (1/2CV-112B) from the RWST	Post-fire manual actions taken in the Fire Area to reposition the valve or its redundant manual valve. Action to de-energize MCC B-32 ensures power removed to valve.	Post-fire manual actions taken in the Fire Area to reposition the valve or its redundant valve. Action to de-energize MCC B-32 ensures power removed to valve.
125V DC Distribution Panels D-31 and D-41 (Unit 2 Fire Area A15 only)	Not applicable	Due to losses associated with D-31 and D-41 (which provide power to DG circuitry), the B03 to B04 cross ties must be used to ensure power to sufficient charging pumps.

5.2.5.3 Manual Operator Actions

- **Manual Actions**

As part of the Fire Area Analysis process described in Section 5.2.5.2, equipment was identified whose normal operation from the Control Room could be lost due to fire. Based on the equipment losses, the Fire Area Analysis determined, which components must be manually operated in order to satisfy post fire safe shutdown conditions. If a redundant component is available and could be electrically operated from the Control Room, then a manual action may not be necessary. However, not all components have a redundant component, or if a redundant component exists, it may not be available for a fire in the given fire area or the redundant component may be a manual component (e.g., manual valve or local instrumentation). Based on this, manual operator actions were specified when required. An evaluation including walk downs was performed to verify the feasibility of performing the manual actions.

Manual operator actions in support of post-fire shutdown are an acceptable means of ensuring post-fire safe shutdown capability. Manual operator actions in support of post-fire shutdown are considered a part of compliance with Section III.G.1 of Appendix R, which states that:

- "Fire protection features shall be provided for structures, systems, and components important to safe shutdown. These features shall be capable of limiting fire damage so that:
  - One train of systems necessary to achieve and maintain hot standby conditions from either the control room or emergency control station(s) is free of fire damage, and
  - Systems necessary to achieve and maintain cold shutdown from either the control room or emergency control station(s) can be repaired within 72 hours."

For the purposes of compliance with Appendix R, manual operator action locations are considered to be "emergency control stations."

- **Feasibility of Manual Actions**

The feasibility of performing a manual action depends on a number of factors. If one of these is not met, then justification or modification may be necessary. For a manual action to be feasible, it should meet the following conditions:

a. The manual action should not require the operator to enter the fire area. When manual actions are necessary in the area under consideration, the analysis should demonstrate that the area or zone is tenable for the actions to be performed and that fire or fire suppressant damage will not prevent the manual action from being performed.

b. Sufficient lighting (with an 8-hour battery power supply) should be available along the pathway to the location of the manual action.

c. The component being manually operated should be sufficiently lit with lighting having an 8-hour battery power supply.

d. The component should be able to be manually operated (e.g., valves should have handwheels and breakers should be designed to allow manual tripping or closing). If tools are required to operate breakers, these tools should be staged at the breaker.

e. Access to the component must be ensured. If a ladder is required, then a ladder must be staged near the component.

f. It is beneficial to have the components labeled with an Appendix R identifier to provide quick identification of equipment to be manually operated. At PBNP, breakers typically have a red "R", a red tag with a flame or strip of red tape; valves typically have their handwheels painted red, and indicators have their gauge housing face painted red.

g. Communication must be available so the Operators can communicate. This is particularly important when Operators must rely on completion of other manual actions (performed by other Operators) before they can perform their assigned manual action.

h. Sufficient time must be available to perform the manual action. Although the extent of fire damage and exact timeframes for acceptability of actions cannot be accurately predicted, there must be reasonable assurance that manual actions can be performed before the plant is placed in an unrecoverable condition. Potential manual actions should also be prioritized for a given area in a manner consistent with the severity of the consequences of the equipment failure.

- **Manual Actions in the Fire Area**

Credit was taken for cold shutdown manual actions for a number of fire areas in, which the component is located in the fire area. These cold shutdown manual actions involve repositioning valves to support cold shutdown safety functions. Fire damage is limited to the valve operator and will not affect the integrity of the valve. With the valve intact and the fire extinguished prior to cooldown, access to the valve and manual operation of the valve are considered feasible.

In some cases, credit can be taken for certain hot standby manual actions in, which the component is located in the fire area where the fire is located. The feasibility of performing the manual action is based on the following:

- Time criticality of the required manual action,
- Combustible loading and ignition sources within the area,
- Potential problems posed by fire and products of combustion,
- Access paths to the equipment, and
- No other reasonable means is available.

- **Generic Manual Actions**

  Certain manual operator actions may be required, regardless of fire area. Guidance has been provided to operators for these types of actions.

  Generic manual operator actions may be grouped as follows:

  a. Manual valves requiring operation to support safe shutdown (e.g., RHR manual valves that keep a flow path isolated during normal operation).

  b. Equipment actuated by automatic initiation signals that have numerous, diverse inputs. This includes equipment actuation by signals such as Safety Injection signals. In these instances, guidance is provided to operators on a generic basis, rather than trying to predict all of the combinations of failures that could result in a spurious automatic initiation signal.

  c. Equipment normally de-energized during normal operation, such as the RHR suction valves or SI Accumulator isolation valves.

- **Time Constraints of Manual Operator Actions**

  The magnitude, duration or complexity of a fire cannot be foreseen to the extent of predicting the timing and quantity of circuit failures. Rather, for all potential spurious operations in any analysis area, focus must be to address each potential spurious operation and to mitigate the effects of each individually. Multiple spurious actuations or signals originating from fire-induced circuit failures may occur as result of a given fire. However, they are not expected to occur simultaneously unless the spurious operations are caused by the fire-induced failure in circuits that can affect multiple components. For example, although control circuits for essentially all plant safety systems are routed through the Control Room, it is not considered credible that the plant must be able to sustain the simultaneous, instantaneous spurious actuation and failure of all these circuits (e.g., all pumps start, valves change position, etc.).

  This approach should not be used to discount or eliminate the credibility of multiple spurious actuations or failures for the duration of a given fire scenario without positive control to ensure that the individual spurious actuations are mitigated and components are placed in a condition that would not adversely affect safe shutdown. Without accounting for multiple spurious actuations or failures for the duration of a given fire scenario, Question 5.3.10 of Generic Letter 86-10 could be misapplied to alleviate the need for meeting separation criteria for redundant circuitry within the same fire area per Section III.G.2 of Appendix R. Reliance on an assumption of only a single spurious operation without operator intervention (i.e., having two normally shut MOVs in series with spurious cables routed through an area, and assuming only one of the valves could spuriously open) is not an acceptable approach for ensuring a success path remains available. Therefore, in identifying the mitigating action for each potential spurious operation in any given fire area, it is not acceptable to mitigate the effects of one spurious operation while ignoring the effects of another potential spurious operation.

Given the above, the focus on the application of Question 5.3.10 of Generic Letter 86-10 should be on the prioritization of operator actions to ensure that spurious actuations or failures that could create the most adverse plant conditions are addressed in an order consistent with the impact on safe shutdown. The recovery of components subject to a single spurious actuation or failure, which, if left unmitigated, could result in an unrecoverable condition should be given the highest priority in safe shutdown procedures. Components or systems, which are subject to adverse conditions or failures only in the event of multiple, simultaneous failures, may be given a lower priority in plant procedures since the likelihood of getting these failures in the shorter timeframe is considered to be less. Operator actions to establish positive control of these components and systems (e.g., operating switches, opening breakers, repositioning valves) shall be included in the plant procedures in order to ensure that safe shutdown systems and components are properly aligned.

The functional requirements analysis performed determined limiting timeframes that could result from fire-induced equipment failures and spurious component actuations. These evaluations were performed using conservative assumptions based on "worst case" initial conditions and limited component availability to mitigate the consequences of a fire event. Therefore, the timeframes that result from these evaluations and calculations are not absolute values for acceptability of operator action or system performance. Instead, the calculations and analysis results, in conjunction with considerations on the likelihood of the event (as discussed below), are used to help prioritize the order in, which manual operator actions are to performed in response to a fire event. While this is particularly important for the alternative shutdown scenarios (e.g., response to a Control Room fire), it is also important in addressing responses to other challenging fire scenarios.

5.2.5.4 Emergency Lighting

Emergency lighting capability with an 8 hour power supply for all operator manual actions and for access and egress routes thereto is discussed in Section 5.6.1.

5.2.5.5 Ladders and Tools

A limited number of manual operator actions require the use of a ladder or simple tools. In instances where these are required, ladders and tools are staged and dedicated for use by operators in support of post-fire safe shutdown.

5.2.5.6 Communications

Communications capability for the operators performing post-fire shutdown operations is discussed in Sections 5.6.2.

5.2.5.7 Safe Shutdown Procedures

This section gives a general overview of the types of procedures used to safely shutdown the plant. A more detailed discussion of these procedures is in the SSAR.

5.2.5.7.1 Abnormal Operating Procedures (AOPs) - Alternate Shutdown

These procedures are utilized for both units to safely shutdown in the event of a fire in the following plant areas:

- Control Room,
- Cable Spreading Room,
- 4160V Vital Switchgear Room,
- Computer and Instrument Rack Room,
- Monitor Tank Room (PAB 26' Elev. Central C-59 area), and
- CCW Heat Exchanger and Boric Acid Tank Room (PAB 44' Elev. Central).

These procedures are also utilized if the Control Room must be evacuated for any reason. The procedure is symptom-based, and accounts for scenarios where offsite power may or may not be available. The procedure has a number of steps that may be performed by operators in the control room prior to evacuation. The steps necessary for post-fire safe shutdown, however, are provided by backup steps, that are performed outside of the control room, to ensure positive control of the safe shutdown flow path.

5.2.5.7.2 Operator Guidance for Non-Alternative Shutdown Fire Areas

Existing procedures are relied upon for non-alternative shutdown fire areas. In addition general guidance procedures have been developed to augment the existing procedures. Where, potential equipment fire damage creates a complex scenario beyond the scope of existing procedures, special procedures have been developed to cope with the fire event.

5.2.5.7.3 Operating Instructions (OIs)

Operating Instructions are available to perform manual actions for several components under certain situations. These instructions are used in conjunction with:

- Abnormal Operating Procedures for the Alternate Shutdown fire scenarios, and
- Operator Guidance for Non-Alternative Shutdown Fire Areas.

These OIs are typically associated with equipment operation lineups used for normal plant operation, abnormal plant operation, or post-fire scenarios.

5.2.5.7.4 Repair and Maintenance Procedures

Repairs can be credited for cold shutdown equipment if the repair can be completed within 72 hours (for non-alternative shutdown scenarios) or if the repair can be completed and cold shutdown achieved within 72 hours (for alternative shutdown scenarios). Per Generic Letter 86-10, repairs cannot be credited for hot shutdown components. Equipment relied upon for the transition from hot standby to cold shutdown is considered cold shutdown equipment and can be repaired, if necessary, in accordance with the requirements and guidance discussed in this section. In accordance with Section III.L.5 of Appendix R, materials for such repairs shall be readily available on site and procedures shall be in effect to implement such repairs.

Repairs include the following activities:

- Replacement of damaged components (e.g. blown fuses and motor),
- Replacement of cabling, and
- Modifications (e.g., wiring changes).

Materials for repairs are readily available onsite and procedures are available to implement such repairs. Tools and materials required to implement the repairs are not dedicated for the repairs if they are readily available on site as part of normal maintenance or installation activities (e.g., tape, heat-shrink tubing, volt-ohm meters, etc.).

5.2.5.8 Key Fire Protection Features

Fire protection features required to ensure compliance with Appendix R and the associated Appendix R Exemptions are outlined in the FHAR as well as Sections 5.1.5, 5.2.6, 6.1, 6.3 and 6.4. The SSAR contains additional discussion of the fire protection feature requirements.

5.2.5.9 Results

Table 5.2.1-1 summarizes key safe shutdown analysis results. Detailed information for each Fire Area is in the SSAR.

5.2.6 Exemptions

Exemption requests as granted by the NRC are alternative ways to address the requirements of 10 CFR 50 Appendix R. As indicated in Generic Letter 86-10, exemptions are not required in some cases. Section 10.0 includes a copy of the correspondence from the NRC of the exemptions granted to PBNP. Table 5.2.6-1 summarizes these exemptions.

TABLE 5.2.6-1
Summary of PBNP Appendix R Exemptions

Title/Subject	Date	Reference DBD T-40	Description (Related To The Appendix R Safe Shutdown Exemption)
1. Unit 1 Motor Control Center Room Fire Zone 156 (formerly Fire Zone 1)	**Granted 7/3/85**	**19.2.118**	**From: 20' horizontal separation (with no intervening combustibles) & full area automatic suppression requirements of Section III.G.2.b**
WE letter from Fay to Denton, Fire Protection Assessment, Response to Generic Letter 81-12	06/30/82	19.2.83	Requested exemptions as described in 3/31/82 letter but in format prescribed on the 5/4/82 NRC letter
NRC letter from Clark to Fay, Draft Safety Evaluation on Appendix R Exemption Requests	01/14/83	19.2.90	Draft SER proposed denying the exemption
WE letter from Fay to Denton, Technical Comments on Draft Safety Evaluation dated January 14, 1983	02/25/83	19.2.94	Formal point-by-point response to NRC on proposed exemption denial in draft SE dated 1/14/83, and comments on the technical content of the SE
WE letter from Fay to Denton, Revision to Appendix R Exemption Requests	04/28/83	19.2.98	Provided additional information including the following changes to proposed modifications: • Part-zone suppression, Zone 1
WE letter from Fay to Denton, Appendix R Exemption Requests	07/20/83	19.2.102	Provides itemized clarifications of information in 4/28/83 exemption submittal in response to informal NRC telecons. Information primarily addresses suppression coverage, cable fire stops, and cable covers.
NRC letter from Butcher to Fay, Issuance of Exemption, Safety Evaluation	07/03/85	19.2.118	Granted III.G exemption as requested in 6/30/82 WE letter and supplemented by WE letters dated 2/25/83, 4/28/83, and 7/20/83 as follows: • Unit 1 MCC Room (Fire Zone 1) - full coverage requirements of III.G.2.b
Requirements and Commitments Resulting from Exemption: • Provide smoke detectors, standpipe hose stations, portable fire extinguishers • Install water curtains in each unprotected entranceway • Relocate one train of redundant charging pump power and control cables • Install approved fire stops in the cable trays located between the redundant trains • Expand sprinkler coverage to all areas of the zone with the exception of the area surrounding the motor control center			

TABLE 5.2.6-1 (continued)
Summary of PBNP Appendix R Exemptions

Title/Subject	Date	Reference DBD T-40	Description (Related To The Appendix R Safe Shutdown Exemption)
2. Safety Injection and Containment Spray Pump Room Fire Zone 151 (formerly Fire Zone 2)	**Granted 7/3/85**	**19.2.118**	**From: Full area automatic suppression requirements of Section III.G.2.b**
WE letter from Fay to Denton, Fire Protection Assessment, Response to Generic Letter 81-12	06/30/82	19.2.83	Requested exemption as described in 3/31/82 letter but in format prescribed on the 5/4/82 NRC letter
NRC letter from Clark to Fay, Draft Safety Evaluation on Appendix R Exemption Requests	01/14/83	19.2.90	Draft SER proposed denying the exemption
WE letter from Fay to Denton, Technical Comments on Draft Safety Evaluation dated January 14, 1983	02/25/83	19.2.94	Formal point-by-point response to NRC on proposed exemption denial in draft SE dated 1/14/83, and comments on the technical content of the SE
WE letter from Fay to Dentou, Revision to Appendix R Exemption Requests	04/28/83	19.2.98	Provided additional information
NRC letter from Butcher to Fay, Issuance of Exemption, Safety Evaluation	07/03/85	19.2.118	Granted III.G exemption as requested in 6/30/82 WE letter and supplemented by WE letters dated 2/25/83, and 4/28/83 as follows: • SI and Containment Spray Pump Room (Fire Zone 2) - full coverage of III.G.2.b

Requirements and Commitments Resulting from Exemption:

- Provide partial coverage wet pipe sprinkler system (including protection for the Train A charging pump power and control cables), smoke detectors, standpipe hose stations, portable fire extinguishers, wet pipe automatic sprinkler system protecting the safety injection pumps
- Install a water curtain at each entranceway
- Relocate the Train B charging pump power and control cables to achieve 20 feet of horizontal separation free of intervening combustibles

Note: Suppression coverage was extended to full area for this Fire Zone. Thus, the area is in full compliance with the requirements of Appendix R, Section III.G.2.b

TABLE 5.2.6-1 (continued)
Summary of PBNP Appendix R Exemptions

Title/Subject	Date	Reference DBD T-40	Description (Related To The Appendix R Safe Shutdown Exemption)
3. Component Cooling Water Pump Room Fire Zone 142 (formerly Fire Zone 3)	**Granted 7/3/85**	**19.2.118**	**From: 20' horizontal separation (with no intervening combustibles) & full area automatic suppression requirements of Section III.G.2.b**
WE letter from Fay to Denton, Fire Protection Assessment, Response to Generic Letter 81-12	06/30/82	19.2.83	Requested exemptions as described in 3/31/82 letter but in format prescribed on the 5/4/82 NRC letter
NRC letter from Clark to Fay, Draft Safety Evaluation on Appendix R Exemption Requests	01/14/83	19.2.90	Draft SER proposed denying the exemption
WE letter from Fay to Denton, Technical Comments on Draft Safety Evaluation dated January 14, 1983	02/25/83	19.2.94	Formal point-by-point response to NRC on proposed exemption denial in draft SE dated 1/14/83, and comments on the technical content of the SE
WE letter from Fay to Denton, Revision to Appendix R Exemption Requests	04/28/83	19.2.98	Provided additional information
WE letter from Fay to Denton, Appendix R Exemption Requests	07/20/83	19.2.102	Provides itemized clarifications of information in 4/28/83 exemption submittal in response to informal NRC telecons. Information primarily addresses suppression coverage, cable fire stops, and cable covers.
NRC letter from Butcher to Fay, Issuance of Exemption, Safety Evaluation	07/03/85	19.2.118	Granted III.G exemption as requested in 6/30/82 WE letter and supplemented by WE letters dated 2/25/83, 4/28/83, and 7/20/83 as follows: • Component Cooling Water Pump Room (Fire Zone 3) - full coverage requirements of III.G.2.b

Requirements and Commitments Resulting from Exemption:

- Provide partial coverage sprinkler system, smoke detectors, standpipe hose stations, portable fire extinguishers
- Install water curtains in each unprotected entranceway
- Provide automatic sprinkler protection to protect the component cooling water pump area
- Relocate the Unit 2 Train A cables
- Completely enclose one train of charging pump power and control cables in an approved 1-hour fire rated barrier
- Extend the existing sprinkler system to the south wall of the zone

NOTE: See Table 5.2.6-1 Item #12 for additional Requirements and Commitments for the CCW Pumps.

TABLE 5.2.6-1 (continued)
Summary of PBNP Appendix R Exemptions

Title/Subject	Date	Reference DBD T-40	Description (Related To The Appendix R Safe Shutdown Exemption)
4. Unit 2 Motor Control Center Room Fire Zone 166 (formerly Fire Zone 4)	**Granted 7/3/85**	**19.2.118**	**From: 20' horizontal separation (with no intervening combustibles) & full area automatic suppression requirements of Section III.G.2.b**
WE letter from Fay to Denton, Fire Protection Assessment, Response to Generic Letter 81-12	06/30/82	19.2.83	Requested exemptions as described in 3/31/82 letter but in format prescribed on the 5/4/82 NRC letter
NRC letter from Clark to Fay, Draft Safety Evaluation on Appendix R Exemption Requests	01/14/83	19.2.90	Draft SER proposed denying the exemption
WE letter from Fay to Denton, Technical Comments on Draft Safety Evaluation dated January 14, 1983	02/25/83	19.2.94	Formal point-by-point response to NRC on proposed exemption denial in draft SE dated 1/14/83, and comments on the technical content of the SE
WE letter from Fay to Denton, Revision to Appendix R Exemption Requests	04/28/83	19.2.98	Provided additional information including the following changes to proposed modifications: • Part-zone suppression, Zone 4
WE letter from Fay to Denton, Appendix R Exemption Requests	07/20/83	19.2.102	Provides itemized clarifications of information in 4/28/83 exemption submittal in response to informal NRC telecons. Information primarily addresses suppression coverage, cable fire stops, and cable covers.
NRC letter from Butcher to Fay, Issuance of Exemption, Safety Evaluation	07/03/85	19.2.118	Granted III.G exemption as requested in 6/30/82 WE letter and supplemented by WE letters dated 2/25/83, 4/28/83, and 7/20/83 as follows: • Unit 2 MCC Room (Fire Zone 4) - full coverage requirements of III.G.2.b

Requirements and Commitments Resulting from Exemption:

- Provide smoke detectors, standpipe hose stations, portable fire extinguishers
- Install water curtains in each unprotected entranceway
- Separate the Train A power and control cables and local control panel
- Install approved fire stops in the cable trays installed between the redundant trains
- Expand sprinkler coverage to all areas of the zone with the exception of the area surrounding the motor control center

TABLE 5.2.6-1 (continued)
Summary of PBNP Appendix R Exemptions

Title/Subject	Date	Reference DBD T-40	Description (Related To The Appendix R Safe Shutdown Exemption)
5. Containment Spray Additive Tank and Monitor Area Fire Zone 187 (formerly Fire Zone 7)	**Granted 7/3/85**	**19.2.118**	**From: fixed fire suppression requirements of Section III.G.3.b. (originally requested from 20' horizontal separation & full area automatic suppression requirements of Section III.G.2.b; changed exemption in 4/28/83 submittal)**
WE letter from Fay to Denton, Fire Protection Assessment, Response to Generic Letter 81-12	06/30/82	19.2.83	Requested exemption as described in 3/31/82 letter but in format prescribed on the 5/4/82 NRC letter
NRC letter from Clark to Fay, Draft Safety Evaluation on Appendix R Exemption Requests	01/14/83	19.2.90	Draft SER proposed denying the exemption
WE letter from Fay to Denton, Technical Comments on Draft Safety Evaluation dated January 14, 1983	02/25/83	19.2.94	Formal point-by-point response to NRC on proposed exemption denial in draft SE dated 1/14/83, and comments on the technical content of the SE
WE letter from Fay to Denton, Revision to Appendix R Exemption Requests	04/28/83	19.2.98	Provided additional information • Changed to exemption from suppression requirement of III.G.3.b • Committed to alternative shutdown (local instrumentation) capability independent of Zone 7
NRC letter from Butcher to Fay, Issuance of Exemption, Safety Evaluation	07/03/85	19.2.118	Granted III.G exemption as requested in 6/30/82 WE letter, supplemented by WE letter dated 2/25/83, and modified by WE letter dated 4/28/83 as follows: • Containment Spray Additive Tank and Monitor (Zone 7) - suppression of III.G.3.b
Requirements and Commitments Resulting from Exemption: • Provide smoke detectors, standpipe hose stations, portable fire extinguishers, no more than moderate combustible loading • Provide alternative indication, including appropriate transfer switches, for pressurizer level and reactor coolant system pressure in the charging pump areas for Units 1 & 2, and for steam generator B level, steam generator B pressure, reactor coolant loop B hot leg temperature, and reactor coolant loop B cold leg temperature in the turbine driven auxiliary feed pump area for Units 1 & 2 • Provide a spare portable instrument (or spare instrument rack) for alternative source range flux indication (if a portable instrument is used, it must be equipped with a plug, and a proper receptacle must be provided) • Provide alternate power sources, independent of the normal shutdown instrumentation power supplies, for the alternate shutdown instrumentation by one of the following methods: 1) Provide a new and independent battery at each instrument location with an ac/dc inverter and battery charger powered from a local 120V ac source; or 2) Provide an ac/dc inverter at each instrument location powered from the new station battery via an independent dc power cable routed to avoid the areas of concern; or 3) Provide an ac/dc inverter at each instrument location powered from an existing station battery via an independent dc power cable routed to avoid the areas of concern			

TABLE 5.2.6-1 (continued)
Summary of PBNP Appendix R Exemptions

Title/Subject	Date	Reference DBD T-40	Description (Related To The Appendix R Safe Shutdown Exemption)
6. Turbine Driven Auxiliary Feedwater Pump Room (Formerly Auxiliary Feedwater Pump Room) Fire Zone 304 (formerly Fire Area 5)	**Granted 7/3/85**	**19.2.118**	**From: 20' horizontal separation (with no intervening combustibles) requirements of Section III.G.2.b**
WE letter from Fay to Denton, Fire Protection Assessment, Response to Generic Letter 81-12	06/30/82	19.2.83	Requested exemption as described in 3/31/82 letter but in format prescribed on the 5/4/82 NRC letter
NRC letter from Clark to Fay, Draft Safety Evaluation on Appendix R Exemption Requests	01/14/83	19.2.90	Draft SER proposed denying the exemption
WE letter from Fay to Denton, Technical Comments on Draft Safety Evaluation dated January 14, 1983	02/25/83	19.2.94	Formal point-by-point response to NRC on proposed exemption denial in draft SE dated 1/14/83, and comments on the technical content of the SE
WE letter from Fay to Denton, Revision to Appendix R Exemption Requests	04/28/83	19.2.98	Provided additional information
NRC letter from Butcher to Fay, Issuance of Exemption, Safety Evaluation	07/03/85	19.2.118	Granted III.G exemption as requested in 6/30/82 WE letter and supplemented by WE letters dated 2/25/83, and 4/28/83 as follows: • Turbine Driven Auxiliary Feedwater Pump Room (Fire Area 5) - 20' separation of III.G.2.b
Requirements and Commitments Resulting from Exemption: • Provide automatic Halon 1301 fire suppression, smoke detectors, standpipe hose stations, portable fire extinguishers			

TABLE 5.2.6-1 (continued)
Summary of PBNP Appendix R Exemptions

Title/Subject	Date	Reference DBD T-40	Description (Related To The Appendix R Safe Shutdown Exemption)
7. 4160 V Switchgear Room Fire Zone 305 (formerly Fire Area 6)	**Denied 8/21/85**	**19.2.119**	**From: 20' horizontal separation (with no intervening combustibles) requirements of Section III.G.2.b**
WE letter from Fay to Denton, Fire Protection Assessment, Response to Generic Letter 81-12	06/30/82	19.2.83	Requested exemption as described in 3/31/82 letter but in format prescribed on the 5/4/82 NRC letter
WE letter from Fay to Denton, Response to Appendix R, Additional Information	10/11/82	19.2.87	Provided supplemental information to the 6/30/82 WE exemption request letter (as requested by 10/1 and 10/6 NRC telecons) related to vertical cable trays for the zone.
NRC letter from Clark to Fay, Draft Safety Evaluation on Appendix R Exemption Requests	01/14/83	19.2.90	Draft SER proposed denying the exemption
WE letter from Fay to Denton, Technical Comments on Draft Safety Evaluation dated January 14, 1983	02/25/83	19.2.94	Formal point-by-point response to NRC on proposed exemption denial in draft SE dated 1/14/83, and comments on the technical content of the SE
WE letter from Fay to Denton, Revision to Appendix R Exemption Requests	04/28/83	19.2.98	Modified exemption requests originally submitted on 6/30/82 (as supplemented on 10/11/82) based on discussions with the NRC on 3/22/82. The change in exemption supported by changes to proposed modifications including: • Additional detection system to actuate Halon in Fire Areas 5, 6, and 8 • Halon system in Fire Area 6 safeguards tie breaker cabinets
WE letter from Fay to Denton, Appendix R Exemption Request - 4160 V Switchgear Room	05/31/83	19.2.100	Revised 4/28/83 letter commitment for 4160 V switchgear room safeguards tie breaker Halon system to an independent Halon system for all A05 and A06 switchgear cabinet sections due to penetrations between cabinets.
WE letter from Fay to Denton, Appendix R Exemption Requests	07/20/83	19.2.102	Provides itemized clarifications of information in 4/28/83 exemption submittal in response to informal NRC telecons. Information primarily addresses suppression coverage, cable fire stops, and cable covers.
WE letter from Fay to Denton, Exemption Requests - Alternate Shutdown Capability	10/26/83	19.2.107	Provides detailed evaluation for alternate shutdown capability, considering all plant areas, which contain safe shutdown equipment required for post-fire shutdown. Includes: • Identification of hot standby and cold shutdown systems and components • Spurious operation evaluation • Related modifications required • Response to Generic Letter 81-12 (Reference 19.2.68) • Fire scenario description and manpower analysis
WE letter from Fay to Denton, Alternate Shutdown Capability	04/04/84	19.2.108	Clarifications to 10/26/83 alternate shutdown submittal (See Table 3.1.3 above)
WE letter from Fay to Denton, Alternate Shutdown Capability	04/27/84	19.2.110	Provides further clarification to the information provided in 4/4/84 letter concerning the hot short protection for the excess letdown isolation valves

TABLE 5.2.6-1 (continued)
Summary of PBNP Appendix R Exemptions

Title/Subject	Date	Reference DBD T-40	Description (Related To The Appendix R Safe Shutdown Exemption)
WE letter from Fay to Denton, Appendix R Exemption Requests - 4160 V Switchgear Room	01/03/85	19.2.114	Reiterates approach for safe shutdown for a fire in the 4160 V switchgear room, provides meeting summary for 12/13/84 meeting at PBNP, and discusses the feasibility of providing alternate shutdown capability independent of the room.
WE letter from Fay to Denton, Modification to January 3, 1985 Exemption Request	01/09/85	19.2.116	This letter corrects the normal and alternate routing of dc control cables in the 4160 V switchgear room as previously described in the 1/3/85 WE letter. Conclusion of 1/3/85 letter not affected by the changes.
NRC letter from Thompson to Fay, Denial of Exemption Request - 4160 V Switchgear Room, Safety Evaluation	08/21/85	19.2.119	Denied 4160 V switchgear room exemptions requested from requirements of III.G by WE letters dated 6/30/82, 9/29/82, 10/11/82, 2/7/83, 2/25/83, 4/28/83, 5/31/83, 7/20/83, 10/26/83, 4/4/84, 4/27/84, 1/3/85, 1/9/85. NOTE: As a result of the denial of this exemption request, an Alternate Shutdown System was installed to meet the requirements of Appendix R Section III.L.
Requirements and Commitments Resulting from Exemption: • None			

TABLE 5.2.6-1 (continued)
Summary of PBNP Appendix R Exemptions

Title/Subject	Date	Reference DBD T-40	Description (Related To The Appendix R Safe Shutdown Exemption)
8. Cable Spreading Room Fire Zone 318 (formerly Fire Area 8)	**Granted 7/3/85**	**19.2.118**	**From: 20' horizontal separation (with no intervening combustibles) requirements of Section III.G.2.b**
NRC letter from Clark to Burstein, Supplement to August 2, 1979 Safety Evaluation	10/21/80	19.2.61	Ten modification items and four incomplete items from 8/2/79 SER remain open. Summary of staff requirements to resolve each of these items provided. Recommended that alternate shutdown capability be provided for the Cable Spreading Room in accordance with the proposed Appendix R Section III.G.3.
WE letter from Fay to Denton, Fire Protection Assessment, Response to Generic Letter 81-12	06/30/82	19.2.83	Requested exemption.
NRC letter from Clark to Fay, Draft Safety Evaluation on Appendix R Exemption Requests	01/14/83	19.2.90	Draft SER proposed denying the exemption
WE letter from Fay to Denton, Technical Comments on Draft Safety Evaluation dated January 14, 1983	02/25/83	19.2.94	Formal point-by-point response to NRC on proposed exemption denial in draft SE dated 1/14/83, and comments on the technical content of the SE.
WE letter from Fay to Denton, Revision to Appendix R Exemption Requests	04/28/83	19.2.98	Provided additional information and changes in exemption supported by changes to proposed modifications including: • Alternative shutdown for charging pump (emergency unit crosstie breaker) • Additional detection system to actuate Halon in Fire Areas 5, 6, and 8
NRC letter from Butcher to Fay, Issuance of Exemption, Safety Evaluation	07/03/85	19.2.118	Granted III.G.2 exemption as requested in 6/30/82 WE letter and supplemented by WE letters dated 2/25/83, and 4/28/83 as follows: • Cable Spreading Room (Fire Area 8) - 20' separation of III.G.2.b • No exemption required from III.G.3 (due to charging pump unit crosstie breaker)

Requirements and Commitments Resulting from Exemption:

- Provide automatic Halon 1301 fire suppression, smoke detectors, standpipe hose stations, portable fire extinguishers
- Reroute power cables for one Unit 1 charging pump and two Unit 2 charging pumps to provide adequate separation
- Enclose power and control cables for one Unit 1 charging pump in a 1-hour fire rated barrier
- Provide an alternate power source to one Unit 1 charging pump (by the addition of breakers in an existing panel)
- Provide an alternate power source to one Unit 2 charging pump (by the addition of breakers in a relocated panel)
- All cables in the Cable Spreading Room have been installed in conduit or covered cable trays with 1/2-inch insulation blanket between the cables and tray cover.

TABLE 5.2.6-1 (continued)
Summary of PBNP Appendix R Exemptions

Title/Subject	Date	Reference DBD T-40	Description (Related To The Appendix R Safe Shutdown Exemption)
9. Control Room Fire Zone 326	**Granted 4/28/83**	**19.2.97**	**From: fixed fire suppression requirements of Section III.G.3. (originally requested from 20' horizontal separation & full area automatic suppression requirements of Section III.G.2.b; changed exemption in 10/11/82 submittal)**
WE letter from Fay to Denton, Fire Protection Assessment, Response to Generic Letter 81-12	06/30/82	19.2.83	Requested exemption from 20' horizontal separation (with no intervening combustibles) & full area automatic suppression requirements of Section III.G.2.b
WE letter from Fay to Denton, Response to Appendix R, Additional Information	10/11/82	19.2.87	Provided supplemental information to the 6/30/82 WE exemption request letter and modified exemption to be from the fixed fire suppression requirements of Section III.G.3
NRC letter from Clark to Fay, Draft Safety Evaluation on Appendix R Exemption Requests	01/14/83	19.2.90	Draft SER proposed approving the exemption.
NRC letter from Clark to Fay, Issuance of Appendix R Exemption	04/28/83	19.2.97	Approved exemption for the control room (no suppression) in response to 6/30/82 as supplemented by WE letter of 10/11/82

Requirements and Commitments Resulting from Exemption:

- Provide for low in-situ fire loading and strict controls over the presence of transient combustibles in the control room
- Provide a fire detection system, and a hose station and portable extinguishers, which are immediately available
- Provide a continuously manned control room
- Provide an alternate safe shutdown system

TABLE 5.2.6-1 (continued)
Summary of PBNP Appendix R Exemptions

Title/Subject	Date	Reference DBD T-40	Description (Related To The Appendix R Safe Shutdown Exemption)
10. Unit 1 SE Containment Sector, El. 21', Fire Zone 511 (formerly Fire Zone 10)	**Not Req'd 7/3/85**	**19.2.118**	**From: 20' horizontal separation (with no intervening combustibles) requirements, suppression and detection, and/or radiant energy shield requirements of Section III.G.2.d, III.G.2.e, and III.G.2.f.**
WE letter from Fay to Denton, Fire Protection Assessment, Response to Generic Letter 81-12	06/30/82	19.2.83	Requested exemption
NRC letter from Clark to Fay, Draft Safety Evaluation on Appendix R Exemption Requests	01/14/83	19.2.90	Draft SER proposed denying the exemption
WE letter from Fay to Denton, Technical Comments on Draft Safety Evaluation dated January 14, 1983	02/25/83	19.2.94	Formal point-by-point response to NRC on proposed exemption denial in draft SE dated 1/14/83, and comments on the technical content of the SE
WE letter from Fay to Denton, Revision to Appendix R Exemption Requests	04/28/83	19.2.98	Provided additional information
NRC letter from Butcher to Fay, Issuance of Exemption, Safety Evaluation	07/03/85	19.2.118	Determined that III.G.2.d/e/f exemption as requested in 6/30/82 WE letter and supplemented by WE letters dated 2/25/83, and 4/28/83 is not required

Requirements and Commitments Resulting from Exemption:

- Install radiant energy shields to separate the redundant pressurizer pressure and level cables

NOTE: In Reference 19.2.118, the NRC determined that no exemption was needed since, with the installation of the radiant energy shields, the requirements of 10 CFR 50 Appendix R, Section III.G.2 were met. Thus the shields remain a requirement, although no exemption was granted.

TABLE 5.2.6-1 (continued)
Summary of PBNP Appendix R Exemptions

Title/Subject	Date	Reference DBD T-40	Description (Related To The Appendix R Safe Shutdown Exemption)
11. Unit 2 SE Containment Sector, El. 21', Fire Zone 611 (formerly Fire Zone 11)	**Withdrawn 7/3/85**	**19.2.118**	**From: 20' horizontal separation (with no intervening combustibles) requirements, suppression and detection, and/or radiant energy shield requirements of Section III.G.2.d, III.G.2.e, and III.G.2.f.**
WE letter from Fay to Denton, Fire Protection Assessment; Response to Generic Letter 81-12	06/30/82	19.2.83	Requested exemption
NRC letter from Clark to Fay, Draft Safety Evaluation on Appendix R Exemption Requests	01/14/83	19.2.90	Draft SER proposed denying the exemption
WE letter from Fay to Denton, Technical Comments on Draft Safety Evaluation dated January 14, 1983	02/25/83	19.2.94	Formal point-by-point response to NRC on proposed exemption denial in draft SE dated 1/14/83, and comments on the technical content of the SE
WE letter from Fay to Denton, Revision to Appendix R Exemption Requests	04/28/83	19.2.98	Exemption request withdrawn
Requirements and Commitments Resulting from Exemption: • None			
12. Auxiliary Building Elevations -19' 3", -5' 3", 8', 26', & 46'. Various Fire Zones in Fire Area A01	**Granted 12/31/86**	**19.2.137**	**From: full area automatic suppression requirements of Section III.G.2.b**
WE letter from Fay to Denton, Revision to Appendix R Exemption Requests	04/28/83	19.2.98	Requested new exemption for the auxiliary building (as a single fire area) from suppression requirement of III.G.2.b
WE letter from Fay to Denton, Exemption Requests - Alternate Shutdown Capability	10/26/83	19.2.107	Provides detailed evaluation for alternate shutdown capability, considering all plant areas, which contain safe shutdown equipment required for post-fire shutdown. Reiterated need for exemption as previously requested.
WE letter from Fay to Denton, Appendix R Exemption Requests	12/11/85	19.2.122	Provided written confirmation of supplemental information provided to the NRC at a 11/26/85 meeting at PBNP related to three unapproved exemptions for the service water pump room, SI pump room, and CCW pump room. Also provided written responses to 12 questions requested by 11/4/85 telecopy.

TABLE 5.2.6-1 (continued)
Summary of PBNP Appendix R Exemptions

Title/Subject	Date	Reference DBD T-40	Description (Related To The Appendix R Safe Shutdown Exemption)
WE letter from Fay to Denton, 10 CFR 50.12 Justification for Outstanding Exemption Requests	10/10/86	19.2.135	Response to 9/18/86 NRC letter. Provided discussion of special circumstances for exemptions previously requested.
NRC letter from Novak to Fay, Exemption from Certain Requirements of 10 CFR 50, Appendix R	12/31/86	19.2.137	NRC issued approved exemption from the following as requested by WE letter dated 4/28/83 as supplemented by WE letters dated 10/26/83, 12/11/85, and 10/10/86: • Auxiliary building fire area at El.-19'-3", El. -5'-3", El. 8', El. 26', El. 46', from automatic suppression requirement of III.G.2.b

Requirements and Commitments Resulting from Exemption:

- Provide an area-wide fire detection system throughout, with alarms annunciated in the control room; fire extinguishers; hose reel stations; wet pipe sprinkler system coverage in several locations; two 1½-inch hose reel stations on the 8' elevation in the west wing; automatic sprinkler systems in rooms 166, 142, 151, 156; and a low fire load
- Provide spare cables for the RHR pumps and CCW pumps and a spare CCW pump motor

TABLE 5.2.6-1 (continued)
Summary of PBNP Appendix R Exemptions

Title/Subject	Date	Reference DBD T-40	Description (Related To The Appendix R Safe Shutdown Exemption)
13. Auxiliary Building - Central part at Elevation 46' Fire Zone 238	**Granted 12/31/86**	**19.2.137**	**From: 3-hour rated barrier requirement of Section III.G.2.a**
WE letter from Fay to Denton, Revision to Appendix R Exemption Requests	04/28/83	19.2.98	Requested new exemption for the central part of the auxiliary building from 3-hour rated floor barrier requirement of III.G.2.a
WE letter from Fay to Denton, Exemption Requests - Alternate Shutdown Capability	10/26/83	19.2.107	Provides detailed evaluation for alternate shutdown capability, considering all plant areas, which contain safe shutdown equipment required for post-fire shutdown. Reiterated need for exemption as previously requested.
WE letter from Fay to Denton, Appendix R Exemption Requests	12/11/85	19.2.122	Provided written confirmation of supplemental information provided to the NRC at a 11/26/85 meeting at PBNP related to three unapproved exemptions for the service water pump room, SI pump room, and CCW pump room. Also provided written responses to 12 questions requested by 11/4/85 telecopy.
WE letter from Fay to Denton, 10 CFR 50.12 Justification for Outstanding Exemption Requests	10/10/86	19.2.135	Response to 9/18/86 NRC letter. Provided discussion of special circumstances for exemptions previously requested.
NRC letter from Novak to Fay, Exemption from Certain Requirements of 10 CFR 50, Appendix R	12/31/86	19.2.137	NRC issued approved exemption from the following as requested by WE letter dated 4/28/83 as supplemented by WE letters dated 10/26/83, 12/11/85, and 10/10/86: • Auxiliary building central part at Elevation 46' from 3-hour floor barrier requirement of III.G.2.a

Requirements and Commitments Resulting from Exemption:

- Provide a fire detection system, with alarms annunciated in the control room, fire extinguishers, 1½-inch hose reel stations, low fire load
- Prohibit locating combustibles near the maintenance access hatches, or in the intervening vertical space
- No equipment or cables required for hot shutdown located in and within the central area.

TABLE 5.2.6-1 (continued)
Summary of PBNP Appendix R Exemptions

Title/Subject	Date	Reference DBD T-40	Description (Related To The Appendix R Safe Shutdown Exemption)
14. Service Water Pump Room Fire Zone 552	**Granted 12/31/86**	**19.2.137**	**From: 20' separation requirements of Section III.G.2.b**
WE letter from Fay to Denton, Exemption Requests - Alternate Shutdown Capability	10/26/83	19.2.107	Provides detailed evaluation for alternate shutdown capability, considering all plant areas, which contain safe shutdown equipment required for post-fire shutdown. Requested additional exemption from Appendix R III.G: • Service water pump room (III.G.2.b 20 foot separation)
WE letter from Fay to Denton, Appendix R Exemption Requests	12/11/85	19.2.122	Provided written confirmation of supplemental information provided to the NRC at a 11/26/85 meeting at PBNP related to three unapproved exemptions for the service water pump room, SI pump room, and CCW pump room. Also provided written responses to 12 questions requested by 11/4/85 telecopy.
WE letter from Fay to Denton, 10 CFR 50.12 Justification for Outstanding Exemption Requests	10/10/86	19.2.135	Response to 9/18/86 NRC letter. Provided discussion of special circumstances for exemptions previously requested.
NRC letter from Novak to Fay, Exemption from Certain Requirements of 10 CFR 50, Appendix R	12/31/86	19.2.137	NRC issued approved exemption from the following as requested by WE letter dated 4/28/83 as supplemented by WE letters dated 10/26/83, 12/11/85, and 10/10/86: • Service water pump room (III.G.2.b 20 foot separation)
Requirements and Commitments Resulting from Exemption: • Provide area wide smoke detection, with alarms annunciated in the control room, an automatic wet pipe fire suppression system with redundant connections to the fire main, fire extinguishers, two 1½-inch hose reel stations located adjacent to the entrance doors, and a low fire load • Provide a partial-height noncombustible radiant energy heat shield that separates the service water pumps into two groups • No intervening combustibles routed over the partial-height barrier wall.			

TABLE 5.2.6-1 (continued)
Summary of PBNP Appendix R Exemptions

Title/Subject	Date	Reference DBD T-40	Description (Related To The Appendix R Safe Shutdown Exemption)
15. RHR Pump Zone Fire Zones 101, 104, 105, 108, 109	**Granted 12/31/86**	**19.2.137**	**From: full area automatic suppression requirements of Section III.G.2.b**
WE letter from Fay to Denton, Exemption Requests - Alternate Shutdown Capability	10/26/83	19.2.107	Provides detailed evaluation for alternate shutdown capability, considering all plant areas, which contain safe shutdown equipment required for post-fire shutdown. Requested additional exemption from Appendix R III.G: • RHR pump zone (III.G.2.b automatic suppression)
WE letter from Fay to Denton, Appendix R Exemption Requests	12/11/85	19.2.122	Provided written confirmation of supplemental information provided to the NRC at a 11/26/85 meeting at PBNP related to three unapproved exemptions for the service water pump room, SI pump room, and CCW pump room. Also provided written responses to 12 questions requested by 11/4/85 telecopy.
WE letter from Fay to Denton, 10 CFR 50.12 Justification for Outstanding Exemption Requests	10/10/86	19.2.135	Response to 9/18/86 NRC letter. Provided discussion of special circumstances for exemptions previously requested.
NRC letter from Novak to Fay, Exemption from Certain Requirements of 10 CFR 50, Appendix R	12/31/86	19.2.137	NRC issued approved exemption from the following as requested by WE letter dated 4/28/83 as supplemented by WE letters dated 10/26/83, 12/11/85, and 10/10/86: • RHR pump zone (III.G.2.b automatic suppression)
Requirements and Commitments Resulting from Exemption: • Provide a fire detection system throughout the fire zone, with alarms annunciated in the control room, fire extinguishers and hose stations within the auxiliary building (the 1½-inch hose station on the 8' elevation can be used within the RHR pump zone), and a negligible fire load • Install a solid reinforced concrete wall running from floor to ceiling separating redundant RHR pumps • Allow no in-situ combustibles in the area			

TABLE 5.2.6-1 (continued)
Summary of PBNP Appendix R Exemptions

Title/Subject	Date	Reference DBD T-40	Description (Related To The Appendix R Safe Shutdown Exemption)
16. CCW Heat Exchanger and BAT Room Fire Zone 237	**Granted 5/23/88**	**19.2.150**	**From: automatic suppression requirements of Section III.G.3.b**
WE letter from Fay to Denton, Exemption Request	06/11/86	19.2.129	Requested exemption from requirement of III.G. Exemption needed due to equipment relocation during TMI modifications: • CCW Heat Exchanger and BAT room (Zone 237) from the suppression requirement of III.G.3.b
WE letter from Fay to Denton, Appendix R Exemption Request	07/01/86	19.2.130	Amends 6/11/86 exemption request to include special circumstances information as required by 10 CFR 50.12.
WE letter from Fay to Denton, 10 CFR 50.12 Justification for Outstanding Exemption Requests	10/10/86	19.2.135	Response to 9/18/86 NRC letter. Provided discussion of special circumstances for exemptions previously requested.
NRC letter from Wagner to Fay, Exemption Request - CCW Heat Exchanger and Computer Rooms	05/23/88	19.2.150	Approval of exemptions requested by WE letter dated 6/11/86 as supplemented by WE letter dated 10/10/86: • CCW Heat Exchanger and BAT Room (Zone 237) from the suppression requirement of III.G.3.b
Requirements and Commitments Resulting from Exemption: • Provide smoke detectors, and a low combustible loading • Provide modifications for necessary safe shutdown monitoring, independent of the CCW heat exchanger and BAT room			

TABLE 5.2.6-1 (continued)
Summary of PBNP Appendix R Exemptions

Title/Subject	Date	Reference DBD T-40	Description (Related To The Appendix R Safe Shutdown Exemption)
17. Computer and Instrument Rack Room Fire Zone 336	**Granted 5/23/88**	**19.2.150**	**From: automatic suppression requirements of Section III.G.3**
WE letter from Fay to Denton, Exemption Request	06/11/86	19.2.129	Requested exemption from requirement of III.G. Exemption needed due to equipment relocation during TMI modifications: • Computer and instrument rack room (Zone 336) from the suppression requirement of III.G.3
WE letter from Fay to Denton, Appendix R Exemption Request	07/01/86	19.2.130	Amends 6/11/86 exemption request to include special circumstances information as required by 10 CFR 50.12
WE letter from Fay to Denton, 10 CFR 50.12 Justification for Outstanding Exemption Requests	10/10/86	19.2.135	Response to 9/18/86 NRC letter. Provided discussion of special circumstances for exemptions previously requested.
NRC letter from Wagner to Fay, Exemption Request - CCW Heat Exchanger and Computer Rooms	05/23/88	19.2.150	Approval of exemptions requested by WE letter dated 6/11/86 as supplemented by WE letter dated 10/10/86: • Computer and instrument rack room (Zone 336) from the suppression requirement of III.G.3
Requirements and Commitments Resulting from Exemption: • Provide smoke detectors, and a low combustible loading • Provide for safe shutdown monitoring, independent of the computer and instrument rack room			

TABLE 5.2.6-1 (continued)
Summary of PBNP Appendix R Exemptions

Title/Subject	Date	Reference DBD T-40	Description (Related To The Appendix R Safe Shutdown Exemption)
18. Turbine Driven Auxiliary Feedwater Pump Room (Formerly Auxiliary Feedwater Pump Room) Fire Zone 304	**Granted 7/18/95**	**19.2.193**	**From: 20' horizontal separation (with no intervening combustibles) requirements of Section III.G.2.b**
WE letter from Link to Document Control Desk, NRC, Exemption Request	8/5/94	19.2.189	Requested exemption from the separation requirement of III.G.2.b for new cable trays installed in the turbine driven auxiliary feedwater pump room in support of the diesel generator addition project.
WE letter from Link to Document Control Desk, NRC, Clarification of Exemption Request	9/9/94	19.2.190	Provided clarification of information contained in the "Plant Instrumentation" and "Cable Separation in Fire Area A23" sections of the original submittal.
WE letter from Link to Document Control Desk, NRC, Response to Request for Additional Information	10/31/94	19.2.191	Provided additional information requested by the NRC (in letters dated 9/13/94 and 10/13/94) concerning the Appendix R exemption request.
WE letter from Link to Document Control Desk, NRC, Clarification of Information Concerning the Exemption Request	2/28/95	19.2.192	Provided clarifying information on five additional issues requested by the NRC during a teleconference held on 12/13/94.
NRC letter from Hansen to Link, Issuance of Exemption	7/18/95	19.2.193	Approval of exemptions requested by WE letter dated 8/5/94 as supplemented by WE letters dated 9/9/94, 10/31/94, and 2/28/95:
NRC letter from Hansen to Link, Correction to Exemption	10/24/95	19.2.194	Corrected errors on pages 3 and 5 of the exemption. Stated that the correction of the errors does not impact the findings providing the basis for granting the exemption.

Requirements and Commitments Resulting from Exemption:

- Code compliant automatic detection and suppression systems in the area
- Sheet metal tray covers on the top and bottom of cable trays GN, GW, and GG between redundant divisions of safe shutdown components.
- Ceramic fiber blanket on top of the cables in the new trays
- Use of IEEE 383 qualified cable in the new trays
- Manual fire suppression capability.
- Spatial separation provided between redundant trains of equipment required for safe shutdown.
- Lack of sufficient combustibles in the vicinity of the new trays.

TABLE 5.2.6-1 (continued)
Summary of PBNP Appendix R Exemptions

Title/Subject	Date	Reference DBD T-40	Description (Related To The Appendix R Safe Shutdown Exemption)
19. Outdoor Emergency Lighting Fire Zone YARD	**Granted 5/7/98**	N/A	**From: emergency lighting requirements of Section III.J**
WE letter from Johnson to Document Control Desk, NRC, Exemption Request	6/5/1997	N/A	Requested exemption from the emergency lighting requirement of III.J for outdoor access and egress routes to buildings containing safe shutdown equipment.
WE letter from Johnson to Document Control Desk, NRC, Exemption Request	6/13/1997	N/A	Additional information for requested exemption
NRC letter from Gundrum to Sellman, Issuance of Exemption	5/7/1998	N/A	Approval of exemptions requested by letters dated 6/5/97 and 6/13/97
Requirements and Commitments Resulting from Exemption: • Portable lighting units are maintained in four "Abnormal Operating Procedure" (AOP) packs located in the control room. Additional hand held, battery powered, portable lighting unit is verified operable in a monthly surveillance and the batteries are replaced every 6 months.			

TABLE 5.2.6-1 (continued)
Summary of PBNP Appendix R Exemptions

Title/Subject	Date	Reference DBD T-40	Description (Related To The Appendix R Safe Shutdown Exemption)
20. Hot Shutdown Repair of Charging Speed Control	**Granted 6/2/05**	N/A	**From: Requirement to maintain one train of Hot Shutdown equipment free of fire damage in Section III.G.1.a.**
WE letter from Middlesworth to Document Control Desk, NRC, Exemption Request	3/5/2004	N/A	Requested exemption from Section III.G.1.a Requirement to maintain one train of hot shutdown equipment free of fire damage such that repair of changing pump speed may be performed.
NMC letter from Koehl to Document Control Desk, NRC, Exemption Request	11/8/2004	N/A	Additional information for requested exemption
NRC letter from Chernoff to Koehl, Issuance of Exemption	6/2/2005	N/A	Approval of exemptions requested by letters dated 3/5/04 and 11/8/04
Requirements and Commitments Resulting from Exemption: • Pre-stage required repair equipment, i.e., air compressor, pneumatic hoses, electrical cords, portable power supply, in an area where no single fire will affect permanent equipment and repair equipment.			

NOTE: The requirement for this exemption is removed following installation and closeout of MR 04-013, "CVCS Charging Pump Drive Replacements".

5.3 CONTROL OF COMBUSTIBLES

5.3.1 In-Plant Combustible Liquids

The Emergency Diesel Generators (EDGs) G01 and G02 are located in the Control Building 8' Elevation in separate rooms. Each EDG has an associated 550-gallon day tank in its respective room. Each room is protected by an automatic wet pipe sprinkler system that is supplied water from the service water system. Backup protection is provided by a hose station and by wheeled and portable fire extinguishers in the area. Each room is separated from other plant areas by 3-hour rated walls, including dampers and penetrations.

The EDGs G03 and G04 are located in the Diesel Generator Building (DGB) in separate rooms. Each EDG has an associated 550-gallon day tank in a separate day tank room within the DGB. Each EDG room and day tank room are protected by an automatic wet pipe sprinkler system. Backup protection is provided by hose stations and portable fire extinguishers in the area. Each EDG room and day tank room are separated from the others by 3-hour rated walls, including dampers and penetrations.

The turbine oil and lubricant storage area is located at the north end of Unit 2 Turbine Building and is over 200' from any safety-related structure. This area is a separate room separated from the others by 3-hour rated walls, including dampers and penetrations. Floor drains from this room are routed to an oil retention sump to prevent the spread of fire. A curb is provided around the tank. The room is protected with a wet pipe sprinkler system. Backup protection is provided by hose stations and portable fire extinguishers in the area.

The Unit 2 turbine lubricating oil reservoir is at the south end of the Unit 2 Turbine Building approximately 18' from the Control Building. The Unit 1 turbine lubricating oil reservoir is at the north end of the Unit 1 Turbine Building about 18' from the Control Building. The control building walls that could be affected are 3-hour rated including dampers, doors and penetration seals. The turbine lubricating oil reservoirs are both protected with oil retention dikes and floor drain sumps. Automatic deluge systems are provided for both reservoirs. Backup protection is provided by hose stations and portable fire extinguishing units in the area.

Miscellaneous collection receptacles for waste oil are located in various places throughout the plant. The Fire Protection Coordinator is responsible for reviewing the provisions for safe storage of the materials.

5.3.2 Bulk Gas Storage

The hydrogen and nitrogen bulk storage tanks are both located outdoors on the east-side of the Turbine Building. The hydrogen storage cylinders are installed with the long axis parallel to the building wall. The hydrogen storage tanks and the nitrogen bulk storage tank are designed and constructed in accordance with the ASME Boiler and Pressure Vessel Code Section VIII. The containers are equipped with safety relief valves in accordance with applicable portions of ASME and NFPA requirements.

Carbon dioxide is stored in commercially supplied gas cylinders designed in accordance with applicable code requirements. The cylinders are stored in racks beneath each turbine generator and are chained to preclude them from becoming missiles.

Cylinders of acetylene and oxygen are stored in the gas storage building adjacent to Warehouse #1 that is remote from plant structures. The cylinders are stored in storage racks that meet the requirements of applicable portions of NFPA and OSHA.

Propane gas storage tanks are located outdoors with their long axis parallel to the building wall. Gas cylinders within the plant are limited to those in use. Gas cylinders used in the chemistry lab are securely fastened in a rack in accordance with applicable portions of NFPA and OSHA requirements. The chemistry lab is separated from safety-related equipment areas.

Oxygen and fuel gas cylinders for welding and cutting are mounted on welding carts that meet OSHA requirements. These units, when not assigned to a specific area in accordance with a maintenance procedure, are kept in the maintenance shop or designated storage areas. The maintenance shop is separated from safety-related equipment areas by 2-hour fire rated walls and doors. Spare cylinders are stored in the Unit 1 Façade on the 39' Elevation platform between the South Service Building and Containment. The cylinders are stored in storage racks that meet the requirements of applicable portions of NFPA and OSHA. The 39' platform is remote from redundant safe shutdown components.

5.3.3 Flame Retardant Plastic Materials

The use of plastic materials is minimized except for some of the original cable installed in non-safety related applications. PVC type cabling is evaluated as part of the fire hazard analysis in determining combustible loading for each fire zone. Where applicable, appropriate fire protection features are included to minimize the hazard presented.

Plastic covering material for general use is treated as a transient combustible and is controlled in accordance with guidelines specified in plant administrative procedures that govern the use of transient combustible materials.

5.3.4 Storage and Handling of Flammable and Combustible Liquids

Storage tanks for combustible liquids are located in various outdoor yard areas. These tanks are installed in accordance with applicable portions of NFPA 30 requirements. Distance between the tanks and the main plant ensure a fire in the tanks would not endanger safe operation or shutdown of the plant.

The day tanks associated with, the diesel generators, the heating boiler and the diesel fire pump are installed in accordance with applicable portions of NFPA 30 requirements.

Administrative procedures are maintained, which provide guidance to personnel handling leaks or spills of flammable or combustible liquids.

5.3.5 Hydrogen Line Design

The ¾" hydrogen header in the Turbine Building contains excess flow and manual isolation valves. The ¾" hydrogen header in the Primary Auxiliary Building contains manual isolation valves.

5.4 ELECTRICAL CABLE CONSTRUCTION AND CABLE TRAYS

5.4.1 Cable Tray Construction

Cable trays, conduits and their associated supports are constructed of galvanized steel, with the exception of conduits used for outcore detectors in nuclear instrumentation systems that are rigid PVC conduits.

5.4.2 Cable Tray Fire Stops

In the case of cables required for safe shutdown located within the same fire area, train separation in conduits and cable trays is generally achieved by inter-area separation requirements of Section III.G.2 of Appendix R. Where the Safe Shutdown Analysis determined that propagation of fire through the cable trays presented a hazard to redundant equipment, cable tray fire stops are installed. Cable and raceway fire stops are located in various areas of the containments, Control Building and Primary Auxiliary Building.

5.4.3 Electrical Raceway Fire Barrier System (ERFBS)

The use of ERFBS (commonly known as "cable wraps") at PBNP supports the requirement to separate redundant trains of safe shutdown equipment where installation of classical physical structural barriers may not be practical. Cable wraps installed to meet the requirements of Section III.G.2.a of 10 CFR 50 Appendix R, shall be 3-hour fire rated. One hour fire rated barriers are acceptable in accordance with the requirements of 10 CFR 50 Appendix R, Section III.G.2.c provided fire detection and suppression are also furnished. Inside containment cable wrap may also be used to provide a non-combustible radiant energy shield in accordance with Section III.G.2.f of Appendix R. The ERFBS used at PBNP is 1-hour rated with the exception of that installed in containment, which is qualified as radiant energy shielding.

5.4.4 Cable Flame Test Requirements

Since the plant was constructed prior to 1974, the cable originally installed in PBNP was not qualified per the fire retardancy standard in IEEE 383-1974. However, the 5 and 15kV cables were required to pass the vertical flame resistance test in accordance with the Insulated Power Cable Engineer's Association (IPCEA) Test S-19-81, Section 6.19.6. The safety-related 600V power and control cables were required to pass the vertical flame resistance tests in accordance with the IPCEA Test S-19-81, Section 6.19.6 and a specially designed Bonfire Test. The safety-related and non-safety-related 600V instrumentation cables were required to pass the IPCEA and Bonfire tests. The non-safety related 600V power and control cables were not required to pass the tests.

New cable installations are qualified per fire retardancy standards IEEE 383, UL-910, UL-1581, NFPA-262, or equivalent cable fire retardancy standards identified in FPTE-011. This applies to cables installed within the protected area. Alternative cable fire tests used to qualify cables are listed in the FPTE-011, Tables 11-1, 11-2, & 11-3 in descending order of fire severity. Any fire test listed above the IEEE-383 test in each of these tables is considered an acceptable qualification test greater than or equal to the IEEE-383 fire test. Note that IEEE-383 is not used to test certain specialty cables such as flexible cords and heat trace cable. Cables in this category will be purchased to one of the fire retardancy standards listed in the FPTE-011 to ensure a minimum level of fire resistance for the cable. However, these tests may not be as severe as an IEEE-383 qualifying fire test but are fire tests currently available for these types of cable.

Cables that do not meet these standards may still be used in the plant based on need, but require a specific evaluation to consider the cable type use, location and potential combustible exposure in its application (e.g., crane cables unique to crane equipment operation, not fire tested to any specific standard but do not present an exposure or combustible pathway to other plant equipment).

5.4.5 Cable Tray Covers and Ceramic Blankets in Cable Trays

Cable trays and risers to the control room from the cable spreading room are totally enclosed in metal enclosures and contain Kaowool blankets. Warning signs are placed on the walls of this room indicating that cable tray cover removal requires a permit.

Trays within the Cable Spreading Room, three north-south trays in the Turbine Driven Auxiliary Feedwater Pump Room and two trays in Unit 1 Containment are totally enclosed, and cables within the trays are covered with mineral-wool-insulated blankets. Several cable trays and conduits are provided with a fire-rated wrapping material where needed to meet separation requirements as described in applicable fire zone hazard evaluations. The wrapping material is installed by a qualified installer and documentation is provided to verify the fire resistance rating of the cable wrap design. Automatic suppression systems are provided where necessary in areas of significant cable concentrations, which contain safe shutdown equipment.

Cable trays in the Cable Spreading Room were installed with solid bottom and screwed on covers. Each cable tray is required to have a ½" thick full width-insulating blanket between the cables and the tray cover. To maintain compliance with the approved exemption for the Turbine Driven Auxiliary Feedwater Pump Room, three cable trays (GW, GN and GC series) are required to have metal tray covers on the top and bottom of each tray and a single layer of ceramic fiber blanket on top of the cables under the metal cover. To meet Appendix R separation requirements in Unit 1 Containment, through the use of radiant energy shields, cable trays 1VG02-1VG05 and 1WC05 are required to have metal tray covers on the top and bottom of each tray and a single layer of ceramic fiber blanket on top of the cables under the metal covers. These radiant energy shields protect the sensing line of level transmitter 1LT-470A.

5.4.6 Storage in Cable Trays and Raceways

Cable trays, raceways, conduits, trenches or culverts and other cable carrying equipment are used for cables only. Cable trays exposed to overhead walkways are covered in the area of the walkway to prevent combustibles or other foreign items from falling into the trays.

VENTILATION

5.5.1 Smoke and Heat Removal

A fixed smoke and heat removal system is provided for the computer and instrument rack room, control room and cable spreading room. The Primary Auxiliary Building (PAB) ventilation system can be controlled and used to exhaust products of combustion as necessary in the event of a fire. In the event that this system is unavailable, portable smoke ejectors are provided for fire brigade use.

5.5.2 Radioactive Smoke or Gas Release

Any smoke exhausted from contaminated areas by use of the ventilation system would be monitored when released to the environment.

5.5.3 Ventilation System Design

In general, ventilation systems are not protected for a fire in the area and are assumed to be inoperable.

5.5.4 Safety-Related Filters

Charcoal filters for the Control Room recirculation system are provided with an automatic waterspray system. Suppression systems are not provided for the PAB exhaust, service building exhaust and the containment purge system charcoal filters since decay heat is not sufficient to cause ignition. These filters are housed in metal cabinets and are remote from ignition sources. The containment purge filters are remote from safety-related equipment and are normally isolated from the containment. Detectors are provided in the areas of the PAB and service building exhaust system charcoal filters to enhance manual response time. Detectors for the control building recirculation system are located within the charcoal cabinets.

5.5.5 Intake Air Supply

The air supply intakes and the nearest exhaust air discharges are separated by greater than 120' for the Control Building, greater than 70' for the G01 and G02 Diesel Generator Rooms and greater than 50' for the Service Water Pump area. The G-03 and G-04 EDG's and G-05 Gas Turbine are located in separate buildings. These intakes are sufficiently remote from one another to minimize the possibility of contaminating the intake with the products of combustion.

5.5.6 Stairwell Design

Enclosed stairwells are designed to minimize smoke infiltration during a fire. Sufficient enclosed stairwells are provided to meet the requirements of the Wisconsin Administrative Code.

5.5.7 Control Room HVAC System

The HVAC system for the Control Room has 100% recirculation capability. During normal operation, the ventilating unit draws in outdoor air and mixes it with return air before discharging to the room. Exfiltrated room air is picked up by the Turbine Building system.

If a fire occurs outside the Control Room, operators can place the ventilation system in full recirculation mode. Smoke detectors are located in the Control Room to enhance the rapid response to a fire. In the event that a fire occurs in the Control Room supply ventilation charcoal filter, the water suppression system is automatically initiated. Water flow in this system is annunciated in the Control Room. The capability exists to isolate this fan-filter assembly completely and to continue operating the normal system. A manually operated smoke exhaust system is installed for the control room.

5.5.8 Portable Ventilation for Appendix R Safe Shutdown

If a fire occurs and there is a loss of offsite power, portable ventilation equipment is available to provide auxiliary ventilation for the Computer Room, Vital Switchgear Room, Cable Spreading Room, Control Room, TDAFW Pump Room and PAB 26' Electrical Equipment Rooms.

5.6 LIGHTING AND COMMUNICATION

5.6.1 Emergency Lights

Fixed emergency lighting is provided to illuminate areas, which contain safe shutdown equipment that may need to be operated manually as well as to illuminate the pathways for accessing those areas. Emergency lighting consists of units provided with 8-hour battery power supplies. During installation, tests were conducted to ensure the adequacy of the emergency lights to perform necessary operations. Periodic surveillance and testing of the emergency lights is conducted by the PBNP Maintenance Group.

In addition to fixed emergency lights, eight-hour, battery powered portable lights are provided in the Control Room for operator use when performing manual operator actions. These lights are designed for mounting on hard hats allowing hands free use. The helmet-mounted lights are provided as a supplement to the fixed emergency lighting for traversing areas of low lighting and to compensate for out-of-service fixed emergency lights. Additional hand-held, battery powered, portable lights are provided in various plant locations for emergency use by the fire brigade and operator; these lights, their location, and use are further described in technical evaluation FPTE-003. An evaluation of the lighting capability is also provided in technical evaluation FPTE-003.

In the exterior areas, emergency lighting is not provided for the access and egress routes. Hand-held lighting units are provided. This approach is approved by a NRC Exemption (see Table 5.2.6-1, Exemption 19).

The G-05 Gas Turbine Building is provided with the capability of supplying the existing lighting in the building from the Gas Turbine start-up battery. This switchover occurs automatically upon a loss of power to normal lighting until the Gas Turbine Auxiliaries are powered and normal lighting is restored to start-up the Gas Turbine.

5.6.2 Communications

The communication system consists of a Gai-tronics public address system and a portable radio system. The Gai-tronics system is normally used for initial notification of the fire brigade. The fire alarm tone is distinctive and can be heard in all plant areas. Portable radio communication units are also provided on site and are available for use by the fire brigade and operations personnel. Portable radios are assigned to plant operators who are satisfying shift manning requirements including those designated as fire brigade members. Emergency communications are monitored in the control room and at the security central alarm station.

With respect to Appendix R, communications availability is considered for two functions: fire brigade notification and shutdown operations. The normal Gai-tronics and radio base stations will be used if available and not damaged by the fire. However, portable radios are the main means of communication credited for Appendix R. The radios will be available for both the fire brigade and plant operators to communicate for safe shutdown. This method will be available for a fire anywhere in the plant. A radio test has been conducted and documented in FPTE-007, which verified this communication equipment outside the Control Room or Cable Spreading Room using these radios with rechargeable batteries in point-to-point mode.

In addition, portable sound powered headphones and cable is available in the turbine driven auxiliary feedwater pump room.

The portable radio system (trunking controller, central controller, ten repeater base stations, central electronics bank and all other periphery devices) is powered from a combination of emergency diesel generator (EDG) backed emergency lighting panels (36-E and 38-E) and a single phase distribution panel (Y-12). Panel Y-12 also powers the Manitowoc County Sheriff's Department Transmitter and is the normal supply to the Gai-tronics system. Panels 36-E and 38-E are both fed from safety related motor control center (MCC) 2B-32. In an emergency, MCC 2B-32 would be normally fed from EDG G-02 and alternately from EDG G-01. Distribution panel is Y-12 supplied by a UPS subsystem consisting of a 120V AC Communications Inverter (1DY-201), which in turn is normally supplied by the non-safety related battery 1D-205 through DC Distribution Panel 1D-201, breaker 9 and the non-safety related battery charger 1D-207. The inverter provides single phase 120V AC power to panel Y-12, which in turn, distributes the power to a portion of the portable radio system and to the Gai-tronics system. Backup power to the inverter is provided through a single phase 480/120V transformer (X-30), located in the Unit 2 facade area at Elevation 46'. This transformer has two sources of power, one source from MCC B-33 and the other source from MCC B-43 through manual transfer switch B-50. This switch can be manually aligned to either power source. MCCs B-33 and B-43 are shed on the applicable Unit's Safety Injection Signal and power to transformer X-30 can be re-aligned via procedure, if the need for backup power to the UPS is required during a Safety Injection Signal. The inverter is located near column-line H-15 El. 52'-0" in the non-nuclear room, east of the radio room.

In addition to the normal supply from distribution panel Y-12, the Gai-tronics system contains two additional sources of alternate power from emergency 120 VAC lighting panels 34-E and 36-E. These panels are supplied by 480/120V volt transformers, which are supplied from safeguards MCC 1B-42 (located near the C-59 panel in the center section of the PAB at Elevation 26' Fire Zone 187) and MCC 2B-32 (located in the north wing of the 8' elevation of the PAB Fire Zone 166). Should the power to distribution panel Y-12 be lost, power is automatically transferred to an energized alternate source via two power seeking relays in panel GAI-0014. After power has been restored to panel Y-12, the source of power is automatically transferred back to panel Y-12.

The fire brigade is normally notified by the fire alarm, which is broadcast over the Gai-tronics system. This alarm is initiated by a switch located in the Control Room. It is not considered credible that a fire in the constantly manned control room could progress to a stage, which would cause loss of the Gai-tronics system prior to initiation of the fire alarm and notification of the fire brigade. Power cables to the alternate supply for inverter 1DY-201 located in the non-nuclear room Fire Zone 251 (the Unit 2 Equipment Room) are routed through the PAB and do not enter the Control Building. The inverter, which serves as the normal supply, provides a one hour uninterruptable supply of power to both the Gai-tronics and radio system. The alternate power cables to the inverter and the Gai-tronics systems are routed in the same fire area in the PAB, however it is not considered credible that a fire in that area could cause total loss of both systems prior to notification of the fire brigade due to the one hour uninterruptable power supply and the level of fire detection and suppression capability in the PAB and the fact that power cables are routed in conduit. Therefore, existing available communications would provide for notification of the fire brigade in the event of a fire. Once the fire brigade has been notified, fire fighting activities can be effectively accomplished even if remote communication capability becomes unavailable using the portable radios with batteries.

6.0 FIRE DETECTION AND SUPPRESSION

6.1 FIRE DETECTION AND ALARM SYSTEM

The detection system and signaling system was designed and installed in accordance with applicable portions of NFPA standards. Periodic tests and inspections of the detector systems are conducted in accordance with plant procedures.

6.1.1 Fire Alarm System

The system transmits alarm and supervisory signals to the control room where they are annunciated. In addition to transmitting fire detector signals, the system transmits indications of water flow from the sprinkler and deluge extinguishing systems, and the status of the fire protection water systems including fire pump running, fire pump trouble and low fire water system pressure. Local fire alarm control panels are provided in areas monitored by fire detectors and are arranged to alarm audibly and visually upon actuation of a detector.

6.1.2 Fire Detection Design and Location Methodology

FPTE-006 documents the PBNP Fire Detection Location Plan. The plan consisted of a selection criteria and fire detection location sheets that list various physical and operating characteristics of the area including a drawing of the area. This plan was approved by the NRC in a SER dated March 5, 1980. New detector applications may also be reviewed against current code requirements.

The PBNP detection and alarm system has been designed and installed utilizing the applicable codes and standards and the PBNP Fire Detection Location Plan. Photoelectric smoke detectors are generally used in the PBNP system. Heat detectors are also used where appropriate.

Control and alarm functions of the PBNP fire detection system are provided by a master control panel (D-400) in the Cable Spreading Room and a master annunciator panel (C-900) in the Control Room. Local power and control "D" panels and local "C" annunciator and test panels are located throughout the plant. The location of these panels and areas provided with fire detection is shown on PBC-218 series drawings. The PBNP fire alarm system is a hard-wired electrical system with Class B electrically supervised circuits installed in accordance with the guidelines of applicable portions of NFPA 72D. Detection zones are established in accordance with plant fire areas or room division boundaries. Individual detector actuation activates a detector-specific alarm at the pertinent local "C" annunciator and test panel and at the local power and control "D" panel, plus an applicable detection zone alarm at the D-400 master control panel and C-900 annunciator panel. Supervisory alarm annunciation is provided at each local power and control "D" panel, the D-400 master control panel, and the C-900 master annunciator panel. Plant fire protection system alarm annunciation is also provided at the D-400 master control and C-900 annunciator panels. This provides for single location monitoring of all plant fire protection in the continuously manned control room. Visual and audible fire protection alarm annunciation is also provided on the C01 and 1C20 main control boards. Power for the fire detection system is generally provided from the normal lighting system. Each detection system control panel is provided with a backup battery power supply.

Annunciator C-panels are of a graphic design with properly located LED alarm lights that enables rapid identification of a fire location. Annunciator C-panels are located at access paths to detection zones to the greatest extent possible.

The existing fire detection system of "C: and "D" panels is being replaced with a system of "FACP" Fire Alarm Control Panels. The fire detection system consists of 2 computers and 12 FACP panels. One computer is located in the control room and the other is located in the Fire Protection Coordinator's office. The computers provide a annunciation and graphical representation of the plant areas and location of the fire detectors.

The 12 FACP's located throughout the plant are connected on a fiber optic loop. Each of the existing fire alarm panels will essentially become terminal boxes as the old fire detection system is replaced with the new fire detection system.

Periodic tests and inspections of the alarm and detection system are conducted in accordance with established procedures. Each zone annunciator and test C-panel is equipped with a remote test station to accommodate testing. The use of photoelectric smoke detectors allows the remote test to be an actual functional detector test instead of a power availability verification.

Additional detection systems have been added for remote buildings that are fed into the existing equipment to provide a central alarming function.

6.1.3 Fire Detector Selection Criteria

The PBNP Fire Detection Location Plan (FPTE-006) includes a decision tree flow chart, which identifies conditions affecting the type of detector best suited for the area. It also includes a detector spacing graph that plots ceiling height in feet against the recommended area coverage in square feet per detector. This part of the plan determines the type of detectors that are installed.

6.2 FIRE PROTECTION WATER SUPPLY SYSTEM

6.2.1 Water Supply and Pumps

The water supply for fire protection is taken from Lake Michigan and can be supplied from either a motor-driven fire pump or a diesel-driven fire pump. The fire pumps are located in the Service Water Pump Room (Fire Zone 552) of the Circulating Water Pumphouse (Fire Zone 553). The fire pumps are separated by a partial height fire barrier and protected similarly to the service water pumps as described in the fire zone hazard evaluation for Fire Zone 552. The individual fire pumps take their suction from independent bays of the Circulating Water Pumphouse. The diesel-driven fire pump is fueled from a 400-gallon diesel oil day tank, which can provide for 8 hours of operation. The day tank can be refilled from the 14,000-gallon emergency fuel oil storage tank, which is located in the Fuel Oil Pumphouse. Actuation power for the diesel-driven fire pump is provided from two independent sets of starting batteries.

The PBNP fire pumps are vertical, centrifugal pumps rated at 2,000 gpm at 125 psig net discharge head and is designed for automatic or manual starting. Fire suppression system flow demands have been designed conservatively to be within the capabilities of a single fire pump and include allowances for both inside and outside hose streams. Both fire pumps are designed for continuous operation until they are shut off manually. Pump running and power failure alarms (fire pump trouble) are provided to the Control Room. Periodic tests and inspections are conducted in accordance with established procedures.

The sprinkler systems for the diesel generator rooms and the hose stations for the Unit 1 and Unit 2 containments are supplied from the plant service water system. Flow demands have been designed to be well within the capabilities of the service water pumps.

6.2.2 Piping, Valves and Hydrants

An underground, 10-inch diameter, cement-lined (cathodically protected, polyethylene-wrapped around the Diesel Generator Building), cast-iron fire main encircles the plant and is supplied from the fire pumps. Valved lead-ins from the yard main supply interior fire protection systems. The fire protection water supply piping is provided with sufficient valving to allow for local isolation without interruption of service to the entire system. Hydrants are strategically located throughout the yard. Hydrant hose houses are provided with hose and accessory fire fighting equipment. A fire department pumper connection is provided to supply the fire main, and a separate fire department suction connection is provided from the Circulating Water Pumphouse forebay to allow suction directly from Lake Michigan.

Periodic tests and inspections of the fire main, valves, hydrants, hydrant hose houses, and associated equipment are conducted in accordance with established procedures.

To satisfy the requirements to maintain core cooling and RCS inventory as specified in NRC Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, a fire protection to service water cross connect using the diesel driven fire pump with remotely operated isolation valves has been installed (Reference NRC 2013-0024).

6.3 WATER SPRINKLER AND HOSE STANDPIPE SYSTEMS

6.3.1 Sprinkler Systems Design

Automatic sprinkler and water spray protection is provided in many areas of the plant. Water suppression systems have been designed and installed utilizing applicable codes and standards. Locations of areas and equipment protected with water suppression systems are depicted on the fire area drawings and schematically shown on P&ID Drawing Numbers M-208, Sheets 1, 2, 4, 6, 9, 10 and 15. Water suppression systems consist of wet-pipe, dry-pipe, and deluge-type sprinkler systems. Periodic tests and inspections of the water suppression systems are conducted in accordance with established test procedures.

The underground yard main headers are extended into and interconnected within the buildings. Each header serves several fire protection systems such as the sprinkler and deluge systems in specific plant areas. Each sprinkler, deluge and standpipe system is equipped with an individual isolation valve. Sprinkler systems are also equipped with a local indication and remote actuation in the Control Room. Standpipe system operation is not directly annunciated, although operation can be inferred by Control Room indication of a fire pump starting.

The service water pump, safety injection pump, component cooling pump, diesel generator, motor control center 1B-32 and 2B-32 room sprinkler systems, and supply piping to the containment hose stations are seismically supported. The G-01 and G-02 Diesel Generator room sprinkler systems and the containment hose reel stations are supplied from the service water system. The hose reel stations and sprinkler systems within the PAB and the Diesel Generator Building are supplied from the fire water system. Failure of any Class III portion of the fire protection system would not damage Class I structures or components. Safety-related equipment, which does not require sprinkler protection, but may be wetted by sprinkler discharge, will not be degraded by wetting due to installed spray shields.

Identified obstruction (vertical, horizontal) for deflectors, upright or pendent sprinklers, shall be evaluated by a Fire Protection Engineer using the NFPA 13 code of record/reference for that systems application.

NFPA 13, provides dimensional guidance and criteria necessary for installation or evaluation of an existing water suppression system.

6.3.2 Supervision of Valves

Automatic sprinkler and deluge system control valves are electrically supervised with visual indication provided in the control room. The yard main post-indicator valves, the fire header isolation valves, and hose station isolation valves are not electrically supervised. The manually operated valves listed above are provided with identification tags and are administratively controlled. The position of these valves is verified locally during periodic inspections. This approach is in accordance with applicable portions of NFPA 26.

6.3.3 Fixed Water Extinguishing Systems

The fixed water extinguishing systems were designed and installed in accordance with applicable portions of NFPA 13 and NFPA 15. Periodic tests and inspections of the water extinguishing systems are conducted in accordance with plant procedures.

6.3.4 Standpipe and Hose Station Design

Fixed manual hose stations are located throughout the plant as shown on the PBC-218 series fire protection drawings, and schematically on P&ID Drawing M-208, Sheet 2 and 15. Additionally, fire hydrants and hydrant hose houses are provided in yard areas. Hose stations supplied by the fire protection system have been designed and installed using NFPA-14-1963. Readily accessible 1" rubber covered hose lines and 1-1/2" collapsible hose reels and in cabinets are distributed throughout the plant so that areas in the Turbine Building, PAB, Service Building and offices are within 30' of a nozzle when attached to not more than 100' (nominal) of hose. In addition to the 1-1/2" hose provided, 1" hoses are also provided for the Cable Spreading Room, Control Room, and Vital Switchgear Room to allow control of the total quantities of water used in fighting a fire in these areas to minimize the risk of equipment damage due to water. Fog nozzles are provided for fire hose stations to allow for effective fighting of fires involving electrical equipment. The remaining interior fire hoses are hydrostatically tested every three years. Exterior fire hoses are hydrostatically tested annually.

Standpipe sizes are in accordance with applicable codes and standards. The standpipe serving the hose stations in areas with safety-related equipment are not of seismic design. However, they do contain shut-off valves and pressure reducing devices outside the areas.

Five hose reels, each with 100' of 1-inch hose are installed within each containment building. These hose reels are supplied by the service water system and will reach all combustible materials inside containment. The 1-inch hose stations provided for the containments control the total quantity of water used in fighting a fire in these areas to minimize the risk of equipment damage due to water. The fire hoses inside containment are hydrostatically tested on a refueling interval.

6.3.5 Hose Nozzles

The proper type of hose nozzle for each area is based on the hazards in the area. "All fog" type nozzles are provided for areas of potential shock hazard or areas that could be damaged by a straight water stream. Other nozzles used are fog nozzles that are adjustable to shut off, straight stream or wide range of fog.

6.4 HALON SUPPRESSION SYSTEMS

6.4.1 Halon Suppression System Design

Automatic total flooding Halon 1301 suppression systems are provided for plant areas where other fire suppression agents could potentially damage sensitive equipment or where the installation of another type of suppression system would be difficult or inappropriate. Halon suppression systems have been designed and installed utilizing the applicable codes and standards. Halon systems for the Cable Spreading Room, Turbine Driven Auxiliary Feed Pump Room, Vital Switchgear, and battery rooms have been designed with redundancy in the detection, initiation, and actuation mechanisms to provide a single-active, failure-proof system. This is considered to ensure automatic system actuation, preclude the development of fires beyond the incipient stage, and ensure that fire damage will be localized and limited to the immediate area of the fire origin. This design also eliminates the possibility of fire damage to redundant safe shutdown systems, equipment and components in these areas. Areas protected with Halon 1301 suppression systems are depicted on the PBC-218 fire protection drawings. Schematic drawings of the Halon 1301 systems provided for the Cable Spreading Room, Turbine Driven Auxiliary Feed Pump Room, Vital Switchgear Room, and battery rooms are provided on P&ID Drawing Number M-208, Sheet 5. Periodic tests and inspections of the Halon suppression systems are conducted in accordance with established test procedures.

6.4.2 HVAC Interlocks

In the fire area/zones where the Halon 1301 system provides fire suppression capability, the ventilation system is controlled in accordance with applicable codes and standards to maintain the necessary gas concentration.

6.5 SPECIAL EXTINGUISHING SYSTEMS

6.5.1 Dry Chemical Suppression System

Automatic dry chemical extinguishing systems are provided for the plant turbine-generator bearings and for the gas turbine-generator exhaust bearing. The systems have been designed and installed using applicable codes and standards. Periodic tests and inspections of the system are conducted in accordance with established test procedures.

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6.6 PORTABLE EXTINGUISHERS

6.6.1 Portable Extinguishers Types and Locations

Dry chemical, carbon dioxide and pressurized water fire extinguishers are distributed throughout the plant in accordance with the guidance of NFPA 10. Additional fire extinguishers are located at the battery rooms, Control Room and Switchgear Rooms. Extinguishers are of the water, dry chemical, and carbon dioxide type in various sizes, including a number of large-wheeled-type extinguishers. Wheeled extinguishers are chained with a quick-release latch in safety related equipment areas to prevent movement of the extinguishers in a seismic event. A complement of spare extinguishers are also available for use as needed. Periodic tests and inspections of portable fire extinguishers are conducted in accordance with established procedures.

6.7 INADVERTANT ACTUATION OF SUPPRESSION SYSTEMS

An evaluation has been conducted to document that the inadvertent actuation or rupture of automatic fire suppression systems at PBNP will not impair the capability of safe shutdown systems. In addition, drainage capabilities have been evaluated to ensure that adequate drainage is available in areas protected with water suppression systems. The effect of systems actuation are considered in the design of fire suppression systems for PBNP. An evaluation of this issue is included in technical evaluation FPTE-002.

7.0 FIRE HAZARDS ANALYSIS

A systematic approach was used for the review of the fire hazards and the exposure of safety-related equipment and components necessary for safe shutdown within an area. The type and quantity of combustible materials, type of fire hazards these materials present in the area, and the fire protection features (passive, active and manual) for the area were reviewed. The effects of postulated fires on the performance of safe shutdown functions and the minimization of radioactive releases to the environment were evaluated.

A safe shutdown analysis has been performed on an area-by-area basis to satisfy the provisions of 10 CFR 50 Appendix R. The safe shutdown analysis is documented in detail in the SSAR. Each fire area is further subdivided into one or more fire zones as discussed in Section 5.1. To facilitate station personnel in assessing fire hazards within each fire zone, a Fire Hazard Evaluation has been performed on a zone by zone basis with consideration for adequate separation between redundant and alternate safe shutdown equipment in accordance with 10 CFR 50 Appendix R. The adequacy of boundaries of fire zones may depend upon the contents of adjoining non-safe shutdown fire zones. The quality or fire rating of boundaries of fire zones, which do not contain safe shutdown equipment may be dictated by granted exemptions. This FPER covers the total PBNP fire protection program and is not restricted to Appendix R considerations. For these reasons, fire hazard analyses are also included for fire zones that do not contain safe shutdown equipment. This analysis is documented in detail in the Fire Hazards Analysis Report (FHAR). This section contains a summary of the results contained in the FHAR.

7.1 FIRE AREA/ZONE IDENTIFICATION

Fire areas are bounded by rated fire barriers or a configuration that can be considered to provide separation equivalent to rated fire barriers. Fire areas may also be bounded by spatial separation in the case of separate structures. Fire area boundaries may contain protective features for penetrations, which have been judged to provide a fire resistance equivalent to the rating of the fire barrier or the hazard posed.

For purposes of data organization, Point Beach Nuclear Plant fire areas have been subdivided into fire zones, which, in most cases, are determined by room boundaries. Fire zones in the Primary Auxiliary and Control Buildings are bounded in most cases by concrete walls that are considered to provide significant resistance to the spread of fire but are not necessarily fire rated by definition.

Certain fire areas were evaluated to be subdivided in order to:

- Facilitate a reproducible safe shutdown analysis and ease the maintenance of long-term configuration control of the Appendix R design and licensing basis, and
- Analyze plant areas in a manner consistent with the original licensing basis.

This effort focused on three plant areas:

a. Subdividing the Turbine Driven Auxiliary Feedwater Pump Room – This effort was performed to provide a more reproducible analysis to support separation arguments within the room. The subdivision allowed the equipment and cables to be associated with portions of the room to ensure physical separation that was necessary to support the basis of the Appendix R exemption for this area.

b. Combining Fire Zones/Areas in the Diesel Generator Building - This was performed due to the additional safe shutdown capability and flexibility provided by the installation of the Train B EDGs (G-03 and G-04). This made reliance on separate fire areas in the DG Building containing Train B equipment unnecessary due to the independence of Train A equipment from these portions of the DG Building.

c. Subdividing Fire Area A01 – General Plant Areas – This effort was performed to provide a more reproducible analysis to support separation arguments within the plant. The subdivision of this fire area was primarily focused on substantiating the design and licensing basis in the PAB, which makes use of exemptions from Appendix R separation requirements. The subdivision was based upon existing plant design features, PBNP licensing basis, and boundary evaluations to justify the separation.

The following table 7.1-1 is an index of fire areas. The list includes the fire area number, description, if it is a safe shutdown fire area and applicability of exemptions.

Table 7.1-1
Point Beach Nuclear Plant Fire Areas Index

Fire Area	Description	Safe Shutdown	Exemption
A01-A	Auxiliary Building-8' El. & Below	Yes	Yes
A01-B	Auxiliary Building-26' El. Central Area & FZ 237	Yes	Yes
A01-B/46	Auxiliary Building -44'El CCW Hx Area	Yes	Yes
A01-CN	Auxiliary Building-26' El. North Wing	Yes	Yes
A01-CS	Auxiliary Building-26' El. South Wing	Yes	Yes
A01-D	Auxiliary Building-44' & 66 El. & Facades (Except FZ 237)	Yes	Yes
A01-E	Turbine Building & South Service Building	Yes	No
A01-F	Yard Area	Yes	Yes
A01-G	Unit 1 Façade	Yes	No
A01-H	Unit 2 Façade	Yes	No
A02	Containment Spray and Safety Injection Pump Room	Yes	Yes
A03	1P2C Charging Pump Room	Yes	No
A04	1P2B Charging Pump Room	Yes	No
A05	1P2A Charging Pump Room	Yes	No
A06	1B32 MCC Area	Yes	Yes
A07	Chemical Drain, Laundry Tank and RCP Seal Filter Room	Yes	No
A08	HVAC Equipment Room & Pipeway 1 Valve Gallery Area	Yes	No
A09	Exhaust Fan Rooms	No	No
A10	Radioactive Gas Treatment Area	Yes	No
A11	Pipeway 4 Valve Gallery	Yes	No
A12	2P2C Charging Pump Room	Yes	No
A13	2P2B Charging Pump Room	Yes	No
A14	2P2A Charging Pump Room	Yes	No
A15	2-B32 MCC Area	Yes	Yes
A16	D106 Battery Room	Yes	No
A17	D04 Electrical Equipment Room	Yes	No
A18	D03 Electrical Equipment Room	Yes	No
A19	D105 Battery Room	Yes	No
A20	Heating Boiler Room	No	No
A21	Heating Boiler Day Tank No. 1 Room	No	No
A22	Heating Boiler Day Tank No. 2 Room	No	No
A23N	North Side of Turbine Driven Auxiliary Feedwater Pump Room	Yes	Yes
A23S	South Side of Turbine Driven Auxiliary Feedwater Pump Room	Yes	Yes
A24	4160V Vital Switchgear Room	Yes	No
A25	D06 Battery Room	Yes	No
A26	D05 Battery Room	Yes	No
A27	G-01 Diesel Generator Room	Yes	No
A28	G-02 Diesel Generator Room	Yes	No
A29	Air Compressor Room	Yes	No
A30	Cable Spreading Room	Yes	Yes
A31	Control Room	Yes	Yes
A32	Computer Room	Yes	Yes
A33	Control Building HVAC Equipment Room	No	No
A34	Technical Support Center	No	No
A35	Maintenance Building	No	No
A36	Unit 1 Containment Area	Yes	No
A37	Unit 1 Facade Stairway/Elevator Area	No	No
A38	Circulating Water & Service Water Pumphouse	Yes	Yes

Table 7.1-1
Point Beach Nuclear Plant Fire Areas Index

Fire Area	Description	Safe Shutdown	Exemption
A39	South Gatehouse	No	No
A40	Fuel Oil Pumphouse	No	No
A41	Flammable Liquids Storage Room	No	No
A42	Lubricating Oil Storage Room	No	No
A43	Blowdown Evaporator Building	No	No
A44	Gas Stripper Building	No	No
A45	Unit 2 Facade Stairway Area	No	No
A46	Unit 2 Containment Area	Yes	No
A47	Extension Building	No	No
A48	Warehouse #1	No	No
A49	Well Water Pumphouse	No	No
A50	Warehouse # 2	No	No
A51	Warehouse # 3	No	No
A52	North Service Building	No	No
A53	Sewage Treatment Plant	No	No
A54	D305 Swing Battery & D301 Charger Rooms	Yes	No
A58	T-175A Fuel Tank Room	Yes	No
A59	T-175B Fuel Tank Room	Yes	No
A61	P-206A & P-207A Fuel Oil Pump Room	Yes	No
A68	Train B East Duct Bank & Manholes	Yes	No
A69	Manhole Z-068 West of DGB	No	No
A70	Train A West Duct Bank & Manholes	Yes	No
A71	Diesel Generator Building, Train B Areas	Yes	No

7.2 FIRE HAZARD ANALYSIS OF FIRE ZONES

Fire hazard analyses have been performed for all safe shutdown related fire zones and significant non-safe shutdown fire zones. The fire hazard analyses methodology is described in detail in the FHAR. The following is an index of fire hazard analyses performed for PBNP fire zones, listed in numerical order. The list includes the fire zone number, fire zone title, combustible loading classification, and if detection and/or suppression is present in the fire zone.

Table 7.2-1

PBNP Fire Hazards Analyses Index

Fire Zone / Fire Area	Description	Combustible Loading Class	Detection	Suppression
101 / A01-A	Valve Pit/Sump Pump Room	Low	Yes	No
104 / A01-A	RHR Pump Room-1P10A	Low	Yes	No
105 / A01-A	RHR Pump Room-1P10B	Low	Yes	No
106 / A01-A	Pipeway	Low	No	No
107 / A01-A	Pipeway	Low	No	No
108 / A01-A	RHR Pump Room-2P10A	Low	Yes	No
109 / A01-A	RHR Pump Room-2P10B	Low	Yes	No
110 / A01-A	Pipeway	Low	No	No
111 / A01-A	Pipeway	Low	No	No
113 / A01-A	RHR HX Corridor	Low	Yes	No
114 / A01-A	Reactor Coolant Drain Tank-Unit 1	Low	No	No
115 / A01-A	RHR Heat Exchanger Room-Unit 1	Low	No	No
117 / A01-A	Sump Tank & Pump Room	Low	No	No
118 / A01-A	Reactor Coolant Drain Tank Unit 2	Moderate	No	No
119 / A01-A	RHR Heat Exchanger Room-Unit 2	Low	No	No
122 / A01-E	Water Treating Equipment Area	Low	No	No
123 / A01-E	Water Treatment Acid Tank Room	Low	No	No
124 / A01-E	Water Treatment Caustic Tank Room	Low	No	No
126 / A01-E	Cation Demineralizer Assembly Area	Low	No	No
128 / A01-B	Holdup Tank Room-T8A	Low	No	No
129 / A01-B	Holdup Tank Room-T8B	Low	No	No
130 / A01-B	Holdup Tank Room-T8C	Low	No	No
131 / A01-A	Holdup Tank Pump Room	Low	Yes	No
137 / A01-A	Valve Gallery-Unit 2	Low	Yes	No
138 / A01-A	Boric Acid Evaporator Room-North	Low	No	No
139 / A01-A	Boric Acid Evaporator Room-South	Low	No	No
140 / A01-A	Valve Gallery-Unit 1	Low	Yes	No
141 / A01-A	Corridor- North	Low	Yes	No
142 / A01-A	Component Cooling Water Pump Room	Low	Yes	Yes
142A / A01-A	Condensate Return Pump Room	Low	Yes	No
143 / A01-A	Corridor-South	Low	Yes	No
144 / A01-A	Seal Water HX Room-North	Low	No	No
145 / A01-A	Non-Regen HX Room-North	Low	No	No
146 / A01-A	Non-Regen HX Room- South	Low	No	No
147 / A01-A	Seal Water HX Room-South	Low	No	No
148 / A01-A	Waste Holdup Tank Room	Low	No	No
149 / A01-A	Waste Evaporator Pump Room	Low	No	No
150 / A01-A	Waste Evaporator Cond. Tank Room	Low	No	No
151 / A02	Safety Injection Pump Room	Low	Yes	Yes
152 / A03	Charging Pump Room-1P2C	Low	Yes	No *

Table 7.2-1

PBNP Fire Hazards Analyses Index

Fire Zone / Fire Area	Description	Combustible Loading Class	Detection	Suppression
153 / A04	Charging Pump Room-1P2B	Low	Yes	No *
154 / A05	Charging Pump Room-1P2A	Low	Yes	No *
155 / A08	Valve Gallery-Pipe Way 1	Low	Yes	No
156 / A06	MCC Room-1B32	Low	Yes	Yes *
157 / A07	RCP Seal Water Filter Room	Low	No	No
158 / A07	Laundry Tank Room	Low	No	No *
159 / A08	HVAC Equipment Room	Low	Yes	No *
160 / A09	Stack Exhaust Fan Room	Low	No **	No
161 / A09	Filter Exhaust Fan Room	Low	No	No
162 / A11	Valve Gallery-Pipe Way 4	Low	Yes	No *
163 / A12	Charging Pump Room-2P2C	Low	Yes	No *
164 / A13	Charging Pump Room-2P2B	Low	Yes	No *
165 / A14	Charging Pump Room-2P2A	Low	Yes	No *
166 / A15	MCC Room-2B32	Low	Yes	Yes *
167 / A10	Cryogenic Room	Low	Yes	No *
168 / A10	Decay Tank Room	Moderate	No	No
180 / A01-E	Pipe Shaft	Low	No	No
181 / A01-CS	Gas Decay Tank Room	Low	No	No
182 / A01-CS	Sample Room	Low	No	No
183 / A01-CS	Valve Gallery	Low	No	No
184 / A01-CS	Corridor	Low	Yes	No
185 / A01-CS	Chemical Mixing Tank Room	Low	Yes	No
186 / A01-CS	Volume Control Tank Room-1T4	Low	No	No
187 / A01-B	Monitor Tank Room	Low	Yes	No
188 / A01-B	Demineralizer Room	Low	No	No
189 / A01-B	Demineralizer Room	Low	No	No
190 / A01-B	Gas Stripper Equipment Room	Low	No	No
191 / A01-B	Gas Stripper Equipment Room	Low	No	No
192 / A01-B	Valve Gallery	Low	No	No
193 / A01-B	Demineralizer Room	Low	No	No
194 / A01-B	Demineralizer Room	Low	No	No
195 / A01-B	Ion Exchanger Room North	Low	No	No
196 / A01-B	Boric Acid Equipment Room	Low	Yes	No
197 / A01-B	Ion Exchanger Room South	Low	No	No
198 / A01-B	Reactor Coolant Filter Room	Low	No	No
199 / A01-B	Reactor Coolant Filter Room	Low	No	No
203 / A01-D	Transfer Canal	Low	No	No
204 / A01-D	Transfer Canal	Low	No	No
205 / A01-D	Spent Fuel Pool	Low	No	No
206 / A01-D	Spent Fuel Pool	Low	No	No
207 / A01-D	Drum Storage Room	Low	No	No
208 / A01-D	Radiological Waste Solidification	Low	Yes	No
208a / A01-D	Radwaste Solidification Waste Tank Eq. Rm	Low	No	No
209 / A01-D	Truck Access Area	Low	No	No
212 / A01-CN	Volume Control Tank Room-2T4	Low	No	No
213 / A01-CN	Concentrates Holding Tank Pump Room	Low	No	No
214 / A01-CN	Sample Room	Low	No	No
215 / A01-CN	Concentrates Holding Tank Pump Room	Low	Yes	No
216 / A01-CN	Valve Gallery	Low	No	No

Table 7.2-1

PBNP Fire Hazards Analyses Index

Fire Zone / Fire Area	Description	Combustible Loading Class	Detection	Suppression
217 / A01-CN	Corridor	Low	No	No
218 / A01-E	Pipe Shaft	Low	No	No
221 / A20	Heating Boiler Room	Low	Yes	Yes
222 / A01-E	Chemical Storage Room	Very High	No	No
223 / A01-E	Hopper Area	Moderate	No	No
224 / A01-E	Alternate Shutdown Panel Zone	Low	No	No
225 / A16	Battery Room-D106	Low	Yes	No
226 / A17	125VDC Electrical Equipment Room-D04	Low	Yes	No
227 / A18	125VDC Electrical Equipment Room-D03	Low	Yes	No
228 / A19	Battery Room-D105	Low	Yes	No
231 / A01-E	General WCC / OCC Area	Low	No	Yes
237 / A01-B/46	CCW HX & Boric Acid Tank Room	Low	Yes	No
238 / A01-D	Gas Stripper Equipment Room	Low	Yes	No
239 / A01-D	Ion-Exchange Filter Room	Low	No	No
240 / A01-D	Waste Gas Equipment Room	Low	No	No
241 / A01-D	New Fuel Storage	Low	No	No
243 / A01-D	Equipment Gallery	Low	No	No
244 / A01-D	Drum Preparation Area	Low	No	No
245 / A01-E	Electrical Equipment Room-Unit 1	Low	Yes	No
246 / A01-E	Electrical Equipment Room-Unit 2	Low	Yes	No
250 / A01-E	HVAC Equipment Room-Unit 1	Low	No	No
251 / A01-E	HVAC Equipment Room-Unit 2	Low	No	No
252 / A21	Day Tank Room No.1	Very High	Yes	Yes
253 / A22	Day Tank Room No.2	Very High	Yes	Yes
271 / A01-D	Service Area	Low	No	No
272 / A01-E	HVAC Fan Room-Unit 1	Low	No	No
273 / A01-E	HVAC Fan Room-Unit 2	Low	No	No
274 / A01-D	Fuel Handling Platform	Low	No	No
300 / A01-E	Lube Oil Reservoir-Unit 1	Very High	Yes	Yes
301 / A01-E	U1 Turbine Building General Area-8'	Low	Yes	Yes
302 / A01-E	Electrical Shop	Moderate	No	No
303 / A01-E	U1 Condenser Pit	Low	No	Yes
304N/A23N	Turbine Driven Auxiliary Feedwater Pump Room - North	Low	Yes	Yes
304S/A23S	Turbine Driven Auxiliary Feedwater Pump Room - South	Low	Yes	Yes
305 / A24	4160V Vital Switchgear Room	Moderate	Yes	Yes
306 / A25	Battery Room-D06	Low	Yes	Yes
307 / A26	Battery Room-D05	Low	Yes	Yes
308 / A27	Diesel Room-G01	Moderate	Yes	Yes
309 / A28	Diesel Room-G02	Moderate	Yes	Yes
310 / A29	Air Compressor Room	Low	Yes	No
311 / A01-E	TDAFP Tunnel	Low	No	No
316 / A01-E	U1 Turbine Building General Area-26'	Low	Yes	Yes
317 / A01-E	Operations Shop	Low	No	Yes
318 / A30	Cable Spreading Room	Moderate	Yes	Yes
319 / A01-E	Non-Vital Switchgear Area	Low	Yes	No
320 / A01-E	Condensate Storage Tank Area	Low	No	No
321 / A54	Swing Battery Room-D305	Low	No	No

Table 7.2-1

PBNP Fire Hazards Analyses Index

Fire Zone / Fire Area	Description	Combustible Loading Class	Detection	Suppression
322 / A01-E	Turbine Building Operating Floor-Unit 1	Low	Yes	Yes
323 / A54	Charger Room-D301	Low	Yes	No
324 / A01-E	Non-safety Related Battery Room-D205	Low	Yes	No
325 / A01-E	Telephone Equipment Room	Low	No	No
326 / A31	Control Room	Low	Yes	No
328 / A31	Snack Bar in Control Room	Low	No	No
329 / A31	Toilet in Control Room	High	No	No
330 / A31	HVAC Passage in Control Room	Low	No	No
331 / A31	Cable Passage in Control Room	High	No	No
333 / A32	North Office in Computer Room	Moderate	No	No
334 / A32	South Office in Computer Room	Moderate	No	No
335 / A32	Computer Room	Low	Yes	Yes
336 / A32	Instrument Rack Room	Low	Yes	Yes
337 / A33	HVAC Equipment Room	Low	Yes	Yes**
338 / A01-E	Elevator Machine Room	Low	Yes	No
360 / A01-E	South Service Building		Yes	Yes
430 / A35	Maintenance Shop		No	No
450 / A34	Technical Support Center		No	No
501 / A36	Unit 1 Reactor Vessel		No	No
505 / A36	Containment-Unit 1-8 ft.	Low	Yes	No
511 / A36	Containment-Unit 1-21 ft.	Low	Yes	No
516 / A36	Containment-Unit 1-46 ft.	Low	Yes	No
520 / A36	Containment-Unit 1-66 ft.	Low	No	No
524 / A01-G	Containment Facade-Unit 1	Low	Yes	No
525 / A01-G	Unit 1 Facade Pump Room	High	No	No
526 / A37	Unit 1 Facade Stairway 1	Low	No	No
526a / A37	Unit 1 Facade Elevator	Low	No	No
531 / A01-D	Unit1 Facade Passage	Low	No	No
536 / A01-D	Elevator Machine Room	Low	No	No
542 / A01-E	Lube Oil Reservoir-Unit 2	Very High	Yes	Yes
547 / A01-E	Turbine Building Operating Floor-Unit 2	Low	No	Yes
550 / A38	Manhole No. 1	Moderate	No	No
551 / A38	Manhole No. 2	Low	No	No
552 / A38	Service Water Pump Room	Low	Yes	Yes
553 / A38	Circulating Water Pump Room	Low	Yes	No
554 / A38	Circ. Water Pump Room Corridor	Low	No	No
555 / A38	Circ. Water Pumphouse Valve Gallery	Low	No	No
556 / A01-F	Main Transformer-Unit 1		Yes	Yes
557 / A01-F	Manhole B		No	No
558 / A39	South Gatehouse		No	No
575 / A53	Sewage Treatment Plant		No	No
576 / A01-F	Fuel Oil Storage Tanks	Very High	Yes	No
577 / A01-F	Manhole No.11	Low	No	No
578 / A40	Fuel Oil Pumphouse Vestibule		Yes	No
579 / A40	Fuel Oil Transfer Pump Room	Low	Yes	Yes
580 / A40	Fuel Oil Pmphse Electrical Equip. Closet		No	No
581 / A41	Flammable Liquids Room	Very High	No	Yes
582 / A42	Oil Storage Room	Very High	No	Yes
583 / A01-E	U2 Turbine Building General Area 8 ft.	Low	No	Yes

Table 7.2-1

PBNP Fire Hazards Analyses Index

Fire Zone / Fire Area	Description	Combustible Loading Class	Detection	Suppression
584 / A01-E	U2 Condenser Pit Area	Low	No	Yes
587 / A01-E	Storage	Low	No	No
588 / A01-E	U2 Turbine Building General Area 26 ft.	Low	No	Yes
591 / A43	Blowdown Evaporator Building	Low	No	No
592 / A44	Gas Stripper Building	Low	No	No
596 / A01-H	Containment Facade-Unit 2	Low	Yes	No
597 / A45	Unit 2 Facade Stairway 57	Low	No	No
597A / A01-H	Unit 2 Façade Elevator	Low	No	No
600 / A01-H	Unit 2 Facade Passage	Low	No	No
606 / A46	Unit 2 Reactor Vessel		No	No
608 / A46	Containment-Unit 2 – 8 ft.	Low	Yes	No
611 / A46	Containment-Unit 2 – 21 ft.	Low	Yes	No
615 / A46	Containment-Unit-2 – 46 ft.	Low	Yes	No
618 / A46	Containment-Unit-2 – 66 ft.	Low	No	No
620 / A47	Extension Building		No	No
666 / A01-F	Manhole No.10		No	No
667 / A48	Warehouse #1		No	Yes
668 / A48	Garage		No	No
669 / A49	Well Water Pumphouse		No	No
671 / A01-F	Manhole No.7		No	No
672 / A01-F	Manhole No.8		No	No
673 / A01-F	Switchyard Control House		No	No
674 / A01-F	Manhole No.6		No	No
675 / A01-F	13.8kV Switchgear Bldg-South (H02)		No	No
676 / A01-F	13.8kV Switchgear Bldg-Center (H01)		No	No
677 / A01-F	13.8kV Switchgear Bldg-North (H03)		No	No
680 / A01-F	Station Auxiliary Transformers		No	Yes
681 / A01-F	Gas Turbine G05	Moderate	Yes	Yes
682 / A01-F	Manhole No.3		No	No
683 / A01-F	Manhole No.4		No	No
684 / A01-F	Manhole No.5		No	No
685 / A01-F	Manhole No.9		No	No
691 / A50	Warehouse #2		No	Yes
692 / A51	Warehouse #3		No	Yes
693 / A01-F	Manhole No.12		No	No
694 / A01-F	Manhole No.13		No	No
698 / A01-F	Main Transformer-Unit 2		Yes	Yes
700 / A50	North Service Building		Yes	Yes
755 / A01-F	Warehouse #4		No	No
761 / A58	T-175A Fuel Tank Room		No	No
762 / A59	T-175B Fuel Tank Room		No	No
763 / A71	P-213A Sump Pump Room	Low	No	No
764 / A71	P-213B Sump Pump Room	Low	No	No
770 / A71	G-03 Diesel Room	Low	Yes	Yes
771 / A61	P-206A&P-207A Fuel Oil Pump Room	Low	Yes	Yes
772 / A71	T-176A Day Tank Room	Very High	Yes	Yes
773 / A71	G-03 Switchgear Room	Low	Yes	No
773A / A71	G-03 Switchgear Room Intake Plenum		No	No
774 / A71	Mechanical Equipment Room	Low	Yes	Yes

Table 7.2-1

PBNP Fire Hazards Analyses Index

Fire Zone / Fire Area	Description	Combustible Loading Class	Detection	Suppression
775 / A71	G-04 Diesel Room	Low	Yes	Yes
776 / A71	P-206B&P-207B Fuel Oil Pump Room	High	Yes	Yes
777 / A71	G-04 Switchgear Room	Low	Yes	No
777A / A71	G-04 Switchgear Room Intake Plenum		No	No
778 / A71	NW Stairwell/Enclosed Stairway	Low	No	No
780 / A71	G-03 Radiator Room	Low	Yes	No
781 / A71	G-03 Diesel Silencer Shaft		No	No
782 / A71	G-04 Diesel Silencer Shaft		No	No
783 / A71	G-04 Radiator Room	Low	Yes	No
784 / A71	G-04 Exhaust Fan Room	Low	No	No
785 / A71	G-03 Exhaust Fan Room	Low	No	No
786 / A71	Enclosed Walkway	Low	No	No
787 / A71	Roof Between Fan Rooms		No	No
790 / A69	Manhole Z-068 Outside DG Building		No	No
791 / A68	Manhole Z-067D		No	No
792 / A70	Manhole Z-066D		No	No
793 / A68	Manhole Z-067C		No	No
794 / A70	Manhole Z-066C		No	No
795 / A68	Manhole Z-067B		No	No
796 / A70	Manhole Z-066B		No	No
799 / A68	Manhole Z-067A		No	No
800 / A70	Manhole Z-066A		No	No
Yard / A01-F	Yard Area		No	No

* Spray Curtain in Entranceway
** In filter enclosure

7.3 SPECIFIC PLANT AREA GUIDELINES

7.3.1 Containment

The fire protection features for each containment includes fire detectors and hose stations supplied from the service water system. The reactor coolant pump lube oil collection system is described in Section 5.1.12.

Radiant energy shielding and cable tray fire stops are provided in various areas of containment to protect redundant trains of equipment. In addition, where cable trays pass through compartment walls, fire stops are installed. These are inspected during each refueling outage.

During refueling and maintenance, the containment is placed under strict administrative controls. Smoking is not permitted within the containment. The introduction of combustibles is minimized and the material is disposed of at the end of the refueling/maintenance activities. Special safety precautions and controlled welding procedures are implemented. Portable extinguishers are provided at the entrance to each containment. Additional portable fire extinguisher equipment is provided in the occupied areas of each Containment. Breathing apparatus is available for use in the containment.

7.3.2 Control Room

The Control Room is located at the 44' elevation of the Control Building. It is separated from other plant areas by doors, floor, roof and walls having a minimum rating of 2 hours. To prevent spread of fire from the Cable Spreading Room below, cable blockouts in the floor beneath the control and instrumentation racks are filled with a flame resistant material around the cables.

The fire protection features for the control room includes fire detection in the general areas and inside cabinets housing redundant safe shutdown cables and equipment. Fire suppression consists of portable extinguishers and two hose reels located outside of the control room adjacent to the entrances. Both the carbon dioxide hoses and the outside hose reels are equipped with fog nozzles.

Breathing air is supplied to the control room by a manifold system from a storage reservoir located outside of the room. Access ports to the manifold system are located at the control panels. Breathing apparatus for essential control room operators is readily available at the control panels. The breathing apparatus includes a self-contained unit with a minimum of one-half hour rating.

Should a postulated fire occur outside the control room, operators can place the ventilation system in a full recirculation mode. The ventilation system can be manually aligned to eject smoke from the Control Room. Additional portable smoke ejecting equipment is also available.

To limit the possibility of a fire originating in the control room, negligible combustible materials, trim, or furnishings are used in its construction.

Electrical circuits in the Control Room are limited to those associated with lighting, instruments, and control. Lighting circuits are 120V AC, instrumentation and control circuits are either 120V AC, 125V DC, or lower, except for the power supply to the nuclear instrumentation, which is 800V DC but is inherently safe. The 120V AC and 125V DC circuits are protected against short circuits by either fuses and/or circuit breakers. The power levels on the signal circuits are so low that short circuits cannot present a fire hazard. In addition, switchboard wiring is flame resistant. Because of the short circuit protection provided for the circuits in the control room, the fire hazard presented by the electrical equipment due to electrical faults, is minimal.

This configuration was reviewed and found acceptable by the NRC per SER letter dated August 2, 1979.

7.3.3 Cable Spreading Room

The fire protection features for the Cable Spreading Room includes fire detectors, a single failure proof automatic Halon 1301 suppression system, portable fire extinguishers and hose reels mounted outside the cable spreading room exits. The ventilation system can be manually aligned to eject smoke from the Cable Spreading Room. Additional portable smoke ejecting equipment is also available.

Cable trays are totally enclosed with solid bottoms and screwed on covers. Each tray has also been provided with a ½" thick full width Kaowool insulating blanket between the cable and the tray cover.

Fire Brigade access can be made through either of two doors on the 26' elevation of the Turbine Building. The Cable Spreading Room to Control Room door is 3 hour rated with a smoke and gas seal.

7.3.4 Computer Rooms

The Computer Room is located at the 60' elevation of the Control Building. The fire protection features for the Computer Room includes fire detectors, portable fire extinguishers and a hose reel station. The ventilation system can be manually aligned to eject smoke from the Cable Spreading Room. Additional portable smoke ejecting equipment is also available.

7.3.5 Switchgear Room

The Vital Switchgear Room is located at the 8' elevation of the Control Building. The fire protection features for the Vital Switchgear Room include fire detectors, a single failure proof automatic Halon 1301 suppression system, portable fire extinguishers and hose reel stations. Smoke venting can be accomplished with portable smoke venting units.

One hour fire wrap is provided for various raceways routed in the area to protect redundant trains of equipment cabling. With the automatic suppression system and detection, this meets the requirements of 10 CFR 50, Appendix R Section III.G.2.

7.3.6 Remote Safe Shutdown Panels

The turbine driven auxiliary feedwater pump local control station is located in the Turbine Driven Auxiliary Feedwater Pump (TDAFP) Room and the alternate shutdown panel is located in Alternate Shutdown Panel Zone (in the 26' Elevation of the U2 Turbine Building). The fire protection features for the TDAFP Room include fire detectors, a single failure proof automatic Halon 1301 suppression system, portable fire extinguishers and a hose reel station. The fire protection features for the Alternate Shutdown Panel Zone include portable fire extinguishers and a hose reel station.

7.3.7 Safety-Related Battery Rooms

The fire protection features for the PAB safety related battery rooms include fire detectors, portable fire extinguishers and a hose reel station. The fire protection features for the Control Building safety related battery rooms include fire detectors, an automatic Halon 1301 suppression system, portable fire extinguishers and a hose reel station. Normal room ventilation is adequate to ensure that hydrogen levels remain negligible and that an explosion hazard does not exist. Loss of the exhaust fans is annunciated in the control room.

7.3.8 Turbine Building

The Turbine Building is separated from adjacent structures containing safety-related equipment by 3-hour rated barriers. The Turbine Generator Oil System is described in Section 5.3.1.

7.3.9 Diesel Generator Areas

Diesel Generators G01 and G02 are located in separate rooms at the 8' Elevation of the Control Building. Diesel Generators G03 and G04 are located in a separate building. The fire protection features for the Diesel Generator rooms includes fire detectors, wet pipe sprinkler systems, portable fire extinguishers and hose reel stations.

7.3.10 Diesel Fuel Oil Storage Areas

There are two 60,000 gallon capacity above ground fuel oil storage tanks that are 260' from the plant structures. The tanks are surrounded by an earthen berm so that potential oil spills would be contained within the berm. The fuel oil storage tanks for the diesel generators are buried tanks beneath the G-03 and G-04 diesel generators in the separate Diesel Generator Building. These tanks are atmospheric tanks and are constructed and installed in accordance with applicable portions of NFPA 30 requirements.

7.3.11 Safety-Related Pumps

The fire hazard analyses show that a fire in one safety-related pump room will not endanger redundant safety-related components or in the case of cold shutdown required pumps, repairs can be performed within 72 hours. The availability of floor drains is described in Section 5.1.10. Smoke and heat removal is discussed in Section 5.5.1.

Fire protection features for the RHR Pump Rooms include fire detectors, portable fire extinguishers and hose reel stations.

Fire protection features for the Component Cooling Water Pump Room includes fire detectors, wet pipe sprinkler systems, portable fire extinguishers and hose reel stations.

Fire protection features for the Safety Injection Pump Room includes fire detectors, wet pipe sprinkler systems, portable fire extinguishers and hose reel stations.

Fire protection features for the Charging Pump Rooms include fire detectors, portable fire extinguishers and hose reel stations.

Fire protection features for the Turbine Driven Auxiliary Feedwater Pump Room include fire detectors, a single failure proof automatic Halon 1301 suppression system, portable fire extinguishers, and hose reel stations. Fire protection features for the motor driven auxiliary feedwater pump rooms include fire detectors, portable fire extinguishers, and hose reel stations.

Fire protection features for the Service Water Pump Room include fire detectors, wet pipe sprinkler systems, portable fire extinguishers and hose reel stations.

Fire protection features for the Fuel Oil Pumphouse and Fuel Oil Pump Rooms include fire detection, wet pipe sprinkler system, portable fire extinguishers and hose stations with a yard fire hydrant.

7.3.12 New Fuel Area

The new fuel storage area is essentially devoid of combustible material. New fuel is stored in an enclosed room with no entrances into the room from adjacent rooms. There is no equipment in this room except for the new fuel and storage racks. No cable trays or conduit pass through the room. The storage configuration of the fuel is such that criticality is precluded even for flooding caused by fire fighting. Portable fire extinguishers and hose reels are located in the central PAB area outside of the room.

7.3.13 Spent Fuel Pool Area

Fire protection features for the spent fuel pool area includes portable fire extinguishers, a hose reel station and detection in the spent fuel pool equipment area.

7.3.14 Radwaste and Decontamination Areas

Fire protection features for the radwaste and decontamination areas includes portable fire extinguishers, a hose reel station and detection in the Radwaste area at the 26' El. of the PAB. Additional radwaste equipment is located in the Evaporator Building and the Stripper Building, which are provided with portable fire extinguishers.

7.3.15 Safety-Related Water Tanks

The refueling water storage tanks (RWSTs) for each unit is located in the Containment facade area. Combustible material is not stored in the vicinity of the RWST. The fire protection features for the RWSTs include portable fire extinguishers and hose reel stations.

7.3.16 Records Storage Area

There are no major, permanent record storage areas inside the plant. A records storage vault is provided in the Nuclear Engineering Building that is more than 500' from the plant. Records storage room fire protection is provided by a wet pipe sprinkler system with automatic shutoff sprinkler heads.

7.3.17 Miscellaneous Areas

Shop areas within the plant are the controlled side machine shop, the clean side machine shop, electrical shop, and operations shop. The controlled side machine shop is located in a non-safety-related area of the PAB and is separated from safety-related equipment by more than 50' and 3-hr rated walls. The clean side machine shop is located on the East Side of the Unit 1 Turbine Building and is separated from safety-related equipment by more than 30' and 3-hr rated walls. The electrical shop is located at the south end of Unit 1 Turbine Building at the 8' elevation and is more than 200' from safety-related equipment. The operations shop is located at the south end of the Unit 1 Turbine Building at the 26' elevation and is more than 200' away from safety-related equipment. The fire protection features for these areas include portable fire extinguishers and hose reel stations.

Warehouses are located in separate buildings over 50' from plant structures. Warehouse fire protection is provided by automatic sprinkler systems and/or portable fire extinguishers.

The heater boiler room is located at the West Side of the Unit 2 Turbine Building 26' Elevation and more than 50' from safety-related equipment. The fire protection features for the heater boiler room includes fire detectors, wet pipe sprinkler systems, portable fire extinguishers and a hose reel station.

7.4 SPECIAL PROTECTION GUIDELINES

7.4.1 Storage of Acetylene-Oxygen Fuel Gases

When not in use, Acetylene-Oxygen tanks are stored in areas, which are separated from safety related areas by 3 hr rated fire barriers or a designated storage area of the Unit 1 Façade, which is remote to safety related equipment and free of ignition sources except for the tanks themselves. Use of the equipment in safety related areas are controlled by administrative procedure.

7.4.2 Storage Areas for Ion Exchange Resins

Ion exchange resins are shipped and stored in a hydrated condition, which does not represent a fire hazard. Resins are stored either in a warehouse or temporarily on the 66' Elevation of the PAB. The warehouse is provided with an automatic sprinkler system. Portable fire extinguishers and hose stations provide fire protection on the 66' Elevation of the PAB.

7.4.3 Hazardous Chemicals

The chemical storage area is adjacent to the Alternate Shutdown Panel Zone at the 8' and 26' Elevations of the Unit 2 Turbine Hall. This area is separated from safety related areas of the PAB by a solid wall of 3-hr fire rating. At the 8' Elevation, a sulfuric acid tank and a sodium hydroxide caustic tank are housed with concrete structures with walls of sufficient height to retain the entire contents of a ruptured tank. Fill connections are located outdoors, which prevent chemical spills within the building. Hydrazine storage consists of storage containers with a diluted solution in water. These drums are stored in the Heating Boiler Room. The chemical storage area at the 26' Elevation is used for storage and preparation of solutions, which do not present a fire hazard.

7.4.4 Materials Containing Radioactivity

Spent resin is sluiced to a steel spent resin cask liner. This tank is designed to store spent resins for an extended period of time prior to offsite shipment. The resin is retained in water in the tank. The tank is located on a track-mounted cart in the central section of the PAB. The fire protection features in this area include full area detection, a partial area wet sprinkler system, portable fire extinguishers and hose reel stations. The area is protected from adjacent areas by 3 hr rated fire barriers and water curtain door sprays in the entranceways from the Unit 2 charging pump area and the SI pump room area.

When the spent resin storage container needs to be emptied, the tank is transported from the 8' Central PAB to the 66' PAB for sluicing into a High Integrity Container. When this High Integrity Container is ready for shipment, the container and spent resin is shipped off site for disposal.

Spent filters containing a high level of radioactivity are stored in a High Integrity Container with steel and concrete materials for shielding. Filters containing low level radioactivity are stored in metal drums in the waste preparation area, which is remote to safety related equipment and free of ignition sources except for the filters themselves.

8.0 PERIODIC INSPECTION AND TESTING OF FIRE PROTECTION SYSTEMS

8.1 OPERABILITY OF FIRE PROTECTION SYSTEMS

8.1.1 Applicability

Applies to the fire protection components, which provide fire protection capability for equipment required for safe plant shutdown at all times when those systems are required to be operable.

8.1.2 Objective

This section specifies the requirements for fire protection components that would be employed to mitigate the consequences of fires that could affect equipment required for safe plant shutdown.

8.1.3 Operating Requirements

A. Fire Suppression Water System

1. Fire Main Loop Water Supply

a. Both fire pumps shall be operable, or

b. One fire pump may be inoperable provided that the second fire pump is tested to demonstrate operability.

c. Both fire pumps may be inoperable provided that a backup fire main loop water supply is operable within 24 hours. Two screen wash pumps operated together are capable of meeting the backup fire main loop water supply requirements.

If a, b, or c, above cannot be fulfilled, both reactors shall be placed in hot standby within the next 6 hours and in cold shutdown within the following thirty (30) hours.

2. Water Sprinkler System

a. The water sprinkler systems listed in Table 8.1-1 shall be operable whenever equipment protected by the system is required to be operable.

b. A water sprinkler system listed in Table 8.1-1 may be inoperable provided that:

1. Within one hour of determining that one or more of the above required spray and/or sprinkler systems are inoperable, for those areas in, which redundant systems or components could be damaged, establish an hourly fire watch inspection and provide backup fire suppression capability. For other areas, establish an hourly fire watch inspection. Restore the system to operable status within 14 days or initiate action in accordance with the station corrective action program.

3. Fire Hose Stations

a. Fire hose stations for the areas listed in Table 8.1-1 shall be operable whenever equipment in the areas protected by the fire hose stations is required to be operable.

b. Within one hour of determining that one or more of the fire hose stations shown in Table 8.1-1 are inoperable, route backup water suppression capability or provide portable fire suppression capability to the unprotected area(s). Restore the fire hose station to operable status within 14 days or initiate action in accordance with the station corrective action program.

4. Halon Gaseous Suppression Systems

a. The Halon Gaseous suppression systems listed in Table 8.1-1 shall be operable whenever equipment protected by the Halon system is required to be operable.

b. One supply source of Halon for the gaseous suppression systems in Table 8.1-1 may be inoperable provided that within one hour of determining the condition, fire hose station suppression capability for the affected area is provided.

c. Both supply sources of Halon for the gaseous suppression systems listed in Table 8.1-1 may be inoperable provided that:

d. Within 1 hour of determining the condition an hourly fire watch inspection is established and that backup fire suppression capability is provided for those areas in, which redundant systems or components could be damaged; for other areas, establish an hourly fire watch inspection. Restore the system to operable status within 14 days or initiate action in accordance with the station corrective action program.

B. Fire Detection

1. Fire Detection Systems

a. The fire detection system components for each area listed in Table 8.1-1 shall be operable whenever equipment protected by the fire detection components is required to be operable.

b. The control room annunciation for the fire detection system may be inoperable provided that within one hour of determining the condition, the area control panels for each area listed in Table 8.1-1 are surveilled hourly.

c. Area control panels for the areas listed in Table 8.1-1 may be inoperable provided that:

1. Within one hour of determining that the area control panel is inoperable, the affected area is inspected to assure that potential fire hazards are minimized,

2. Activity in the affected area is restricted to that, which is necessary for continued operation, and

3. A fire watch inspection is performed in the affected area hourly.

d. For each area listed in Table 8.1-1, which is not protected by a Halon gaseous suppression system:

1. A single detection device may be inoperable,

2. As long as at least 75% of an area's detection devices remain operable, multiple non-adjacent detection devices may be inoperable, and

3. More than 25% of an area's detection devices or multiple adjacent detection devices may be inoperable provided that:

I. Within one hour of determining that the detection device(s) are inoperable, the affected area is inspected to assure that potential fire hazards are minimized,

II. Activity in the affected area is restricted to that, which is necessary for continued operation, and

III. A fire watch inspection is performed in the affected area hourly.

e. For each area listed in Table 8.1-1, which is protected by Halon gaseous suppression system, any number of detection device(s) may be inoperable provided that:

1. Within one hour of determining that the detection device(s) are inoperable, the affected area is inspected to assure that potential fire hazards are minimized,

2. Activity in the affected area is restricted to that, which is necessary for continued operation, and

3. A fire watch inspection is performed in the affected area hourly.

Restore the inoperable instrument(s) to operable status within 14 days, or initiate action in accordance with the station corrective action program.

C. Fire Barriers

1. Fire Barrier Penetration Seals

a. All fire barrier penetration seals protecting safety-related areas shall be operable

b. A fire barrier penetration seal may be inoperable provided that:

1. Within one hour of determining that the fire barrier penetration seal is inoperable, the immediate area on each side of the fire barrier is inspected to assure that potential fire hazards are minimized,

2. Activity in the immediate area on each side of the fire barrier is restricted to that, which is necessary:

I. for continued operation, and

II. to enable restoration of penetration seal operability.

3. A fire watch inspection shall be performed on each side of the fire barrier hourly, and

4. Restore the inoperable fire barrier to operable status within 7 days or initiate action in accordance with the station corrective action program.

8.1.4 Basis

The overall fire protection program at Point Beach Nuclear Plant utilizes the principles of defense in depth. This includes early warning fire detection and redundant fire suppression capability. Collectively, these measures ensure equipment operability, provide adequate capability to prevent and minimize damage to safety-related equipment, and allow safe plant shutdown in the event of a fire occurrence. Should a portion or component of the fire protection system be inoperable, these specifications provide assurance that redundant methods of fire protection are readily available and that the capability to mitigate the consequences of a fire is maintained.

8.1.5 Reportability

Degradation of fire protection systems or components as described in Section 8.1.3 present a failure to maintain the plant fire protection systems as previously approved by the NRC. Such failures shall be identified in accordance with the station corrective action program. The corrective action program should outline action(s) taken, the cause of the inoperability, and the plans and schedule for restoring the system to operable status.

8.1.6 Documentation

Fire protection system and component operability is verified by periodic tests. Test procedures and completed tests are maintained by plant staff for future review.

8.1.7 Compensatory Measures

If operating requirements of Fire Protection Equipment and Systems are not employed, alternate compensatory measures can be placed provided an evaluation is performed to determine the impact of the proposed compensatory measures to the FPER and their adequacy compared to the operating requirements (compensatory measures) required by the FPER. The evaluation should evaluate the impact of the alternate compensatory measure on the ability of fire protection components to mitigate the consequences of fires that could affect equipment required for safe shutdown.

8.2 SURVEILLANCE OF FIRE PROTECTION SYSTEMS

8.2.1 Applicability

Applies to the periodic inspection and testing requirements of fire protection equipment specified in Section 8.1.3.

8.2.2 Objective

To verify the operability of fire protection system components.

8.2.3 Specification

TEST	FREQUENCY
A. Fire Suppression Systems	
1. Fire Main Loop Water Supply	
a. Flow path valve position verification	Monthly
b. Fire pump functional test	Monthly
c. Fire pump capacity test	Yearly
d. Diesel driven fire pump engine	
(1) Fuel volume verification	Monthly
(2) Diesel fuel sample analysis	Quarterly
(3) Periodic inspection	18 months
e. Diesel driven fire pump battery and charger	
(1) Battery voltage verification	Weekly
(2) Electrolyte level	Monthly
(3) Electrolyte specific gravity	Quarterly
(4) Periodic inspection	18 months
2. Water Sprinkler Systems	
a. Flow path valve position verification	Monthly
b. Inspector's test	Yearly

c. Visual header and nozzle inspection	18 months
3. Fire Hose Stations	
a. Visual inspection	Monthly
b. Hose Hydrostatic test	3 years
c. Valve cycle test	3 years
4. Halon Gaseous Suppression Systems	
a. Halon quantity verification	6 months
b. Functional test	Yearly
c. Visual header and nozzle inspection	Yearly
B. Fire Detection	
1. Fire Detection System	
a. Channel functional test	6 months
C. Fire Barriers	
1. Fire Barrier Penetration Seals	
a. Visual inspection	4.5 years (approximately 1/3 per 18 months)

8.2.4 Basis

Normally, the fire protection is not in use. However, the system components are required to perform as designed in the event of a fire emergency. The National Fire Protection Association and the plant insurance carrier have specified periodic tests and inspections to demonstrate fire protection equipment operability. The listed tests and inspections are based upon the requirements of these organizations. Testing more frequently than that listed is not considered necessary to ensure operability and performance.

Table 8.1-1
Safe Shutdown Area Fire Protection

Area	Elevation	Automatic Suppression		Manual Suppression	Fire Detection
		Water Sprinkler System	Gas Suppression System	Fire Hose Station	
1. Auxiliary Building South	8'	(X) Partial		X	15
2. Auxiliary Building Center A. Safety Injection Pumps B. Component Cooling Water Pump	 8'	 X X		 X	 13
3. Auxiliary Building North	8'	(X) Partial		X	9
4. Auxiliary Building West	8' & Below			X	16
5. Auxiliary Building South	26'			X	3
6. Auxiliary Building Center	26'			X	17
7. Auxiliary Building North	26'			X	7
8. Auxiliary Building Center	46'			X	6
9. Turbine Driven Auxiliary Feedwater Pump Room	8'		X	X	18
10. Vital Switchgear & Battery Room	8'		X	X	8
11. G01 Diesel Generator Room	8'	X		X	4
12. G02 Diesel Generator Room	8'	X		X	4
13. Cable Spreading Room	26'		X	X	17
14. Circulating Water Pumphouse A. Service Water Pumps	 8'	 X		 X	 15
15. G03 Diesel Generator Room	28'	X		X*	3
16. G04 Diesel Generator Room	28'	X		X*	3
17. G03 Vital Switchgear Room	28'			X*	2

Table 8.1-1
Safe Shutdown Area Fire Protection

Area	Elevation	Automatic Suppression		Manual Suppression	Fire Detection
		Water Sprinkler System	Gas Suppression System	Fire Hose Station	
18. G04 Vital Switchgear Room	28'			X*	2
19. G03 Fuel Oil Day Tank Room	28'	X		X*	1
20. G04 Fuel Oil Day Tank Room	28'	X		X*	1
21. G01/G02 Fuel Oil Transfer Pump Room	28'	X		X*	1
22. Control Room	44'			X	12
23. Computer/Inst. Rack Room	60'			X	11
24. Unit 1 MDAFW Pump Room	8'			X	1
25. Unit 2 MDAFW Pump Room	8'			X	1

*Diesel Generator Building fire hose stations are located in Mechanical Equipment Room.

9.0 CONTROL OF APPENDIX R SAFE SHUTDOWN EQUIPMENT

The FPER and SSAR demonstrate the capabilities to safely shutdown in the event of a fire. The systems and equipment used to achieve and maintain safe shutdown are discussed in Section 5.2. The capabilities of the systems and features used to achieve safe shutdown capability are based on the design basis capabilities of the systems and components. Calculations have been developed to demonstrate that the system capabilities meet the performance requirements relied on in the FPER and SSAR.

Existing PBNP tests, inspections, and maintenance activities demonstrate the capabilities of such systems to perform their design basis functions. For purposes of demonstrating compliance with Appendix R, the existing PBNP tests are relied on to demonstrate the functional capabilities of the systems. Some specific tests or inspections to demonstrate the functional capabilities have also been developed, such as G-05 gas turbine testing, alternate shutdown instrumentation calibration, Appendix R power supply. In addition, operability of transformers, load centers, and distribution panels is demonstrated by the operability of the downstream equipment, which would result in alarms if the downstream equipment was out of service as a result of inoperability of the upstream equipment. The ability to energize or deenergize downstream equipment is demonstrated during normal maintenance and tagout activities conducted on the downstream equipment.

The Safe Shutdown Analysis assumes all safe shutdown equipment is available and in its normal position at the beginning of an Appendix R fire event. During routine operation of the plant it may be necessary to take one or more components out of service. Therefore, administrative controls are established to ensure that the Appendix R Safe Shutdown Equipment will be available to perform its intended safe shutdown function.

9.0.1 The out-of-service time for Appendix R Safe Shutdown equipment is restricted by the applicable Technical Specification(s) or 30 days, whichever is more limiting.

9.0.2 IF the requirements of 9.0.1 cannot be met, THEN IMPLEMENT appropriate compensatory measures to address the impaired post fire safe shutdown function within the following 72 hours AND initiate action in accordance with the station corrective action program.

9.1 COMPENSATORY MEASURES

Appendix R Safe Shutdown Equipment which is out of service should be evaluated to determine whether it is impaired from performing its Appendix R safe shutdown function. The Safe Shutdown Analysis Report (SSAR) provides a detailed listing of the Appendix R Safe Shutdown components and the Appendix R safe shutdown functions. The establishment of compensatory measures should ensure the operators are aware of the degraded post fire safe shutdown system conditions, and should include consideration of:

- Temporary repair procedures
- Temporary fire barriers, fire detection or suppression
- Temporary restrictions on activities which could increase the risk of an Appendix R event
- Alternate means to ensure the safe shutdown function is accomplished.

An evaluation of the impact of proposed compensatory measures on the ability to achieve and maintain safe shutdown must be performed.

9.2 Cold Shutdown Equipment

Appendix R allows the use of repair activities on equipment, which is only required for cold shutdown provided materials for repairs are readily available onsite and procedures are in effect to implement such repairs.

Materials required for these repair activities shall not be used for other activities unless compensatory measures are provided that are considered adequate by the Fire Protection Engineer. A temporary technical evaluation shall also be required.

If at any time it is determined that any of the materials required for these repair activities are missing or inoperable, replace or repair the material within 7 days or contact the Fire Protection Engineer for compensatory action guidance.

9.3 Compensatory Measure Fire Watch Responsibilities

Compensatory Measure Fire Watches (CMFWs) are individuals designated to inspect fire zones for potential fire hazards. Fire watches may be assigned whenever plant conditions warrant based on fire protection and/or Appendix R Safe Shutdown Equipment being inoperable. The CMFWs shall be responsible for inspecting fire zones for the following:

1. Combustible materials that are not normally located in the fire zone that may present a fire exposure to cables or equipment in the room if they were to become ignited.

2. Work activities in the fire zone that will introduce a potential ignition source presenting a fire exposure to cables or equipment in the area.

3. Any other abnormal activities in the fire zone that could introduce an increased likelihood of a fire starting in the fire zone.

4. The fire watch should report any abnormal fire hazards, combustible materials or work activities to the Fire Protection Coordinator and Shift Manager.

9.4 Emergency Lighting

9.4.1 Requirements

Battery-operated emergency lighting units designed to provide adequate illumination for an 8-hour lighting duration are provided at local control panels and along the normal access routes traveled by operators to establish the Appendix R hot standby condition. A technical evaluation of PBNP emergency lighting capability is documented in FPTE-003. Periodic testing of emergency lighting units in accordance with the manufacturer's recommendations is accomplished via normal equipment call-up procedures. Lamp orientation is also checked to maintain lineup with the established operator access routes.

9.4.2 Addition

Modification activity may require the installation of additional emergency lights. Responsible personnel shall advise PBNP Maintenance of any emergency lights and the lamp orientation of such lights that are added to accommodate Appendix R safe shutdown requirements to ensure that the added units are included in the maintenance call-up system.

9.4.3 Temporary Changes

Modification or maintenance activity may require a temporary change in lamp orientation. Responsible personnel shall advise the designated PBNP Maintenance representative of any change of lamp orientation and notification that the lamp orientation has been returned to the normal position. Responsible personnel shall also advise PBNP Operations of changes in lamp orientation for operator awareness and the appropriate location of hand-held battery lanterns.

9.4.4 Impairment

Emergency lighting units are tested in accordance with the manufacturer's recommendations. If a unit is found to be impaired or inoperable, it shall be restored to operability within 30 days, or action initiate in accordance with the station corrective action program. In addition, PBNP Operations shall be advised of the location of the impaired unit so that hand-held battery lanterns can be provided for compensatory measures.