

Quad Cities Nuclear Power Station

Fire Protection Report

(FPR)

VOLUME 2

**Quad Cities Nuclear Power Station, Unit 1 and 2
Renewed Facility Operating License Nos. DPR-29 (Unit 1) and DPR-30 (Unit 2)
NRC Docket Nos. STN 50-254 (Unit 1), 50-265 (Unit 2) and 72-53**

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1.0 Introduction

1.1 Objective

Paragraph 50.48(b) of 10 CFR 50, which became effective on February 17, 1981, requires all nuclear plants licensed to operate prior to January 1, 1979, to comply with Sections III.G, III.J, and III.O of Appendix R to 10 CFR 50, regardless of the status of previous Fire Protection Safety Evaluation Reports (FPSEs).

Section III.G requires that fire protection features be provided for those systems, structures, and components important for safe shutdown. These features must be capable of limiting fire damage so that:

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

Section III.O establishes requirements for oil collection systems for reactor coolant pumps. This section is not applicable to Quad Cities 1&2 because the containment is inerted during normal operation.

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

Section III.L of Appendix R, and Generic Letter 81-12 (February 20, 1981), Enclosure 1 "Staff Position," provide additional guidance on the NRC staff's requirements for this safe shutdown capability.

The objective of this analysis has been to provide the technical basis for achieving compliance with 10 CFR 50, Appendix R, Sections III.G, III.J and III.L with respect to the requirements for a post-fire safe shutdown capability. This objective has been achieved by first identifying equipment which could be used to achieve safe shutdown (see Section 3.0). This equipment is referred to as "safe shutdown equipment." The equipment was evaluated on a fire area basis to determine if there was adequate separation or an alternative shutdown method available independent of the subject fire area (see Section 4.0). Where deficiencies existed, a modification was completed or an exemption from the specific Appendix R requirements requested.

1.2 Development of the Safe Shutdown Report

Quad Cities developed safe shutdown analysis (SSA) acceptance criteria to determine the acceptability of this revision to the SSA. These criteria, developed by a multi-discipline team of station and corporate engineers, assures that the goals of the current safe shutdown methodology are fully incorporated. These acceptance criteria are presented in Table 1.2-1.

The actions described above led to the development of a revised SSA in 2000, which included the following major activities:

- Incorporation of the Station Blackout (SBO) Diesel Generators
- Evaluation of the availability of offsite power
- Additional common power supply reviews which included breaker coordination, multiple high-impedance faults, and potential loss of 4 kV bus protection
- Additional common enclosure evaluations, including 250 Vdc control power circuits
- Expanded spurious operations scope for additional pumps and valves
- Expanded unit interactions to address effects of fire to the non-fire unit
- Revalidation of the time line for performing manual actions

The SSA was reviewed against the acceptance criteria shown in Table 1.2-1.

In addition, the revised SSA was reviewed against the approved exemptions. This review was to determine the changes to the SSA that affected the bases of the exemptions or the bases of the NRC approval of the exemptions contained within the NRC safety evaluation reports. The exemptions are identified in Table 1.2-2, and the NRC safety evaluation reports are listed in Table 1.2-3.

1.3 Safe Shutdown Functions

This report documents the review of the safe shutdown functions required to achieve and maintain cold shutdown conditions for Quad Cities Units 1&2.

The specific safe shutdown functions necessary to satisfy Appendix R criteria of achieving and maintaining cold shutdown (described in Chapter 3.0) are as follows:

- Reactivity control
- Reactor coolant makeup
- Reactor pressure control and decay heat removal
- Suppression pool cooling
- Process monitoring
- Support

Various analytical methods can be used to determine that sufficient plant systems are available to perform the identified safe shutdown 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 fires cannot be precisely determined. Appropriate plant fire protection features limit potential fire damage to the extent that unaffected plant systems would be available to achieve safe shutdown. However, an extensive effort would be required to identify the effects of postulated fires in all potential plant locations and to all of the plant systems that are available to support safe shutdown.

As an alternative to such an approach, a minimum set of plant systems (i.e., Appendix R safe shutdown systems) and components were identified in response to the requirements of Appendix R. These systems and components can achieve and maintain safe shutdown -- with or without a loss of offsite power -- for fire areas in III.G.3 compliance. All other Fire Areas are in compliance with III.G.1, which does not require the loss of offsite power be assumed unless it is lost due to fire damage. The development of the equipment required to achieve and maintain safe shutdown was an iterative process. The process of identifying the safe shutdown equipment started with a review of the unit system descriptions. Using the guidance of Generic Letter 81-12, system P&IDs, wiring and cable routing diagrams, and the clarification of General Letter 81-12, a review was accomplished considering the effects of essential or associated circuits. Demonstration of adequate protection of this minimum set of plant systems from the effects of postulated fires constitutes an adequate and conservative approach to demonstrate the ability to achieve and maintain safe shutdown for the purposes of fire protection. Spurious operations of components that may adversely affect safe shutdown have been identified and are addressed in this report (see subsection 5.2). The number of modifications were minimized by taking credit for manual operation of existing equipment whenever possible.

The safe shutdown systems and components for Quad Cities Units 1&2 are capable of achieving and maintaining safe hot shutdown conditions in the reactor, maintaining reactor coolant inventory, commencing activities to achieve cold shutdown conditions within 72 hours after scram, and maintaining cold shutdown conditions thereafter.

1.4 Background Information

As part of the continuing NRC evaluation following the fire at the Browns Ferry Nuclear Station in March 1975, ComEd outlined its fire protection program and features at Quad Cities 1&2 in a number of documents submitted to the NRC between 1976 and the present.

The document entitled, "Information Relevant to Fire Protection Systems and Programs -- Parts 1-3, April 1977," provided ComEd's response to the NRC initial request for a comparison of the fire protection provisions of Quad Cities 1&2 to the guidelines of Appendix A to BTP APCS 9.5-1. This document was ComEd's first fire hazards analysis of Quad Cities Units 1&2, and resulted in ComEd carrying out a number of fire protection modifications.

ComEd also responded to NRC guidelines regarding nuclear power plant fire protection programs in the following documents:

- Supplementary Guidance on Information Needed for Fire Protection Evaluation, September 30, 1976
- Sample Technical Specifications, June 24, 1977
- Nuclear Plant Fire Protection Functional Responsibilities, Administrative Controls, and Quality Assurance, August 12, 1977

Following the review of these ComEd submittals and a plant inspection, the NRC staff docketed a Fire Protection Safety Evaluation Report (FPSE) for Quad Cities Units 1&2 in July 1979. A staff letter of February 12, 1981, confirmed that all FPSE items were considered closed, with the exception of "safe shutdown capabilities." Implementation of these guidelines resulted in additional fire protection measures being incorporated to enhance the existing fire protection program and to satisfy the NRC defense-in-depth philosophy. Many studies and much discussion were also associated with the subsequent NRC fire protection guidelines and requirements.

The fire protection rule, 10 CFR 50.48 and Appendix R of 10 CFR 50, was issued on November 19, 1980. 10 CFR 50.48 states:

"Except for the requirements of Section III.G, III.J, and III.O the provisions of Appendix R to this part shall not be applicable to nuclear power plants licensed to operate prior to January 1, 1979, to the extent that fire protection features proposed or implemented by the licensee have been accepted by the NRC staff as satisfying the provisions of Appendix A to Branch Technical Position BTP APCSB 9.5-1 reflected in staff fire protection safety evaluation reports issued prior to the effective date of this rule, or to the extent that fire protection features were accepted by the staff in comprehensive fire protection safety evaluation reports issued before Appendix A to Branch Technical Position BTP APCSB 9.5-1 was published in August 1976."

At that time, the shutdown analyses and subsequent related correspondence for Quad Cities 1&2 were well underway and being reviewed by the NRC staff. ComEd continued to provide the NRC staff with all necessary information for their review of the station's safe shutdown capability.

On July 1, 1982, ComEd submitted the final response and position on Generic Letter 81-12 questions regarding safe shutdown capability, and associated circuits, along with a listing of the exact shutdown methods and necessary shutdown modifications for Quad Cities 1&2. Submitted with this response was the Quad Cities 1&2 "Fire Protection Associated Circuits Analysis and Modifications Report." (Figure 1.4-1 identifies the process used to develop the referenced report.) The cable discrepancy report was revised and resubmitted August 13, 1982, as a supplement to the Modifications Report.

Enclosure D of the July 1, 1982, submittal included the first formal exemption requests from the requirement of Appendix R, Section III.G.3.b for fixed fire suppression, and Section III.G.2 for 3-hour fire barriers separating redundant divisions of safe shutdown equipment. The request for exemption from Section III.G.3.b was made for nine fire zones having electrical equipment critical to the power distribution necessary for normal and emergency operation of safety-related equipment for Units 1 and 2. The request for exemption from Section III.G.2 was made for essential and associated cables in the reactor building basements of Units 1 and 2. A formal exemption was granted on June 23, 1983, from the requirements of Sections III.G.2 and III.G.3 for the zones under consideration.

By cover letter dated December 30, 1982, the NRC staff stated that they had completed the review of Quad Cities 1&2 alternate shutdown capability, which is used to achieve safe shutdown in the event of a fire. This capability was evaluated against the requirements of Sections III.G. and III.L of Appendix R to 10 CFR 50. Based on this review, the NRC staff concluded that Quad Cities 1&2 was in compliance with Appendix R, Sections III.G.3 and III.L, regarding safe shutdown in the event of a fire. A Safety Evaluation Report (SER) was written on this Appendix R review. The conclusion of this evaluation states:

“We [the NRC staff] have reviewed the licensee's proposed alternate shutdown capability for Quad Cities in accordance with Appendix R criteria. Based on that review, we conclude that the performance goals for accomplishing safe shutdown in the event of a fire, i.e., reactivity control, inventory control, decay heat removal, pressure control, process monitoring, and support functions, are met by the proposed alternate. Therefore, we conclude that the requirements of Appendix R, Sections III.G.3 and III.L, are satisfied. However, once the alternate system is implemented, the licensee will propose technical specifications for the new safe shutdown makeup pump comparable to those currently existing for the RCIC pump.”

On the basis of these conclusions, ComEd management was confident that the intent of Appendix R had been satisfied, and continued working to implement the identified modifications in accordance with 10 CFR 50.48(c)(4).

On October 19, 1983, Generic Letter 83-33, which reemphasized NRC positions on certain requirements of Appendix R, was transmitted to Quad Cities 1&2. As a result, ComEd management decided to perform a reevaluation of the previous analysis to verify that misinterpretations did not exist.

As a result of the reevaluation, a series of exemption requests from the requirements of Appendix R were submitted to the NRC. The exemption requests were approved by the NRC as a series of safety evaluations beginning December 1, 1987 (see Table 1.2-3, Items II.3 through II.12). The process used to develop these exemption requests is shown in Figure 1.4-2.

On September 30, 1991, ComEd submitted for NRC review a license amendment requesting: 1) incorporation of the standard fire protection license condition and 2) removal of the fire protection features from the Technical Specifications. This change was developed in accordance with Generic Letter 88-12, “Removal of Fire Protection Requirements From Technical Specifications”. The NRC approved the license amendment on May 13, 1993 (see amendments 141 and 136 for Unit 1 and Unit 2 respectively).

During the time between the reevaluation and the fall of 1997, the Appendix R analysis was updated periodically to incorporate changes to the plant.

Due to a number of Appendix R deficiencies identified in the late 1990s, Exelon committed to improve post-fire safe shutdown capabilities at Quad Cities. These commitments were made to resolve inconsistencies between the Appendix R safe shutdown procedures and supporting safe shutdown analyses. To confirm Exelon's actions, the NRC issued a Confirmatory Action Letter (CAL) on January 16, 1998. As part of the CAL closure, EGC made additional commitments and associated changes to reduce the need to evacuate the main control room for certain fire events.

During the period from June 1998 and November 2000 an effort was initiated to improve the Quad Cities Units 1&2 safe shutdown capability by revising the existing safe shutdown analysis documentation to incorporate the analysis performed and to conform procedures to the safe shutdown analysis. The goals of this project are to reduce manual actions, improve 125Vdc availability, fewer and simpler procedures, to assure that the design basis reflects the plant as currently configured, and to improve unit independence. This review identified that HPCI could be utilized for injection and the SBO Diesel Generators would be credited for on-site AC power for fire areas where the Emergency Diesel Generators were effected by the Fire. Additional potential spurious operations are evaluated. Protective device coordination was updated to reflect modifications that have been made to the plant. Associated circuit analyses have been expanded.

Analyses were also performed to evaluate the impact of Extended Power Uprate (EPU).

As a result of the plant upgrades discussed above, Exelon was in a position to evaluate certain fire areas as having redundant safe shutdown capability in accordance with Appendix R, III.G.2. The goal was to further simplify the safe shutdown procedures by eliminating the requirement to include the onsite emergency power source for fire areas where offsite power was verified available and a redundant safe shutdown train was free of fire damage. The reclassification from III.G.3 to III.G.2 was evaluated and implemented under QCNPS fire protection license condition 3.F, which allows changes to the approved fire protection program without prior NRC approval when those changes would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire. The following areas were established as III.G.2 fire areas in 2000: RB-1N, RB-1S, RB-2N, RB-2S, TB-I, TB-III, 13-1, 24-1, CT-1 (new fire area), BC-1 (new fire area) and BC-2 (new fire area).

During a subsequent Triennial Fire Protection Inspection (Inspection Report 05000254(265)/2006002(DRS) dated July 31, 2006), the Inspectors reviewed EGC's basis for transitioning from III.G.3 to III.G.2 and found that the change was not consistent with 10 CFR 50 Appendix R requirements. In particular, the Inspectors issued two violations that concluded: (1) the use of the inter-unit crossties for Residual Heat Removal Service Water, and (2) the re-classification of Reactor Core Isolation Cooling and Safe Shutdown Makeup Pump systems as redundant for reactor makeup, were not appropriate under a redundant shutdown scheme.

The two NCVs were determined to have very low safety significance since all of the circuitry involved was appropriately evaluated in the Safe Shutdown Analysis, and the issues were entered into the station's corrective action program. EGC elected to contest the NRC's position (letter from T. J. Tulon to U. S. NRC, "Response to NRC Triennial Fire Protection Baseline Inspection Report," dated August 31, 2006). The violations were subsequently upheld by the NRC (letter from E. G. Grant to C. Crane, "Response to Disputed Non-Cited Violations Quad Cities Nuclear Power Station Units 1 and 2 Inspection Report 05000254/2006002(DRS); 05000265/2006002(DRS)" dated June 5, 2007).

The NCVs concluded that that the basis for transitioning to III.G.2 in 2000 did not fully meet regulatory requirements. To resolve the violations, procedure changes were implemented in 2009 that revert the post-fire safe shutdown strategy for the affected areas from redundant (III.G.2) to alternative (III.G.3) shutdown, consistent with the original fire protection safe shutdown licensing basis established in the early 1980s. Safe shutdown procedures were revised accordingly to reflect the onsite power source requirements in 10 CFR 50, Appendix R, Section III.L. The transition to III.G.3 affected the following fire areas: RB-1N, RB-1S, RB-2N, RB-2S, TB-I, TB-III, 13-1, 24-1, CT-1, BC-1 (reincorporated into TB-III) and BC-2 (reincorporated into TB-I). Reverting the safe shutdown compliance strategy to III.G.3 for these fire areas does not adversely impact the benefits realized from the initiatives implemented in the 2000 timeframe. While the systems used to implement safe shutdown remain consistent with the plant's original III.G.3 licensing basis, significant implementation improvements resulted from the upgrades completed in 2000. These upgrades strengthened the safe shutdown program including plant modifications targeted at protecting safe shutdown equipment and the development of a robust circuit routing database. Prior to this effort, the capability to operate safe shutdown equipment from the main control room was limited, resulting in complex procedures. Currently, injection and onsite power systems can be aligned from the main control room for most fire areas.

1.5 Governing Regulatory Guidelines

The criteria used in this analysis are derived from the following regulatory documents that form the basis for the conclusion and recommendations:

1. "Fire Protection Program for Operating Nuclear Power Plants," 10 CFR 50 Appendix R (45 FR 76611, November 19, 1980, and 46 FR 44735, September 8, 1981).

This program requires provision of reasonable assurance that at least one train of systems necessary to achieve and maintain hot shutdown remains free of fire damage in the unlikely event of fire in any plant area. Systems necessary to achieve and maintain cold shutdown conditions may likewise be protected or repaired to the extent that cold shutdown can be achieved within 72 hours.

2. Letter to all power reactor licensees with plants licensed prior to January 1, 1979, from Mr. D. G. Eisenhut (NRR/DL), Subject: "Fire Protection Rule 45 FR 76602, November 19, 1980 - Generic Letter 81- 12," dated February 20, 1981.

This letter was issued subsequent to the promulgation of Appendix R. The purpose of the letter was to identify and clarify the information required for staff review of licensing submittals describing safe shutdown functions, systems, components and their associated circuits. To this end, Generic Letter 81-12 supplements the final rule and provides additional criteria that must be considered.

3. Memorandum to Mr. D. G. Eisenhut (NRR/DL) from Dr. R. J. Mattson (NRR.DSI), Subject: "Fire Protection Rule - Appendix R," dated March 22, 1982 (clarification of Generic Letter 81-12).

Generic Letter 81-12 was clarified by this letter and transmitted to power reactor licensees between March and May 1982. This letter provided the following:

- Clarification of the NRC's request for information concerning the alternative or dedicated shutdown system
- Clarification of the definition of associated circuits
- Clarification of NRC request for information concerning associated circuits

4. Memorandum to Mr. R. H. Vollmer (NRR/DE) from Dr. R. J. Mattson (NRR/DSI), Subject: "Position Paper on Allowable Repairs for Alternative Shutdown and the Appendix R Requirement for Time Required to Achieve Cold Shutdown," dated July 2, 1982.

The Mattson to Vollmer memorandum addressed two issues concerning safe shutdown and allowable repairs, and allowable time to achieve safe shutdown.

These issues had resulted from a lack of definition for the term "repairs" and apparent inconsistencies in requirements for repair and shutdown activities relative to the 72-hour limit. This memorandum resolved the principal aspects of these issues as follows:

a. Repair

1. Repair activities may not be credited in assuming hot shutdown system availability.
2. Manual operation of valves, switches, and circuit breakers is not considered to be a repair activity and, hence, is allowable for hot shutdown systems.
3. Repairs – such as wiring changes that are allowed for cold shutdown systems and/or components that are not used for hot shutdown, or whose fire or fire suppressant-induced motor-operated valve (MOV) maloperations could directly affect hot shutdown systems – must be achievable prior to the maloperations causing an unrecoverable plant condition.

b. Time

1. The sum of the repair time and time to achieve cold shutdown must be 72 hours or less, and cold shutdown must be achieved using onsite power only for areas in III.G.3 compliance or if the fire affects the availability of offsite power.
 2. Offsite power is assumed to be restored after 72 hours for areas of III.G.3 compliance. Equipment and systems not needed until 72 hours may be powered by offsite power only.
5. Memorandum to Dr. R. J. Mattson (NRR/DSI) from Mr. L. S. Rubenstein (DSI/AD), Subject: "Statement of Staff Position Regarding Source Range Flux, Reactor Coolant Temperature and Steam Generator Pressure Indication to Meet Appendix R, Alternate Shutdown Capability," dated January 7, 1983.

The staff documented the process monitoring criteria for Appendix R compliance in the Rubenstein to Mattson memorandum. This document identified the following BWR instrument requirements:

- Reactor water level and pressure
 - Suppression pool level and temperature
 - Isolation condenser level
 - Diagnostic instrumentation for shutdown systems
 - Level indication for all tanks used
1. NRC Positions on Certain Requirements of Appendix R to 10 CFR 50 (Generic Letter 83-33), dated October 19, 1983. |
- Generic Letter 83-33 addressed the inconsistencies between the staff's and licensees' interpretations of certain requirements of Appendix R subsequent to evaluation of exemption requests. NRC staff positions were presented on the following issues:
- Detection and automatic suppression
 - Fire areas
 - Structural steel related to fire barriers
 - Fixed suppression system
 - Intervening combustibles
 - Transient fire hazards
7. IE Information Notice No. 84-09: Lessons Learned from NRC Inspections of Fire Protection Safe Shutdown Systems (10 CFR 50, Appendix R), dated February 13, 1984.

Notice 84-09 was promulgated to address significant items of noncompliance identified during inspections of various power reactor facilities. Supplemental guidance, prepared by the NRC staff and based on the non-compliance identified, was appended and addressed the following:

- Fire areas
- Fire barrier testing and configuration
- Protection of equipment necessary to achieve hot shutdown
- Licensee's reassessment for conformance with Appendix R
- Identification of safe shutdown systems and components
- Combustibility of electrical cable insulation
- Detection and automatic suppression
- Applicability of 10 CFR 50, Appendix R, Section III.L
- Instrumentation necessary for alternative shutdown
- Procedures for alternative shutdown capability
- Fire protection features for cold shutdown system
- RCP oil collection systems

8. IE Information Notice No. 84-09, Revision 1: Lessons Learned from NRC Inspections of Fire Protection Safe Shutdown Systems (10 CFR 50, Appendix R), dated March 7, 1984.

This notice corrected an error regarding the protection of equipment necessary to achieve safe shutdown that appeared in IN 84-09.

9. Generic Letter 85-01, Fire Protection Policy Steering Committee Report, dated January 9, 1985.

GL 85-01 transmitted a copy of the NRC Fire Protection Policy Steering Committee Report to licensees. Enclosed with the report were the following:

- Memo to H. Denton et al. on review of NRC fire protection policy and programs
- Generic letter on fire protection
- Interpretations of Appendix R
- Guidance for enforcement actions concerning fire protection requirements
- Fire protection license condition
- Appendix R questions and answers
- Steering committee memoranda

10. IE Information Notice No. 85-09: Isolation Transfer Switches and Post-Fire Shutdown Capability, dated January 31, 1985.

Notice 85-09 alerted licensees to potential deficiencies in the electrical design of isolation transfer switches installed outside the control room of many nuclear power plants.

11. Generic Letter 86-10, Implementation of Fire Protection Requirements, dated April 24, 1986.

In Enclosure 1 of this letter, "Interpretations to Appendix R," stated that "to the extent that this guidance may be inconsistent with prior guidance (including Generic Letter 83-33), it is intended that the current letter take precedence." The interpretations provided dealt with:

- Process monitoring instrumentation
- Repair of cold shutdown equipment
- Fire damage
- Fire area boundaries
- Automatic detection and suppression
- Alternative or dedicated shutdown

In addition, Enclosure 2 to the letter contained a compilation of questions and answers intended to assist in clarifying particular issues related to Appendix R compliance.

12. Supplement 1 to Generic Letter 86-10, "Fire Endurance Test Acceptance Criteria for Fire Barrier Systems Used to Separate Redundant Safe Shutdown Trains within the same Fire Area," dated March 25, 1994.

This supplement provides licensees with guidance which "will be used by the staff in evaluating the adequacy of fire endurance tests and fire barrier systems proposed by licensees . . . to satisfy existing NRC fire protection rules and regulations." This guidance redefines and clarifies the criteria specified in Generic Letter 86-10.

13. IE Information Notice No. 87-50, "Potential LOCA at High-Low-Pressure Interfaces from Fire Damage," dated October 9, 1987.

This notice addressed the issue of high-low-pressure interfaces and the prospect for a non-isolatable LOCA resulting from a fire in the control room or cable spread room. In particular, the notice dealt with a configuration involving a motor operated valve which bypassed a check valve used as an interface isolation device. Hot shorts could cause the inadvertent opening of the bypass valve and consequent overpressurization of low-pressure piping.

14. IE Information Notice No. 88-45, "Problems in Protective Relay and Circuit Breaker Coordination," dated July 7, 1988.

This notice alerted licensees to potentially significant problems concerning the possible lack of protective relay and circuit breaker coordination. It cited several recent events at operating facilities.

15. IE Information Notice No. 90-69, "Adequacy of Emergency and Essential Lighting," dated October 31, 1990.

This notice alerted licensees to possible problems regarding the adequacy of lighting for performing manual operations. Such problems involved the adequacy of the installed lighting to provide the requisite illumination, improper aiming of lighting units, and inadequate preventive maintenance.

16. NRC Information Notice No. 91-51: "Inadequate Fuse Control Programs," dated August 20, 1991.

Notice 91-51 alerted licensees to inadequacies in fuse control programs so that suitable actions to remedy similar problems could be undertaken. The problems identified included inadequate root cause evaluations of blown fuses, inadequate verification of design information for installed and replacement fuses, inadequate labeling of fuses, and lack of coordination between fuses and circuit breakers. Other problems, such as personnel errors, were also highlighted.

17. NRC Information Notice No. 91-53, "Failure of Remote Shutdown System Instrumentation Because of Incorrectly Installed Components," dated September 4, 1991.

This notice advised licensees of an event in which incorrectly installed components would have caused the failure of certain remote shutdown functions.

18. NRC Information Notice No. 92-18, "Potential for Loss of Remote Shutdown Capability During a Control Room Fire," dated February 28, 1992.

Information Notice 92-18 addressed conditions resulting from a control room fire which could result in a loss of the ability to maintain the reactor in a safe shutdown condition. In particular, the notice identified a situation in which a hot short resulting from a control room fire could, in combination with other factors, result in damage to motor-operated valves. This damage could prevent the use of the valves during the safe shutdown process.

19. NRC Information Notice No. 94-12, "Insights Gained from Resolving Generic Issue 57: System Effects of Fire Protection System Actuation on Safety-Related Equipment," dated February 9, 1994.

The insights highlighted by this notice were:

- Mercury relays
- Seismic dust/smoke detectors
- Water deluge systems
- Fire suppression availability during a seismic event
- Switchgear fires
- Electro-mechanical components in cable spreading rooms

20. NRC Information Notice No. 95-36, "Potential Problems with Post-Fire Emergency Lighting," dated August 29, 1995.

Notice 95-36 alerted licensees to potential problems regarding emergency lighting provided for safe shutdown purposes. Such problems ranged from component performance to configuration control.

21. Supplement 1 to NRC Information Notice 95-36, "Potential Problem with Post-Fire Emergency Lighting," dated June 10, 1997.

Supplement 1 dealt with potential problems with emergency lighting units, including inoperabilities resulting from taking electrical buses out of service, and failures to respond appropriately to problems identified.

22. NRC Information Notice 97-01, "Improper Electrical Grounding Results in Simultaneous Fires in the Control Room and the Safe-Shutdown Equipment Room," dated January 8, 1997.

This information notice described an event in which an electrical design error in concert with a single electrical fault resulted in simultaneous fires in the plant. This fire could have resulted in operational challenges which are outside of the plant's design basis.

23. Generic Letter 88-20, Supplement 4, "Individual Plant Examination of External of External Events (IPEEE For Severe Accident Vulnerabilities- 10CFR 50.54(f))."

- Quad Cities initial fire IPEEE submitted in letter E. S. Kraft to USNRC, "Fire Report- Individual Plant Examination of External Events (IPEEE)," dated February 17, 1997.
- Quad Cities updated fire IPEEE submitted in letter J. Dimmette to USNRC, "Upgraded Individual Plant Examination of External Events (IPEEE) Internal Fires Analysis," dated May 27, 1999.

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Table 1.2-1
ACCEPTANCE CRITERIA FOR QUAD CITIES UNITS 1&2 SAFE SHUTDOWN ANALYSIS REVIEW

Rule	Requirements	Guidance
<p>Appendix R, Section III.G.1.a. and b.</p>	<p>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:</p> <ul style="list-style-type: none"> a. One train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station(s) is free of fire damage; and b. Systems necessary to achieve and maintain cold shutdown (from either the control room or emergency control stations) can be repaired within 72 hours. 	<p>Guidance on <i>fire protection features</i> is provided in GL 86-10.</p> <p>The performance goals and objectives for the safe shutdown functions are further delineated in GL 81-12, Section 2, Limiting Safe Consequences and Required Shutdown Functions; and Section 3, Performance Goals.</p> <p>Equipment generally necessary for hot shutdown is addressed in Section 6 of GL 81-12. Equipment generally necessary for cold shutdown is addressed in Section 7 of GL 81-12.</p> <p>Repair of cold shutdown equipment is discussed in GL 86-10, Enclosure 1, Section 2.</p>

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Table 1.2-1 (continued)
ACCEPTANCE CRITERIA FOR QUAD CITIES UNITS 1&2 SAFE SHUTDOWN ANALYSIS REVIEW

Rule	Requirements	Guidance
<p>Appendix R, Section III.G.2.a., b. and c.</p> <p>(Note: Sub-parts d., e. and f. do not apply since the containment is inerted)</p>	<p>Except as provided for paragraph G.3 of this section, where cables or equipment, including associated non-safety circuits that could prevent operation or cause maloperation due to hot shorts, open circuits, or shorts to ground, or redundant trains of systems necessary to achieve and maintain hot shutdown conditions are located within the same fire area outside of primary containment, <i>one</i> of the following means of ensuring that one of the redundant trains is free of fire damage shall be provided:</p> <p>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 in that required of the barrier, or</p> <p>B. Separation of cable 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; or</p> <p>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.</p>	<p>Additional guidance on <i>separation criteria</i> is provided in GL 86-10, Appendix R Questions and Answers, sections 3.5 and 3.6.</p> <p>Guidance on <i>associated circuits</i> analysis is described in GL 86-10 and NRC's letter dated April 28, 1982, from D. Vassallo to L. DelGeorge, RE: Quad Cities Units 1 and 2 Fire Protection Rule, Docket Nos 50-254 and 50-265. The NRC letter states: The following discussion provides a) a definition of associated circuits for Appendix R considerations, b) the guidelines for protecting the safe shutdown capability from the fire-induced failures of associated circuits and c) the information required by the staff to review associated circuits. The definition of associated circuits has not changed from the definition in Generic Letter 81-12, however, it has been clarified. It is important to note that our interest is only with those circuits (cables) whose fire-induced failure could effect shutdown. The guidelines for protecting the safe shutdown capability from the fire-induced failures of associated circuits are not requirements. These guidelines should be used only as guidance when needed. These guidelines do not limit the alternatives available to the licensee for protecting the shutdown capability. All proposed methods for protection of the shutdown capability from fire-induced failures will be evaluated by the staff for acceptability.</p>

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Table 1.2-1 (continued)
ACCEPTANCE CRITERIA FOR QUAD CITIES UNITS 1&2 SAFE SHUTDOWN ANALYSIS REVIEW

Rule	Requirements	Guidance
<p>Appendix R, Section III.G.2.a., b. and c.</p> <p>(Note: Sub-parts d., e. and f. do not apply since the containment is inerted)</p>		<p>A. Our concern is that circuits within the fire area will be fire damaged which can affect shutdown capability and thereby prevent post-fire safe shutdown. Associated Circuits <i>*/</i> of concern are defined as those cables (safety related, non-safety related, Class 1E, and non-Class 1E) that::</p> <ol style="list-style-type: none"> 1. Have a physical separation less than that required by Section III.G.2 of Appendix R, and; <ol style="list-style-type: none"> a. A common power source with the shutdown equipment (redundant or alternative) and the power source is not electrically protected from the circuit of concern by coordinated breakers, fuses, or similar devices, or b. A connection to circuits of equipment whose spurious operation would adversely affect the shutdown capability (e.g., RHR/RCS isolation valves, ADS valves, PORVs, steam generator atmospheric dump valves, instrumentation, steam bypass, etc.), or c. A common enclosure (e.g., raceway, panel, junction) with the shutdown cables (redundant and alternative) and, <p><i>*/ The definition for associated circuits is not exactly the same as the definition presented in IEEE-384-1977.</i></p>

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Table 1.2-1 (continued)
ACCEPTANCE CRITERIA FOR QUAD CITIES UNITS 1&2 SAFE SHUTDOWN ANALYSIS REVIEW

Rule	Requirements	Guidance
<p>Appendix R, Section III.G.2.a., b., and c. (continued)</p> <p>(Note: Sub-parts d., e. And f. do not apply since the containment is inerted)</p>		<ul style="list-style-type: none"> 1) are not electrically protected by circuit breakers, fuses or similar devices, or 2) will allow propagation of the fire into the common enclosure. <p>B. The following guidelines are for protecting the shutdown capability from fire-induced failures of circuits (cables) in the fire area. The guidance provided below for interrupting devices applies only to new devices installed to provide electrical isolation of associated circuits of concern, or as part of the alternative or dedicated shutdown system. The shutdown capability may be protected from the adverse effect of damage to associated circuits of concern by the following methods:</p> <ul style="list-style-type: none"> 1. Provide protection between the associated circuits of concern and the shutdown circuits as per Section III.G.2 of Appendix R, or 2a. For a common power source case of associated circuit: Provide load fuse/breaker (interrupting devices) to feeder fuse/breaker coordination to prevent loss of the redundant or alternative shutdown power source. To ensure that the following coordination criteria are met, the following should apply:

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Table 1.2-1 (continued)
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Rule	Requirements	Guidance
<p>Appendix R, Section III.G.2.a., b. and c. (continued)</p> <p>(Note: Sub-parts d., e. and f. do not apply since the containment is inerted)</p>		<ol style="list-style-type: none"> 1) The associated circuit of concern interrupting devices (breakers or fuses) time-overcurrent trip characteristic for all circuit faults should cause the interrupting device to interrupt the fault current prior to initiation of a trip of any upstream interrupting device which will cause a loss of the common power source. 2) The power source shall supply the necessary fault current for sufficient time to ensure the proper coordination without loss of function of the shutdown loads. <p>2b. For circuits of equipment and/or components whose spurious operation would affect the capability to safely shutdown:</p> <ol style="list-style-type: none"> (1) provide a means to isolate the equipment and/or components from the fire area prior to the fire (i.e., remove power cables, open circuit breakers); or (2) provide electrical isolation that prevents spurious operation. Potential isolation devices include

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Table 1.2-1 (continued)
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Rule	Requirements	Guidance
<p>Appendix R, Section III.G.2.a., b. and c. (continued)</p> <p>(Note: Sub-parts d., e. And f. Do not apply since containment is inerted)</p>		<p>(Breakers, fuses, amplifiers, control switches, current XFRS, fiber optic couplers, relays and transducers); or</p> <p>(3) provide a means to detect spurious operations and the procedures to defeat the maloperation of equipment (i.e., closure of the block valve if PORV spuriously operates, opening of the breakers to remove spurious operation of safety injection);</p> <p>2c. For common enclosure cases of associated circuits:</p> <p>(1) provide appropriate measures to prevent propagation of the fire; and</p> <p>(2) provide electrical protection (i.e., breakers, fuses or similar devices)</p> <p>(Note: The guidance in Section C for the fire area approach has not changed at Quad Cities.</p> <p>HIGH-LOW PRESSURE INTERFACE For either approach (fire area or systems approach) chosen the following concern dealing with high-low pressure interface should be addressed:</p>

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Table 1.2-1 (continued)
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Rule	Requirements	Guidance
<p>Appendix R, Section III.G.2.a., b. and c. (continued)</p> <p>(Note: Sub-parts d., e. And f. Do not apply since containment is inerted)</p>		<ol style="list-style-type: none"> 1. The residual heat removal system is generally a low-pressure system that interfaces with the high-pressure primary coolant system. To preclude a LOCA through this interface, we require compliance with the recommendations of Branch Technical Position RSB 5-1. Thus, the interface most likely consists of two redundant and independent motor-operated valves. These two motor-operated valves and their associated cables may be subject to a single fire hazard. It is our concern that this single fire could cause the two valves to open, resulting in a fire-initiated LOCA through the high-low pressure system interface. To ensure that this interface and other high-low pressure interfaces are adequately protected from the effects of a single fire, we require the following information: <ol style="list-style-type: none"> a. Identify each high-low pressure interface that uses redundant electrically controlled devices (such as two series motor operated valves) to isolate or preclude rupture of any primary coolant boundary.

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Table 1.2-1 (continued)
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Rule	Requirements	Guidance
<p>Appendix R, Section III.G.2.a., b. and c. (continued)</p> <p>(Note: Sub-parts d., e. And f. Do not apply since containment is inerted)</p>		<ul style="list-style-type: none"> b. For each set of redundant valves identified in "a.," verify the redundant cabling (power and control) has adequate physical separation as required by Section III.G.2 of Appendix R. c. For each case where adequate separation is not provided, show that fire-induced failures (hot short, open circuits or short to ground) of the cables will not cause maloperation and result in a LOCA.
<p>Appendix R, Section III.G.3</p>	<p>Alternative or dedicated shutdown capability and its associated circuits, independent of cables, systems or components in the area, room or zone under consideration, shall be provided:</p> <ul style="list-style-type: none"> a. Where the protection of systems whose function is required for hot shutdown does not satisfy the requirement of Paragraph G.2; or b. Where redundant trains of systems required for hot shutdown 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. <p>In addition, the fire detection and a fixed fire suppression system shall be installed in the area, room or zone under consideration.</p>	<p>Additional guidance is provided in GL 86-10, Section 6 and in Appendix R Questions and Answers Section 5.</p>

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Table 1.2-1 (continued)
ACCEPTANCE CRITERIA FOR QUAD CITIES UNITS 1&2 SAFE SHUTDOWN ANALYSIS REVIEW

Rule	Requirements	Guidance
Appendix R, Section III.J	Emergency lighting units with at least an 8-hour battery power supply shall be provided in all areas needed for operation of safe shutdown equipment and in access and egress routes thereto.	Additional guidance is provided in GL 86-10 Appendix R Questions and Answers Section 4.
Appendix R, Section III.L.1	<p>1. Alternative or dedicated shutdown capability provided for a specific fire area shall be able to:</p> <ul style="list-style-type: none"> a. Achieve and maintain subcritical reactivity conditions in the reactor, b. Maintain reactor coolant inventory, c. Achieve and maintain hot standby /*/ conditions for a PWR (hot shutdown /*/ for a BWR), d. Achieve cold shutdown conditions within 72 hours and, e. Maintain cold shutdown conditions thereafter. During the post-fire shutdown, the reactor coolant system 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 or any primary coolant boundary, or rupture of the containment boundary. <p>/*/ = As defined in the Standard Technical Specifications.</p>	Additional guidance is provided in GL 86-10, Appendix R Questions and Answers Section 5.

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Table 1.2-1 (continued)
ACCEPTANCE CRITERIA FOR QUAD CITIES UNITS 1&2 SAFE SHUTDOWN ANALYSIS REVIEW

Rule	Requirements	Guidance
Appendix R, Section III.L.2.a, b., c., d., and e.	<p>The performance goals for the shutdown functions shall be:</p> <ul style="list-style-type: none"> 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 above the top of the core for BWRs and be 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. 	Additional guidance is provided in GL 81-12, Section 3, Section 6 and Section 7.

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Table 1.2-1 (continued)
ACCEPTANCE CRITERIA FOR QUAD CITIES UNITS 1&2 SAFE SHUTDOWN ANALYSIS REVIEW

Rule	Requirements	Guidance
Appendix R, 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 alternative shutdown capability shall be independent of the specific fire area(s) and shall accommodate positive conditions where offsite power is available and where offsite power is not available for 72 hours. Procedures shall be in effect to implement this capability.	Also refer to guidance in GL 86-10, Appendix R Questions and Answers Section 5.
Appendix R, Section III.L.4	If the capability to achieve and maintain cold shutdown will not be available because of fire damage, the equipment and systems comprising means to achieve and maintain the hot standby or hot shutdown condition shall be capable of maintaining such conditions until cold shutdown can be achieved. If such equipment and systems will not be capable of being powered by both onsite and offsite electric power systems because of fire damage, an independent onsite power system shall be provided. The number of operating shift personnel, exclusive of fire brigade members, required to operate such equipment and systems shall be on site at all times.	General references to onsite power and manpower functions are listed in GL81-12, Sections 3.6, 3.7, and 8(h) and in GL86-10, Section 5.3.6.

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Table 1.2-1 (continued)
ACCEPTANCE CRITERIA FOR QUAD CITIES UNITS 1&2 SAFE SHUTDOWN ANALYSIS REVIEW

Rule	Requirements	Guidance
Appendix R, Section III.L.5	Equipment and systems comprising 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 on site and procedures shall be in effect to implement such repairs. If such equipment and systems used prior to 72 hours after the fire will not be capable of being powered by both onsite and offsite electric power systems because of fire damage, an independent onsite power system shall be provided. Equipment and systems used after 72 hours may be powered by offsite power only.	Also refer to guidance in GL 86-10, Enclosure 1, Section 2 and GL 86-10, Enclosure 2, section 5.3.6. General reference to onsite power is also listed in GL 81-12, Sections 3.6 and 3.7.
Appendix R, 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.	Also refer to guidance in GL 86-10, Appendix R questions and answers in Section 7.

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Table 1.2-1 (continued)
ACCEPTANCE CRITERIA FOR QUAD CITIES UNITS 1&2 SAFE SHUTDOWN ANALYSIS REVIEW

Rule	Requirements	Guidance
Appendix R, Section III.L.7.	<p>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 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 fire involving associated circuits will not prevent safe shutdown/*/.</p> <p><i>/*/ = 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 fires affect trays from only one safety division.</i></p>	Also refer to guidance in GL 86-10, Appendix R Questions and Answers Section 5.

Note: Quad Cities licensing basis pertains only to Sections G., J., and L. of 10CFR50 Appendix R.

Table 1.2-2
APPENDIX R EXEMPTIONS

No.	Exemption Section	Exemption Description	SER Approval Date & Section
		Section III.G.1 Exemptions	
1	9.1	Justification for removal of control power to defeat high impedance faults	April 20, 1988
2	10.1	Justification for pulling and replacement of fuses in lieu of redundant fusing	April 20, 1988
3	12.1	Justification for fuse pulling to preclude spurious equipment operation	Feb. 25, 1991, Section 2.4
		Section III.G.2 Exemptions	
4	3.2	Separation of redundant RHR divisions within Unit 1 reactor building	July 21, 1988, Section 2.0
5	4.2	Separation of redundant RHR divisions within Unit 2 reactor building	July 21, 1988, Section 2.0
6	5.2	Separation of southern and central zone groups in the turbine building	July 21, 1988, Section 9.0
7	5.3	Separation of southern and northern zone groups in the turbine building	July 21, 1988, Section 10.0
8	5.8	Separation of equivalent fire areas (8.2.8.A, 8.2.8.B, 8.2.8.C, and 8.2.8.D) on operating floor of turbine building	July 21, 1988, Section 12.0
9	5.9	Separation of fire zone 11.1.1.B and southern zone groups in the turbine building	July 21, 1988, Section 13.0

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Table 1.2-2 (continued)
APPENDIX R EXEMPTIONS

No.	Exemption Section	Exemption Description	SER Approval Date & Section
10	11.1	Separation of redundant reactor vessel level instrumentation within the reactor buildings	Feb. 25, 1991, Section 2.1
11	11.2	Separation of redundant suppression pool level instrumentation within the reactor buildings	Feb. 25, 1991, Section 2.2
		Section III.G.3 Exemptions	
12	6.2	Complete suppression in AEER (fire zone 6.3)	July 21, 1988, Section 5.0
13	6.3	Complete suppression in the control room	July 21, 1988, Section 5.0
14	8.2	Complete detection and suppression in the Unit 1 drywell expansion gap	July 21, 1988, Section 8.0
15	8.2	Complete detection and suppression in the Unit 2 drywell expansion gap	July 21, 1988, Section 8.0

Table 1.2-3
List of Safety Evaluation Reports

- I. Safety Evaluation Reports for Appendix A to BTP APCSB 9.5-1 and Functional Responsibilities
 1. July 27, 1979, Fire Protection Safety Evaluation Report
 2. November 5, 1980, Supplemental to Safety Evaluation Report on Fire Protection
 3. February 12, 1981, Supplement 2 to Safety Evaluation Report on Fire Protection
- II. Safety Evaluation Reports for 10 CFR 50, Appendix R, Sections III.G and III.L and 10 CFR 50.48
 1. December 30, 1982, Safety Evaluation Report for Appendix R to 10 CFR 50, Sections III.G and III.L
 2. February 2, 1983, Safety Evaluation Report for Request for Exemption from Requirements of Appendix R to 10 FR 50, Section III.G
 3. December 1, 1987, Safety Evaluation Report for Interim Compensatory Measures and Request for Exemption from 10 CFR 50, Appendix R, Section III.G.1 Regarding Hot Shutdown Repairs
 4. April 20, 1998, Revised Safety Evaluation for Exemption from 10 CFR 50, Appendix R, Section III.G.1
 5. December 11, 1987, Safety Evaluation Report for Exemptions from the Requirement of 10 CFR 50, Appendix R, Section III.G
 6. July 21, 1988, revised Safety Evaluation Report from Exemptions from 10 CFR 50, Appendix R, Section III.G
 7. August 18, 1989, Exemption from Technical Requirements of Appendix R to 10 CFR 50
 8. May 10, 1990, Appendix R, Section III.G, Exemption Safety Evaluation Report Comments (comments from ComEd on July 21, 1988, Safety Evaluation Report)
 9. May 11, 1990, Hot Shutdown Repairs in the Event of a Fire (Comments from ComEd on April 30, 1988, Safety Evaluation Report)
 10. February 25, 1991, Safety Evaluation of Licensee Requests for Exemptions from Certain Technical Requirements of Appendix R to 10 CFR Part 50
 11. May 21, 1991, Exemption from Technical Requirements of Appendix R to 10 CFR 50
 12. November 5, 1991, Request for Revision to Appendix R Exemption Approval
 13. March 2, 1994, Request for Exemption From 10CFR Part 50, Appendix R
 14. December 21, 2001, Issuance of Amendments for Extended Power Uprate
 15. September 27, 2001, Revocation of Exemptions from Requirements of 10CFR Part 50, Appendix R

Table 1.2-4
List of Generic Letter 86-10 Evaluations

Generic Letter 86-10 Evaluations	
Purpose	Document Number
Non 3 hr. Fire Barrier between RB-1 and RB-2	QC-98-001
Non 3 hr. Fire Barrier between RB-1 and TB-IV	QC-98-002
Non 3 hr. Fire Barrier between TB-I and RW	QC-98-003
Non 3 hr. Fire Barrier between TB-II and RW	QC-98-004
Non 3 hr. Fire Barrier between TB-III and RW	QC-98-005
Non 3 hr. Fire Barrier between TB-III and SB-II	QC-98-008
Non 3 hr. Fire Barrier between TB-II and 13-1, 14-1, 23-1, 24-1, & TB-IV	QC-98-009
Non 3 hr. Fire Barrier between TB-I and TB-IV	QC-98-010
Non 3 hr. Fire Barrier between TB-III and TB-IV	QC-98-011
Non 3 hr. Fire Barrier between TB-I and TB-II	QC-98-012
Non 3 hr. Fire Barrier between TB-I and EDG-2	Q-EDCS-00-0171
Non 3 hr. Fire Barrier for SBGT system and Electrical Bus Ducts between RB-1N and RB-2N	S040-QH-0610
Non 3 hr. Fire Barrier between Reactor Building and Turbine Building on Unit 1	S040-QH-0611
Non 3 hr. Fire Barrier between Reactor Building and Turbine Building on Unit 2	S040-QH-0612
Non 3 hr. Fire Barrier between 23-1 and TB-I & TB-II	S040-QH-0613
Lack of Complete Fire Suppression and Detection in Unit 1 Reactor Building	S040-QH-0614
Lack of Complete Fire Suppression and Detection in Unit 2 Reactor Building	S040-QH-0615
Lack of Complete Fire Suppression and Detection in TB-III	NTSC 98-020.001
Lack of Complete Fire Suppression and Detection in TB-II	NTSC 98-020.002
Lack of Complete Fire Suppression and Detection in TB-III	NTSC 98-020.003
Lack of Complete Fire Suppression and Detection in 13-1 and 24-1	NTSC 98-020.004
Lack of Complete Fire Suppression and Detection in Fire Zone 8.2.1.A	S040-QH-0609
Separation of Cables Associated with MO 1-2301-4 and MO 1-1301-16	Q-EDCS-00-0167
Separation of Cables Associated with the Inboard and Outboard Main Steam Isolation Valves	Q-EDCS-00-169
Justification for Lack of Detection and Fixed Suppression In Fire Zone 8.2.10. (Supplement for NTSC 98-020.002)	EC 368863

2.0 IDENTIFICATION OF FIRE AREAS

2.1 Zone Interaction Analysis Procedure

The Quad Cities 1&2 Fire Protection Associated Circuits Analysis and Modifications Report, submitted to the NRC in July 1982 in response to Generic Letter 81-12, was based on fire zones as defined in the 1977 Fire Hazards Analysis, not on fire areas. The 1982 report identified an alternate shutdown method to be utilized in the event of a fire, and presented modifications related to both fire protection and safe shutdown which enhanced the station personnel's ability to safely shut down the plant in the event of a fire. The Appendix R verification analysis documented in the July 1982 report confirmed that the shutdown methods identified for each fire zone, along with the modifications proposed, were appropriate. However, in light of the staff position presented in Generic Letter 83-33, some additional modifications were proposed as a result of the 1984 analysis to ensure separation between shutdown methods that are commensurate with the requirements of 10 CFR 50, Appendix R.

The 1984 evaluation of the Quad Cities 1&2 compliance with Section III.G of Appendix R was accomplished by conducting a review of each fire zone to determine a) what safe shutdown components, including associated circuits, were present in the zone; b) what safe shutdown components were present in all adjacent zones; and c) what constituted the boundary between adjacent zones. Given this information and the location of equipment and cabling associated with the hot shutdown paths identified in the 1982 Associated Circuits Analysis, it was determined where there were deviations from the fire area criteria of Sections III.G and III.L of Appendix R. Where it was determined that Appendix R separation was not achieved between adjacent zones due to unsealed penetrations, hatchways, etc., the configuration of equipment, cabling and barriers were analyzed, and a resolution was achieved in one of the following four ways:

1. The same safe shutdown path was verified to be available for a fire in any of the adjacent zones so that fire spread could be tolerated. These groups of zones are now considered part of the same fire area.
2. A modification was proposed to eliminate the deviation (e.g., upgrading of barriers, installation of suppression systems, rated fire wraps, etc.).
3. An exemption to Appendix R was requested and approved via Safety Evaluation Reports (SERs) where the existing and/or proposed level of protection was equivalent to that of Section III.G. These SERs also provided the justification for treating a group of fire zones as fire areas in the safe shutdown analysis.
4. An engineering evaluation was performed to demonstrate the adequacy of the barriers between fire areas.

The exemption requests and proposed modifications were transmitted to the NRC by letter on December 18, 1984. These exemption requests were updated in submittals to the NRC in 1985 and 1986. Additional exemption requests were submitted from 1987 to 1991.

As a result of the zone interaction analysis described above, each of the fire zones has been, in part or in total, incorporated into a fire area as shown in Table 2.1-1, Figures 2.2-1, 2.2-2, 2.2-3, and 2.2-4, and described in subsection 2.2. For the fire areas containing safe shutdown equipment and cabling, each is separated from the others by 3-hour rated fire barriers unless an exemption from complying with the requirements of Appendix R, Section III.G has been approved by the NRC

or an 86-10 evaluation has been performed to justify the configuration. Accordingly, for each fire area or equivalent fire area, a shutdown method has been identified which would be free of fire damage and available to bring the plant to hot shutdown given a fire in that fire area. Similarly, a method has been identified which would be repairable and capable of bringing the plant to cold shutdown within 72 hours. Several areas of the plant have been identified as being without either a rated barrier, separation or an exemption to justify the boundaries of these fire areas. However, these areas contain no safe shutdown equipment, are separated by substantial "non-rated" barriers to fire, and do not present a hazard to alternate trains of safe shutdown equipment.

2.2 Equivalent Fire Area Description

2.2.1 Fire Area Unit 1 Reactor Building

The Unit 1 Reactor Building (RB-1) fire area consists of the entire refuel floor and Unit 1 Reactor Building, excluding the primary containment (see Figure 2.2-1). The fire zone(s) contained within this fire area can be found in Table 2.1-1. Section 4 of the Updated Fire Hazards Analysis contains barrier descriptions for all zones contained within this fire area.

Two drywell penetrations (X-100B and X-104F) are to be used to connect the temporary power supplies to valves (RV 1-0203-3B (DC power), RV 1-0203-3C (DC power), and MO 1-0202-5B(AC power)) necessary to achieve and maintain cold shutdown. These penetrations are protected by 3-hour rated enclosures (see DCP 9700393).

The reactor building basement has been divided near column line 16. This separation provides assurance that one division of RHR would be available for a fire anywhere in the reactor building. To facilitate the safe shutdown analysis, the terms RB-1N and RB-1S are used through the remainder of this report as defined below. RB-1S consists of the southern half of fire zone 1.1.1.1 and fire zones 11.2.1 and 11.2.2. RB-1N consists of the remainder of the Unit 1 Reactor Building excluding primary containment and including the entire refuel floor. Approval for this separation is found in the SER dated July 21, 1988.

Redundant reactor vessel level instrumentation is found in this fire area. Separation of the instrumentation and instrument lines is adequate to ensure that at least one level instrument is available to monitor the reactor. Justification and approval for this separation can be found in the SER dated February 25, 1991.

Redundant reactor vessel pressure instrumentation is found in this fire area. Separation of the instrumentation is adequate to assure that at least one pressure instrument is available to monitor the reactor. Justification and approval for this separation can be found in the SER dated July 21, 1988. Since this instrumentation is required for use prior to fire extinguishment, an evaluation (NDIT QDC-98-060) was performed to demonstrate that at least one pressure instrument can be accessed for a fire anywhere in the reactor building.

The HPCI system must be manually tripped or isolated in the event of a spurious start for a fire in RB-1N. HPCI can be mechanically tripped or remotely from the Control Room. An 86-10 evaluation was performed for these actions to demonstrate accessibility to the HPCI Room and the Control Room action to secure HPCI during an RB-1N Fire.

2.2.2 Fire Area Unit 2 Reactor Building

The Unit 2 Reactor Building (RB-2) fire area consists of the Unit 2 Reactor Building, excluding primary containment and the refuel floor (see Figure 2.2-2). The fire zone(s) contained within this fire area can be found in Table 2.1-1. Section 4 of the Updated Fire Hazards Analysis contains barrier descriptions for all zones contained within this fire area.

Two drywell penetrations (X-100F and X-104A) are to be used to connect the temporary power supplies to valves (RV 2-0203-3B (DC power), RV 2-0203-3C (DC power) and MO 2-0202-5B (AC power) necessary to achieve and maintain cold shutdown. These penetrations are protected by 3-hour rated enclosures (see DCP 9700399).

The reactor building basement has been divided near column line 10. This separation provides assurance that one division of RHR would be available for a fire anywhere in the reactor building. To facilitate the safe shutdown analysis, the terms RB-2N and RB-2S are used through the remainder of the report as defined below. RB-2S consists of the southern half of fire zone 1.1.2.1 and fire zones 11.1.4, 11.3.1 and 11.3.2. RB-2N consists of the remainder of the Unit 2 Reactor Building excluding the primary containment and the refuel floor. Approval for this separation is found in SER dated July 21, 1988.

Redundant reactor vessel level instrumentation is found in this fire area. Separation of the instrumentation and instrument lines is adequate to ensure that at least one level instrument is available to monitor the reactor. Justification and approval for this separation can be found in the SER dated February 25, 1991.

Redundant reactor vessel pressure instrumentation is found in this fire area. Separation of the instrumentation and instrument lines is adequate to assure that at least one pressure instrument is available to monitor the reactor. Justification and approval for this separation can be found in the SER dated July 21, 1988. Since this instrumentation is required for use prior to fire extinguishment, an evaluation (NDIT QDC-98-060) was performed to demonstrate that at least one pressure instrument can be accessed for a fire anywhere in the reactor building.

2.2.3 Fire Area Reactor Building Center

Reactor building center (RB-1/2) contains the Unit ½ emergency diesel generator and is located east of the Unit 1 and Unit 2 reactor buildings (see Figure 2.2-2). The fire zone(s) contained within this fire area can be found in Table 2.1-1.

2.2.4 Fire Area Unit 1 Primary Containment

The Unit 1 primary containment is located within the Unit 1 Reactor Building. The fire zone(s) contained within this fire area can be found in Table 2.1-1.

2.2.5 Fire Area Unit 2 Primary Containment

The Unit 2 primary containment is located within the Unit 2 Reactor Building. The fire zone(s) contained within this fire area can be found in Table 2.1-1.

2.2.6 Fire Area Unit 2 Turbine Building

Turbine building Unit 2 (TB-I) is comprised of Unit 2 fire zones located on several elevations on the northern end of the turbine building (see Figure 2.2-3). The fire zone(s) contained within this fire area can be found in Table 2.1-1.

2.2.7 Fire Area Unit 2 Cable Tunnel (CT-2)

The Unit 2 Cable Tunnel Fire Area consists of the Unit 2 Cable Tunnel located below elevation 595 in the Unit 1 and Unit 2 Turbine Building. This area was modified to a 3 hour rated area and is no longer part of the Unit 2 Turbine Building Fire Area (TB-I), (DCP 9900174).

2.2.8 Fire Area Unit 2 Emergency Diesel Generator Room (DG-2)

The Unit 2 Emergency Diesel Generator Room consists of the Diesel Room located in the Unit 2 Turbine Building. This area was evaluated to establish this as a 3-hour rated area and is no longer part of the Unit 2 Turbine Building Fire Area (TB-I).

2.2.9 Fire Area Turbine Building Center

Turbine building center (TB-II) is comprised of fire zones located on several elevations in the center of the turbine building (see Figure 2.2-3). The fire zone(s) contained within this fire area can be found in Table 2.1-1. Section 4 of the Updated Fire Hazards Analysis contains barrier descriptions for this fire area.

2.2.10 Fire Area Unit 1 Turbine Building

Turbine building Unit 1 (TB-III) is comprised of Unit 1 fire zones located on several elevations in the southern end of the turbine building (see Figure 2.2-3). The fire zone(s) contained within this fire area can be found in Table 2.1-1.

Redundant feeds for the Unit ½ emergency diesel generator cooling water pump are located within this fire area. The Unit 2 feed is protected with a 1-hour fire barrier wrap.

2.2.11 Fire Area Unit 1 Cable Tunnel (CT-1)

The Unit 1 Cable Tunnel Fire Area consists of the Unit 1 Cable Tunnel located below elevation 595 in the Unit 1 Turbine Building. This area was modified to a 3 hour rated area and is no longer part of the Unit 1 Turbine Building Fire Area (TB-III), (DCP 9900059).

2.2.12 Fire Area Turbine Operating Floor

The Turbine Operating Floor Fire Area (TB-IV) is comprised of the turbine operating floor and the reactor and turbine building vent fan rooms (see Figures 2.2-3 and 2.2-4). The fire zone(s) contained within this fire area can be found in Table 2.1-1. Based on the approved exemptions to Appendix R, four equivalent fire areas have been established on the turbine operating floor.

2.2.12.1 Equivalent Fire Area 13-1 (Zone 8.2.8.B)

Equivalent fire area 13-1 includes the portion of the turbine building bounded by walls on the north, south, and east sides, and the abandoned MG set on the west side. It contains 4 kV switchgear 13-1 and 480 V switchgears 18 and 19. The area consists of a single fire zone 8.2.8.B (see Figures 2.2-3 and 2.2-4).

2.2.12.2 Equivalent Fire Area 14-1 (Zone 8.2.8.A)

Equivalent fire area 14-1 includes the portion of the turbine building bounded by walls on the north, south, and east sides, and the abandoned MG set on the west side. It contains 4 kV switchgear 14-1. The area consists of a single fire zone 8.2.8.A (see Figures 2.2-3 and 2.2-4).

2.2.12.3 Equivalent Fire Area 24-1 (Zone 8.2.8.C)

Equivalent fire area 24-1 includes the portion of the turbine building bounded by walls on the north, south, and east sides, and the abandoned MG set on the west side. This area contains 4 kV switchgear 24-1, 480 V switchgear 28 and 29. The area consists of a single fire zone 8.2.8.C (see Figures 2.2-3 and 2.2-4).

2.2.12.4 Equivalent Fire Area 23-1 (Zone 8.2.8.D)

Equivalent fire area 23-1 includes the portion of the turbine building bounded by walls on the north, south, and east sides, and the abandoned MG set on the west side. It contains 4 kV switchgear 23-1. The area consists of a single fire zone 8.2.8.D (see Figures 2.2-3 and 2.2-4).

2.2.13 Fire Area Turbine Building TB-V (Zone 11.1.1.B)

Fire area TB-V is comprised of the Unit 1 B/C RHRSW vault (see Figure 2.2-3). This area contains the ½ emergency diesel generator cooling water pump, the Unit 1 B RHR service water pump and the Unit 1 C RHR service water pump. This fire area consists of a single fire zone 11.1.1.B.

2.2.14 Fire Area Service Building (SB-I)

Fire Area Service Building (SB-I) is comprised of fire zones located on several elevations of the service building, including the control room, cable spreading room, auxiliary electric equipment room (AEER), and the old computer room (see Figure 2.2-3). The fire zone(s) contained within this fire area can be found in Table 2.1-1. The adequacy of barriers and other physical features to separate the AEER from the effects of fire in other portions of Fire Area SB-I has been evaluated (NTSC 98-020.006). This separation is necessary to provide a separate means of inhibiting ADS independent of the control room.

2.2.15 Fire Area Service Building (SB-II)

Fire area service building (SB-II) is comprised of three zones located on several floors of the service building. The fire zone(s) contained within this fire area can be found in Table 2.1-1.

2.2.16 Fire Area Radwaste Building

Fire area radwaste building (RW) consists of several zones containing the radwaste collection and holding area and the maximum recycle radwaste building. The fire zone(s) contained within this fire area can be found in Table 2.1-1.

2.2.17 Fire Area Crib House

Fire area crib house (CH) consists of several zones on two elevations in the crib house. This building is physically isolated from the rest of the plant. The fire zones contained within this fire area can be found in Table 2.1-1.

2.2.18 Fire Area Off-Gas Filter Building

Fire area off-gas filter building (OG) is physically isolated from the rest of the plant.

2.2.19 Outside Fire Area

The outside area is comprised of various buildings and equipment areas separate from the main plant buildings. The fire zones contained within this fire area can be found in Table 2.1-1.

2.2.20 Fire Area Station Blackout Diesel Generator Building

The station blackout diesel generator building (SBO) fire area consists of multiple rooms located in the station blackout diesel generator building.

Table 2.1-1
INDEX OF FIRE AREAS AND ZONES

<u>Fire Zone</u>	<u>Description</u>	<u>Fire Area</u>	<u>F-Drawing</u>	<u>Description Section</u>
1.1.1.1.N	Basement (north)	RB-1N	F-2-1	2.2.1
1.1.1.1.S	Basement (south)	RB-1S	F-2-1	2.2.1
1.1.1.2	Ground floor	RB-1N	F-3-1	2.2.1
1.1.1.3	Mezzanine floor	RB-1N	F-4-1	2.2.1
1.1.1.4	Main floor	RB-1N	F-5-1	2.2.1
1.1.1.5	Reactor floor	RB-1N	F-6-1	2.2.1
1.1.1.5.A	Vent fan room	TB-IV	F-16-1	2.2.12
1.1.1.6	Refueling floor	RB-1N	F-7-1	2.2.1
1.1.1.6.A	Vent fan room	TB-IV	F-16-1	2.2.12
1.1.2.1.N	Basement (north)	RB-2N	F-2-1	2.2.2
1.1.2.1.S	Basement (south)	RB-2S	F-2-1	2.2.2
1.1.2.2	Ground floor	RB-2N	F-3-1	2.2.2
1.1.2.3	Mezzanine floor	RB-2N	F-4-1	2.2.2
1.1.2.4	Main floor	RB-2N	F-5-1	2.2.2
1.1.2.5	Reactor floor	RB-2N	F-6-1	2.2.2
1.2.1	Drywell	DW-1	F-2-1 through F-6-1	2.2.4
1.2.2	Drywell	DW-2	F-2-1 through F-6-1	2.2.5
2.0	Control room	SB-I	F-8-1	2.2.14
3.0	Cable spread room	SB-I	F-8-1	2.2.14
4.0	Computer room	SB-I	F-8-1	2.2.14
5.0	Safe shutdown pump room	TB-II	F-13-1	2.2.9
6.1.A	DC panel room	TB-III	F-14-1	2.2.10
6.1.B	DC panel room	TB-III	F-14-1	2.2.10
6.2.A	DC panel room	TB-I	F-15-1	2.2.6
6.2.B	DC panel room	TB-I	F-15-1	2.2.6
6.3	Electrical equipment room	SB-I	F-8-1	2.2.14

Table 2.1-1 (continued)
INDEX OF FIRE AREAS AND ZONES

<u>Fire Zone</u>	<u>Description</u>	<u>Fire Area</u>	<u>F-Drawing</u>	<u>Description Section</u>
7.1	Battery room	TB-III	F-14-1	2.2.10
7.2	Battery room	TB-I	F-15-1	2.2.6
8.1	Clean and dirty oil tank room	TB-II	F-12-1	2.2.9
8.2.1.A	Condensate pump room	TB-III	F-9-1	2.2.10
8.2.1.B	Condensate pump room	TB-I	F-9-1	2.2.6
8.2.1.C	Turbine foundation	TB-III	F-9-1	2.2.10
8.2.1.D	Turbine foundation	TB-I	F-9-1	2.2.6
8.2.2.A	Upper basement	TB-I	F-10-1	2.2.6
8.2.2.B	Radwaste pipe tunnel	TB-I	F-10-1	2.2.6
8.2.3.A	Upper basement	TB-III	F-10-1	2.2.10
8.2.3.B	Radwaste pipe tunnel	TB-III	F-10-1	2.2.10
8.2.4	Cable tunnel	CT-1	F-11-1	2.2.11
8.2.5	Cable tunnel	CT-2	F-11-1	2.2.7
8.2.6.A	Ground floor	TB-III	F-12-1	2.2.10
8.2.6.B	Ground floor	TB-III	F-12-1	2.2.10
8.2.6.C	Ground floor	TB-II	F-12-1, F-13-1	2.2.9
8.2.6.D	Ground floor	TB-I	F-13-1	2.2.6
8.2.6.E	Ground floor	TB-I	F-13-1	2.2.6
8.2.7.A	Mezzanine floor	TB-III	F-14-1	2.2.10
8.2.7.B	Mezzanine floor	TB-III	F-14-1	2.2.10
8.2.7.C	Mezzanine floor	TB-II	F-14-1, F-15-1	2.2.9
8.2.7.D	Mezzanine floor	TB-I	F-15-1	2.2.6
8.2.7.E	Mezzanine floor	TB-I	F-15-1	2.2.6
8.2.8.A	Switchgear area	14-1	F-17-1	2.2.12.2
8.2.8.B	Switchgear area	13-1	F-5-1, F-17-1	2.2.12.1
8.2.8.C	Switchgear area	24-1	F-5-1, F-18-1	2.2.12.3
8.2.8.D	Switchgear area	23-1	F-18-1	2.2.12.4
8.2.8.E	Turbine operating floor	TB-IV	F-17-1, F-18-1	2.2.12
8.2.10	Off-gas recombiner room	TB-II	F-22-1, F-23-1	2.2.9

Table 2.1-1 (continued)
INDEX OF FIRE AREAS AND ZONES

<u>Fire Zone</u>	<u>Description</u>	<u>Fire Area</u>	<u>F-Drawing</u>	<u>Description Section</u>
9.1	Diesel generator 1 room	TB-III	F-12-1	2.2.10
9.2	Diesel generator 2 room	DG-2	F-13-1	2.2.8
9.3	Diesel generator ½ room	RB-1/2	F-3-1	2.2.3
11.1.1.A	RHR service water pump room	TB-III	F-9-1	2.2.10
11.1.1.B	RHR service water pump room	TB-V	F-9-1	2.2.13
11.1.1.C	RHR service water pump room	TB-III	F-9-1	2.2.10
11.1.2.A	RHR service water pump room	TB-I	F-9-1	2.2.6
11.1.2.B	RHR service water pump room	TB-I	F-9-1	2.2.6
11.1.2.C	RHR service water pump room	TB-I	F-9-1	2.2.6
11.1.3	HPCI room	RB-1N	F-9-1	2.2.1
11.1.4	HPCI room	RB-2S	F-9-1	2.2.2
11.2.1	Southwest corner room	RB-1S	F-2-1	2.2.1
11.2.2	Southeast corner room	RB-1S	F-2-1	2.2.1
11.2.3	Northwest corner room	RB-1N	F-2-1	2.2.1
11.2.4	Northeast corner room	RB-1N	F-2-1	2.2.1
11.3.1	Southwest corner room	RB-2S	F-2-1	2.2.2
11.3.2	Southeast corner room	RB-2S	F-2-1	2.2.2
11.3.3	Northwest corner room	RB-2N	F-2-1	2.2.2
11.3.4	Northeast corner room	RB-2N	F-2-1	2.2.2
11.4.A	Basement	CH	F-19-1	2.2.17
11.4.B	Ground floor	CH	F-19-1	2.2.17
13.1	Guardhouse	Outside	---	2.2.19
14.1	Radwaste collection and handling area	RW	F-20-1, F-21-1	2.2.16
14.1.1	Off-gas recombiner room	TB-III	F-22-1	2.2.10
14.1.2	Off-gas recombiner room	TB-I	F-23-1	2.2.6

Table 2.1-1 (continued)
INDEX OF FIRE AREAS AND ZONES

<u>Fire Zone</u>	<u>Description</u>	<u>Fire Area</u>	<u>F-Drawing</u>	<u>Description Section</u>
14.1.2	Off-gas recombiner room	TB-I	F-23-1	2.2.6
14.3.1	Maximum recycle radwaste building	RW	F-20-1, F-21-1	2.2.16
15.1	Security DG building	Outside	---	2.2.19
16.1	HRSS north building (Unit 2)	Outside	---	2.2.19
16.2	HRSS south building (Unit 1)	Outside	---	2.2.19
17.1.1	Main power transformer 1	Outside	F-12-1	2.2.19
17.1.2	Auxiliary power transformer II	Outside	F-24-1	2.2.19
17.1.3	Reserve auxiliary power transformer 12	Outside	F-24-1	2.2.19
17.2.1	Main power transformer 2	Outside	F-13-1	2.2.19
17.2.2	Auxiliary power transformer 21	Outside	F-24-1	2.2.19
17.2.3	Reserve auxiliary power transformer 22	Outside	F-24-1	2.2.19
18.1	Technical support center	Outside	---	2.2.19
19.1	Service building offices	SB-II	F-8-1	2.2.15
19.2	Service building offices	SB-II	F-8-1	2.2.15
19.3	Control room air handling unit room	SB-II	F-8-1	2.2.15
20.1	Spray canal lift station	Outside	---	2.2.19
21.1	Secondary alarm station	Outside	---	2.2.19
22.1	Off-gas filter building	OG	---	2.2.18
23.1	Central alarm station	SB-II	---	2.2.15
24.1	Heating boiler building	Outside	---	2.2.19
25.1	LTD Building	Outside	---	2.2.19

Table 2.1-1 (continued)
INDEX OF FIRE AREAS AND ZONES

26.1	Interim Radwaste Storage Facility	Outside	---	2.2.19
27.1	Robust Flexible Storage Building	Outside	---	2.2.19
---	Station blackout diesel generator building	SBO	---	2.2.20

_____	690' - 6"
_____	666' - 6"
_____	647' - 6"
_____	623' - 0"
_____	595' - 0" Ground
_____	554' - 0"

1.1.1.6 RB-1N		1.1.1.5 RB-1N		1.1.1.4 RB-1N		1.1.1.3 RB-1N		1.1.1.2 RB-1N	
HPCI		11.2.3 RB-1N	11.2.4 RB-1N	North 1.1.1.1.N RB-1N	South 1.1.1.1.S RB-1S	11.2.1 RB-1S	11.2.2 RB-1S		

The bold lines show fire area boundaries

<p>QUAD-CITIES STATION UNITS 1 & 2</p>	<p>FIGURE 2.2-1 SHUTDOWN AREAS FOR QUAD-CITIES UNIT 1 REACTOR BUILDING (RB)</p>
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1.1.1.6 RB-1N	690' - 6"
1.1.2.5 RB-2N	666' - 6"
1.1.2.4 RB-2N	647' - 6"
1.1.2.3 RB-2N	623' - 0"
1.1.2.2 RB-2N	DG 1/2
HPCI	9.3 RB-1/2
11.1.4 RB-2S	595' - 0" Ground
11.3.1 RB-2S	
11.3.2 RB-2S	
South 1.1.2.1.S RB-2S	
North 1.1.2.1.N RB-2N	
11.3.4 RB-2N	
11.3.3 RB-2N	

The bold lines show fire area boundaries

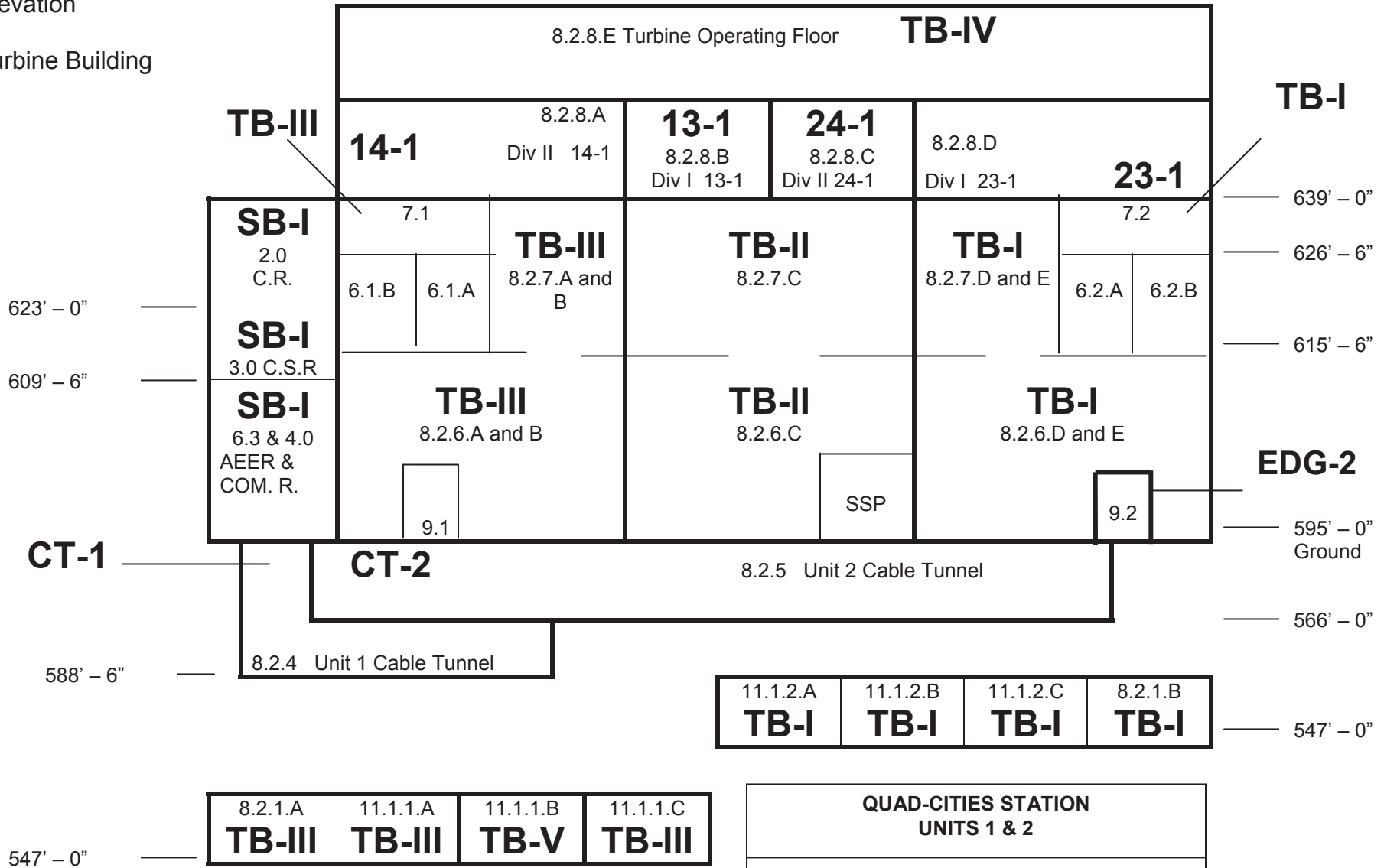
QUAD-CITIES STATION UNITS 1 & 2
FIGURE 2.2-2 SHUTDOWN AREAS FOR QUAD-CITIES UNIT 2 REACTOR BUILDING (RB)

QUAD CITIES 1&2
SAFE SHUTDOWN REPORT

REVISION 23
OCTOBER 2017

Units 1 & 2
Elevation

Turbine Building



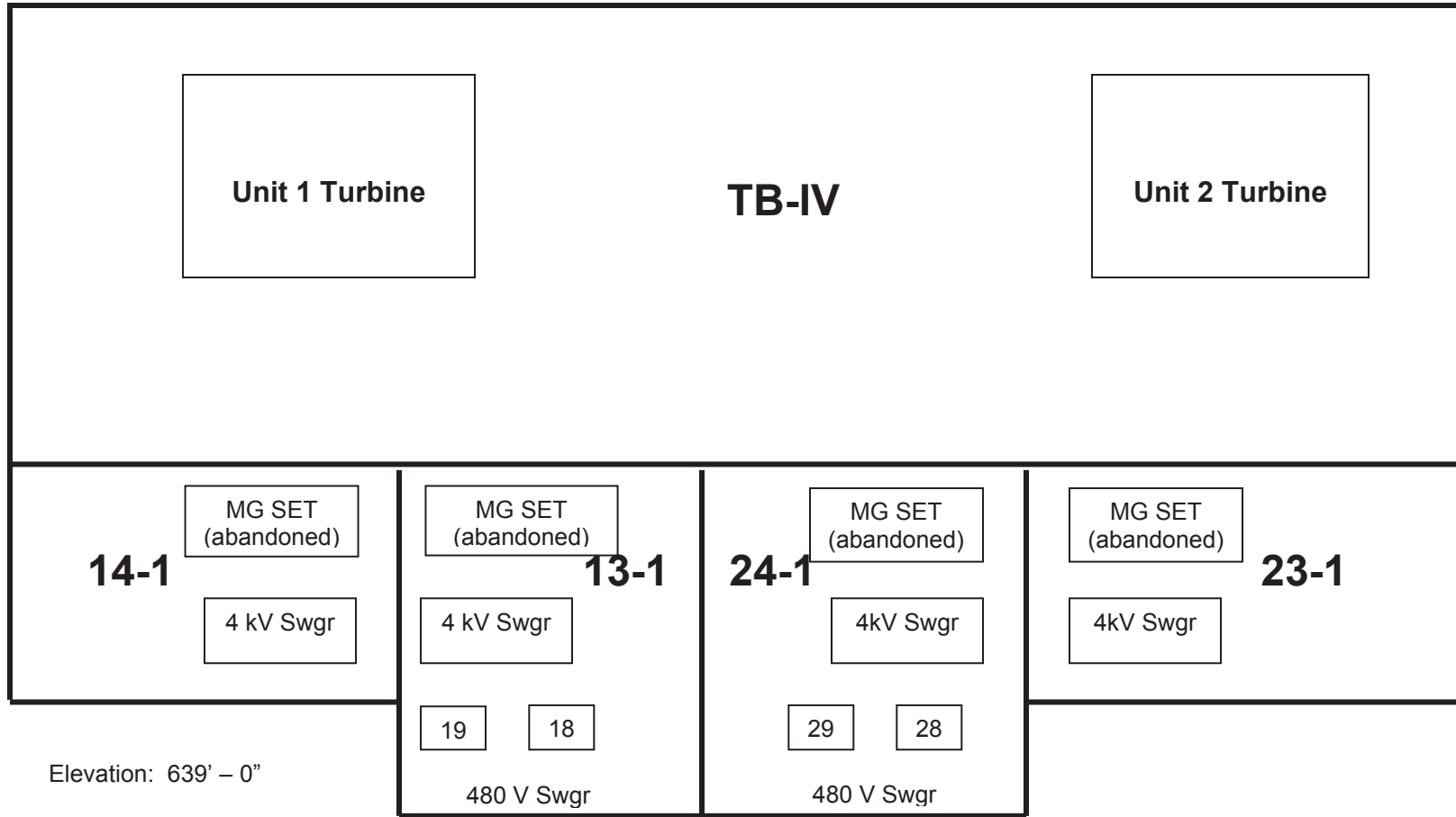
The bold lines show fire area boundaries

11.1.2.A	11.1.2.B	11.1.2.C	8.2.1.B
TB-I	TB-I	TB-I	TB-I

8.2.1.A	11.1.1.A	11.1.1.B	11.1.1.C
TB-III	TB-III	TB-V	TB-III

QUAD-CITIES STATION
UNITS 1 & 2

FIGURE 2.2-3
SHUTDOWN AREAS FOR
QUAD-CITIES UNIT 1 & 2
TURBINE BUILDING (TB)



The bold lines show fire area boundaries

**QUAD-CITIES STATION
UNITS 1 & 2**

**FLOOR FIGURE 2.2-4
SHUTDOWN AREAS FOR
QUAD-CITIES UNIT 1 & 2
TURBINE BUILDING (TB)
OPERATING**

3.0 APPROCH TO SAFE SHUTDOWN

3.0.1 Analysis Method

To satisfy the requirements of 10 CFR 50 Appendix R, Quad Cities Station demonstrated the use of Alternate (III.G.3 compliance) or Redundant (III.G.2 compliance) shutdown capability for each of the Fire Areas that contain safe shutdown equipment or cabling. The Fire Areas for which Alternate or Redundant safe shutdown capability has been demonstrated are identified in the Safe Shutdown Area Compliance Assessments (QDC-0000-E-1038 Attachment H). The Safe Shutdown Area Compliance Assessments were performed to ensure that a minimum set of safe shutdown equipment would be available to meet the performance criteria of 10 CFR 50 Appendix R. The measures taken to protect the availability of this equipment from fire-induced damage (i.e. spurious operation, hot shorts, etc.) are described in the Compliance Assessment Summaries and in Section 5.0. Safe Shutdown Area Compliance Assessments were not performed for plant areas that do not contain safe shutdown equipment or cabling.

3.0.2 Analysis Assumptions

The assumptions, criteria and bases used in performing the Quad Cities Safe Shutdown Analysis are defined in the following instructions. These instructions are located in QDC-0000-E-1038 Attachment A, Attachment D and Attachment G respectively:

- PI-001 – Quad Cities Safe Shutdown Equipment Selection and Logic Diagram Development
- PI-002 – Quad Cities Safe Shutdown Equipment Circuit Analysis
- PI-003 – Quad Cities Appendix R Fire Area Compliance Assessment

3.0.3 Development Of Safe Shutdown Compliance Assessment Packages

For each safe shutdown Fire Area, systems were identified to meet the hot and cold shutdown requirements of 10 CFR 50 Appendix R. For the systems selected, a safe shutdown equipment list (Table 3.0-1) was developed using the methodology specified in PI-001. Safe shutdown logic diagrams (QDC-0000-E-1038 Attachment C) were created to depict the interrelationships between the safe shutdown systems and components required to achieve safe shutdown.

For each electrically supervised component selected, circuit analysis worksheets were prepared using the methodology specified in PI-002. The circuit analysis worksheets identified the required safe shutdown cables associated with the component. The Fire Zone routing for the cables was then obtained by the use of plant design basis information (i.e. design drawings, SLICE) and plant walkdowns. Each Fire Zone was then associated to a plant Fire Area (a given Fire Area may contain more than one Fire Zone). With this information, all safe shutdown cables and associated equipment were identified.

To facilitate the use and manageability of the Quad Cities safe shutdown information, a Safe Shutdown Database (QDC-0000-E-1038) was developed. This database contains the safe shutdown equipment list by system, a list of all safe shutdown cables associated with the individual components and their Fire Zone/Fire Area routing. The systems, equipment and cables potentially affected by the fire were identified by manipulation of the database information. The discrepant cables for each safe shutdown component were identified and a resolution code was developed for each discrepant cable in the Fire Area of concern.

The information obtained from the above analysis was then compiled into Safe Shutdown Compliance Packages. These Compliance Packages define the systems, components and cables required to achieve and maintain safe shutdown for each Fire Area under evaluation.

3.1 Safe Shutdown Systems

3.1.1 Reactivity Control

Credit is assumed for a Reactor SCRAM from the Main Control Room. This action would be initiated prior to Main Control Room evacuation should evacuation be required. It is not necessary to ensure the availability of the neutron monitoring instrumentation since control rod insertion is sufficient to ensure sub-criticality (i.e. boration is not required).

The Reactor Protection System (RPS) is a grounded AC system. Its cables are in conduit and routed separately from the non-RPS cables. The circuits are fused and connected to normally closed devices that initiate their protective function on de-energization of relay coils. These cables are shielded and are not routed with other types of cables. This separated routing prevents the possibility of fire-induced "hot shorts". The cables are normally energized and will cause a Reactor trip on loss of power. If fire-induced cable damage (i.e. open circuit, short to ground) were to occur, a Reactor trip would be initiated. An evaluation (S040-QH-0391) has determined that for a fire outside of Fire Area SB-1, the operators will be able to manually scram the Reactor via the Main Control Room SCRAM pushbuttons. This SCRAM will be available regardless of fire-induced electrical faults on cables elsewhere in the plant. Based on the failsafe design of the RPS system, it is unnecessary to take any additional actions to ensure the SCRAM was successful.

3.1.2 Inventory Control

Following a Reactor SCRAM, steam generation will continue at a rate equal to the decay heat produced in the Reactor core. If the Reactor vessel is isolated and the Feedwater system is not available to provide makeup water to the core, Reactor inventory will begin to decrease. Reactor inventory will be maintained above the top of active fuel by establishing a source of high-pressure injection. The injection must be established within 32 minutes of the Reactor SCRAM. It must also contain sufficient capacity to make up for the inventory losses due to sustained decay heat generation. Inventory control will also be obtained by limiting the amount of coolant loss due to spurious operation of equipment that would cause a vent path from the Reactor.

3.1.2.1 Reactor Core Isolation Cooling System (RCIC)

Section 5.4.6 of the UFSAR provides a description of the Reactor Core Isolation Cooling (RCIC) system. The RCIC system is utilized to provide makeup water for the Reactor Vessel. Reactor Vessel injection will be initiated within 32 minutes after a manual Reactor SCRAM to ensure Reactor inventory remains above the top of active fuel. To maintain appropriate vessel level, the RCIC system may be shutdown or have its flow reduced. RCIC may be operated for short periods in excess of its normal design temperature. This has been evaluated in calculation GE-NE-A22-00103-56-01-Q Reference 22 and deemed to be acceptable. For Fire Areas that utilize RCIC for inventory control, the system will be initiated and controlled locally from the RCIC Room. With the exception of turbine over speed, all interlocks, trip/isolation functions and automatic initiation signals may not be available due to potential fire-induced damage.

The system is initially aligned to take suction from the Contaminated Condensate Storage Tanks (CCST) and will be transferred to the Torus once injection is established. This transfer is required to ensure an adequate water supply is available for the Safe Shutdown Makeup Pump (SSMP) system if it is required for the opposite unit and it reduces the amount of inventory to be drained from the Torus.

All of the motor operated valves associated with the RCIC system are 250V DC except valve 1(2)-1301-16 which is 208V AC. All of the RCIC valves requiring manipulation will be operated manually once power to the valves has been removed. The Unit 2 RCIC inboard steam isolation valve (MO 2-1301-16) may spuriously close due to fire induced cable damage. To ensure the valve is open prior to RCIC initiation, an alternate 208V AC power supply is provided from SBO 120V AC Distribution Panel 75-1-1. The alternate feed has been provided to allow manual

operation of the valve from the valve breaker. To remove additional spurious operation concerns, a remote/local control switch is mounted on MCC 28-1A-1 to isolate the control circuitry prior to valve manipulation.

To maintain RCIC room habitability for Operator manual actions, the RCIC Condensate and Vacuum Pumps are required to remain operable. The Condensate Pump has been modified (DCP 9800063) so the pump will automatically cycle on and off based on the Vacuum Tank level. The cycling will occur when the pump is operated in the local mode and is powered from its normal supply. The existing Vacuum Tank level switch will be used to monitor tank level and operated the Condensate Pump. Use of the RCIC Turbine during an Appendix R event will require the Condensate Pump to be operated in the LOCAL mode due to the circuits for remote pump control being affected by the fire. Power to the Condensate and Vacuum Pumps can be aligned to the opposite units 250V DC by realigning the power in the Unit 1 and Unit 2 RCIC Rooms. In this alignment, the automatic function described above is bypassed. The Main Control Room Operator on the non-fire unit will control the pump.

3.1.2.2 Safe Shutdown Makeup Pump System (SSMP)

Section 5.4.6.5 of the UFSAR provides a description of the Safe Shutdown Makeup Pump (SSMP) system. The SSMP system is utilized to provide makeup water for the Reactor Vessel. Reactor Vessel injection will be initiated within 32 minutes after a manual Reactor SCRAM to ensure Reactor inventory remains above the top of active fuel. The SSMP system may be started and controlled from the Main Control Room at Panel 912-8 or locally in the SSMP Room at Panel 2251-104. The pump, room cooler, 4kV SWGR 31, 480V MCC 30 and all motor operated valves are located in the SSMP Room. The capability to isolate and control all components locally is provided at Panel 2251-104 in the SSMP Room.

The system is initially aligned to take suction from the Contaminated Condensate Storage Tanks (CCST). Suction can be manually aligned to the Fire Water system when a low CCST level is reached. The manual alignment to the Fire Water system can be performed once the fire is extinguished. The SSMP Pump suction gauge is not rated for the higher pressure of the Fire Water system. When suction is transferred from the CCSTs to the Fire Water system, the suction gauge will be valved out of the piping. Calculation QDC-3300-M-0542 demonstrates that the CCSTs will have an adequate water supply for 3-hours of Reactor Vessel makeup following an Appendix R event. This will allow sufficient time for SSMP suction to be manually aligned to the Fire Water system.

For injection to Unit 1, the SSMP discharges directly into the Reactor Feedwater piping and for Unit 2, injection discharges through the High Pressure Coolant Injection (HPCI) piping to the Reactor Feedwater system piping. Air operated check valve AO 1(2)-2301-7 will prevent any flow diversion into the HPCI system and ensures that all makeup water from the SSMP is injected into the Reactor Vessel. (DCP 9900060, 9900061, EC 331679)

All valves for the SSMP system can be operated from Main Control Room Panel 912-8 or locally from the SSMP Room at Panel 1/2-2251-104. System flow will be controlled by FIC 1/2-2940-7 from the Main Control Room or by FIC 1/2-2941-6 in the SSMP Room. A power supply transfer switch is available to transfer power from the Unit 1 or Unit 2 Essential Service Bus for the Main Control Room flow controller. If Main Control Room indication is lost, all instrumentation required to operate the system is available in the SSMP Room.

If Service Water is not available to supply cooling for the SSMP Room Cooler, the Fire Water system will be manually aligned to provide the cooling water. Calculation QDC-4100-M-0537 provides the hydraulic evaluation to ensure the Fire Water system can supply the necessary flow rate for the SSMP Room Cooler and required suppression systems.

4kV SWGR 31 supplies power to the pump and to 480V MCC 30, which in turn, provides power for the motor operated valves, room cooler, lighting and local instrumentation. Depending on the location of the fire, power for the SSMP system is supplied from 4kV SWGR 14-1 (normal) or 4kV SWGR 24-1 (reserve). Power from either of these SWGR can feed 4kV SWGR 31. If offsite power is not available to 4kV SWGR 14-1 or 4kV SWGR 24-1, one of the Unit Emergency Diesel Generators or the Unit 1 or Unit 2 Station Blackout Diesel Generators will supply power to these SWGR.

3.1.2.3 High Pressure Coolant Injection System (HPCI)

Section 6.3.2.3 of the UFSAR provides a description of the HPCI system. The HPCI System provides a high pressure source of water for injection into the vessel. The system will be operated from the Control Room.

Although the HPCI System will automatically initiate on either low reactor water level or high drywell pressure, only manual initiation by the operators is credited for post fire safe shutdown. The manual pushbutton is located at Panel 901-3 in the Main Control Room, and the button must be held down until all valves have repositioned. Valves can also be controlled individually from the Control Room. Due to possible fire damage to the HPCI flow controller the system flow will be controlled from the control room using the Motor Gear Unit (MGU).

The HPCI pump is normally aligned to take suction from the CCSTs, with a subsequent automatic transfer to the torus. The CCSTs will be available for a fire in TB-II, since RCIC will be used for Unit 2 and will initially be lined up to the CCST then take a suction on the Unit 2 Torus approximately 30 minutes after injection is established. Transferring the suction path of HPCI to the Torus is an automatic transfer that will occur when Torus level reaches +5 inches.

After transferring HPCI suction to the torus, adequate net positive suction head (NPSH) may not be available for the HPCI pump with only one RHR pump and one RHRSW pump (i.e., a half RHR train) running. Thus, a full RHR train is required to provide adequate Torus cooling.

3.1.3 Hot Shutdown Reactor Pressure Control and Decay Heat Removal from the Reactor

During hot shutdown, pressure control and decay heat removal will be provided by the Reactor Pressure Vessel (RPV) relief valve operating in the relief mode. When the RCIC or HPCI system is utilized for reactor inventory makeup, the RCIC or HPCI turbine also assists in pressure control and decay heat removal.

Uncontrolled depressurization of the vessel is prevented by isolating flow paths from the vessel. This is done on a systems basis and takes into account flow paths that could have opened or remained opened due to fire-induced spurious signals, expected plant response to loss of off-site power, or the potential for automatic isolation signals to fail due to fire-induced damage. ADS, Main Steam, HPCI and RCIC Systems are isolated to prevent uncontrolled depressurization. HPCI and RCIC will not be isolated when used for reactor inventory makeup. All high/low pressure interfaces were analyzed and action has been taken preemptively to prevent simultaneous opening of all of the valves protecting the high/low pressure interface for a fire in any one fire area. Further discussion of spurious operations is found in section 5.2.

The Automatic Depressurization System (ADS) is required to depressurize the reactor vessel in order to initiate RHR shutdown cooling. At least one of the five valves must be operable to perform this function, however two specific valves are preferred.

The solenoids that actuate the relief valves are located in the drywell. The cables supplying DC power to energize the solenoids are routed from the control room to the drywell penetrations. Any damage to the power cables for the solenoid valves will require that an alternative source of 125 VDC power be spliced to the existing power cable beyond the fire damage. Repair procedures are used to supply the alternative source of 125 VDC power to the undamaged portion of the solenoid power cable at the drywell penetration.

3.1.4 Torus Cooling and Torus Water Reject

Since RCIC, HPCI, and the RPV safety relief valve discharge steam to the Torus, continued operation of these systems will result in heat up of the Torus water. Operation of SSMP (taking a suction on the CCST or Fire Water System) and HPCI (initially taking a suction on the CCST) and the RPV safety relief valve discharge will also result in an increase in water level. To maintain the Torus water temperature, the residual heat removal (RHR) system is placed into operation in the Torus cooling mode. Section 6.2.2 of the UFSAR provides a description of the Containment Heat Removal system. A full train of RHR and RHRSW is required to limit the maximum Torus temperature achieved. Calculation QDC-2300-M-1034, which demonstrated torus temperature when using HPCI also calculated torus level using HPCI. This calculation demonstrates that the Torus water level will remain below the level which could cause damage to the tailpipe of the safety-relief valve as long as Torus reject is established, when necessary, within 4 hours after the reactor scram.

To establish Torus cooling and reject, the RHR and RHRSW pumps may be started from the control room or by manually closing the breakers at the 4 kV switchgear if 125 VDC is not available. RHR and RHRSW valves required for Torus cooling and rejection may be operated manually (if required due to fire damage to valve cables) after securing electrical power to those valves. Certain valves may need to be manually operated that are in the fire area. These actions have been evaluated, which verified that sufficient time is available to operate the valve, once the fire is extinguished, to establish the systems configuration.

The RHR Service Water (RHRSW) system is required to provide cooling to the RHR heat exchangers in both the Torus cooling and shutdown cooling modes. Normally, the unit's own RHRSW system is utilized to provide cooling to the RHR heat exchangers 1(2)-1003A/B. If necessary, the other unit's RHRSW system can be cross connected by opening locked closed manual valve 1/2-1099-1A for Division I or 1/2-1099-1B for Division II. Check valves prevent backflow through the idle RHRSW pumps; and the remainder of the affected unit's RHRSW supply and discharge header is utilized.

To establish heat removal from the RHR system, the RHRSW pumps may be started from the control room or by manually closing the breakers at the 4k VAC switchgear if 125 VDC power is not available. To supply power to RHRSW pumps 1(2)-1001-65A and B, 4k VAC switchgear 13(23) will be energized, and 4k VAC switchgear 14(24) will be energized to power pumps 1(2)-1001-65C and D. These switchgears are normally fed from off-site power. In the event off-site power is lost, these switchgears will be backfed from their associated safety related switchgears which will be supplied from one of the SBO DGs or EDGs.

3.1.5 Reactor Cool Down and Cold Shutdown Decay Heat Removal

Once the reactor is placed in a hot shutdown condition, station personnel can realign valves and make temporary repairs as needed within 72 hours to achieve and maintain cold shutdown conditions.

De-pressurization is achieved by releasing steam to the Torus via relief valves 1(2)-0203-3B and 1(2)-0203-3C. A repair of the power cables to the relief valves may be necessary before de-pressurization of the reactor can be initiated. This repair provides an alternate 125 VDC power source from Reactor Building Distribution Panel #1 or #2. To ensure 125 VDC remains available for long term alternate shutdown cooling, a battery charger has been verified available to support ADS valve operation.

In the Alternate Shutdown Cooling Mode, the RHR pump continues to take suction on the Torus and its discharge is transferred to the reactor vessel. The ADS valves used to depressurize the vessel are opened, and vessel level is allowed to increase until water flows out the ADS valves and back to the Torus. Decay heat continues to be transferred to the RHRSW system in the RHR heat exchangers.

Once the reactor is de-pressurized to approximately 70 psig, using the available ADS valves, the RHR system is shifted from Torus cooling mode to alternate shutdown cooling mode for decay heat removal by realignment of system. RHR and RHRSW valves necessary for alternate shutdown cooling may be manually positioned after removing electrical power if the fire damages their cables. Valves MO 1(2)-0202-5A or -5B will be operated electrically since they are located in the drywell. In areas where the valves' MCC or power to the MCC may be damaged by fire, a repair procedure is available to operate the valves from MCC 18/19-5 or 28/29-5. The repair procedure requires that the source of power be spliced to the valve cable leads at the penetration, which is protected by a 3 hour fire barrier if the fire may damage these cables. (Ref. ECRs 47448, 47479, 47488, and 47486). It is possible for the control power transformer to fail due to overcurrent on the secondary side due to short in the control circuit. For fire areas where the control circuit of the valves MO 1(2)-0202-5A(B) are routed, the control power transformer may need to be replaced.

3.1.6 Support Systems

3.1.6.1 On-Site AC Power

During a fire, off-site power will be used for safe shutdown when it is available. Off-site power is normally fed through Transformer 12(22) if the unit is not in MODE 1. If the unit is in MODE 1 auxiliary AC can be powered from Transformer 11(21) or 12(22). In the event off-site power is lost, all AC power required for safe shutdown will be supplied by the Station Blackout (SBO) Diesel Generators and Unit Emergency Diesel Generators (EDGs). Section 8.3 of the UFSAR provides a description of the SBO and EDG systems.

Off-site power has been demonstrated to remain available for some of the fire areas at Quad Cities. In some cases, off-site power was demonstrated to be available for the non-fire affected unit, and this power can be cross-tied to power equipment on the fire unit.

Electrical cables and electrical distribution equipment required to provide power to safe shutdown required components have been evaluated for fire effects in the safe shutdown analysis for that system and have been determined to be free of fire damage or a mitigative action has been identified.

The SBO fuel oil day tanks are sized for 4 hours of SBO DG operation. The day tanks can be refilled from a 15,000-gallon underground storage tank, utilizing the fuel oil transfer pumps in the auto mode. The fuel oil transfer pumps may be started manually, utilizing a control switch on the 2201(2)-104 panel. This control switch bypasses the DCS day tank high level signal that would prevent the transfer pump from operating.

Each SBO DG has its own 125 VDC battery system that is separate from the stations' 125 VDC battery system. Any part of the SBO DG 125 VDC system that is routed outside of the SBO building is either protected by circuit interrupting devices, such that a fire-induced fault will be isolated and not affect the remaining system, or the cable is routed in fire areas where the associated SBO diesel is not being used for safe shutdown. SBO 125 VDC is available at Switchgears 61 and 71 to operate the breakers electrically for the fire areas where that diesel is being used for safe shutdown. There is also an alternate feeds to Buses 13-1, 14-1, 23-1 and 24-1 from the SBO 125VDC system. This is required when the normal 125VDC supply to these buses is affected by the fire.

The Emergency Diesel Generators (EDGs) provide an independent, on-site source of emergency 4160VAC electrical power to the safe shutdown buses. In the event that off-site power is affected by fire damage, the EDGs are available in some fire areas to provide on-site AC power to safe shutdown loads. Unit 1 EDG will supply Unit 1 Division II power at Bus 14-1, while the Unit 2 EDG will supply Unit 2 Division II power at Bus 24-1. The Unit 1/2 EDG will align to either Bus 13-1 (Unit 1 Division I) or Bus 23-1 (Unit 2 Division I), depending upon which unit lost power first and whether or not a loss of coolant accident (LOCA) signal is present. If no LOCA signal is present, the Unit 1/2 EDG will align to the Unit that lost power first. If a LOCA signal is present, then the Unit 1/2 EDG will align to the unit with the LOCA signal. If desired, any one of the EDGs can be manually aligned to either unit via Essential Service Bus cross tie breakers.

On-site fuel availability to support EDG and/or SBO operation was evaluated. For the EDGs, a separate fuel oil storage tank is provided for each diesel system (Unit 1, Unit 2 and Unit 1/2). The storage tank capacity supports a two-day (minimum) supply of fuel oil for each EDG. This time frame allows ample operating margin to replenish the EDG storage tanks from an offsite fuel oil source to support 72 hours of operation. Typically, a fuel oil truck can be brought in within eight hours to replenish the fuel oil supply.

The Unit 1 and Unit 2 SBOs have separate fuel oil day tanks but share a common underground fuel oil storage tank. A fuel oil consumption evaluation was completed for fire area SB-I, which is considered limiting with respect to SBO operation, in Calculation QDC-5280-M-1553. As described above, a fuel oil truck can be brought in within eight hours to replenish the fuel oil supply, which provides sufficient operating margin to replenish the SBO fuel oil storage tank from an offsite fuel source to support 72 hours of operation.

3.1.6.2 250 VDC System

250 VDC is required to provide power to the SSMP Flow Indicator ½- 2940-7, RCIC condensate and vacuum pumps and system valves for both HPCI and RCIC and some instrumentation.

Non-safe shutdown loads located on a safe shutdown bus may be tripped prior to loading the safe shutdown load. This action will also ensure that SSD loads are not lost due to lack of circuit breaker coordination, and will protect the capacity of the battery to supply the safe shutdown loads.

For all fire areas where 250 VDC is credited a review of battery capacity was performed to ensure a battery charger was available or appropriate actions identified to ensure battery capacity is not challenged (Calculation QDC-8300-E-1716).

3.1.6.3 125 VDC System

The 125 VDC system is utilized to provide control power to circuit breakers to ensure that circuit breakers will trip for the fire-induced faults. This will protect the switchgear from damage and ensure that secondary fires will not occur. Breakers may have to be operated manually if 125 VDC power for the breaker control circuit has been lost due to the fire. All loads that are being reenergized to support safe shutdown have been confirmed to be free of fire damage. Therefore, closing the breaker into a faulted cable is not a concern and will not result in personnel injury. The batteries capacity was reviewed to ensure either battery charger was available to provide long term power or appropriate actions identified to eliminate battery capacity concerns.

Control power to upstream circuit breakers is available for a fire in any fire area where a power cable is susceptible to a fire-induced fault to provide the protection described above. Circuit breaker coordination insures that protection is provided for downstream buses that may have lost 125 VDC control power due to the fire.

125 VDC control power may be used to electrically operate circuit breakers whenever it is not damaged by fire. 125 VDC control power will be isolated when necessary to prevent spurious operation of the breaker.

This system also provides 125 VDC power to the HPCI and ADS system. The areas where 125 VDC is relied upon to support HPCI or ADS has been reviewed and confirmed to be free of fire damage or appropriate actions identified to ensure power remains available.

3.1.6.4 Fire Water System

The fire water system is used to provide cooling water to the SSMP room cooler and as a suction source for the SSMP when the suction is transferred from CCSTs. The diesel-driven fire pumps automatically start on low fire main pressure. Only one of the two (2) diesel-driven fire pumps is required to support Appendix R safe shutdown requirements.

The day tanks for the diesel-driven fire pumps are interconnected with a pair of locked closed manual isolation valves. By opening these cross-tie isolation valves, the fuel supply from both day tanks will be made available to enable the operating pump to run for a minimum of 48 hours. This 48-hour duration is consistent with the operation durations provided to the Unit 1 and Unit 2 emergency diesel generators by their oil storage tanks. This time frame allows ample operating margin to replenish the diesel-driven fire pump day tanks from an offsite fuel source to support 72 hours of pump operation. A fill station, equipped with a pair of locked closed manual isolation valves and day tank level indication, is provided outside of the crib house to accommodate normal day tank refilling operations from an offsite fuel source.

3.1.6.5 HVAC

For the purposes of achieving post-fire safe shutdown, most of the plant's normal ventilation systems are not credited.

Reactor building post-LOCA temperature analysis calculation (QDC-0020-M-0551) bounds the heat load generated in the reactor building during an Appendix R event. This calculation is based on a loss of reactor building ventilation without a loss of off-site power. Components required for safe shutdown are capable of operation in the reactor building temperature environment with a loss of ventilation. Personnel access to the reactor building will not be hindered by the temperature environment.

The primary components of heat gain in the Turbine Building are heat transfer from steam piping and electrical heat loads. Heat transfer from steam piping will rapidly decrease by closing the MSIV's. Since many of the turbine building electrical loads will be deenergized either by procedure or due to a loss of off-site power, heat up in electrical switchgear areas, including the battery rooms, will be minimal. The temperatures in the DC distribution rooms were evaluated. The charger room doors will be opened (if required) within 30 minutes to keep temperatures within the equipment qualifications (NDIT QDC-98-086). When the area becomes inaccessible due to the fire, the opposite units alternate DC sources may be realigned. If additional turbine building ventilation is required, trackway and other outside/inside doors will be opened.

The SSMP Room has a dedicated room cooler (1/2-5799) which is powered from 480 VAC MCC 30 located in the SSMP room. When it is used during a fire, its cooling water will be manually aligned to the fire system if Service Water is not available. Local temperature switches control the room cooler.

SBO DG ventilation is established (automatically) by area temperature. This system can also be established by manually starting the ventilation fans in the SBO DG building. Power and control for the SBO ventilation system is contained within the SBO building and is unaffected by any fire outside the SBO building. MCC 65-1 (75-1) and the 120/208V distribution panel 65-1-1 (75-1-1) will power this system.

The EDGs also have dedicated room exhaust fans that automatically start whenever their respective EDG is started. If the automatic logic is damaged by the fire, actions will be taken to start the exhaust fans locally.

The availability of the room cooler fans has also been assured for the rooms containing the RCIC, RHR, diesel generator cooling water, HPCI, and RHRSW pumps. The RCIC, HPCI, and RHR room cooler cooling water is provided by the DGCWP. The DGCWP and RHRSW room cooler cooling water is taken from the pump discharge of their respective pumps.

A LOCAL/REMOTE control switch has been installed in 480V MCC 29-1 to allow control of the 2B Core Spray Pump Room Air Handling Unit (AHU). This is to ensure that the AHU remains reliable for a postulated Appendix R fire in the Turbine Building. The selection of the local mode will isolate those portions of the circuit which could be damaged by the fire and start the AHU. This will ensure adequate cooling is provided to the RCIC room for proper equipment operation and room habitability. (DCP 9800063)

The RHR Emergency Room Cooler transfer switches were relocated due to Appendix R concerns which rise from the possibility of fire destroying the control cables associated with the switches which are used to transfer power between normal and alternate sources. (DCP 9800076 and DCP 9800077)

Analysis (NDIT QDC-98-058) of the room temperatures for the rooms with the pumps operating produced the following results. These results are incorporated in the safe shutdown procedures.

- The DG cooling water pump cubicle cooler must be started within 8 hours of starting the pump.
- The RHRSW pump vault cooler must be started within 80 minutes of starting the pump.
- The RCIC room temperature, with the Core Spray/RCIC room cooler in operation 30 minutes after RCIC is started, will not exceed equipment qualification temperatures or impede personnel access to the rooms. This is based on the core spray pump in the same room operating from a spurious start for the first 10 minutes of the transient and normal RCIC auxiliaries operating.
- The RHR corner room cooler must be started within 8 hours of the RHR pump start to avoid excessive temperatures for personnel protection and within 52 hours for equipment protection.

The HPCI room cooler is credited to automatically start on high HPCI room temperature, and this feature has been demonstrated to be available for Fire Area TB-II, the only area for which HPCI is credited. Calculation BSA-Q-96-07, "HPCI Room Thermal Response with Loss of HPCI Room Cooler", demonstrated that with the room cooler running and no cooling water supplied, the time required for the HPCI room to heat up to the high room temperature trip setpoint is approximately 36 hours. Although the calculation is based on no cooling water, the cooling water supply to the room cooler will be established soon after the system is operating.

RHR valves which are necessary for Torus cooling or shutdown cooling are located in the Torus compartment (i.e., reactor building basement). Calculation QDC-1500-M-1156 shows that a peak average temperature as high as approximately 159°F could be experienced in this area. Additionally, a peak Torus surface temperature of approximately 189°F was calculated. Therefore, whole body cooling units are available to the operators to allow access to stroke the RHR valves during hot shutdown conditions. Operations personnel have experience with these whole body cooling units as they are used when accessing high temperature areas of the plant, such as drywell inspections and hot valve work.

The affect of spurious pump starts on room temperature has been evaluated for the RHRSW, DGCW, RCIC, CS and RHR pumps. These evaluations determined that there are no significant effects on equipment or personnel access to the rooms based on room coolers starting as described above.

The control room HVAC was evaluated for each fire where the control room will be occupied. This evaluated for habitability and equipment performance. In some areas blocking ventilation dampers or establishing temporary ventilation is required.

3.1.7 Process Monitoring Instrumentation

In Information Notice 84-09, the NRC provided a list of the minimum monitoring capability the staff considered necessary to achieve safe shutdown. The required instrumentation applicable to Quad Cities 1&2 is:

- Reactor water level and pressure
- Torus level and temperature
- Diagnostic instrumentation for shutdown systems
- Level indication for all tanks used

The required instrumentation for each system is listed on the safe shutdown equipment list (Table 3.0-1) for that system. Where control room indication is affected by fire damage, the monitoring of process variables may be performed at local mechanical indicators with no AC or DC power required for operation.

3.1.7.1 Reactor Water Level and Pressure

Instruments in the Control Room that have been evaluated and determined to be available in some of the fire areas are LI 1(2)-0263-106A(B) and LI 2-0263-101 for Reactor Level and PI 1(2)-0263-156 for Reactor Pressure. If control room indications become unavailable then at one of the following racks monitor level and pressure:

<u>RACK</u>	<u>INSTRUMENT</u>	<u>FUNCTION</u>
2201(2)-5	PI 1(2)-0263-60A	Reactor pressure
	LI 1(2)-0263-59A	Reactor water level
2201(2)-6	PI 1(2)-0263-60B	Reactor pressure
	LI 1(2)-0263-59B	Reactor water level
2201(2)-7	LI 1(2)-0263-151A	Reactor water level
2201(2)-8	LI 1(2)-0263-151B	Reactor water level
2201(2)-10A	PI 1(2)-262-10B	Reactor pressure
2201(2)-9	PI 1(2)-262-10A	Reactor pressure
Wall mounted	LI 1(2)-1360-28 & 29	Reactor water level
2201(2)-58	PI 1(2)-1360-12	Reactor pressure

An evaluation (NDIT MSD-98-026) was done in accordance with the requirements of NRC Generic Letter 86-10 to verify that adequate separation of, and access paths to, these redundant instruments exists. If a fire occurs in the reactor building, operator access to the instrument racks for the pressure instruments is provided by two separate routes. If a fire is located on the ground floor of the reactor building that restricts access to instrument racks 2201-9(2202-9), 2201-10A(2202-10A) and 2201-58(2202-58), then instrument racks 2201-5 (2202-5) or 2201-6 (2202-6) can be accessed from the reactor building of the other unit. If a fire is located on the mezzanine floor of the reactor building that restricts access to instrument racks 2201-5 (2202-5) and 2201-6 (2202-6), instrument racks 2201-9(2202-9), 2201-10A(2202-10A) and 2201-58(2202-58) can be accessed from the ground floor of the reactor building. Therefore, operator access to one of the instrument racks listed above is justified by this evaluation. (SER Dated February 25, 1991)

PI 1(2)-0262-10A & B indicate reactor pressure at the A & B recirculation pump #1 seal cavity respectively. The sensing lines for the instruments will be isolated if both the recirculation pump suction valve, MO1(2)-0202-4A(B), and the recirculation pump discharge valve, MO1(2)-0202-5A(B) are closed.

Even though adequate separation exists for the pressure instruments, and personnel access to these instruments is available, the instrument lines for the various pressure instruments eventually go through the same fire areas to get to the drywell penetrations. However, this is not a concern since the reactor pressure sensing lines are not impacted by exposure to a fire. The pressure sensing lines are open to the reactor vessel through the condensing chamber. Any density change to the fluid in the sensing line caused by a fire will expand back into the reactor vessel through the condensing chamber. This expansion may cause a very minor increase in reactor pressure; however, the pressure instrument connected to the sensing line will measure true reactor pressure. On this basis, it can be concluded that at least one means of monitoring reactor pressure indication located on these instrument racks will be available.

3.1.7.2 Torus Level and Temperature

Instruments in the Control Room that have been evaluated and determined to be available in some of the fire areas are LI 1(2)-1640-10A(B) for Torus Level and TR 1(2)-1640-9 for Torus Temperature. If control room indications become unavailable then the operator will locally monitor the Torus level on level glass LG 1(2)-1602-10.

If Torus temperature monitoring instrumentation is not available in the control room the operator can locally monitor the Torus temperature with a portable temperature-monitoring device. This device is placed on the ECCS suction header at several locations to determine an accurate average Torus temperature indication.

3.1.7.3 Diagnostic Instrumentation

3.1.7.3.1 HPCI System

The HPCI discharge flow can be monitored on LI 1-0263-106B, Reactor Vessel Level, which can be monitored in the control room and flow adjustments made based on vessel level.

3.1.7.3.2 RCIC System

RCIC discharge flow and pressure can be monitored locally on mechanical flow indicator FI 2-1360-30 and pressure indicator PI 2-1360-5, both located in the RCIC Room.

3.1.7.3.3 SSMP System

The safe shutdown makeup pump discharge pressure and flow will be monitored from the control room on FIC 1/2-2940-7 or locally monitored in the SSMP Room on indicators PI 1/2-2941-8, and FIC 1/2-2941-6.

3.1.7.3.4 RHR System

The RHR flow can be monitored in the Control Room on FT 1(2)-1049A(B) or FR 1(2)-1040-7. If the control room is unavailable RHR pump can be monitored by local discharge pressure indicators PI 1(2)-1001-71A, PI 1(2)-1001-71B, PI 1(2)-1001-71C, or PI 1(2)-1001-71D. RHRSW flow can be monitored in the Control Room on FI 1(2)-1040-1A(B) or local mechanical flow indicators FI 1(2)-1041-12A or FI 1(2)-1041-12B located in the RHR rooms.

3.1.7.3.5 DGCWP Instrumentation

DGCWP flow to the room coolers can be verified using the following instrumentation: FI 1-3941-28, FI 2-3941-26, FI 2-3941-28 and FI ½-3941-27. Adequate instrumentation has been verified to be free of fire damage for all fire areas to assure flow is directed to the room coolers.

3.1.7.3.6 Level Indication for Tanks

CCST level can be monitored in the Main Control Room on level indicator LI ½-3340-3 and/or LI ½-3340-4. If control room indication is unavailable, local indication is available on level indicator LI ½-3341-77A or LI ½-3341-77B located on the ground floor of the Unit 1 Turbine Building (Fire Area TB-III), in the Unit 2 HPCI Room at pressure indicator PI 2-2381 or in the Unit 2 RCIC Room at pressure indicator PI 2-1360-20. Pressure indicators PI 2-2381 and PI 2-1360-20 will be utilized to monitor CCST level for a fire located in Fire Area TB-III. A conversion chart is available in the safe shutdown procedures to convert the pressure reading to tank volume. The conversion charts were derived from calculations QDC-3300-M-0500 (for PI 2-2381) and QDC-3300-M-1763 (for PI 2-1360-20). To utilize pressure indicator PI 2-2381 for CCST tank level monitoring, valve MO 2-2301-6 must remain in the normally open position. This valve is subject to fire-induced spurious operation for a fire in Fire Area TB-III. Valve MO 2-2301-6 is confirmed to be in the required open position by Operator manual actions contained in the safe shutdown procedures. For pressure indicator PI 2-1360-20, valve MO 2-1301-22 must remain in the normally open position. This valve has been verified to be free of fire damage in Fire Area TB-III and therefore is not subject to fire-induced spurious operation when required for use.

The sensing lines for LI ½-3341-77A&B are fed from two vertical standpipes (one for each tank) that are on the reference leg piping from each CCST. LI ½-3341-77A&B senses pressure to read tank level. Fire exposure to these sensing lines will cause the fluid in the sensing line to expand and the resulting pressure increase will relieve through the tank vent or the standpipe vent. Since the sensing lines are ultimately vented to the atmosphere, there cannot be an increase in pressure in the sensing line due to expansion of the sensed fluid. Therefore, the instruments will still read the correct tank level even if the sensing line is heated due to a fire.

Diesel fuel oil level in the diesel fire pump day tanks will be monitored locally from sight glasses LG ½-5241-15 and -16, which are mounted on the day tanks. The day tanks can be refilled from a local fill station outside the crib house (see subsection 3.1.6.4).

Diesel fuel level in the SBO day tanks may be monitored from the control room or locally from mechanical instrument gauges LI 1-5280-202 and LI 2-5280-202, which are mounted on the day tanks. The fuel oil day tanks are sized for four hours of SBO DG operation. The day tanks can be refilled from a 15,000-gallon underground storage tank, utilizing the transfer pumps. Day tank level is observed while making this fuel transfer. The level for the SBO DG underground tank can be monitored utilizing instrument gauges LI 1-5280-207 and LI 2-5280-207 located on the 2201-105 and 2202-105 panels, respectively.

The EDG storage tank levels can be verified by mechanical sounding methods through the storage tank fill line.

3.2 Redundant Fusing of Control Circuits Analysis

NRC Information Notice 85-09 notified utilities about a possible scenario in which a hot shutdown circuit has alternate shutdown isolation switches, but has only one fuse common to both the local and remote control circuitry. Should a fire-induced fault on the remote circuit blow the fuse before the isolation switch is operated, the local control circuit will not function until the fuse is replaced. (Note: The remote position is the control room. The local position is local to the component being operated.) (Reference NDIT QDC-98-073)

A review of Quad Cities hot shutdown circuits was performed for fuses that would be vulnerable to this scenario. Listed below are the components that have alternate shutdown switches that may be used to operate safe shutdown systems.

MO1/2-2901-6 (SSMP System)
MO1/2-2901-7 (SSMP System)
MO1-2901-8 (SSMP System)
MO2-2901-8 (SSMP System)
Breaker control at 4KV Switchgear 14-1, breaker 1425
Breaker control at 4KV Switchgear 31, breaker 3101
Breaker control at 4KV Switchgear 31, breaker 3103
Breaker control at 4KV Switchgear 31, breaker 3104
Breaker control at 4KV Switchgear 31, breaker 3102
Breaker control at 4KV Switchgear 24-1, breaker 2425
MO1-1301-16 (RCIC System)
MO2-1301-16 (RCIC System)
RCIC Gland Seal Vacuum Pump (Units 1&2)
RCIC Condensate Pumps (Units 1&2)
½-4101A, Diesel Driven Fire Pump A
½-4101B, Diesel Driven Fire Pump B
2-5748B (Unit 2 Core Spray Emergency Air Handling Unit)
1-5203 Unit 1 Diesel Fuel Oil Transfer Pump
2-5203 Unit 2 Diesel Fuel Oil Transfer Pump

The components for the SSMP system are provided with alternate shutdown isolation switches that isolate the control room to support local operation of the required components. The 4k VAC breakers that supply 4k VAC power either from the normal supply at Switchgear 14-1 or the alternate supply at Switchgear 24-1 are provided with a local isolation switch that isolates the control room from the control circuit and allows local control of the breaker from the SSMP room. The control circuits for the MOVs have redundant fuses in the control circuits. The control circuits for all the 4k VAC breakers have redundant fuses in the positive leg of the DC control circuit and the negative leg of the trip circuit. However, they only have one fuse in the negative leg of the closing circuit. This design is adequate because any short to ground on the conductors in the cable for the closing circuit that leaves the SSMP room will only blow the fuse in the positive lead of that control circuit. This is because the breaker closing circuit is between the negative fuse at the switchgear and the conductor that leaves the SSMP room. The resistance offered by the breaker closing circuit prevents a direct short to ground on the negative leg of the DC power supply. The positive leg will short directly to ground and the fuse in the positive leg will blow. It should be noted that electrical breaker control might not be possible because the 125 VDC control power to the breaker controls may be lost due to the fire. If this occurs, the breakers will be operated manually.

The control circuit for the room cooler for the SSMP pump room only has local control. Since the control circuit for the cooler does not leave the room, redundant fusing is not required and not provided.

The RCIC system has alternate shutdown switches for MO1(2)-1301-16 located at MCC 18-1A-1 (28-1A-1). When this valve is operated for safe shutdown following a fire, an alternate power supply to the valve is supplied from 208 VAC distribution panel 65-1-1 (75-1-1) in the SBO diesel generator building. The control circuit for MO1(2)-1301-16 does not have fuses. The control circuit is coupled directly to the breaker output at MCC 18-1A-1 (28-1A-1). The voltage level at the MCC is 120/208. The control circuit goes from one breaker to ground at the 120 V level. Any fire-induced faults that

occur outside the fire area where the MCC is located will be switched out of the control circuit when the isolation switch is switched to the "LOCAL" position. Any shorts on the conductors that occur before the isolation switch is moved to the "LOCAL" position may trip the breaker for MO1(2)-1301-16 at the MCC. When the valve is operated from the alternate shutdown station, the alternate power supply from 65-1-1 (75-1-1) will be switched into supply power to the valve. The possible tripping of the normal power supply breaker at MCC 18-1A-1 (28-1A-1) is not a concern since a new power supply is being switched in as part of alternate shutdown for this valve. Because a new power supply breaker is being energized as part of alternate shutdown, not having redundant fusing in this circuit is acceptable.

The RCIC vacuum pump and condensate pump have redundant fuses that are switched into the control circuits when the pumps are operated from the alternate shutdown panels in the RCIC room. Any fire-related faults that might occur on the control circuits for these components may blow the fuses in the control circuit. When the alternate shutdown switch is switched from the remote to local position, the fire-affected fuses are switched out of the circuit and redundant fuses that have not been affected by the fire are switched into the circuit.

The control circuits in both diesel driven fire pumps have local control and have fuses that isolate the circuits that are external to the crib house where the pumps are located. The diesel fire pump control circuit does not have an alternate shutdown switch that isolates the control room portion of the circuit but instead relies on fuses to blow and isolate any faults that occur. Overload protection for the local control is provided by a circuit breaker in the fire pump control panel. The fuses that isolate fire induced faults in the control circuit exterior to the crib house are coordinated with the circuit breaker on the fire pump control panel. Fire induced faults on the conductors that exit the crib house will blow the fuses for the conductors. The diesel fire pump control circuit will still operate from the local circuit breaker in the fire pump control panel.

The control circuits for the SBO DGs do not have redundant fuses and none are required. The control room functions to operate the SBO DGs are controlled through the Distributed Control System (DCS). Once the DCS is deenergized, the control room functions are isolated from the SBO DG control circuit logic. If the DCS is energized, a fire-induced fault in the control room cannot cause damage to control circuits for the SBO DGs. A control room signal is an input to the DCS which causes a particular output from the DCS. Shorts, grounds or hot shorts on the control room circuits for the DCS will be seen as inputs to the system that may cause outputs that cause spurious operation of equipment in the SBO. However, these inputs to the DCS from fire-induced grounds or hot shorts outside of the SBO DG Building cannot be transmitted through the DCS and cause damage or blow fuses in the portion of the control circuit located in the SBO DG Building. Therefore, redundant fusing is not required in the SBO DG control circuits to protect the control circuits from overload conditions caused by a fire outside of the SBO DG Building.

The Emergency Diesel Generators (EDGs) are provided with local isolation switches to run the diesels locally when necessary as identified in the compliance assessments. Redundant fusing for the EDG control circuits is not necessary since they will not be used as an on-site power source if their control circuits are exposed to fire damage.

Alternate shutdown isolation switches are installed in the control circuit for the Unit 2 core spray emergency air handling unit (2-5748B) to isolate cables that are affected by a fire in fire area TB-II. The RCIC system is being used to achieve shutdown for a fire in fire area TB-II and this cooler fan is required for RCIC to be functional. The control circuit for the air handling unit is an ungrounded circuit feed from a control power transformer. The control circuit is not fused and not required to be fused. The part of the control circuit that is routed in fire area TB-II contains conductors for only one side of the control power transformer. A short in these conductors will cause the cooler fan to

spuriously start, which is the desired condition for safe shutdown. A short to ground will not cause any damage since the circuit is an ungrounded circuit. The only failure mode is an open circuit, which will prevent the cooler fan from running. Isolation switches have been added to the control circuit to isolate the conductors that could be affected by the fire and to start and run the cooler fan from a local control switch. Fuses are not required in the control circuit to protect against fire-related damage since the control power transformer will not be damaged by fire-related shorts and grounds in fire area TB-II.

Alternate shutdown isolation switches, with redundant fuses, have been added to the control circuits of the Diesel Fuel Oil Transfer Pumps, 1-5203 and 2-5203. Fuses were added to the existing control circuit to protect the control power transformer from damage. These fuses will be switched out of the circuit when the alternate shutdown switches are switched to local and redundant fuses are switched into the circuit.

**QUAD CITIES 1&2
SAFE SHUTDOWN REPORT**

**REVISION 24
OCTOBER 2019**

**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

Electrical Equipment Equipment	Function	Position	Comment
125V DC Batt Charger 1A	Power Supply		
125V DC Batt Charger 2	Power Supply		
125V DC Batt Charger 2A	Power Supply		
125V DC Battery 1	Power Supply		
125V DC Battery 2	Power Supply		
125V DC Battery Bus 1	Power Supply		
125V DC Battery Bus 2	Power Supply		
125V DC Distribution Panel 1	Power Supply		
125V DC Distribution Panel 2	Power Supply		
125V DC Main Bus 1A	Power Supply		
125V DC Main Bus 1A-1	Power Supply		
125V DC Main Bus 1A-2	Power Supply		
125V DC Main Bus 2A	Power Supply		
125V DC Main Bus 2A-1	Power Supply		
125V DC Main Bus 2A-2	Power Supply		
125V DC Reserve Bus 1B	Power Supply		
125V DC Reserve Bus 1B-1	Power Supply		
125V DC Reserve Bus 1B-2	Power Supply		
125V DC Reserve Bus 2B	Power Supply		
125V DC Reserve Bus 2B-1	Power Supply		
125V DC Reserve Bus 2B-2	Power Supply		
125V DC SBO Battery 1	Power Supply		
125V DC SBO Battery 2	Power Supply		
480V MCC 18-2	Power Supply		
480V MCC 19-2	Power Supply		
480V MCC 28-2	Power Supply		
480V MCC 29-2	Power Supply		
1301	TURB BLDG 480V SWGR 15		1-6800-15
1302	COND & BOOSTER PUMP 1A		1-3302A
1303	MAIN FEED XFRMR 11 (UAT)		1-6703-13
1304	CONTROL ROD DRIVE FEED PUMP 1A		1-302-3A
1305	SERVICE WATER PUMP 1A		1-3901A
1306	CIRC WTR PUMP 1A		1-4401A
1307	COND & BOOSTER PUMP 1B		1-3302B
1308	RHRWS PUMP 1B		1-1001-65B
1309	RESERVE FEED XFRMR 12 (RAT)		1-6703-13
1310	CIRC WTR PUMP 1B		1-4401B
1311	RHRWS PUMP 1A		1-1001-65A
1312	TIE TO BUS 13-1		1-6705-13-1
1313	RADWASTE BLDG 480V TRANS 1A		1-7800-1A-1
1314	SPARE		
13UV	Undervoltage Circuit		
4kV SWGR 13	Power Supply		
T12	Undervoltage Circuit		

**QUAD CITIES 1&2
SAFE SHUTDOWN REPORT**

**REVISION 24
OCTOBER 2019**

**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

Electrical Equipment Equipment	Function	Position	Comment
131UV	Undervoltage Circuit		
1321	EDG #1/2		1-6705-13-1
1322	CORE SPRAY PUMP 1A		1-1401A
1323	PUMP HOUSE TRANS FEED		
1324	RHR PUMP 1B		1-1002B
1325	TIE TO 480V TRANS 18		1-7100-18
1326	480V OFF-GAS FILTER BLDG TRANS 10		1-7800-10-1
1327	TIE FROM BUS 13		1-6705-13-1
1328	RHR PUMP 1A		1-1002A
1329	BUS 23-1 TIE		1-6705-13-1
1330	SBO DG #1 FROM BUS 61		1-6705-13-1
4kV SWGR 13-1	Power Supply		
1401	SPARE		
1402	COND & BOOSTER PUMP 1D		1-3302D
1403	CONTROL ROD DRIVE FEED PUMP 1B		1-302-3B
1404	TURB BLDG 480V SWGR 17		1-7800-17-1
1405	RESERVE FEED XFRMR 12 (RAT)		1-6704-14
1406	SERVICE WATER PUMP 1B		1-3901B
1407	COND & BOOSTER PUMP 1C		1-3302C
1408	SERVICE WATER PUMP ½		1/2-3901
1409	RHR SW PUMP 1C		1-1001-65C
1410	TIE TO BUS 14-1		1-6706-14-1
1411	CIRC WTR PUMP 1C		1-4401C
1412	MAIN FEED XFRMR 11 (UAT)		1-6704-14
1413	RHR SW PUMP 1D		1-1001-65D
1414	TURB BLDG 480V SWGR 16		1-7800-16-1
14UV	Undervoltage Circuit		
4kV SWGR 14	Power Supply		
T12	Undervoltage Circuit		
	SPARE		
141UV	Undervoltage Circuit		
1421	BUS 24-1 FEED		1-6706-14-1
1422	CORE SPRAY PUMP 1B		1-1401B
1423	TIE TO 480V TRANS 19		1-7200-19
1424	RHR PUMP 1D		1-1002D
1425	NORMAL FEED SSD SYSTEM (SWGR 31)		1/2-6707-31
1426	SEE RE-53-Q (GATEHOUSE)		
1427	TIE FROM BUS 14		1-6706-14-1
1428	RHR PUMP 1C		1-1002C
1429	EDG #1		1-6706-14-1
1430	SBO DG #1 FROM BUS 61		1-6706-14-1
4kV SWGR 14-1	Power Supply		
480V SWGR 15	Power Supply		
480V MCC 15-2	Power Supply		

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**Table 3.0-1
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Electrical Equipment Equipment	Function	Position	Comment
182B	TIE FROM 480V TRANS 18		1-7100-18
182C	TIE TO 480V AC SWGR 19		1-7200-19
183A	RX BLDG SERV 480V AC MCC 18-1A		1-7800-18-1A
183B	RX BLDG SUPPLY FAN 1B		1-5703B
183C	FUEL POOL COOLING WTR PMP 1A		1-1902A
183D	E TURB BLDG SUPPLY FAN 1A		1-5702A
184A	TURB BLDG ESS SERV 480V AC 18-2		1-7800-18-2
184B	RX BLDG SUPPLY FAN 1C		1-5703C
184C	ESS SERV DCWP #1/2		1/2-3903
184D	120/240V AC UNINTERRUPTIBLE POWER SUPPLY PNL 901-63		
185A	RX BLDG 480V AC MOTOR CONTROL CENTER 18-3		1-7800-18-3
185B	RX BLDG EXHAUST FAN 1A		1-5704A
185C	RX BLDG COOLING WTR PMP 1A		1-3701A
185D	TURB & RX BLDG LTG #1		
186A	RX BLDG 480V MCC 18/19-5		1-7800-18195
186B	INSTR AIR COMP ½		1/2-4709
186C	RX BLDG ESS SERV 480V MCC 18-1B		1-7800-18-1B
186D	CONT RM STANDBY HVAC 480V MCC 18-4		1-7800-18-4
18UV	Undervoltage Circuit		
480V SWGR 18	Power Supply		
480V MCC 18-1A	Power Supply		
120V MCC 18-1A-1	Power Supply		
480V MCC 18-1B	Power Supply		
480V MCC 18-2	Power Supply		
120V DIST PNL 18-2-1	Power Supply		
480V MCC 18-4	Control Room Standby HVAC MCC		
480V MCC 18/19-5	Power Supply		
192B	TIE FROM 480V TRANS 19		1-7200-19
192C	TIE TO BUS 18		1-7100-18
193A	TURB BLDG ESS SERV 480V AC MCC 19-3		1-7800-19-3
193B	TURB BLDG EXHAUST FAN 1C		1-5705C
193C	RX BLDG SUPPLY FAN 1A		1-5703A
193D	E TURB BLDG SUPPLY FAN 1B		1-5702B
194A	TURB BLDG ESS SERV 480V AC MCC 19-2		1-7800-19-2
194B	RX BLDG EXHAUST FAN 1C		1-5704C
194C	RX BLDG COOLING WTR PUMP 1/2C		1/2-3701C
194D	RX BLDG LTG 1B		
195A	RX BLDG ESS SERV 480V AC MCC 19-1		1-7800-19-1
195B	RX BLDG EXHAUST FAN 1B		1-5704B
195C	RX BLDG COOLING WTR PUMP 1B		1-3701B
195D	FUEL POOL COOLING WTR PUMP 1B edg #2 cwp alt feed		1-1902B
196A	ESS SERV DGCWP #1		1-3903
196B	RX BLDG ESS SERV MCC 18/19-5		1-7800-18195
196C	RX BLDG ESS SERV 480V AC MCC 19-4		1-7800-19-4

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**Table 3.0-1
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Electrical Equipment Equipment	Function	Position	Comment
196D	RX BLDG SERV 480V AC MCC 19-6		1-7800-19-6
19UV	Undervoltage Circuit		
480V SWGR 19	Power Supply		
480V MCC 19-1	Power Supply		
120V MCC 19-1-1	Power Supply		
480V MCC 19-2	Power Supply		
480V MCC 19-4	Power Supply		
2301	TIE TO 4160 V SWGR 23-1 (ESS DIV I)		2-6705-23-1
2302	CONTROL ROD DRIVE FEED PUMP 2A		2-302-3A
2303	CIRC WTR PUMP 2A		2-4401A
2304	TIE TO MAIN FEED XFRMR 22 (RAT)		2-6703-23
2305	RHR SW PUMP 2A		2-1001-65A
2306	COND & BOOSTER PUMP 2A		2-3302A
2307	CIRC WTR PUMP 2B		2-4401B
2308	SERVICE WATER PUMP 2A		2-3901A
2309	RHR SW PUMP 2B		2-1001-65B
2310	TIE TO RESERVE FEED XFRMR 21 (UAT)		2-6703-23
2311	COND & BOOSTER PUMP 2B		2-3302B
2312	TURB BLDG 480V SWGR 25		2-6800-25
2313	480V RADWASTE BLDG TRANS 2A		2-7800-2A-1
2314	ILRT COMPRESSOR		
23UV	Undervoltage Circuit		
4kV SWGR 23	Power Supply		
T22	Undervoltage Circuit		
231UV	Undervoltage Circuit		
2321	BUS 13-1 TIE		2-6705-23-1
2322	CORE SPRAY PUMP 2A		2-1401A
2323	TIE FROM BUS 23		2-6705-23-1
2324	RHR PUMP 2A		2-1002A
2325	TO 480V OFF-GAS FILTER BLDG TRANS #20		2-7800-20-1
2326	RHR PUMP 2B		2-1002B
2327	TIE TO 480V TRANS 28		2-7100-28
2328	SBO DG #2 FROM BUS 71		2-6705-23-1
2329	EDG #1/2		2-6705-23-1
4kV SWGR 23-1	Power Supply		
2401	TURB BLDG 480V SWGR 26		2-7800-26
2402	RHR SW PUMP 2C		2-1001-65C
2403	MAIN FEED XFRMR 21 (UAT)		2-6704-24
2404	CIRC WTR PUMP 2C		2-4401C
2405	COND & BOOSTER PUMP 2C		2-3401C
2406	RHR SW PUMP 2D		2-1001-65D
2407	SERVICE WATER PUMP 2B		2-3901B
2408	COND & BOOSTER PUMP 2D		2-3401D
2409	SERVICE WATER PUMP 1/2		1/2-3901

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**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

Electrical Equipment Equipment	Function	Position	Comment
2410	RESERVE FEED XFRMR 22 (RAT)		2-6704-24
2411	TURB BLDG 480V SWGR 27		2-7800-27-1
2412	CONTROL ROD DRIVE FEED PUMP 2B		2-302-3B
2413	TIE TO BUS 24-1		2-6706-24-1
2414	WELL WATER PUMP #5		1/2-4200-5
2415	SPARE		
24UV	Undervoltage Circuit		
4kV SWGR 24	Power Supply		
T22	Undervoltage Circuit		
241UV	Undervoltage Circuit		
2421	EDG #2		2-6706-24-1
2422	SBO DG #2 FROM BUS 71		2-6706-24-1
2423	TIE FROM BUS 24		2-6706-24-1
2424	RHR PUMP 2C		2-1002C
2425	RES FEED SSD SYSTEM (SWGR 31)		1/2-6707-31
2426	RHR PUMP 2D		2-1002D
2427	TIE TO 480V TRANS 29		2-7200-29
2428	CORE SPRAY PUMP 2B		2-1401B
2429	BUS 14-1 TIE		2-6706-24-1
4kV SWGR 24-1	Power Supply		
480V SWGR 25	Power Supply		
480V MCC 25-2	Power Supply		
250V DC Batt Charger 1	Power Supply		
250V DC Batt Charger ½	Power Supply		
250V DC Batt Charger 2	Power Supply		
250V DC Battery 1	Power Supply		
250V DC Battery 2	Power Supply		
250V DC MCC 1	Power Supply		
250V DC MCC 1A	Power Supply		
250V DC MCC 1B	Power Supply		
250V DC MCC 2	Power Supply		
250V DC MCC 2A	Power Supply		
250V DC MCC 2B	Power Supply		
480V MCC 18-2	Power Supply		
480V MCC 19-2	Power Supply		
480V MCC 28-2	Power Supply		
480V MCC 29-2	Power Supply		
282B	TIE FROM 480V TRANS 28		2-7100-28
282C	TIE TO BUS 29		2-7200-28
283A	RX BLDG ESS SERV 480V MCC 28-1A		2-7800-28-1A
283B	RX BLDG SUPPLY FAN 2B		2-5703B
283C	FUEL POOL COOLING WTR PUMP 2A		2-1902A
283D	E TURB BLDG SUPPLY FAN 2A		2-5702A
284A	TURB BLDG ESS SERV 480V MCC 28-2		2-7800-28-2

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Electrical Equipment Equipment	Function	Position	Comment
284B	RX BLDG SUPPLY FAN 2C		2-5703C
284C	ESS SERV DGCWP 1/2-3903 ALT FEED		1/2-3903
284D	120/240V AC UNINTERRUPTIBLE POWER SUPPLY PNL 902-63		
285A	RX BLDG 480V MCC 28-3		2-7800-28-3
285B	RX BLDG EXHAUST FAN 2A		2-5704A
285C	RX BLDG COOLING WTR PUMP 2A		2-3701A
285D	TURB & RX BLDG LTG 2B		
286A	FUTURE		
286B	RX BLDG ESS SERV MCC 28/29-5		2-7800-28295
286C	1/2B INSTR AIR COMPRESSOR		0-4709B
286D	RX BLDG ESS SERV 480V MCC 28-1B		2-7800-28-1B
28UV	Undervoltage Circuit		
480V SWGR 28	Power Supply		
480V MCC 28-1A	Power Supply		
120V MCC 28-1A-1	Power Supply		
480V MCC 28-1B	Power Supply		
480V MCC 28-2	Power Supply		
120V DIST PNL 28-2-1	Power Supply		
480V MCC 28/29-5	Power Supply		
292B	TIE FROM 480V TRANS 29		2-7200-29
292C	TIE TO BUS 28		2-7100-28
293A	TURB BLDG ESS SERV 480V AC MCC 29-3		2-7800-29-3
293B	TURB BLDG EXHAUST FAN 2C		2-5705C
293C	RX BLDG SUPPLY FAN 2A		2-5703A
293D	E TURB BLDG SUPPLY FAN 2B		2-5702B
294A	TURB BLDG ESS SERV 480V AC MCC 29-2		2-7800-29-2
294B	RX BLDG EXHAUST FAN 2C		2-5704C
294C	RX BLDG COOLING WTR PUMP 1/2		1/2-3701C
294D	RX BLDG LTG 2		
295A	RX BLDG ESS SERV 480V AC MCC 29-1		2-7800-29-1
295B	RX BLDG EXHAUST FAN 2B		2-5704B
295C	RX BLDG COOLING WTR PUMP 2B		2-3701B
295D	FUEL POOL COOLING WTR PUMP 2B edg #1 cwp alt feed		2-1902B
296A	ESS SERV DGCWP 2-3903		2-3903
296B	RX BLDG ESS SERV MCC 28/29-5		2-7800-28295
296C	RX BLDG ESS SERV 480V AC MCC 29-4		2-7800-29-4
296D	RX BLDG ESS SERV 480V AC MCC 29-6		2-7800-29-6
29UV	Undervoltage Circuit		
480V SWGR 29	Power Supply		
480V MCC 29-1	Power Supply		
120V MCC 29-1-1	Power Supply		
480V MCC 29-2	Power Supply		
480V MCC 29-4	Power Supply		

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**Table 3.0-1
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Electrical Equipment Equipment	Function	Position	Comment
120V AC DIST PNL FROM MCC 30	Power Supply		
480V MCC 30	Power Supply		
3101	Safe Shutdown System Normal Feed (from Swgr. 14-1)		1/2-6707-31
3102	Safe Shutdown System Res Feed (from Swgr. 24-1)		1/2-6707-31
3103	Safe Shutdown Pump (1/2-2901)		1/2-2901
3104	Transformer 31 Feed to 480V MCC 30		1/2-7800-30
4kV SWGR 31	Power Supply		
4kV SWGR 61	Power Supply		
6101	SBO DG 1 Feed to Bus 61		1-6760-61
6103	Bus 13-1 Feed		1-6705-13-1
6104	Bus 14-1 Feed		1-6706-14-1
6106	Spare Circuit Breaker		
6107	480V Transformer 65 Feed		1-7860-65-1
6108	Main Feed from SBO Transformer T42R-6		1-6760-61
480V MCC 65-1	Power Supply		
120V AC DIST PNL 65-1-1	Power Supply		
4kV SWGR 71	Power Supply		
7101	SBO DG 2 Feed to Bus 71		2-6760-71
7103	Bus 23-1 Feed		2-6705-23-1
7104	Bus 24-1 Feed		2-6706-24-1
7106	Spare Circuit Breaker		
7107	480V Transformer 75 Feed		2-7860-75-1
7108	Main Feed from SBO Transformer T42R-6		2-6760-71
480V MCC 75-1	Power Supply		
120V AC DIST PNL 75-1-1	Power Supply		
120V PNL 901-49	Power Supply		
250V DC MCC 1	Power Supply		
480V MCC 18-2	Power Supply		
480V SWGR 18	Power Supply		
120V PNL 901-50	Power Supply		
480V MCC 15-2	Power Supply		
480V MCC 18-2	Power Supply		
120V PNL 902-49	Power Supply		
250V DC MCC 2	Power Supply		
480V MCC 28-2	Power Supply		
480V SWGR 28	Power Supply		
120V PNL 902-50	Power Supply		
480V MCC 25-2	Power Supply		
480V MCC 28-2	Power Supply		

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**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

SSMP

Equipment

Equipment	Function	Position	Comment
1-2301-22	U-1 HPCI Suction Isolation Valve	Closed	
1-2301-80	U-1 HPCI Turbine Cooling Water Pump Suction Isolation Valve	Closed	
1/2-2901	SSMP Safe Shutdown Makeup Pump	Running	4kV SWGR 31 Bkr 3103
1/2-2901-1	SSMP CCST Suction Valve	Available	Locked Open Manual Valve
1/2-2901-2	SSMP Firewater Suction Valve	Available	Locked Closed Manual Valve
1/2-2901-25	SSMP Service Water Normal Room cooler supply valve	Closed	
1/2-2901-3	SSMP Firewater Suction Valve	Available	Locked Closed Manual Valve
1/2-2901-9	SSMP Room Cooler Supply From Firemain	Available	Locked Closed Manual Valve
1/2-2999-9	SSMP Room Cooler Bypass Valve	Closed	Normally Open Manual Valve
1/2-3303A	U-1/2 "A" CCST	Available	
1/2-3303B	U-1/2 "B" CCST	Available	
1/2-4101A	U-1/2 Diesel Fire Pump "A"	Running	
1/2-4101B	U-1/2 Diesel Fire Pump "B"	Running	
1/2-5205A	U-1/2 "A" Diesel Fire Pump Day Tank	Available	
1/2-5205B	U-1/2 "B" Diesel Fire Pump Day Tank	Available	
1/2-5799	SSMP Room Cooler	Running	480V MCC 30 Cub B2
2-2301-22	U-2 HPCI Suction Isolation Valve	Closed	
2-2301-80	U-2 HPCI Turbine Cooling Water Pump Suction Isolation Valve	Closed	
AO 1-2301-7	U-1 HPCI Injection Isolation Check Valve	Available	
AO 2-2301-7	U-2 HPCI Injection Isolation Check Valve	Available	
FE 1/2-2941-4	SSMP Pump Discharge Flow	Available	
FIC 1/2-2940-7	SSMP Flow Control For MO 1/2-2901-6	Available	
FIC 1/2-2941-6	SSMP Flow Control For MO 1/2-2901-6	Available	
FT 1/2-2941-22	SSMP Flow Transmitter For FIC 1/2-2941-6	Available	
FT 1/2-2941-5	SSMP Flow Transmitter For FIC 1/2-2940-7	Available	
LG 1/2-5241-15	U-1/2 "B" Diesel Fire Pump Day Tank Sight Glass	Available	
LG 1/2-5241-16	U-1/2 "A" Diesel Fire Pump Day Tank Sight Glass	Available	
LI 1/2-3340-3	U-1/2 "A" CCST Level Indication (901-6)	Available	
LI 1/2-3340-4	U-1/2 "B" CCST Level Indication (901-6)	Available	
LI 1/2-3341-77A	U-1/2 "A" CCST Level Indicator	Available	Local Indicator
LI 1/2-3341-77A	U-1/2 "A" CCST Local Level Indicator	Available	
LI 1/2-3341-77B	U-1/2 "B" CCST Level Indicator	Available	Local Indicator
LI 1/2-3341-77B	U-1/2 "B" CCST Local Level Indicator	Available	

**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

**SSMP
Equipment**

Function	Position	Comment
LT 1/2-3341-76A	U-1/2 "A" CCST Level Transmitter	Available Transducer Power Supply Cab 941-28
LT 1/2-3341-76B	U-1/2 "B" CCST Level Transmitter	Available Transducer Power Supply Cab 941-28
MO 1-1301-22	U-1 RCIC CCST Suction Valve	Closed
MO 1-1301-60.P	U-1 RCIC Min Flow Valve	Closed
MO 1-1301-62.P	U-1 RCIC Cooling Water Isolation Valve	Closed
MO 1-2301-14.P	U-1 HPCI Min Flow Valve	Closed
MO 1-2301-48	U-1 HPCI Cooling Water Return Valve	Closed 250V DC MCC 1A Cub I01
MO 1-2301-6	U-1 HPCI CCST Suction Valve	Closed
MO 2-2301-6.P	U-2 HPCI CCST Suction Valve	Open
MO 1-2901-8	SSMP U-1 Injection Valve	Available 480V MCC 30 Cub C3
MO 1/2-2901-6	SSMP Flow Control Valve	Throttled 480V MCC 30 Cub C1
MO 1/2-2901-7	SSMP Throttled Test Valve	Available 480V MCC 30 Cub C2
MO 2-1301-22	U-2 RCIC CCST Suction Valve	Closed
MO 2-1301-60.P	U-2 RCIC Min Flow Valve	Closed
MO 2-1301-62.P	U-2 RCIC Cooling Water Isolation Valve	Closed
MO 2-2301-14	U-2 HPCI Min Flow Valve	Closed
MO 2-2301-48	U-2 HPCI Cooling Water Return Valve	Closed
MO 2-2301-6	U-2 HPCI CCST Suction Valve	Closed
MO 2-2301-6.P	U-2 HPCI CCST Suction Valve	Open
MO 2-2901-8	SSMP U-2 Injection Valve	Available 480V MCC 30 Cub C4
PI 1/2-2940-05	SSMP Pump Discharge Pressure	Available Pnl 912-8
PI 1/2-2941-08	SSMP Pump Discharge Pressure	Available Local Indicator
PI 2-2381	U-1/2 CCST Local Level Indicator	Available MO 2-2301-6 Required Open
PI 2-1360-20	U-1/2 CCST Local Level Indicator	Available Local Indicator MO 2-1301-22 Required Open
TS 1/2-5741-1A	SSMP Room Cooler Temp Switch	Available
TS 1/2-5741-1B	SSMP Room Cooler Temp Switch	Available
0-5299-182A	Fill Container Isolation Valve	Available Locked Closed Manual Valve
0-5299-182B	Fill Container Isolation Valve	Available Locked Closed Manual Valve
0-5299-187A	1/2A DFP Day Tank Cross-Tie Isolation	Open Locked Closed Manual Valve
0-5299-187B	1/2B DFP Day Tank Cross-Tie Isolation	Open Locked Closed Manual Valve

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**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

Equipment	Function	Position	Comment
1-3903	U-1 DG Cooling Water Pump	Running	Normal Feed – 196A @ Swgr 19
1-4600A	U-1 DG Air Receiver Tank	Available	
1-4600B	U-1 DG Air Receiver Tank	Available	
1-4600C	U-1 DG Air Receiver Tank	Available	
1-4600D	U-1 DG Air Receiver Tank	Available	
1-5201	U-1 DG Diesel Fuel Oil Storage Tank	Available	
1-5202	U-1 DG Diesel Fuel Oil Day Tank	Available	
1-5203	U-1 DG Fuel Oil Transfer Pump	Available	Normal Feed = C5 @ MCC 19-1 Alt Feed = G3 @ MCC 29-1
1-5727	U-1 DG Room Vent Fan	Running	Normal Feed = C5 @ MCC 19-1
1-5749A	U-1 EDG CWP Cubicle Cooler	Running	Normal Feed = E5 @ Bus 19-2 Alt Feed = B3 @ Bus 29-2
1-5749B	U-1 EDG CWP Cubicle Cooler	Running	Normal Feed = F1 @ Bus 19-2 Alt Feed = B3 @ Bus 29-2
1-6601	U-1 DG Diesel Engine	Running	All mechanical components included
AO 1-5772-86A	U-1 DG Room Exhaust Isolation Damper	Open	
AO 1-5772-86B	U-1 DG Room Exhaust Isolation Damper	Open	
AO 1-5772-87 East	U-1 DG Room Supply Isolation Damper	Open	
AO 1-5772-87 West	U-1 DG Room Supply Isolation Damper	Open	
AO 1-5772-94	U-1 DG Room Outside Air Intake Damper	Available	
AO 1-5772-95	U-1 DG Room Modulation Damper	Available	
AO 1-5772-96	U-1 DG Room Modulation Damper	Available	
LG 1-5241-13	U-1 DG Diesel Fuel Oil Day Tank Local Level Gauge	Available	
LS 1-5241-3	U-1 DG Day Tank Level	Available	
SO 1-4699-310	U-1 DG Air Start Solenoid	Available	
SO 1-5772-89	U-1 DG Normal Air Supply To Dampers	Available	
SO 1-5799-553	U-1 DG Air Supply to Dampers	Available	
U1EDG-AUTO	U-1 EDG Automatic Start Logic		
1-5299-181	U-1 DG Fuel Oil Transfer to Day Tank Isolation Valve	Available	

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**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

**U1 HPCI
Equipment**

Equipment	Function	Position	Comment
1-2301-197	U-1 HPCI Drain Pot		
1-2302	U-1 HPCI Pump	Running	Powered By Steam Driven Turbine
1-2303	U-1 HPCI Turbine	Running	Steam Driven
1-2303-MGU	U-1 HPCI Motor Gear Unit	Available	
1-2303-MSG	U-1 HPCI Motor Speed Changer	Available	
1-2303-TTG	U-1 HPCI Turning Gear	Available	
1-2304	U-1 HPCI Condensate Pump	Running	250V DC MCC 1A Cub L02
1-2305	U-1 HPCI Gland Seal Condenser	Available	
1-2306	U-1 HPCI Gland Seal Exhauster	Running	250V DC MCC 1A Cub C02
1-2308	U-1 HPCI Aux Oil Pump	Running	250V DC MCC 1A Cub B01
1-2315	U-1 HPCI Oil Tank	Available	
1-2319	U-1 HPCI Condensator Hotwell		
1-3903	U-1 DG Cooling Water Pump	Running	Normal Feed = 196A @ Swgr 19 Alt Feed = 295D @ Swgr 29
1-5747	U-1 HPCI Room Cooler	Running	480V MCC 19-1 Cub D4
1-5749A	U-1 EDG CWP Cubicle Cooler	Running	Normal Feed = E5 @ Bus 19-2 Alt Feed = B3 @ Bus 29-2
1-5749B	U-1 EDG CWP Cubicle Cooler	Running	Normal Feed = F1 @ Bus 19-2 Alt Feed = B3 @ Bus 29-2
½-3303A	U-1/2 "A" CCST	Available	
1/2-3303B	U-1/2 "B" CCST	Available	
1/2-3903	U-1/2 DG Cooling Water Pump	Available	Normal Feed=184C @ Swgr 18 Alt Feed = 284C @ Swgr 28
1/2-3999-89	U-1/2 EDG CWP To U-1 ECCS Room Coolers		
1/2-5749A	U-1/2 EDG CWP Cubicle Cooler	Running	Normal Feed = 184C @ Swgr 18 Alt Feed = 284C @ Swgr 28
1/2-5749B	U-1/2 EDG CWP Cubicle Cooler	Running	Normal Feed = 184C @ Swgr 18 Alt Feed = 284C @ Swgr 28
2-2301-22	U-2 HPCI Suction Isolation Valve	Closed	
2-2301-80	U-2 HPCI Turbine Cooling Water Pump Suction Isolation Valve	Closed	
AO 1-2301-28	U-1 HPCI Steam Leak-off Drain To Torus	Available	125V DC Bus 1B-1
AO 1-2301-29	U-1 HPCI Steam Leak-off Drain To Condenser	Available	125V DC Bus 1B-1
AO 1-2301-30	U-1 HPCI Steam Leak-off Drain To Condenser	Available	125V DC Bus 1B-1
AO 1-2301-31	U-1 HPCI Steam Trap Bypass Valve	Available	
AO 1-2301-64	U-1 HPCI Turbine Stop Valve Above Seat Drain Valve	Closed	
AO 1-2301-65	U-1 HPCI Turbine Stop Valve Above Seat Drain Valve	Closed	
FI 1-3941-28	U-1 ECCS Room Coolers Flow Indicator	Available	
FIC 1-2340-1	U-1 HPCI Flow Indicating Controller	Available	120V Panel 901-49
FIS 1-2354	U-1 HPCI Minimum Flow Control	Available	Field Device
FT 1-2358	U-1 HPCI Flow Transmitter	Available	120V Panel 901-49
HO 1-2317	U-1 HPCI Turbine Stop Valve	Open	125V DC Bus 1B-1
HO 1-2321	U-1 HPCI Turbine Control Valve	Open	
LI 1/2-3340-3	U-1/2 "A" CCST Level Indication (901-6)	Available	Transducer Power Supply Cab 941-28
LI 1/2-3340-4	U-1/2 "B" CCST Level Indication (901-6)	Available	Transducer Power Supply Cab 941-28
LI 1/2-3341-77A	U-1/2 "A" CCST Level Indicator	Available	Local Indicator

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Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists

LI 1/2-3341-77B	U-1/2 "B" CCST Level Indicator	Available	Local Indicator
LIS 1-2341-1	U-1 HPCI Oil Tank Level	Available	Local Indicator
LS 1-2341-8202	U-1 HPCI Condensate Pump Level Switch	Available	Field Device
LS 1-2365	U-1 HPCI Drain Pot Level Switch	Available	Field Device
LS 1-2369	U-1 HPCI Drain Pot Level Switch	Available	Field Device
LT 1/2-3341-76A	U-1/2 "A" CCST Level Transmitter	Available	Transducer Power Supply Cab 941-28
LT 1/2-3341-76B	U-1/2 "B" CCST Level Transmitter	Available	Transducer Power Supply Cab 941-28
MO 1-1301-22	U-1 RCIC CCST Suction Valve	Closed	
MO 1-1301-60.P	U-1 RCIC Min Flow Valve	Closed	
MO 1-1301-62.P	U-1 RCIC Cooling Water Isolation Valve	Closed	
MO 1-2301-10	U-1 HPCI Test Return Valve	Closed	250V DC MCC 1A Cub J02
MO 1-2301-14	U-1 HPCI Min Flow Valve	Available	250V DC MCC 1A Cub H01
MO 1-2301-15	U-1 HPCI CCST Test Return Valve	Closed	250V DC MCC 1A Cub E02
MO 1-2301-3	U-1 HPCI Steam Supply Valve	Open	250V DC MCC 1A Cub G01
MO 1-2301-35	U-1 HPCI Torus Suction Valve	Available	250V DC MCC 1A Cub K01
MO 1-2301-36	U-1 HPCI Torus Suction Valve	Available	250V DC MCC 1A Cub E01
MO 1-2301-4.P	U-1 HPCI Inboard Steam Isolation Valve	Open	480V MCC 19-1 Cub B2
MO 1-2301-48.P	U-1 HPCI Cooling Water Return Valve	Open	250V DC MCC 1A Cub I01
MO 1-2301-49	U-1 HPCI Cooling Water Test Return Valve	Closed	250V DC MCC 1A Cub F01
MO 1-2301-5.P	U-1 HPCI Outboard Steam Isolation Valve	Open	250V DC MCC 1A Cub G02
MO 1-2301-6	U-1 HPCI CCST Suction Valve	Available	250V DC MCC 1A Cub K02
MO 1-2301-8	U-1 HPCI Injection Isolation Valve	Open	250V DC MCC 1A Cub H02
MO 1-2301-9	U-1 HPCI Injection Isolation Valve	Open	250V DC MCC 1A Cub I02
MO 1-2399-40	U-1 HPCI Vacuum Breaker Isolation Valve	Available	480V MCC 19-1 Cub D5
MO 1-2399-41	U-1 HPCI Vacuum Breaker Isolation Valve	Available	250V DC MCC 1B Cub M02
MO 2-1301-22	U-2 RCIC CCST Suction Valve	Closed	
MO 2-1301-60.P	U-2 RCIC Min Flow Valve	Closed	Feed = T01 250Vdc MCC 2B
MO 2-1301-62.P	U-2 RCIC Cooling Water Isolation Valve	Closed	
MO 2-2301-14	U-2 HPCI Min Flow Valve	Closed	
MO 2-2301-48	U-2 HPCI Cooling Water Return Valve	Closed	
MO 2-2301-6	U-2 HPCI CCST Suction Valve	Closed	
MO 2-2301-6.P	U-2 HPCI CCST Suction Valve	Open	
PI 1-2357	U-1 HPCI Pump Discharge Pressure	Available	Local Indicator
PI 1-2363	U-1 HPCI Turbine Steam Pressure	Available	Local Indicator
SO 1-2301-32	U-1 HPCI Steam Leak-off Drain To Gland Seal Condenser	Available	125V DC Bus 1B-1
TS 1-5711-2	U-1 HPCI Room Temperature	Available	
U1HPCI-ISOLATION	U-1 HPCI Automatic Isolation Logic		
U1HPCI-MAN	U-1 HPCI System Manual Initiation		
LS 1-2351-A	Torus Level +5 inch Suction Transfer	Available	Field Device
LS 1-2351-B	Torus Level +5 inch Suction Transfer	Available	Field Device

Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists

U1 INSTRUMENTS

Equipment	Function	Position	Comment
FR 1-1040-7	U-1 RHR Div I or Div II Total Flow	Available	
FT 1-1049A	U-1 RHR Flow Transmitter DIV I	Available	
FT 1-1049B	U-1 RHR Flow Transmitter DIV II	Available	
LI 1-0263-106A	U-1 Reactor Level Indicator DIV I	Available	
LI 1-0263-106B	U-1 Reactor Level Indicator DIV II	Available	
LI 1-1640-10A	U-1 Torus Level Indicator	Available	
LI 1-1640-10B	U-1 Torus Level Indicator	Available	
PI 1-0263-156	U-1 Reactor Pressure Indicator DIV I	Available	
TR 1-1640-9	U-1 Torus Temperature Indicator	Available	

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**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

**U1 Off-site Power
Equipment**

	Function	Position	Comment
11	4KV SWGR 11	Available	
1104	4KV SWGR 11 Reserve Feed Breaker		
12	4KV SWGR 12	Available	
1301	TURB BLDG 480V SWGR 15		1-6800-15
1302	COND & BOOSTER PUMP 1A		1-3302A
1303	MAIN FEED XFRMR 11 (UAT)		1-6703-13
1304	CONTROL ROD DRIVE FEED PUMP 1A		1-302-3A
1305	SERVICE WATER PUMP 1A		1-3901A
1306	CIRC WTR PUMP 1A		1-4401A
1307	COND & BOOSTER PUMP 1B		1-3302B
1308	RHRWS PUMP 1B		1-1001-65B
1309	RESERVE FEED XFRMR 12 (RAT)		1-6703-13
1310	CIRC WTR PUMP 1B		1-4401B
1311	RHRWS PUMP 1A		1-1001-65A
1312	TIE TO BUS 13-1		1-6705-13-1
1313	RADWASTE BLDG 480V TRANS 1A		1-7800-1A-1
1314	SPARE		
1401	SPARE		
1402	COND & BOOSTER PUMP 1D		1-3302D
1403	CONTROL ROD DRIVE FEED PUMP 1B		1-302-3B
1404	TURB BLDG 480V SWGR 17		1-7800-17-1
1405	RESERVE FEED XFRMR 12 (RAT)		1-6704-14
1406	SERVICE WATER PUMP 1B		1-3901B
1407	COND & BOOSTER PUMP 1C		1-3302C
1408	SERVICE WATER PUMP ½		1/2-3901
1409	RHRWS PUMP 1C		1-1001-65C
1410	TIE TO BUS 14-1		1-6706-14-1
1411	CIRC WTR PUMP 1C		1-4401C
1412	MAIN FEED XFRMR 11 (UAT)		1-6704-14
1413	RHRWS PUMP 1D		1-1001-65D
1414	TURB BLDG 480V SWGR 16		1-7800-16-1
CKT BKR 4-6	345KV Switchyard Breaker for T-12	Closed	

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**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

**U1 RCIC
Equipment**

Equipment	Function	Position	Comment
1-0220-59A	U-1 RCIC System Boundry On Feed Line	Closed	Manual Check Valve
1-1301	U-1 RCIC EGM Control Box	Available	
1-1302	U-1 RCIC Pump	Running	
1-1303	U-1 RCIC Turbine	Running	
1-1303B	U-1 RCIC Trip Throttle Valve	Open	
1-1304	U-1 RCIC Condensate Pump	Running	Feed = S01 @ 250Vdc MCC 1B
1-1305	U-1 RCIC Vacuum Pump	Running	Feed = V02 @ 250Vdc MCC 1B
1-1306	U-1 RCIC Vacuum Tank	Available	
1-2301-22	U-1 HPCI Suction Isolation Valve	Closed	
1-2301-80	U-1 HPCI Turbine Cooling Water Pump Suction Isolation Valve	Closed	
1-3903	U-1 DG Cooling Water Pump	Running	Normal Feed = 196A @ Swgr 19 Alt Feed = 295D @ Swgr 29
1-5748A	U-1 RCIC Room Cooler (C/S AHU 1A)	Running	Feed = F2 @ MCC 18-1A
1-5749A	U-1 EDG CWP Cubicle Cooler	Running	Normal Feed = E5 @ Bus 19-2 Alt Feed = B3 @ Bus 29-2
1-5749B	U-1 EDG CWP Cubicle Cooler	Running	Normal Feed = F1 @ Bus 19-2 Alt Feed = B3 @ Bus 29-2
1/2-3303A	U-1/2 "A" CCST	Available	
1/2-3303B	U-1/2 "B" CCST	Available	
1/2-3903	U-1/2 DG Cooling Water Pump	Available	Normal Feed = 184C @ Swgr 18 Alt Feed = 284C @ Swgr 28
1/2-3999-89	U-1/2 EDG CWP To U-1 ECCS Room Coolers	Available	
1/2-5749A	U-1/2 EDG CWP Cubicle Cooler	Available	Normal Feed = 184C @ Swgr 18 Alt Feed = 284C @ Swgr 28
1/2-5749B	U-1/2 EDG CWP Cubicle Cooler	Available	Normal Feed = 184C @ Swgr 18 Alt Feed = 284C @ Swgr 28
2-2301-22	U-2 HPCI Suction Isolation Valve	Closed	
2-2301-80	U-2 HPCI Turbine Cooling Water Pump Suction Isolation Valve	Closed	
AO 1-1301-32	U-1 RCIC Steam Drain Trap Bypass Valve	Available	125V DC MCC 1A-2
AO 1-1301-34	U-1 RCIC Steam Line Drain Valve	Available	125V DC MCC 1A-2
AO 1-1301-35	U-1 RCIC Steam Line Drain Valve	Available	125V DC MCC 1A-2
FI 1-3941-28	U-1 ECCS Room Coolers Flow Indicator	Available	Local Indicator
FIC 1-1340-1	U-1 RCIC Flow Controller (901-4)	Available	
FIS 1-1360-7	U-1 RCIC Minimum Flow Control	Available	
FT 1-1360-4	U-1 RCIC Pump Discharge Flow Transmitter	Available	
HO 1-1303A	U-1 RCIC Governor Valve	Open	
LI 1/2-3340-3	U-1/2 "A" CCST Level Indication (901-6)	Available	
LI 1/2-3340-4	U-1/2 "B" CCST Level Indication (901-6)	Available	
LI 1/2-3341-77A	U-1/2 "A" CCST Level Indicator	Available	Local Indicator
LI 1/2-3341-77B	U-1/2 "B" CCST Level Indicator	Available	Local Indicator
LS 1-1301-101	U-1 RCIC Condensate Pump Control	Available	
LS 1360-13	U-1 RCIC Drain Pot Level Switch	Available	Field Device
LT 1/2-3341-76A	U-1/2 "A" CCST Level Transmitter	Available	Transducer Power Supply Cab 941-28
LT 1/2-3341-76B	U-1/2 "B" CCST Level Transmitter	Available	Transducer Power Supply Cab 941-28
MO 1-1301-16.P	U-1 RCIC Inboard Steam Isolation Valve	Open	Feed = B1 @ MCC 18-1A-1
MO 1-1301-17.P	U-1 RCIC Outboard Steam Isolation Valve	Open	Feed = O02 @ 250Vdc MCC 1B

**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

**U1 RCIC
Equipment**

Equipment	Function	Position	Comment
MO 1-1301-22	U-1 RCIC CCST Suction Valve	Available	Feed = N02 @ 250Vdc MCC 1B
MO 1-1301-25	U-1 RCIC Torus Suction Valve	Available	Feed = P02 @ 250Vdc MCC 1B
MO 1-1301-26	U-1 RCIC Torus Suction Valve	Available	Feed = U02 @ 250Vdc MCC 1B
MO 1-1301-48	U-1 RCIC Injection Valve	Open	Feed = V01 @ 250Vdc MCC 1B
MO 1-1301-49	U-1 RCIC Injection Valve	Open	Feed = Q02 @ 250Vdc MCC 1B
MO 1-1301-53	U-1 RCIC Test Return Valve	Closed	Feed = P01 @ 250Vdc MCC 1B
MO 1-1301-60	U-1 RCIC Min Flow Valve	Available	Feed = T01 @ 250Vdc MCC 1B
MO 1-1301-61	U-1 RCIC Steam Supply Valve	Open	Feed = W02 @ 250Vdc MCC 1B
MO 1-1301-62	U-1 RCIC Lube Oil Cooler Supply Valve	Open	Feed = O01 @ 250Vdc MCC 1B
MO 1-2301-14.P	U-1 HPCI Min Flow Valve	Closed	
MO 1-2301-48	U-1 HPCI Cooling Water Return Valve	Closed	250V DC MCC 1A Cub I01
MO 1-2301-6	U-1 HPCI CCST Suction Valve	Closed	250V DC MCC 1A Cub K02
MO 2-1301-22	U-2 RCIC CCST Suction Valve	Closed	
MO 2-1301-60.P	U-2 RCIC Min Flow Valve	Closed	Feed = T01 250Vdc MCC 2B
MO 2-1301-62.P	U-2 RCIC Cooling Water Isolation Valve	Closed	
MO 2-2301-14	U-2 HPCI Min Flow Valve	Closed	
MO 2-2301-48	U-2 HPCI Cooling Water Return Valve	Closed	
MO 2-2301-6	U-2 HPCI CCST Suction Valve	Closed	
MO 2-2301-6.P	U-2 HPCI CCST Suction Valve	Open	
PI 1-1340-3	U-1 RCIC Turbine Exhaust Pressure (901-4)	Available	
PI 1-1360-25	U-1 RCIC Turbine Exhaust Press Indicator	Available	Local Indicator
PI 1-1360-5	U-1 RCIC Local Discharge Press	Available	2201-58 Rack
PT 1-1360-24	U-1 RCIC Turbine Exhaust Pressure Transmitter	Available	
TS 1-5703-178	U-1 RCIC Room Cooler Control	Available	
U1RCIC-ISOLATION	U-1 RCIC Automatic Isolation Logic		
U1RCIC-MAN	U-1 RCIC System Manual Initiation		

**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

U1 Reactor Inventory

Equipment	Function	Position	Comment
1-0220-58A	U-1 Reactor Feed Line Check Valve	Closed	High/low pressure interface
1-0220-58B	U-1 Reactor Feed Line Check Valve	Closed	High/low pressure interface
1-2308	U-1 HPCI Aux Oil Pump		250V DC MCC 1A Cub B01
AO 1-0203-1A	U-1 A MSIV Inboard	Closed	Close from Pnl 901-3
AO 1-0203-1B	U-1 B MSIV Inboard	Closed	Close from Pnl 901-3
AO 1-0203-1C	U-1 C MSIV Inboard	Closed	Close from Pnl 901-3
AO 1-0203-1D	U-1 D MSIV Inboard	Closed	Close from Pnl 901-3
AO 1-0203-2A	U-1 A MSIV Outboard	Closed	Close from Pnl 901-3
AO 1-0203-2B	U-1 B MSIV Outboard	Closed	Close from Pnl 901-3
AO 1-0203-2C	U-1 C MSIV Outboard	Closed	Close from Pnl 901-3
AO 1-0203-2D	U-1 D MSIV Outboard	Closed	Close from Pnl 901-3
AO 1-0220-44	U-1 Recirc Line Sample Valve	Closed	Close from Pnl 901-4
AO 1-0220-45	U-1 Recirc Line Sample Valve	Closed	Close from Pnl 901-4
AO 1-0220-46	U-1 Rx Head Vent	Closed	Close from Pnl 901-4
AO 1-0220-47	U-1 Rx Head Vent	Closed	Close from Pnl 901-4
AO 1-0302-21A	U-1 SDV Vent Valve	Closed	Close from scram signal
AO 1-0302-21B	U-1 SDV Vent Valve	Closed	Close from scram signal
AO 1-0302-21C	U-1 SDV Vent Valve	Closed	Close from scram signal
AO 1-0302-21D	U-1 SDV Vent Valve	Closed	Close from scram signal
AO 1-0302-22A	U-1 SDV Drain Valve	Closed	Close from scram signal
AO 1-0302-22B	U-1 SDV Drain Valve	Closed	Close from scram signal
AO 1-0302-22C	U-1 SDV Drain Valve	Closed	Close from scram signal
AO 1-0302-22D	U-1 SDV Drain Valve	Closed	Close from scram signal
AO 1-1301-32	U-1 RCIC Steam Drain Trap Bypass Valve	Closed	125V DC MCC 1A-2
AO 1-1301-34	U-1 RCIC Steam Line Drain Valve	Closed	125V DC MCC 1A-2
AO 1-1301-35	U-1 RCIC Steam Line Drain Valve	Closed	125V DC MCC 1A-2
AO 1-2301-29	U-1 HPCI Steam Leak-off Drain To Condenser	Closed	125V DC Bus 1B-1
AO 1-2301-30	U-1 HPCI Steam Leak-off Drain To Condenser	Closed	125V DC Bus 1B-1
FCV 1-1239	U-1 Reactor Water Cleanup (RWCU) Flow Control Valve	Closed	
HO 1-2317.P	U-1 HPCI Turbine Stop Valve	Closed	125V DC Bus 1B-1
MO 1-0220-1	U-1 Inboard Steam Line Drain Isolation Valve	Closed	Feed = D3 @ MCC 18-1A
MO 1-0220-2	U-1 Outboard Steam Line Drain Isolation Valve	Closed	
MO 1-0220-4	U-1 Steam Line Drain Isolation Valve	Closed	
MO 1-1001-47	U-1 RHR Shutdown Cooling Suction Valve	Available	250V DC MCC 1A Cub J01
MO 1-1001-50	U-1 RHR Shutdown Cooling Suction Valve	Available	480V MCC 18-1B Cub C2
MO 1-1201-2	U-1 Reactor Water Cleanup (RWCU) Inboard Isolation Valve	Closed	
MO 1-1201-5	U-1 Reactor Water Cleanup (RWCU) Outboard Isolation Valve	Closed	
MO 1-1201-76	U-1 Blowdown Orifice Bypass (RWCU) Valve	Closed	
MO 1-1201-77	U-1 Reject to WCT Shutoff (RWCU) Valve	Closed	
MO 1-1201-78	U-1 Reject to Condenser Shutoff (RWCU) Valve	Closed	

**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

U1 Reactor Inventory

Equipment	Function	Position	Comment
MO 1-1301-16	U-1 RCIC Inboard Steam Isolation Valve	Closed	Feed = B1 @ MCC 18-1A-1
MO 1-1301-17	U-1 RCIC Outboard Steam Isolation Valve	Closed	Feed = O02 @ MCC 1B
MO 1-1301-61.P	U-1 RCIC Steam Supply Valve	Closed	Feed = W02 @ 250Vdc MCC 1B
MO 1-2301-3.P	U-1 HPCI Steam Supply Valve	Closed	250V DC MCC 1A Cub G01
MO 1-2301-4	U-1 HPCI Inboard Steam Isolation Valve	Closed	480V MCC 19-1 Cub B2
MO 1-2301-5	U-1 HPCI Outboard Steam Isolation Valve	Closed	250V DC MCC 1A Cub G02
RO 1-2301-63B	U-1 HPCI Steam Line Drain Orifice		
RO 1-2301-63C	U-1 HPCI Steam Line Drain Orifice		
RV1-0203-3A	U-1 Main Steam Relief Valve A	Available	
RV1-0203-3A.P	U-1 Main Steam Relief Valve A	Off	Close from Pnl 901-3
RV1-0203-3B	U-1 Main Steam Relief Valve B	Available	
RV1-0203-3B.P	U-1 Main Steam Relief Valve B	Off	Close from Pnl 901-3
RV1-0203-3C	U-1 Main Steam Relief Valve C	Available	
RV1-0203-3C.P	U-1 Main Steam Relief Valve C	Off	Close from Pnl 901-3
RV1-0203-3D	U-1 Main Steam Relief Valve D	Available	
RV1-0203-3D.P	U-1 Main Steam Relief Valve D	Off	Close from Pnl 901-3
RV1-0203-3E	U-1 Main Steam Relief Valve E	Available	
RV1-0203-3E.P	U-1 ADS Automatic Initiation Logic	Off	Close from Pnl 901-3
U1ADS-AUTO	U-1 HPCI Automatic Initiation Logic		
U1HPCI-AUTO	U-1 RCIC Automatic Initiation Logic		
U1RCIC-AUTO			

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**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

U1 RHR DIV 1

Equipment

Equipment	Function	Position	Comment
1-1001-141A	1A RHR Pump Min Flow SV	Closed	
1-1001-141B	1B RHR Pump Min Flow SV	Closed	
1-1002A	U-1 RHR Pump A	Running	4kV SWGR 13-1 Bkr 1328
1-1002B	U-1 RHR Pump B	Running	4kV SWGR 13-1 Bkr 1324
1-1003A	U-1 RHR A Heat Exchanger	Available	
1-3903	U-1 DG Cooling Water Pump	Running	Normal Feed = 196A @ Swgr 19 Alt Feed = 295D @ Swgr 29 480V MCC 18-1A Cub C4
1-5746A	U-1 RHR Room Cooler 1A	Running	
1-5749A	U-1 EDG CWP Cubicle Cooler	Running	
1-5749B	U-1 EDG CWP Cubicle Cooler	Running	
1/2-2001-82	U-1/2 Torus-Cond X-Tie To RDT	Closed	Normally Closed Manual Valve
½-3903	U-1/2 DG Cooling Water Pump	Running	Normal Feed = 480V SWGR 18 Compt 184C Alt Feed = 480V SWGR 28 Compt 284C Normally Closed Manual Valve
1/2-3999-89	U-1/2 EDG CWP To U-1 ECCS Room Coolers	Open	
1/2-5749A	U-1/2 EDG CWP Cubicle Cooler	Running	Normal Feed = 184C @ Swgr 18 Alt Feed = 284C @ Swgr 28
1/2-5749B	U-1/2 EDG CWP Cubicle Cooler	Running	Normal Feed = 184C @ Swgr 18 Alt Feed = 284C @ Swgr 28 Normally Closed Manual Valve
2-3999-89	U-1/2 EDG CWP To U-2 ECCS Room Coolers	Closed	
DPT 1-1001-81A	U-1 RHR Minimum Flow Transmitter	Available	
FI 1-3941-28	U-1 ECCS Room Coolers Flow Indicator	Available	Local Indicator
FI 1/2-3941-27	U-1/2 EDGCW Pump Flow	Available	Local Indicator
MO 1-0202-5A	U-1 Recirc Pump 1A Discharge Valve	Closed	480V MCC 18/19-5 Cub B2
MO 1-1001-16A	U-1 RHR HTX Bypass Valve	Throttled	480V MCC 18-1B Cub C3
MO 1-1001-18A	U-1 RHR Min Flow Valve	Available	208V MCC 18-1A-1 Cub C3
MO 1-1001-19A	U-1 RHR Loop Cross-Tie Valve	Closed	Cold shutdown only
MO 1-1001-23A	U-1 RHR Drywell Spray Valve	Closed	480V MCC 18-1B Cub B1
MO 1-1001-23B	U-1 RHR Drywell Spray Valve	Closed	480V MCC 19-4 Cub B1
MO 1-1001-26A	U-1 RHR Drywell Spray Valve	Closed	480V MCC 18-1B Cub A1
MO 1-1001-26B	U-1 RHR Drywell Spray Valve	Closed	480V MCC 19-4 Cub A1
MO 1-1001-28A	U-1 RHR Vessel Injection Valve	Available	480V MCC 18/19-5 Cub C1
MO 1-1001-29A	U-1 RHR Vessel Injection Valve	Available	480V MCC 18/19-5 Cub B4
MO 1-1001-34A	U-1 RHR Torus Injection Valve	Available	480V MCC 18-1B Cub C1
MO 1-1001-36A	U-1 RHR Torus Injection Valve	Available	480V MCC 18-1B Cub D1
MO 1-1001-43A	U-1 RHR Shutdown Cooling Suction Valve	Available	480V MCC 18-1B Cub B3
MO 1-1001-43B	U-1 RHR Shutdown Cooling Suction Valve	Available	480V MCC 18-1B Cub D4
MO 1-1001-47	U-1 RHR Shutdown Cooling Suction Valve	Available	250V DC MCC 1A Cub J01
MO 1-1001-50	U-1 RHR Shutdown Cooling Suction Valve	Available	480V MCC 18-1B Cub C2
MO 1-1001-7A	U-1 RHR Torus Suction Valve	Available	480V MCC 18-1B Cub D3
MO 1-1001-7B	U-1 RHR Torus Suction Valve	Available	480V MCC 18-1B Cub A3
PI 1-1001-71A	U-1 RHR A Pump Discharge Pressure	Available	Local Indicator @ Inst Rack 2201-59A
MO 1-1001-20	U-1 RHR Sys to Radwaste Valve	Closed	Normally Closed
MO 2-1001-21	U-1 RHR Sys to Radwaste Valve	Closed	Normally Closed
PI 1-1001-71B	U-1 RHR B Pump Discharge Pressure	Available	Local Indicator @ Inst Rack 2201-59A
TS 1-5703-181	U-1 RHR Air Handling Unit Control	Available	
U1D1LPCI-AUTO	U-1 DIV I RHR LPCI Initiation Logic		
U1RHR1ALOS-TRIP	U-1 DIV I RHR Pump 1A Loss of Suction Trip Logic		

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Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists

**U1 RHR DIV 1
Equipment**
U1RHR1BLOS-TRIP

Function	Position	Comment
U-1 DIV I RHR Pump 1B Loss of Suction Trip Logic		

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**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

U1 RHR DIV 2

Equipment	Function	Position	Comment
1-1001-141C	1D RHR Pump Min Flow SV	Closed	
1-1001-141C	1C RHR Pump Min Flow SV	Closed	
1-1002C	U-1 RHR Pump C	Running	4kV SWGR 14-1 Bkr 1428
1-1002D	U-1 RHR Pump D	Running	4kV SWGR 14-1 Bkr 1424
1-1003B	U-1 RHR B Heat Exchanger	Available	
1-3903	U-1 DG Cooling Water Pump	Running	Normal Feed = 196A @ Swgr 19 Alt Feed = 295D @ Swgr 29
1-5746B	U-1 RHR Room Cooler 1B	Running	Normal Feed - 480V MCC 19-1A Cub H1 Alt Feed = 480V MCC 29-1 Cub G5
1-5749A	U-1 EDG CWP Cubicle Cooler	Running	
1-5749B	U-1 EDG CWP Cubicle Cooler	Running	
1/2-2001-82	U-1/2 Torus-Cond X-Tie To RDT	Closed	Normally Closed Manual Valve
½-3903	U-1/2 DG Cooling Water Pump	Running	Normal Feed - 480V SWGR 18 Compt 184C Alt Feed = 480V SWGR 28 Compt 284C
1/2-3999-89	U-1/2 EDG CWP To U-1 ECCS Room Coolers	Open	Normally Closed Manual Valve
1/2-5749A	U-1/2 EDG CWP Cubicle Cooler	Running	Normal Feed = 184C @ Swgr 18 Alt Feed = 284C @ Swgr 28
1/2-5749B	U-1/2 EDG CWP Cubicle Cooler	Running	Normal Feed = 184C @ Swgr 18 Alt Feed = 284C @ Swgr 28
2-3999-89	U-1/2 EDG CWP To U-2 ECCS Room Coolers	Closed	Normally Closed Manual Valve
DPT 1-1001-81B	U-1 RHR Minimum Flow Transmitter	Available	
FI 1-3941-28	U-1 ECCS Room Coolers Flow Indicator	Available	Local Indicator
FI ½-3941-27	U-1/2 EDGCW Pump Flow	Available	Local Indicator
MO 1-0202-5B	U-1 Recirc Pump 1B Discharge Valve	Closed	480V MCC 18/19-5 Cub E2
MO 1-1001-16B	U-1 RHR HTX Bypass Valve	Throttled	480V MCC 19-4 Cub A4
MO 1-1001-18B	U-1 RHR Min Flow Valve	Available	208V MCC 19-1-1 Cub B1
MO 1-1001-19B	U-1 RHR Loop Cross-Tie Valve	Closed	Cold shutdown only
MO 1-1001-23A	U-1 RHR Drywell Spray Valve	Closed	480V MCC 18-1B Cub B1
MO 1-1001-23B	U-1 RHR Drywell Spray Valve	Closed	480V MCC 19-4 Cub B1
MO 1-1001-26A	U-1 RHR Drywell Spray Valve	Closed	480V MCC 18-1B Cub A1
MO 1-1001-26B	U-1 RHR Drywell Spray Valve	Closed	480V MCC 19-4 Cub A1
MO 1-1001-28B	U-1 RHR Vessel Injection Valve	Available	480V MCC 18/19-5 Cub F1
MO 1-1001-29B	U-1 RHR Vessel Injection Valve	Available	480V MCC 18/19-5 Cub E4
MO 1-1001-34B	U-1 RHR Torus Injection Valve	Available	480V MCC 19-4 Cub C1
MO 1-1001-36B	U-1 RHR Torus Injection Valve	Available	480V MCC 19-4 Cub D1
MO 1-1001-43C	U-1 RHR Shutdown Cooling Suction Valve	Available	480V MCC 19-4 Cub B4
MO 1-1001-43D	U-1 RHR Shutdown Cooling Suction Valve	Available	480V MCC 19-4 Cub D2
MO 1-1001-47	U-1 RHR Shutdown Cooling Suction Valve	Available	250V DC MCC 1A Cub J01
MO 1-1001-50	U-1 RHR Shutdown Cooling Suction Valve	Available	480V MCC 18-1B Cub C2
MO 1-1001-7C	U-1 RHR Torus Suction Valve	Available	480V MCC 19-4 Cub B3
MO 1-1001-7D	U-1 RHR Torus Suction Valve	Available	480V MCC 19-4 Cub C3
PI 1-1001-71C	U-1 RHR C Pump Discharge Pressure	Available	Local Indicator @ Inst Rack 2201-59B
MO 1-1001-20	U-1 RHR Sys to Radwaste Valve	Closed	Normally Closed
MO 1-1001-21	U-1 RHR Sys to Radwaste Valve	Closed	Normally Closed
PI 1-1001-71D	U-1 RHR D Pump Discharge Pressure	Available	Local Indicator @ Inst Rack 2201-59B
TS 1-5703-180	U-1 RHR Air Handling Unit Control	Available	

Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists

U1 RHR DIV 2

Equipment

U1D2LPCI-AUTO

U1RHR1CLOS-TRIP

U1RHR1DLOS-TRIP

Function

U-1 DIV II RHR LPCI Initiation Logic

U-1 DIV II RHR Pump 1C Loss of Suction
Trip Logic

U-1 DIV II RHR Pump 1D Loss of Suction
Trip Logic

Position Comment

Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists

**U1 RHRSW DIV 1
Equipment**

Equipment	Function	Position	Comments
1-1001-65A	U-1 RHRSW Pump A	Running	Feed = 1311 @ Bus 13
1-1001-65B	U-1 RHRSW Pump B	Running	Feed = 1308 @ Bus 13
1-1003A	U-1 RHR A Heat Exchanger	Available	
1-5745A	U-1 RHRSW Room Cooler 1A	Running	Feed = F1, F2, F3, F4 @ MCC 18-2
1-5745B	U-1 RHRSW Room Cooler 1B	Running	Feed = G2, G3, G4, G5 @ MCC 18-2
1/2-1099-1A	U-1/2 RHRSW A-Loop Unit Crosstie Valve	Available	Locked Closed Manual Valve
2-1001-65A	U-2 RHRSW Pump 2A	Running	Feed 2305 @ Bus 23
2-1001-65B	U-2 RHRSW Pump 2B	Running	Feed 2309 @ Bus 23
2-5745A	U-2 RHRSW Room Cooler 2A	Running	Feed = F1, F2, F3, F4 @ MCC 28-2
2-5745B	U-2 RHRSW Room Cooler 2B	Running	Feed = G2, G3, G4, G5 @ MCC 28-2
FI 1-1040-1A	U-1 RHRSW Flow Indication DIV I	Available	Pnl 901-3
FI 1-1041-12A	U-1 RHRSW A-Loop Flow Indicator	Available	Local Indicator
MO 1-1001-185A	U-1 RHRSW 1A HX Flow Reverse	Available	Feed=H2 @ 18-1A
MO 1-1001-186A	U-1 RHRSW 1A HX Flow Reverse	Available	Feed=B2 @ 18-1A
MO 1-1001-187A	U-1 RHRSW 1A HX Flow Reverse	Available	Feed=G1 @ 18-1A
MO 1-1001-4A	U-1 RHRSW 1A HX Flow Reverse	Available	Feed=A2 @ 18-1A
MO 1-1001-5A	U-1 RHRSW 1A HX Throttle Valve	Throttled	Feed=B4 @ 18-1B
MO 2-1001-5A	U-2 RHRSW 2A HX Throttle Valve	Throttled	Feed=B4 @ 28-1B

**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

U1 RHRSW DIV 2

Equipment

Equipment	Function	Position	Comment
1-1001-65C	U-1 RHRSW Pump C	Running	Feed = 1409 @ Bus 14
1-1001-65D	U-1 RHRSW Pump D	Running	Feed = 1413 @ Bus 14
1-1003B	U-1 RHR B Heat Exchanger	Available	
1-5745C	U-1 RHRSW Room Cooler 1C	Running	Feed = E1, E2, E3, E4 @ MCC 19-2
1-5745D	U-1 RHRSW Room Cooler 1D	Running	Feed = F2, F3, F4, F5 @ MCC 19-2
1/2-1099-1B	U-1/2 RHRSW B-Loop Unit Crosstie Valve	Available	Locked Closed Manual Valve
2-1001-65C	U-2 RHRSW Pump 2C	Running	Feed = 2402 @ Bus 24
2-1001-65D	U-2 RHRSW Pump 2D	Running	Feed = 2406 @ Bus 24
2-5745C	U-2 RHRSW Room Cooler 2C	Running	Feed = E1, E2, E3, E4 @ MCC 29-2
2-5745D	U-2 RHRSW Room Cooler 2D	Running	Feed = F2, F3, F4, F5 @ MCC 29-2
FI 1-1040-1B	U-1 RHRSW Flow Indication DIV II	Available	Pnl 901-3
FI 1-1041-12B	U-1 RHRSW B-Loop Flow Indicator	Available	Local Indicator
MO 1-1001-185B	U-1 RHRSW 1B HX Flow Reverse	Available	Feed = E2 @ MCC 19-1
MO 1-1001-186B	U-1 RHRSW 1B HX Flow Reverse	Available	Feed = C2 @ MCC 19-1
MO 1-1001-187B	U-1 RHRSW 1B HX Flow Reverse	Available	Feed = F3 @ MCC 19-1
MO 1-1001-4B	U-1 RHRSW 1B HX Flow Reverse	Available	Feed = B3 @ MCC 19-1
MO 1-1001-5B	U-1 RHRSW 1B HX Throttle Valve	Throttled	Feed = D3 @ MCC 19-4
MO 2-1001-5B	U-2 RHRSW 2B HX Throttle Valve	Throttled	Feed = C3 @ MCC 29-4

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**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

U1 SBO Diesel Generator

Equipment	Function	Position	Comment
1-4680-21A	U-1 SBO DG Starting Air Receiver A	Available	
1-4680-21B	U-1 SBO DG Starting Air Receiver A	Available	
1-5280-202	U-1 SBO DG Fuel Oil Transfer Pump	Available	Feed = B3 @ MCC 65-1
1-5280-204	U-1 SBO DG Fuel Oil Storage Tank	Available	
1-5790-6001	U-1 SBO DG Diesel Exhaust Fan	Available	Feed = J3/J4 @ MCC 65-1
1-5790-6002	U-1 SBO DG Diesel Exhaust Fan	Available	Feed = G1 @ MCC 65-1
1-5790-6003	U-1 SBO DG Diesel Exhaust Fan	Available	Feed = H1 @ MCC 65-1
1-5790-6004	U-1 SBO DG Elec Equip Rm Exhaust Fan	Available	Feed = K3/K4 @ MCC 65-1
1-5790-6005	U-1 SBO DG Elec Equip Rm Exhaust Fan	Available	Feed = L1 @ MCC 65-1
1-5790-6006	U-1 SBO DG Day Tank Exhaust Fan	Running	Feed = Brkr 7 @ Dist Pnl 65-1-1 via A2 @ MCC 65-1
1-5790-6007	U-1 SBO DG Battery Room Exhaust Fan	Running	Feed = Brkr 8 @ Dist Pnl 65-1-1 via A2 @ MCC 65-1
1-5790-6008	U-1 SBO DG Battery Room AHU	Available	Feed = G4 @ MCC 65-1
1-5790-6009	U-1 SBO DG Battery Room AHU Compressor	Available	Feed = K1 @ MCC 65-1
1-6620-1	U-1 SBO DG Generator	Available	
1-6620-204A	U-1 SBO DG #2 Radiator Fan	Running	Feed = C1 @ MCC 65-1
1-6620-204B	U-1 SBO DG #2 Radiator Fan	Running	Feed = E1 @ MCC 65-1
1-6620-206A	U-1 SBO DG Jacket Water Booster Pump	Running	Feed = E2 @ MCC 65-1
1-6620-206B	U-1 SBO DG Jacket Water Booster Pump	Running	Feed = D2 @ MCC 65-1
1-6620-214A	U-1 SBO DG #1 Radiator Fan	Running	Feed = B1 @ MCC 65-1
1-6620-214B	U-1 SBO DG #1 Radiator Fan	Running	Feed = D1 @ MCC 65-1
1-8330	U-1 SBO DG Battery Charger	Available	
1/2-5280-200	U-1(2) SBO Fuel Oil Storage Tank	Available	
LI 1-5280-202	U-1 SBO DG Day Tank Level Gauge	Available	
MO 1-5790-6019	U-1 SBO DG Discharge Damper	Available	
MO 1-5790-6020	U-1 SBO DG Discharge Damper	Available	
MO 1-5790-6021	U-1 SBO DG Discharge Damper	Available	
MO 1-5790-6022	U-1 SBO DG Discharge Damper	Available	
MO 1-5790-6023	U-1 SBO DG Discharge Damper	Available	
SO 1-4689-40A/B	U-1 SBO DG Starting Air Stop Valve	Available	
SO 1-4689-41A/B	U-1 SBO DG Starting Air Stop Valve	Available	
SO 1-5790-6015 A thru H	U-1 SBO DG Intake Damper	Available	
SO 1-5790-6016A & D	U-1 SBO DG Intake Damper	Available	
SO 1-5790-6016B & C	U-1 SBO DG Intake Damper	Available	
SO 1-5790-6017A	U-1 SBO DG Intake Damper	Available	
SO 1-5790-6017B & C	U-1 SBO DG Intake Damper	Available	
SO 1-5790-6018	U-1 SBO DG Intake Damper	Available	

**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

U1 Secure Feedwater

Equipment	Function	Position	Comment
MO 1-3205A	U-1 FW Reg. Isol. Valve	Closed	Close from Pnl 901-6
MO 1-3205B	U-1 FW Reg. Isol. Valve	Closed	Close from Pnl 901-6
CKT BKR 3-4	345KV Switchyard Breaker for T-12	Open	Open from Pnl 912-2
CKT BKR 4-6	345KV Switchyard Breaker for T-12	Open	Open from Pnl 912-2
1102	U-1 Reactor Feed Pump 1C	Open	Pull to Lock from Pnl 901-6
1105	U-1 Reactor Feed Pump 1A	Open	Pull to Lock from Pnl 901-6
1201	U-1 Reactor Feed Pump 1B	Open	Pull to Lock from Pnl 901-6
1203	U-1 Reactor Feed Pump 1C	Open	Pull to Lock from Pnl 901-6
1301	TURB BLDG 480V SWGR 15		1-6800-15
1302	COND & BOOSTER PUMP 1A		1-3302A
1307	COND & BOOSTER PUMP 1B		1-3302B
1309	RESERVE FEED XFRMR 12 (RAT)		1-6703-13
1402	COND & BOOSTER PUMP 1D		1-3302D
1407	COND & BOOSTER PUMP 1C		1-3302C
152B	Main Feed from BUS 13		
155A	Tie to 480V MCC 15-2		

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**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

U1/2 Diesel Generator

Equipment	Function	Position	Comment
1/2-3903	U-1/2 DG Cooling Water Pump	Running	Normal Feed = 184C @ Swgr 18 Alt Feed = 284C @ Swgr 28
1/2-4600A	U-1/2 DG Air Receiver Tank	Available	
1/2-4600B	U-1/2 DG Air Receiver Tank	Available	
1/2-4600C	U-1/2 DG Air Receiver Tank	Available	
1/2-4600D	U-1/2 DG Air Receiver Tank	Available	
1/2-5201	U-1/2 DG Diesel Fuel Oil Storage Tank	Available	
1/2-5202	U-1/2 DG Diesel Fuel Oil Day Tank	Available	
1/2-5203	U-1/2 DG Diesel Fuel Oil Transfer Pump	Available	Normal Feed = E1 @ MCC 18-1A Alt Feed = A1 @ MCC 28-1A
1/2-5727	U-1/2 DG Room Vent Fan	Running	Normal Feed = G2 @ MCC 18-1A Alt Feed = A2 @ MCC 28-1A
1/2-5749A	U-1/2 EDG CWP Cubicle Cooler	Running	Normal Feed = 184C @ Swgr 18 Alt Feed = 284C @ Swgr 28
1/2-5749B	U-1/2 EDG CWP Cubicle Cooler	Running	Normal Feed = 184C @ Swgr 18 Alt Feed = 284C @ Swgr 28
1/2-6601	U-1/2 DG Diesel Engine	Running	All mechanical components included
AO 1/2-5772-86 East	U-1/2 DG Room Supply Isolation Damper	Open	
AO 1/2-5772-86 West	U-1/2 DG Room Supply Isolation Damper	Open	
AO 1/2-5772-87 Bottom	U-1/2 DG Room Exhaust Isolation Damper	Open	
AO 1/2-5772-87 Top	U-1/2 DG Room Exhaust Isolation Damper	Open	
AO 1/2-5772-88	U-1/2 DG Inlet Vane Control Damper	Available	
FI 1/2-3941-27	U-1/2 EDG CWP Flow Indicator		
LG 1/2-5241-14	U-1/2 DG Day Tank Local Level Gauge	Available	
LS 1/2-5241-5	U-1/2 DG Day Tank Level	Available	Field Device
SO 1/2-4699-310	U-1/2 DG Air Start Solenoid	Open	
SO 1/2-5799-553	U-1/2 DG Ventilation Solenoid Valve	Available	
U1/2EDG-U1AUTO	U1/2 EDG Auto start logic from Unit 1		
U1/2EDG-U2AUTO	U1/2 EDG Auto start logic from Unit 2		
U1/2EDGAUXSVCSXFER	U1/2 EDG Auxiliary Services Transfer		

**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

**U2 Diesel Generator
Equipment**

Equipment	Function	Position	Comment
2-4600A	U-2 DG Cooling Water Pump	Running	Normal Feed = 296A @ Swgr 29 Alt Feed = 195D @ Swgr 19
2-4600A	U-2 DG Air Receiver Tank	Available	
2-4600B	U-2 DG Air Receiver Tank	Available	
2-4600C	U-2 DG Air Receiver Tank	Available	
2-4600D	U-2 DG Air Receiver Tank	Available	
2-5201	U-2 DG Diesel Fuel Oil Storage Tank	Available	
2-5202	U-2 DG Diesel Fuel Oil Day Tank	Available	
2-5203	U-2 DG Fuel Oil Transfer Pump	Available	Normal Feed = B2 @ MCC 29-1 Alt Feed = B5 @ MCC 19-1
2-5727	U-2 DG Room Vent Fan	Running	Normal Feed = G1 @ MCC 29-1
2-5749A	U-2 EDG CWP Cubicle Cooler	Running	Normal Feed = E5 @ MCC 29-2 Alt Feed = B1 @ MCC 19-2
2-5749B	U-2 EDG CWP Cubicle Cooler	Running	Normal Feed = F1 @ MCC 29-2 Alt Feed = B1 @ MCC 19-2
2-6601	U-2 DG Diesel Engine	Running	All mechanical components included
AO 2-5772-86A	U-2 DG Room Exhaust Isolation Damper	Open	
AO 2-5772-86B	U-2 DG Room Exhaust Isolation Damper	Open	
AO 2-5772-87 East	U-2 DG Room Supply Isolation Damper	Open	
AO 2-5772-87 West	U-2 DG Room Supply Isolation Damper	Open	
AO 2-5772-94	U-2 DG Room Outside Air Intake Damper	Available	
AO 2-5772-95	U-2 DG Room Modulation Damper	Available	
AO 2-5772-96	U-2 DG Room Modulation Damper	Available	
FI 1/2-3941-26	U-2 EDG CWP Flow Indicator		
LG 2-5241-13	U-2 DG Day Tank Local Level Gauge	Available	
LS 2-5241-3	U-2 DG Day Tank Level	Available	
SO 2-4699-310	U-2 DG Air Start Solenoid	Available	Captured on the ama;usos fpr breaker 2421
SO 2-5772-89	U-2 DG Normal Air Supply To Dampers	Closed	
SO 2-5799-553	U-2 DG Ventilation Solenoid Valve	Available	
U2EDG-AUTO	U-2 EDG Automatic Start Logic		
2-5299-181	U-2 DG Fuel Oil Transfer to Day Tank Isolation Valve	Open	

Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists

U2 INSTRUMENTS

Equipment	Function	Position	Comment
FR 2-1040-7	U-2 RHR Div I or Div II Total Flow	Available	
FT 2-1049A	U-2 RHR Flow Transmitter DIV I	Available	
FT 2-1049B	U-2 RHR Flow Transmitter DIV II	Available	
LI 2-0263-101	U-2 Reactor Level Indicator DIV I	Available	
LI 2-0263-106A	U-2 Reactor Level Indicator DIV I	Available	
LI 2-0263-106B	U-2 Reactor Level Indicator DIV II	Available	
LI 2-1640-10A	U-2 Torus Level DIV I	Available	
LI 2-1640-10B	U-2 Torus Level DIV II	Available	
PI 2-0263-156	U-2 Reactor Pressure Indicator DIV I	Available	
TR 2-1640-9	U-2 Torus Temperature DIV I and Div II	Available	

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**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

**U2 Off-site Power
Equipment**

	Function	Position	Comment
21	4kV SWGR 21		
22	4kV SWGR 22		
2204	4kV SWGR 22 Reserve Feed Breaker		
2301	TIE TO 4160 V SWGR 23-1 (ESS DIV I)		2-6705-23-1
2302	CONTROL ROD DRIVE FEED PUMP 2A		2-302-3A
2303	CIRC WTR PUMP 2A		2-4401A
2304	TIE TO MAIN FEED XFRMR 22 (RAT)		2-6703-23
2305	RHRWS PUMP 2A		2-1001-65A
2306	COND & BOOSTER PUMP 2A		2-3302A
2307	CIRC WTR PUMP 2B		2-4401B
2308	SERVICE WATER PUMP 2A		2-3901A
2309	RHRWS PUMP 2B		2-1001-65B
2310	TIE TO RESERVE FEED XFRMR 21 (UAT)		2-6703-23
2311	COND & BOOSTER PUMP 2B		2-3302B
2312	TURB BLDG 480V SWGR 25		2-6800-25
2313	480V RADWASTE BLDG TRANS 2A		2-7800-2A-1
2314	ILRT COMPRESSOR		
2401	TURB BLDG 480V SWGR 26		2-7800-26
2402	RHRWS PUMP 2C		2-1001-65C
2403	MAIN FEED XFRMR 21 (UAT)		2-6704-24
2404	CIRC WTR PUMP 2C		2-4401C
2405	COND & BOOSTER PUMP 2C		2-3401C
2406	RHRWS PUMP 2D		2-1001-65D
2407	SERVICE WATER PUMP 2B		2-3901B
2408	COND & BOOSTER PUMP 2D		2-3401D
2409	SERVICE WATER PUMP 1/2		1/2-3901
2410	RESERVE FEED XFRMR 22 (RAT)		2-6704-24
2411	TURB BLDG 480V SWGR 27		2-7800-27-1
2412	CONTROL ROD DRIVE FEED PUMP 2B		2-302-3B
2413	TIE TO BUS 24-1		2-6706-24-1
2414	WELL WATER PUMP #5		1/2-4200-5
2415	SPARE		
CKT BKR 9-10	345KV Switchyard Breaker for T-22	Closed	

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**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

**U2 RCIC
Equipment**

Equipment	Function	Position	Comment
1-1304	U-1 RCIC Condensate Pump		Alt Feed & Control for 2-1304 from S01 @250Vdc MCC 1B
1-1305	U-1 RCIC Vacuum Pump		Alt Feed & Control for 2-1305 from V02@250Vdc MCC 1B
1-2301-22	U-1 HPCI Suction Isolation Valve	Closed	
1-2301-80	U-1 HPCI Turbine Cooling Water Pump Suction Isolation Valve	Closed	
1/2-3303A	U-1/2 "A" CCST	Available	
1/2-3303B	U-1/2 "B" CCST	Available	
1/2-3903	U-1/2 DG Cooling Water Pump	Available	Normal Feed = 184C @ Swgr 18 Alt Feed = 284C @ Swgr 18
1/2-5749A	U-1/2 EDG CWP Cubicle Cooler	Available	Normal Feed = 184C @ Swgr 18 Alt Feed = 284C @ Swgr 28
1/2-5749B	U-1/2 EDG CWP Cubicle Cooler	Available	Normal Feed = 184C @ Swgr 18 Alt Feed = 284C @ Swgr 28 Manual Check Valve
2-0220-59A	U-2 RCIC System Boundry On Feed Line	Closed	
2-1301	U-2 RCIC EGM Control Box	Available	
2-1302	U-2 RCIC Pump	Running	
2-1303	U-2 RCIC Turbine	Running	
2-1303B	U-2 RCIC Trip Throttle Valve	Open	
2-1304	U-2 RCIC Condensate Pump	Running	Feed = S01 @ 250Vdc MCC 2B
2-1305	U-2 RCIC Vacuum Pump	Running	Feed = N01 @ 250Vdc MCC 2B
2-1306	U-2 RCIC Vacuum Tank	Available	
2-2301-22	U-2 HPCI Suction Isolation Valve	Closed	
2-2301-80	U-2 HPCI Turbine Cooling Water Pump Suction Isolation Valve	Closed	
2-3903	U-2 DG Cooling Water Pump	Running	Normal Feed = 296A @ Swgr 29 Alt Feed = 195D @ Swgr 19
2-3999-89	U-1/2 EDG CWP To U-2 ECCS Room Coolers	Available	
2-5748B	U-2 RCIC Room Cooler (C/S AHU 2B)	Running	
2-5749A	U-2 EDG CWP Cubicle Cooler	Running	Normal Feed = E5 @ MCC 29-2 At Feed = B1 @ MCC 19-2
2-5749B	U-2 EDG CWP Cubicle Cooler	Running	Normal Feed = F1 @ MCC 29-2 Alt Feed = B1 @ MCC 19-2
AO 2-1301-32	U-2 RCIC Steam Drain Trap Bypass Valve	Available	125V DC MCC 1A-2
AO 2-1301-34	U-2 RCIC Steam Line Drain Valve	Closed	Feed = 125Vdc @ MCC 2A
AO 2-1301-35	U-2 RCIC Steam Line Drain Valve	Closed	Feed = 125Vdc @ MCC 2A
FI 2-3941-28	U-2 ECCS Room Coolers Flow Indicator	Available	Local Indication
FIC 2-1340-1	U-2 RCIC Flow Controller (902-4)	Available	
FIS 2-1360-7	U-2 RCIC Minimum Flow Control	Available	
FT 2-1360-4	U-2 RCIC Pump Discharge Flow Transmitter	Available	
HO 2-1303A	U-2 RCIC Governor Valve	Open	
LI 1/2-3340-3	U-1/2 "A" CCST Level Indication (901-6)	Available	Transducer Power Supply Cab 941-28
LI 1/2-3340-4	U-1/2 "B" CCST Level Indication (901-6)	Available	Transducer Power Supply Cab 941-28
LI 1/2-3341-77A	U-1/2 "A" CCST Level Indicator	Available	Local Indication
LI 1/2-3341-77B	U-1/2 "B" CCST Level Indicator	Available	Local Indication
LS 2-1301-101	U-2 RCIC Condensate Pump Control	Available	
LT 1/2-3341-76A	U-1/2 "A" CCST Level Transmitter	Available	Transducer Power Supply Cab 941-28
LT 1/2-3341-76B	U-1/2 "B" CCST Level Transmitter	Available	Transducer Power Supply Cab 941-28
MO 1-1301-22	U-1 RCIC CCST Suction Valve	Closed	

**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

**U2 RCIC
Equipment**

Equipment	Function	Position	Comment
MO 1-1301-60.P	U-1 RCIC Min Flow Valve	Closed	
MO 1-1301-62.P	U-1 RCIC Cooling Water Isolation Valve	Closed	
MO 1-2301-14.P	U-1 HPCI Min Flow Valve	Closed	
MO 1-2301-48	U-1 HPCI Cooling Water Return Valve	Closed	250V DC MCC 1A Cub I01
MO 1-2301-6	U-1 HPCI CCST Suction Valve	Closed	250V DC MCC 1A Cub K02
MO 2-1301-16.P	U-2 RCIC Inboard Steam Isolation Valve	Open	Feed = B1 @ MCC 28-1A-1 Alt Feed = 120/208 VAC DIST PNL 75-1-1 CKT 4
MO 2-1301-17.P	U-2 RCIC Outboard Steam Isolation Valve	Open	Feed = O02 250Vdc MCC 2B
MO 2-1301-22	U-2 RCIC CCST Suction Valve	Available	Feed = N02 250Vdc MCC 2B
MO 2-1301-25	U-2 RCIC Torus Suction Valve	Available	Feed = P02 250Vdc MCC 2B
MO 2-1301-26	U-2 RCIC Torus Suction Valve	Available	Feed = U02 250Vdc MCC 2B
MO 2-1301-48	U-2 RCIC Injection Valve	Open	Feed = M02 250Vdc MCC 2B
MO 2-1301-49	U-2 RCIC Injection Valve	Open	Feed = Q02 250Vdc MCC 2B
MO 2-1301-53	U-2 RCIC Test Return Valve	Closed	Feed = P01 250Vdc MCC 2B
MO 2-1301-60	U-2 RCIC Min Flow Valve	Available	Feed = T01 250Vdc MCC 2B
MO 2-1301-61	U-2 RCIC Steam Supply Valve	Open	Feed = R01 250Vdc MCC 2B
MO 2-1301-62	U-2 RCIC Lube Oil Cooler Supply Valve	Open	Feed = O01 250Vdc MCC 2B
MO 2-2301-14	U-2 HPCI Min Flow Valve	Closed	
MO 2-2301-48	U-2 HPCI Cooling Water Return Valve	Closed	
MO 2-2301-6	U-2 HPCI CCST Suction Valve	Available	
MO 2-2301-6.P	U-2 HPCI CCST Suction Valve	Open	
FI 2-1360-30	U-2 RCIC Pump Flow	Available	Local Indication
PI 2-1360-25	U-2 RCIC Turbine Exhaust Pressure	Available	Local Indication
PI 2-1360-5	U-2 RCIC Pump Discharge Pressure	Available	2202-58 Rack
PI 2-2381	U-1/2 CCST Local Level Indicator	Available	
TS 1-5703-178	U-2 RCIC Room Cooler Control	Available	
U2RCIC-ISOLATION	U-2 RCIC Automatic Isolation Logic		
U2RCIC-MAN	U-2 RCIC System Manual Initiation		

**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

**U2 Reactor Inventory
Equipment**

Equipment	Function	Position	Comment
2-0220-58A	U-2 Reactor Feed Line Check Valve	Closed	High/low pressure interface
2-0220-58B	U-2 Reactor Feed Line Check Valve	Closed	High/low pressure interface
2-2308	U-2 HPCI Aux Oil Pump		
AO 2-0203-1A	U-2 A MSIV Inboard	Closed	Close on Panel 902-3
AO 2-0203-1B	U-2 B MSIV Inboard	Closed	Close on Panel 902-3
AO 2-0203-1C	U-2 C MSIV Inboard	Closed	Close on Panel 902-3
AO 2-0203-1D	U-2 D MSIV Inboard	Closed	Close on Panel 902-3
AO 2-0203-2A	U-2 A MSIV Outboard	Closed	Close on Panel 902-3
AO 2-0203-2B	U-2 B MSIV Outboard	Closed	Close on Panel 902-3
AO 2-0203-2C	U-2 C MSIV Outboard	Closed	Close on Panel 902-3
AO 2-0203-2D	U-2 D MSIV Outboard	Closed	Close on Panel 902-3
AO 2-0220-44	U-2 Recirc Line Sample Valve	Closed	Close from Pnl 902-4
AO 2-0220-45	U-2 Recirc Line Sample Valve	Closed	Close from Pnl 902-4
AO 2-0220-46	U-2 Rx Head Vent	Closed	Close from Pnl 902-4
AO 2-0220-47	U-2 Rx Head Vent	Closed	Close from Pnl 902-4
AO 2-0302-21A	U-2 SDV Vent Valve	Closed	Close from scram signal
AO 2-0302-21B	U-2 SDV Vent Valve	Closed	Close from scram signal
AO 2-0302-21C	U-2 SDV Vent Valve	Closed	Close from scram signal
AO 2-0302-21D	U-2 SDV Vent Valve	Closed	Close from scram signal
AO 2-0302-22A	U-2 SDV Drain Valve	Closed	Close from scram signal
AO 2-0302-22B	U-2 SDV Drain Valve	Closed	Close from scram signal
AO 2-0302-22C	U-2 SDV Drain Valve	Closed	Close from scram signal
AO 2-0302-22D	U-2 SDV Drain Valve	Closed	Close from scram signal
AO 2-1301-32	U-2 RCIC Steam Drain Trap Bypass Valve	Closed	125V DC MCC 1A-2
AO 2-1301-34	U-2 RCIC Steam Line Drain Valve	Closed	Feed = 125Vdc @ MCC 2A
AO 2-1301-35	U-2 RCIC Steam Line Drain Valve	Closed	Feed = 125Vdc @ MCC 2A
AO 2-2301-29	U-2 HPCI Steam Leak-off Drain To Condenser	Closed	125V DC Bus 2B-1
AO 2-2301-30	U-2 HPCI Steam Leak-off Drain To Condenser	Closed	125V DC Bus 2B-1
FCV 2-1239	U-2 Reactor Water Cleanup (RWCU) Flow Control Valve	Closed	
HO 2-2317	U-2 HPCI Turbine Stop Valve	Closed	
MO 2-0220-1	U-2 Inboard Steam Line Drain Iso Valve	Closed	Feed = C3 @ MCC 28-1A
MO 2-0220-2	U-2 Outboard Steam Line Drain Isolation Valve	Closed	Feed = C3 @ MCC 28-1A
MO 2-0220-4	U-2 Steam Line Drain Isolation Valve	Closed	
MO 2-1001-47	U-2 RHR Shutdown Cooling Suction Valve	Closed	250V DC 28-1BB Cub 2
MO 2-1001-50	U-2 RHR Shutdown Cooling Suction Valve	Closed	480 DCC 28-1 Cub C2
MO 2-1201-2	U-2 Reactor Water Cleanup (RWCU) Inboard Isolation Valve	Closed	
MO 2-1201-5	U-2 Reactor Water Cleanup (RWCU) Outboard Isolation Valve	Closed	
MO 2-1201-76	U-2 Blowdown Orifice Bypass (RWCU) Valve	Closed	
MO 2-1201-77	U-2 Reject to WCT Shut-off RWCU Valve	Closed	
MO 2-1201-78	U-2 Reject to Condenser (RWCU) Valve	Closed	
MO 2-1301-16	U-2 RCIC Inboard Steam Isolation Valve	Closed	Feed = B1 @ MCC 28-1A-1
MO 2-1301-17	U-2 RCIC Outboard Steam Isolation Valve	Closed	Feed = O02 @ MCC 2B

**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

**U2 Reactor Inventory
Equipment**

Equipment	Function	Position	Comment
MO 2-1301-61.P	U-2 RCIC Steam Supply Valve	Open	Feed = R01 250Vdc MCC 2B
MO 2-2301-3	U-2 HPCI Steam Supply Valve	Closed	
MO 2-2301-4	U-2 HPCI Inboard Steam Isolation Valve	Closed	Feed = E2 @ MCC 29-1
MO 2-2301-5	U-2 HPCI Outboard Steam Isolation Valve	Closed	Feed = G02 @ MCC 2A
RO 2-2301-63B	U-2 HPCI Steam Line Drain Orifice		
RO 2-2301-63C	U-2 HPCI Steam Line Drain Orifice		
RV2-0203-3A	U-2 Main Steam Relief Valve A	Available	
RV2-0203-3A.P	U-2 Main Steam Relief Valve A	OFF	Close from Pnl 902-3
RV2-0203-3B	U-2 Main Steam Relief Valve B	Available	
RV2-0203-3B.P	U-2 Main Steam Relief Valve B	OFF	Close from Pnl 902-3
RV2-0203-3C	U-2 Main Steam Relief Valve C	Available	
RV2-0203-3C.P	U-2 Main Steam Relief Valve C	OFF	Close from Pnl 902-3
RV2-0203-3D	U-2 Main Steam Relief Valve D	Available	
RV2-0203-3D.P	U-2 Main Steam Relief Valve D	OFF	Close from Pnl 902-3
RV2-0203-3E	U-2 Main Steam Relief Valve E	Available	
RV2-0203-3E.P	U-2 Main Steam Relief Valve E	OFF	Close from Pnl 902-3
U2ADS-AUTO	U-2 ADS Automatic Initiation Logic		
U2HPCI-AUTO	U-2 HPCI Automatic Initiation Logic		
U2RCIC-AUTO	U-2 RCIC Automatic Initiation Logic		

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**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

U2 RHR DIV 1

Equipment	Function	Position	Comment
1/2-2001-82	U-1/2 Torus-Cond X-Tie To RDT	Closed	Normally Closed Manual Valve
1/2-3903	U-1/2 DG Cooling Water Pump	Running	Normal Feed = 480V SWGR 18 Compt 184 Alt Feed = 480V SWGR 28 Compt 284C
1/2-3999-89	U-1/2 EDG CWP To U-1 ECCS Room Coolers	Closed	Normally Closed Manual Valve
1/2-5749A	U-1/2 EDG CWP Cubicle Cooler	Running	Normal Feed = 184C @ Swgr 18 Alt Feed = 284C @ Swgr 28
1/2-5749B	U-1/2 EDG CWP Cubicle Cooler	Running	Normal Feed = 184C @ Swgr 18 Alt Feed = 284C @ Swgr 28
2-1001-141A	2A RHR Pump Min Flow SV	Closed	
2-1001-141B	2B RHR Pump Min Flow SV	Closed	
2-1002A	U-2 RHR Pump A	Running	4kV SWGR 23-1 Bkr 2324
2-1002B	U-2 RHR Pump B	Running	4kV SWGR 23-1 Bkr 2326
2-1003A	U-2 RHR A Heat Exchanger	Available	
2-1003A	U-2 RHR A Heat Exchanger	Available	
2-2301-22	U-2 HPCI Suction Isolation Valve	Closed	
2-2301-80	U-2 HPCI Turbine Cooling Water Pump Suction Isolation Valve	Closed	
2-3903	U-2 DG Cooling Water Pump	Running	Normal Feed = 480V SWGR 29 Compt 296A Alt Feed = 480V SWGR 19 Compt 195D
2-3999-89	U-1/2 EDG CWP To U-2 ECCS Room Coolers	Open	Normally Closed Manual Valve
2-5746A	U-2 RHR Room Cooler 2A	Running	Normal Feed = 480V MCC 28-1A Cub B3 Alt Feed = 480V MCC 18-1A Cub C2
2-5749A	U-2 EDG CWP Cubicle Cooler	Running	Normal Feed = E5 @ MCC 29-2 Alt Feed = B1 @ MCC 19-2
2-5749B	U-2 EDG CWP Cubicle Cooler	Running	Normal Feed = F1 @ MCC 29-2 Alt Feed = B1 @ MCC 19-2
DPT 2-1001-81A	U-2 RHR Minimum Flow Transmitter	Available	
FI 2-3941-28	U-2 ECCS Room Coolers Flow Indicator	Available	Local Indicator
MO 2-0202-5A	U-2 Recirc Pump 1A Discharge Valve	Closed	480V MCC 28/29-5 Cub B2
MO 2-1001-16A	U-2 RHR HTX Bypass Valve	Throttled	480V MCC 28-1B Cub C3
MO 2-1001-18A	U-2 RHR Min Flow Valve	Available	208V MCC 28-1A-1 Cub C3
MO 2-1001-19A	U-2 RHR Loop Cross-Tie Valve	Closed	Cold shutdown only
MO 2-1001-23A	U-2 RHR Drywell Spray Valve	Closed	480V MCC 28-1B Cub B1
MO 2-1001-23B	U-2 RHR Drywell Spray Valve	Closed	
MO 2-1001-26A	U-2 RHR Drywell Spray Valve	Closed	
MO 2-1001-26B	U-2 RHR Drywell Spray Valve	Closed	
MO 2-1001-28A	U-2 RHR Vessel Injection Valve	Available	480V MCC 28/29-5 Cub C1
MO 2-1001-29A	U-2 RHR Vessel Injection Valve	Available	480V MCC 28/29-5 Cub B4
MO 2-1001-34A	U-2 RHR Torus Injection Valve	Available	480V MCC 28-1B Cub C1
MO 2-1001-36A	U-2 RHR Torus Injection Valve	Available	480V MCC 28-1B Cub D1
MO 2-1001-43A	U-2 RHR Shutdown Cooling Suction Valve	Available	480V MCC 28-1B Cub B3
MO 2-1001-43B	U-2 RHR Shutdown Cooling Suction Valve	Available	480V MCC 28-1B Cub D4
MO 2-1001-47	U-2 RHR Shutdown Cooling Suction Valve	Available	250V DC MCC 2A Cub K02
MO 2-1001-50	U-2 RHR Shutdown Cooling Suction Valve	Available	480V MCC 28-1B Cub C2
MO 2-1001-7A	U-2 RHR Torus Suction Valve	Available	480V MCC 28-1B Cub D3
MO 2-1001-7B	U-2 RHR Torus Suction Valve	Available	480V MCC 28-1B Cub A3
PI 2-1001-71A	U-2 RHR A Pump Discharge Pressure	Available	Local Indicator @ Inst Rack 2202-59A
MO 2-1001-20	U-2 RHR Sys to Radwaste Valve	Closed	Normally Closed
MO 2-1001-21	U-2 RHR Sys to Radwaste Valve	Closed	Normally Closed
PI 2-1001-71B	U-2 RHR B Pump Discharge Pressure	Available	Local Indicator @ Inst Rack 2202-59A
TS 2-5703-181	U-2 RHR Air Handling Unit Control	Available	

Table 3.0-1

Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists

U2 RHR DIV 1

Equipment

U2D1LPCI-AUTO
U2RHR2ALOS-TRIP
U2RHR2BLOS-TRIP

Function

U-2 DIV I RHR LPCI Initiation Logic
U-2 DIV I RHR Pump 2A Loss of
Suction Trip Logic
U-2 DIV I RHR Pump 2B Loss of
Suction Trip Logic

Position Comment

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**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

U2 RHR DIV 2

Equipment	Function	Position	Comment
1/2-2001-82	U-1/2 Torus-Cond X-Tie To RDT	Closed	Normally Closed Manual Valve
1/2-3903	U-1/2 DG Cooling Water Pump	Running	480V SWGR 28 Compt 284C (Alt Feed)
1/2-3999-89	U-1/2 EDG CWP To U-1 ECCS Room Coolers	Closed	Normally Closed Manual Valve
1/2-5749A	U-1/2 EDG CWP Cubicle Cooler	Running	Normal Feed = 184C @ Swgr 18 Alt Feed = 284C @ Swgr 28
1/2-5749B	U-1/2 EDG CWP Cubicle Cooler	Running	Normal Feed = 184C @ Swgr 18 Alt Feed = 284C @ Swgr 28
2-1001-141C	2C RHR Pump Min Flow SV	Closed	
2-1001-141C	2C RHR Pump Min Flow SV	Closed	
2-1002C	U-2 RHR Pump C	Running	4kV SWGR 24-1 Bkr 2424
2-1002D	U-2 RHR Pump D	Running	4kV SWGR 24-1 Bkr 2426
2-1003B	U-2 RHR B Heat Exchanger	Available	
2-2301-22	U-2 HPCI Suction Isolation Valve	Closed	
2-2301-80	U-2 HPCI Turbine Cooling Water Pump	Closed	
2-3903	U-2 DG Cooling Water Pump	Running	Normal Feed = 480V SWGR 29 Compt 296A Alt Feed = 480V SWGR 19 Compt 195D
2-3999-89	U-1/2 EDG CWP To U-2 ECCS Room Coolers	Open	Normally Closed Manual Valve
2-5746B	U-2 RHR Room Cooler 2B	Running	Normal Feed = 480V MCC 29-1 Cub F1 Alt Feed = 480V MCC 19-1 Cub G2
2-5749A	U-2 EDG CWP Cubicle Cooler	Running	Normal Feed = E5 @ MCC 29-2 Alt Feed = B1 @ MCC 19-2
2-5749B	U-2 EDG CWP Cubicle Cooler	Running	Normal Feed = F1 @ MCC 29-2 Alt Feed = B1 @ MCC 19-2
DPT 2-1001-81B	U-2 RHR Minimum Flow Transmitter	Available	
FI 2-3941-28	U-2 ECCS Room Coolers Flow Indicator	Available	Local Indicator
MO 2-0202-5B	U-2 Recirc Pump 1B Discharge Valve	Closed	480V MCC 28/29-5 Cub E2
MO 2-1001-16B	U-2 RHR HTX Bypass Valve	Throttled	480V MCC 29-4 Cub D4
MO 2-1001-18B	U-2 RHR Min Flow Valve	Available	208V MCC 29-1-1 Cub B1
MO 2-1001-19B	U-2 RHR Loop Cross-Tie Valve	Closed	Cold shutdown only
MO 2-1001-23A	U-2 RHR Drywell Spray Valve	Closed	480V MCC 28-1B Cub B1
MO 2-1001-23B	U-2 RHR Drywell Spray Valve	Closed	
MO 2-1001-26A	U-2 RHR Drywell Spray Valve	Closed	
MO 2-1001-26B	U-2 RHR Drywell Spray Valve	Closed	
MO 2-1001-28B	U-2 RHR Vessel Injection Valve	Available	480V MCC 28/29-5 Cub F1
MO 2-1001-29B	U-2 RHR Vessel Injection Valve	Available	480V MCC 28/29-5 Cub E4
MO 2-1001-34B	U-2 RHR Torus Injection Valve	Available	480V MCC 29-4 Cub B1
MO 2-1001-36B	U-2 RHR Torus Injection Valve	Available	
MO 2-1001-43C	U-2 RHR Shutdown Cooling Suction Valve	Available	480V MCC 29-4 Cub B4
MO 2-1001-43D	U-2 RHR Shutdown Cooling Suction Valve	Available	480V MCC 29-4 Cub C2
MO 2-1001-47	U-2 RHR Shutdown Cooling Suction Valve	Available	250V DC MCC 2A Cub K02
MO 2-1001-50	U-2 RHR Shutdown Cooling Suction Valve	Available	480V MCC 28-1B Cub C2
MO 2-1001-7C	U-2 RHR Torus Suction Valve	Available	480V MCC 29-4 Cub A3
MO 2-1001-7D	U-2 RHR Torus Suction Valve	Available	480V MCC 29-4 Cub B3
PI 2-1001-71C	U-2 RHR C Pump Discharge Pressure	Available	Local Indicator @ Inst Rack 2202-59B
MO 2-1001-20	U-2 RHR Sys to Radwaste Valve	Closed	Normally Closed
MO 2-1001-21	U-2 RHR Sys to Radwaste Valve	Closed	Normally Closed
PI 2-1001-71D	U-2 RHR D Pump Discharge Pressure	Available	Local Indicator @ Inst Rack 2202-59B

Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists

U2 RHR DIV 2

Equipment

TS 2-5703-180

U2D2LPCI-AUTO

U2RHR2CLOS-TRIP

U2RHR2DLOS-TRIP

Function

U-2 RHR Air Handling Unit Control

U-2 DIV II RHR LPCI Initiation Logic

U-2 DIV II RHR Pump 2C Loss of
Suction Trip Logic

U-2 DIV II RHR Pump 2D Loss of
Suction Trip Logic

Position

Available

Comment

**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

**U2 RHRSW DIV 1
Equipment**

Equipment	Function	Position	Comment
1-1001-65A	U-1 RHRSW Pump A	Running	Feed = 1311 @ Bus 13
1-1001-65B	U-1 RHRSW Pump B	Running	Feed = 1308 @ Bus 13
1-5745A	U-1 RHRSW Room Cooler 1A	Running	Feed = F1, F2, F3, F4 @ MCC 18-2
1-5745B	U-1 RHRSW Room Cooler 1B	Running	Feed = G2, G3, G4, G5 @ MCC 18-2
1/2-1099-1A	U-1/2 RHRSW A-Loop Unit Crosstie Valve	Available	Locked Closed Manual Valve
2-1001-65A	U-2 RHRSW Pump 2A	Running	Feed 2305 @ Bus 23
2-1001-65B	U-2 RHRSW Pump 2B	Running	Feed 2309 @ Bus 23
2-1003A	U-2 RHR A Heat Exchanger	Available	
2-5745A	U-2 RHRSW Room Cooler 2A	Running	Feed = F1, F2, F3, F4 @ MCC 28-2
2-5745B	U-2 RHRSW Room Cooler 2B	Running	Feed = G2, G3, G4, G5 @ MCC 28-2
FI 2-1040-1A	U-2 RHRSW Flow Indication DIV I	Available	Pnl 902-3
FI 2-1041-12A	U-2 RHRSW 2A Flow Indicator	Available	Local Indicator
MO 1-1001-5A	U-1 RHRSW 1A HX Throttle Valve	Throttled	Feed=B4 @ 18-1B
MO 2-1001-185A	U-2 RHRSW 2A HX Flow Reverse	Available	Feed=G2 @ 28-1A
MO 2-1001-186A	U-2 RHRSW 2A HX Flow Reverse	Available	Feed=F1 @ 28-1A
MO 2-1001-187A	U-2 RHRSW 2A HX Flow Reverse	Available	Feed=D2 @ 28-1B
MO 2-1001-4A	U-2 RHRSW 2A HX Flow Reverse	Available	Feed=B1 @ 28-1A
MO 2-1001-5A	U-2 RHRSW 2A HX Throttle Valve	Throttled	Feed=B4 @ 28-1B

**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

U2 RHRSW DIV 2

Equipment

Equipment	Function	Position	Comment
1-1001-65C	U-1 RHRSW Pump C	Running	Feed = 1409 @ Bus 14
1-1001-65D	U-1 RHRSW Pump D	Running	Feed = 1413 @ Bus 14
1-5745C	U-1 RHRSW Room Cooler 1C	Running	Feed = E1, E2, E3, E4 @ MCC 19-2
1-5745D	U-1 RHRSW Room Cooler 1D	Running	Feed = F2, F3, F4, F5 @ MCC 19-2
1/2-1099-1B	U-1/2 RHRSW B-Loop Unit Crosstie Valve	Available	Locked Closed Manual Valve
2-1001-65C	U-2 RHRSW Pump 2C	Running	Feed = 2402 @ Bus 24
2-1001-65D	U-2 RHRSW Pump 2D	Running	Feed = 2406 @ Bus 24
2-1003B	U-2 RHR B Heat Exchanger	Available	
2-5745C	U-2 RHRSW Room Cooler 2C	Running	Feed = E1, E2, E3, E4 @ MCC 29-2
2-5745D	U-2 RHRSW Room Cooler 2D	Running	Feed = F2, F3, F4, F5 @ MCC 29-2
FI 2-1040-1B	U-2 RHRSW Flow Indication DIV II	Available	Pnl 902-3
FI 2-1041-12B	U-2 RHRSW 2B Flow Indicator	Available	Local Indicator
MO 1-1001-5B	U-1 RHRSW 1B HX Throttle Valve	Throttled	Feed = D3 @ MCC 19-4
MO 2-1001-185B	U-2 RHRSW 2B HX Flow Reverse	Available	Feed = H2 @ MCC 29-1
MO 2-1001-186B	U-2 RHRSW 2B HX Flow Reverse	Available	Feed = H3 @ MCC 29-1
MO 2-1001-187B	U-2 RHRSW 2B HX Flow Reverse	Available	Feed = H4 @ MCC 29-1
MO 2-1001-4B	U-2 RHRSW 2B HX Flow Reverse	Available	Feed = H1 @ MCC 29-1
MO 2-1001-5B	U-2 RHRSW 2B HX Throttle Valve	Throttled	Feed = C3 @ MCC 29-4

**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

U2 SBO Diesel Generator

Equipment	Function	Position	Comment
1/2-5280-200	U-1(2) SBO Fuel Oil Storage Tank	Available	
2-4680-21A	U-2 SBO DG Starting Air Receiver A	Available	
2-4680-21B	U-2 SBO DG Starting Air Receiver A	Available	
2-5280-202	U-2 SBO DG Fuel Oil Transfer Pump	Available	Feed = B3 @ MCC 75-1
2-5280-204	U-2 SBO DG Fuel Oil Storage Tank	Available	
2-5790-6001	U-2 SBO DG Diesel Exhaust Fan	Available	Feed = J3/J4 @ MCC 75-1
2-5790-6002	U-2 SBO DG Diesel Exhaust Fan	Available	Feed = G1 @ MCC 75-1
2-5790-6003	U-2 SBO DG Diesel Exhaust Fan	Available	Feed = H1 @ MCC 75-1
2-5790-6004	U-2 SBO DG Elec Equip Rm Exhaust Fan	Available	Feed = K3/K4 @ MCC 75-1
2-5790-6005	U-2 SBO DG Elec Equip Rm Exhaust Fan	Available	Feed = L1 @ MCC 75-1
2-5790-6006	U-2 SBO DG Day Tank Exhaust Fan	Running	
2-5790-6007	U-2 SBO DG Battery Room Exhaust Fan	Running	
2-5790-6006	U-2 SBO DG Day Tank Exhaust Fan	Running	Feed = Brkr 7 @ Dist Pnl 75-1-1 via A2 @ MCC 75-1
2-5790-6007	U-2 SBO DG Battery Room Exhaust Fan	Running	Feed = Brkr 8 @ Dist Pnl 75-1-1 via A2 @ MCC 75-1
2-5790-6008	U-2 SBO DG Battery Room AHU	Available	Feed = G4 @ MCC 75-1
2-5790-6009	U-2 SBO DG Battery Room AHU Compressor	Available	Feed = K1 @ MCC 75-1
2-6620-1	U-2 SBO DG Generator	Available	
2-6620-204A	U-2 SBO DG #2 Radiator Fan	Running	Feed = C1 @ MCC 75-1
2-6620-204B	U-2 SBO DG #2 Radiator Fan	Running	Feed = E1 @ MCC 75-1
2-6620-206A	U-2 SBO DG Jacket Water Booster Pump	Running	Feed = E2 @ MCC 75-1
2-6620-206B	U-2 SBO DG Jacket Water Booster Pump	Running	Feed = D2 @ MCC 75-1
2-6620-214A	U-2 SBO DG #1 Radiator Fan	Running	Feed = B1 @ MCC 75-1
2-6620-214B	U-2 SBO DG #1 Radiator Fan	Running	Feed = D1 @ MCC 75-1
2-8330	U-2 SBO DG Battery Charger 7A	Available	
LI 2-5280-202	U-2 SBO DG Day Tank Level Gauge	Available	
MO 2-5790-6019	U-2 SBO DG Discharge Damper	Available	
MO 2-5790-6020	U-2 SBO DG Discharge Damper	Available	
MO 2-5790-6021	U-2 SBO DG Discharge Damper	Available	
MO 2-5790-6022	U-2 SBO DG Discharge Damper	Available	
MO 2-5790-6023	U-2 SBO DG Discharge Damper	Available	
SO 2-4689-40A/B	U-2 SBO DG Starting Air Stop Valve	Available	
SO 2-4689-41A/B	U-2 SBO DG Starting Air Stop Valve	Available	
SO 2-5790-6015 A thru H	U-2 SBO DG Intake Damper	Available	
SO 2-5790-6016A & D	U-2 SBO DG Intake Damper	Available	
SO 2-5790-6016B & C	U-2 SBO DG Intake Damper	Available	
SO 2-5790-6017A	U-2 SBO DG Intake Damper	Available	
SO 2-5790-6017B & C	U-2 SBO DG Intake Damper	Available	
SO 2-5790-6018	U-2 SBO DG Intake Damper	Available	
U-2 Air Start System	U-2 SBO DG Air Start of Diesel	Available	

**Table 3.0-1
Unit 1&2 Appendix R Safe Shutdown Required Equipment Lists**

U2 Secure Feedwater

Equipment	Function	Position	Comment
MO 2-3205A	U-2 FW Inlet Valve	Closed	Trip from Pnl 902-6 Note 3
MO 2-3205B	U-2 FW Inlet Valve	Closed	Trip from Pnl 902-6 Note 3
GCB 1-11	345KV Switchyard Breaker For T-21	Open	Open from Pnl 912-2
GCB 10-11	345 KV Switchyard Breaker For T-21	Open	Open from Pnl 912-2
GCB 6-7	345KV Switchyard Breaker For T-11	Open	Open from Pnl 912-2
GCB 7-8	345 KV Switchyard Breaker For T-11	Open	Open from Pnl 912-2
GCB 8-9	345KV Switchyard Breaker For T-22	Open	Open from Pnl 912-2
GCB 9-10	345 KV Switchyard Breaker For T-22	Open	Open from Pnl 912-2
2101	U-2 Reactor Feed Pump 2A	Open	Pull to Lock from Pnl 902-6
2104	U-2 Reactor Feed Pump 2C	Open	Pull to Lock from Pnl 902-6
2203	U-2 Reactor Feed Pump 2C	Open	Pull to Lock from Pnl 902-6
2205	U-2 Reactor Feed Pump 2B	Open	Pull to Lock from Pnl 902-6
2304	TIE TO MAIN FEED XFRMR 22 (RAT)		2-6703-23
2306	COND & BOOSTER PUMP 2A		2-3302A
2311	COND & BOOSTER PUMP 2B		2-3302B
2312	TURB BLDG 480V SWGR 25		2-6800-25
2405	COND & BOOSTER PUMP 2C		2-3401C
2408	COND & BOOSTER PUMP 2D		2-3401D
252B	Main Feed from BUS 23		
255A	Tie to 480V MCC 25-2		

4.0 Safe Shutdown Analysis

To satisfy the requirements of 10 CFR 50 Appendix R, Quad Cities Station demonstrated the use of Redundant (III.G.1 and/or III.G.2) or Alternative (III.G.3) shutdown capability for each of the Fire Areas that contain safe shutdown equipment or cabling. The Fire Areas for which Alternative safe shutdown capability has been demonstrated are identified in the Safe Shutdown Area Compliance Assessments (QDC-0000-E-1038 Attachment H). The Safe Shutdown Area Compliance Assessments were performed to ensure that a minimum set of safe shutdown equipment would be available to meet the performance criteria of 10 CFR 50 Appendix R. The measures taken to protect the availability of this equipment from fire-induced damage (i.e. spurious operation, hot shorts, etc.) are described in the Compliance Assessment Summaries and in Section 5.0 of the Safe Shutdown Report. Safe Shutdown Area Compliance Assessments were not performed for plant areas that do not contain safe shutdown equipment or cabling.

The following subsections present the results for each Fire Area.

4.1 Fire Area RB-1N – Unit 1 Reactor Building

Fire Area RB-1N consists of Fire Zones 1.1.1.1.N (Unit 1 Reactor Building Basement - North Half), 1.1.1.2 (Unit 1 Reactor Building Ground Floor), 1.1.1.3 (Unit 1 Reactor Building Mezzanine Level), 1.1.1.4 (Unit 1 Reactor Building Main Floor), 1.1.1.5 (Unit 1 Reactor Building Reactor Floor), 1.1.1.6 (Reactor Building Refuel Floor), 11.1.3 (Unit 1 HPCI Room), 11.2.3 (Unit 1 Reactor Building Northwest Corner Room (1A Core Spray)) and 11.2.4 (Unit 1 Reactor Building Northeast Corner Room (1A RHR)).

4.1.1 Unit 1 Shutdown Analysis

Alternative shutdown (10 CFR 50 Appendix R III.G.3 compliance) is utilized for this area.

Reactivity Control

Reactivity control is provided by the Reactor Protection System as discussed in Section 3.1.1 of the Safe Shutdown Report.

Inventory Control

The Safe Shutdown Makeup Pump (SSMP) is used to provide reactor water for inventory control. The SSMP will be started and operated from the Main Control Room within 32 minutes to ensure that Reactor level is maintained above top of active fuel. Initial reactor makeup water will be from the Contaminated Condensate Storage Tanks (CCST) and manually transferred to the Fire Water System upon CCST low level. Alignment of the Fire Water System to the SSMP requires manually closing valve ½-2901-1 and manually opening valves ½-2901-2 and ½-2901-3 to establish the suction path for SSMP injection utilizing the Fire Water System. The Fire Water System also provides cooling water to the SSMP Room Cooler if Service Water is not available. To establish the flow path from the Fire Water System to the SSMP Room Cooler requires manually closing valves ½-2901-25 and ½-2999-9 and manually opening valve ½-2901-9. Power to SSMP 4kV SWGR 31 will be supplied by 4kV SWGR 14-1 utilizing Unit 1 offsite power. If Unit 1 offsite power is unavailable, the Unit 2 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 24-1 and then cross-tied to 4kV SWGR 14-1.

Reactor Pressure Control

The Target Rock Safety/Relief Valve (1-0203-3A) acting in the safety mode (mechanical) will control Reactor pressure at approximately 1135 psig. A fire cannot affect the safety mode of the Target Rock Safety/Relief Valve.

Decay Heat Removal

Unit 1 Division II of the Residual Heat Removal (RHR) System will be utilized for Suppression Pool (Torus) Cooling and Alternate Shutdown Cooling. To ensure adequate Net Positive Suction Head (NPSH), due to high Torus temperature, both the 1-1002C and 1-1002D RHR pumps are required to provide additional cooling for the Torus. The RHR pumps (1-1002C and 1-1002D) will be operated locally at 4kV SWGR 14-1. To establish Torus Cooling and Alternate Shutdown Cooling, motor operated valves must be re-aligned to provide a flow path for the required RHR pumps. The cables associated with these motor operated valves are subject to fire-induced damage and potential spurious actuation. Because of the possible cable damage, these valves will be de-energized and manually placed in their required position to achieve Torus and Alternate Shutdown Cooling. Power for the Unit 1 Division II RHR System will be supplied by Unit 1 offsite power to 4kV SWGR 14-1. If Unit 1 offsite power is unavailable, the Unit 2 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 24-1 and then cross-tied to 4kV SWGR 14-1.

Unit 1 Division II Residual Heat Removal Service Water (RHRSW) System is unavailable for a fire in Fire Area RB-1N due to the 480V power feeds for the RHRSW pumps cubicle coolers being routed through the Fire Area. To support the Unit 1 Division II Torus and Alternate Shutdown Cooling modes of RHR, the Unit 2 Division II RHRSW pumps (2-1001-65C and 2-1001-65D) will be used to provide cooling to the Unit 1 Division II RHR heat exchangers. This is accomplished by opening Division II RHRSW crosstie valve ½-1099-1B. The Unit 2 Division II RHRSW Pumps will be started and controlled from Main Control Room Panel 902-3. Power for the Unit 2 Division II RHRSW System will be supplied by Unit 2 offsite power to 4kV SWGR 24. If Unit 2 offsite power is unavailable, the Unit 2 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 24-1 and back fed to 4kV SWGR 24.

Support Functions

The Unit 1 Diesel Generator Cooling Water Pump (DGCWP) will supply cooling water for the Unit 1 Division II RHR Room Cooler (1-5746B). The alternate feed from Unit 2 480V SWGR 29 will supply power to the Unit 1 DGCWP (1-3903) and the alternate feed from Unit 2 480V MCC 29-2 will supply power to the Unit 1 DGCWP Cubicle Coolers (1-5749A and 1-5749B). Power for the Unit 1 Division II RHR Room Cooler will be supplied by the alternate feed from Unit 2 480V MCC 29-1. 480V MCC 29-2 will supply power for the Unit 2 Division II RHRSW vault room coolers.

The Unit 2 125V DC system remains available to supply control power for the required 4kV and 480V SWGR. Unit 2 125V DC Battery Charger 2 remains available to supply power to 125V DC Battery Bus 2.

Reactor water level and pressure, Torus level and temperature, diagnostic instrumentation for shutdown systems and level indication for tanks will be monitored using local instrumentation.

Cold Shutdown Repairs

To ensure that there is no backflow through the Recirculation Pump and injection bypassing the Reactor, motor operated valve 1-0202-5B must be closed when reconfiguring the Unit 1 Division II RHR System for Shutdown Cooling. 480V MCC 18/19-5 supplies power to this motor operated valve which is located inside primary containment and is not readily accessible. A fire in Fire Zone 1.1.1.2 and/or 1.1.1.3 may damage the power cables, control cables or 480V MCC 18/19-5. Because of the location of valve 1-0202-5B and the potential cable damage, a repair is required to remotely close valve 1-0202-5B from Unit 2 480V MCC 28/29-5.

A fire in this area may potentially damage the control cables associated with relief valves 1-0203-3B and 1-0203-3C. To prevent spurious actuation during Hot Shutdown, these valves have been manually disabled. Before depressurization of the reactor can be initiated to achieve Cold Shutdown, a repair to relief valves 1-0203-3B and 1-0203-3C is required. This Cold Shutdown repair consists of splicing cables from Unit 2 125V DC Reactor Building Distribution Panel 2 to Drywell penetration X-100B. Once the repair is complete, the reactor vessel will be depressurized by alternating Relief Valves 1-0203-3B and 1-0203-3C as required to maintain depressurization. This is accomplished by opening and closing the appropriate breakers on Unit 2 125V DC Reactor Building Distribution Panel 2.

4.1.2 Unit 2 Shutdown Analysis

A Compliance Assessment was performed on this Fire Area to determine the effects of the fire on the non-fire unit. The assessment determined that there is a minimum set of safe shutdown equipment available to safely shutdown the non-fire unit. If required, the non-fire unit will be placed in Cold Shutdown utilizing existing station procedures. For this Fire Area there is not a specific Safe Shutdown Procedure required to achieve and maintain Cold Shutdown.

4.2 Fire Area RB-1S – Unit 1 Reactor Building

Fire Area RB-1S consists of Fire Zones 1.1.1.1.S (Unit 1 Reactor Building Basement – South Half), 11.2.1 (Unit 1 Reactor Building Southwest Corner Room (1B Core Spray)) and 11.2.2 (Unit 1 Reactor Building Southeast Corner Room (1B RHR)).

4.2.1 Unit 1 Shutdown Analysis

Alternative shutdown (10 CFR 50 Appendix R III.G.3 compliance) is utilized for this area.

Reactivity Control

Reactivity control is provided by the Reactor Protection System as discussed in Section 3.1.1 of the Safe Shutdown Report.

Inventory Control

The Safe Shutdown Makeup Pump (SSMP) is used to provide reactor water for inventory control. The SSMP will be started and operated from the Main Control Room within 32 minutes to ensure that Reactor level is maintained above top of active fuel. Initial reactor makeup water will be from the Contaminated Condensate Storage Tanks (CCST) and manually transferred to the Fire Water System upon CCST low level. Alignment of the Fire Water System to the SSMP requires manually closing valve ½-2901-1 and manually opening valves ½-2901-2 and ½-2901-3 to establish the flow path for SSMP injection utilizing the Fire Water System. The Fire Water System also provides cooling water to the SSMP Room Cooler if Service Water is not available. To establish the flow path from the Fire Water System to the SSMP Room Cooler requires manually closing valves ½-2901-25 and ½-2999-9 and manually opening valve ½-2901-9. Power to SSMP 4kV SWGR 31 will be supplied by 4kV SWGR 14-1 utilizing Unit 1 offsite power. If Unit 1 offsite power is unavailable, the Unit 1 Emergency Diesel Generator (EDG) will supply AC power to 4kV SWGR 14-1.

Reactor Pressure Control

The Target Rock Safety/Relief Valve (1-0203-3A) acting in the safety mode (mechanical) will control Reactor pressure at approximately 1135 psig. A fire cannot affect the safety mode of the Target Rock Safety/Relief Valve.

Decay Heat Removal

Unit 1 Division I of the Residual Heat Removal (RHR) System will be utilized for Suppression Pool (Torus) Cooling and Alternate Shutdown Cooling. To ensure adequate Net Positive Suction Head (NPSH), due to high Torus temperature, both the 1-1002A and 1-1002B RHR pumps are required to provide additional cooling for the Torus. The RHR pumps (1-1002A and 1-1002B) will be started and controlled from Main Control Room Panel 901-3. To establish Torus Cooling and Alternate Shutdown Cooling, motor operated valves must be re-aligned to provide a flow path for the required RHR pumps. The cables associated with these motor operated valves are free of fire damage and will also be manipulated from the Main Control Room. Power for the Unit 1 Division I RHR System will be supplied by Unit 1 offsite power to 4kV SWGR 13-1. If Unit 1 offsite power is unavailable, the Unit 1 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 13-1.

Unit 1 Division I Residual Heat Removal Service Water (RHRSW) System is available for a fire in Fire Area RB-1S. To support the Unit 1 Division I Torus and Alternate Shutdown Cooling modes of RHR, the Unit 1 Division I RHRSW pumps (1-1001-65A and 1-1001-65B) will be used to provide cooling to the Unit 1 Division I RHR heat exchangers. The Unit 1 Division I RHRSW Pumps will be started and controlled from Main Control Room Panel 901-3. Power for the Unit 1 Division I RHRSW System will be supplied by Unit 1 offsite power to 4kV SWGR 13. If Unit 1 offsite power is unavailable, the Unit 1 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 13-1 and back fed to 4kV SWGR 13.

Support Functions

The Unit 1 Diesel Generator Cooling Water Pump (DGCWP) will supply cooling water for the Unit 1 Division I RHR Room Cooler (1-5746A). The normal feed from Unit 1 480V SWGR 19 will supply power to the Unit 1 DGCWP (1-3903) and the normal feed from Unit 1 480V MCC 19-2 will supply power to the Unit 1 DGCWP Cubicle Coolers (1-5749A and 1-5749B). Power for the Unit 1 Division I RHR Room Cooler will be supplied by the normal feed from Unit 1 480V MCC 18-1A. 480V MCC 18-2 will supply power for the Unit 1 Division I RHRSW vault room coolers.

The Unit 1 and Unit 2 125V DC systems remain available to supply control power for the required 4kV and 480V SWGR. Unit 1 125V DC Battery Charger 1A remains available to supply power to 125V DC Battery Bus 1 and Unit 2 125V DC Battery Charger 2 remains available to supply power to 125V DC Battery Bus 2.

Reactor water level and pressure will be monitored using instrumentation available in the Main Control Room.

Cold Shutdown Repairs

There are no Cold Shutdown Repairs required for this Fire Area.

4.2.2 Unit 2 Shutdown Analysis

A Compliance Assessment was performed on this Fire Area to determine the effects of the fire on the non-fire unit. The assessment determined that there is a minimum set of safe shutdown equipment available to safely shutdown the non-fire unit. If required, the non-fire unit will be placed in Cold Shutdown utilizing existing station procedures. For this Fire Area there is not a specific Safe Shutdown Procedure required to achieve and maintain Cold Shutdown.

4.3 Fire Area RB-2N – Unit 2 Reactor Building

Fire Area RB-2N consists of Fire Zones 1.1.2.1.N (Unit 2 Reactor Building Basement – North Half), 1.1.2.2 (Unit 2 Reactor Building Ground Floor), 1.1.2.3 (Unit 2 Reactor Building Mezzanine Level), 1.1.2.4 (Unit 2 Reactor building Main Floor), 1.1.2.5 (Unit 2 Reactor Building Reactor Floor), 11.3.3 (Unit 2 Reactor Building Northwest Corner Room (2A Core Spray)) and 11.3.4 (Unit 2 Reactor Building Northeast Corner Room (2A RHR)).

4.3.1 Unit 2 Shutdown Analysis

Alternative shutdown (10 CFR 50 Appendix R III.G.3 compliance) is utilized for this area.

Reactivity Control

Reactivity control is provided by the Reactor Protection System as discussed in Section 3.1.1 of the Safe Shutdown Report.

Inventory Control

The Safe Shutdown Makeup Pump (SSMP) is used to provide reactor water for inventory control. The SSMP will be started and operated from the Main Control Room within 32 minutes to ensure that Reactor level is maintained above top of active fuel. Initial reactor makeup water will be from the Contaminated Condensate Storage Tanks (CCST) and manually transferred to the Fire Water System upon CCST low level. Alignment of the Fire Water System to the SSMP requires manually closing valve ½-2901-1 and manually opening valves ½-2901-2 and ½-2901-3 to establish the flow path for SSMP injection utilizing the Fire Water System. The Fire Water System also provides cooling water to the SSMP Room Cooler if Service Water is not available. To establish the flow path from the Fire Water System to the SSMP Room Cooler requires manually closing valves ½-2901-25 and ½-2999-9 and manually opening valve ½-2901-9. Power to SSMP 4kV SWGR 31 will be supplied by 4kV SWGR 14-1 utilizing Unit 1 offsite power. If Unit 1 offsite power is unavailable, the Unit 1 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 14-1.

Reactor Pressure Control

The Target Rock Safety/Relief Valve (2-0203-3A) acting in the safety mode (mechanical) will control Reactor pressure at approximately 1135 psig. A fire cannot affect the safety mode of the Target Rock Safety/Relief Valve.

Decay Heat Removal

Unit 2 Division II of the Residual Heat Removal (RHR) System will be utilized for Suppression Pool (Torus) Cooling and Alternate Shutdown Cooling. To ensure adequate Net Positive Suction Head (NPSH), due to high Torus temperature, both the 2-1002C and 2-1002D RHR pumps are required to provide additional cooling for the Torus. The RHR pumps (2-1002C and 2-1002D) will be operated locally at 4kV SWGR 24-1. To establish Torus Cooling and Alternate Shutdown Cooling, motor operated valves must be re-aligned to provide a flow path for the required RHR pumps. The cables associated with these motor operated valves are subject to fire-induced damage and potential spurious actuation. Because of the possible cable damage, these valves will be de-energized and manually placed in their required position to achieve Torus and Alternate Shutdown Cooling. Power for the Unit 2 Division II RHR System will be supplied by Unit 2 offsite power to 4kV SWGR 24-1. If Unit 2 offsite power is unavailable, the Unit 1 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 14-1, which in turn, will be cross-tied to 4kV SWGR 24-1.

Unit 2 Division II Residual Heat Removal Service Water (RHRSW) System is unavailable for a fire in Fire Area RB-2N due to the 480V power feeds for the RHRSW pumps cubicle coolers being routed through the Fire Area. To support the Unit 2 Division II Torus and Alternate Shutdown Cooling modes of RHR, the Unit 1 Division II RHRSW pumps (1-1001-65C and 1-1001-65D) will be used to provide cooling to the Unit 2 Division II RHR heat exchangers. This is accomplished by opening Division II RHRSW crosstie valve ½-1099-1B. The Unit 1 Division II RHRSW Pumps will be started and controlled from Main Control Room Panel 901-3. Power for the Unit 1 Division II RHRSW System will be supplied by Unit 1 offsite power to 4kV SWGR 14. If Unit 1 offsite power is unavailable, the Unit 1 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 14-1 and back fed to 4kV SWGR 14.

Support Functions

The Unit 2 Diesel Generator Cooling Water Pump (DGCWP) will supply cooling water for the Unit 2 Division II RHR Room Cooler (2-5746B). The alternate feed from Unit 1 480V SWGR 19 will supply power to the Unit 2 DGCWP (2-3903) and the alternate feed from Unit 1 480V MCC 19-2 will supply power to the Unit 2 DGCWP Cubicle Coolers (2-5749A and 2-5749B). Power for the Unit 2 Division II RHR Room Cooler will be supplied by the alternate feed from Unit 1 480V MCC 19-1. 480V MCC 19-2 will supply power for the Unit 1 Division II RHRSW vault room coolers.

The Unit 1 125V DC system remains available to supply control power for the required 4kV and 480V SWGR. Unit 1 125V DC Battery Charger 1 remains available to supply power to 125V DC Battery Bus 1.

Reactor water level and pressure, Torus level and temperature, diagnostic instrumentation for shutdown systems and level indication for tanks will be monitored using local instrumentation.

Cold Shutdown Repairs

To ensure that there is no backflow through the Recirculation Pump and injection bypassing the Reactor, motor operated valve 2-0202-5B must be closed when reconfiguring the Unit 2 Division II RHR System for Shutdown Cooling. 480V MCC 28/29-5 supplies power to this motor operated valve which is located inside primary containment and is not readily accessible. A fire in Fire Zone 1.1.2.2 and/or 1.1.2.3 may damage the power cables, control cables or 480V MCC 28/29-5. Because of the location of valve 2-0202-5B and the potential cable damage, a repair is required to remotely close valve 2-0202-5B from Unit 1 480V MCC 18/19-5.

A fire in this area may potentially damage the control cables associated with relief valves 2-0203-3B and 2-0203-3C. To prevent spurious actuation during Hot Shutdown, these valves have been manually disabled. Before depressurization of the reactor can be initiated to achieve Cold Shutdown, a repair to relief valves 2-0203-3B and 2-0203-3C is required. This Cold Shutdown repair consists of splicing cables from Unit 1 125V DC Reactor Building Distribution Panel 1 to Drywell penetration X-104A. Once the repair is complete, the reactor vessel will be depressurized by alternating Relief Valves 2-0203-3B and 2-0203-3C as required to maintain depressurization. This is accomplished by opening and closing the appropriate breakers on Unit 1 125V DC Reactor Building Distribution Panel 1.

4.3.2 Unit 1 Shutdown Analysis

A Compliance Assessment was performed on this Fire Area to determine the effects of the fire on the non-fire unit. The assessment determined that there is a minimum set of safe shutdown equipment available to safely shutdown the non-fire unit. If required, the non-fire unit will be placed in Cold Shutdown utilizing existing station procedures. For this Fire Area there is not a specific Safe Shutdown Procedure required to achieve and maintain Cold Shutdown.

4.4 Fire Area RB-2S – Unit 2 Reactor Building

Fire Area RB-2S consists of Fire Zones 1.1.2.1.S (Unit 2 Reactor Building Basement – South Half), 11.1.4 (Unit 2 HPCI Room), 11.3.1 (Unit 2 Reactor Building Southwest Corner Room (2B Core Spray)) and 11.3.2 (Unit 2 Reactor Building Southeast Corner Room (2B RHR)).

4.4.1 Unit 2 Shutdown Analysis

Alternative shutdown (10 CFR 50 Appendix R III.G.3 compliance) is utilized for this area.

Reactivity Control

Reactivity control is provided by the Reactor Protection System as discussed in Section 3.1.1 of the Safe Shutdown Report.

Inventory Control

The Safe Shutdown Makeup Pump (SSMP) is used to provide reactor water for inventory control. The SSMP will be started and operated from the Main Control Room within 32 minutes to ensure that Reactor level is maintained above top of active fuel. Initial reactor makeup water will be from the Contaminated Condensate Storage Tanks (CCST) and manually transferred to the Fire Water System upon CCST low level. Alignment of the Fire Water System to the SSMP requires manually closing valve ½-2901-1 and manually opening valves ½-2901-2 and ½-2901-3 to establish the flow path for SSMP injection utilizing the Fire Water System. The Fire Water System also provides cooling water to the SSMP Room Cooler if Service Water is not available. To establish the flow path from the Fire Water System to the SSMP Room Cooler requires manually closing valves ½-2901-25 and ½-2999-9 and manually opening valve ½-2901-9. Power to SSMP 4kV SWGR 31 will be supplied by 4kV SWGR 14-1 utilizing Unit 1 offsite power. If Unit 1 offsite power is unavailable, the Unit 1 Emergency Diesel Generator (EDG) will supply AC power to 4kV SWGR 14-1.

Reactor Pressure Control

The Target Rock Safety/Relief Valve (2-0203-3A) acting in the safety mode (mechanical) will control Reactor pressure at approximately 1135 psig. A fire cannot affect the safety mode of the Target Rock Safety/Relief Valve.

Decay Heat Removal

Unit 2 Division I of the Residual Heat Removal (RHR) System will be utilized for Suppression Pool (Torus) Cooling and Alternate Shutdown Cooling. To ensure adequate Net Positive Suction Head (NPSH), due to high Torus temperature, both the 2-1002A and 2-1002B RHR pumps are required to provide additional cooling for the Torus. The RHR pumps (2-1002A and 2-1002B) will be started and controlled from Main Control Room Panel 902-3. To establish Torus Cooling and Alternate Shutdown Cooling, motor operated valves must be re-aligned to provide a flow path for the required RHR pumps. The cables associated with these motor operated valves are free of fire damage and thus, the motor operated valves will also be manipulated from the Main Control Room. Power for the Unit 2 Division I RHR System will be supplied by Unit 2 offsite power to 4kV SWGR 23-1. If Unit 2 offsite power is unavailable, the Unit 2 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 23-1.

Unit 2 Division I Residual Heat Removal Service Water (RHRSW) System is available for a fire in Fire Area RB-2S. To support the Unit 2 Division I Torus and Alternate Shutdown Cooling modes of RHR, the Unit 2 Division I RHRSW pumps (2-1001-65A and 2-1001-65B) will be used to provide cooling to the Unit 2 Division I RHR heat exchangers. The Unit 2 Division I RHRSW Pumps will be started and controlled from Main Control Room Panel 902-3. Power for the Unit 2 Division I RHRSW System will be supplied by Unit 2 offsite power to 4kV SWGR 23. If Unit 2 offsite power is unavailable, the Unit 2 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 23-1 and back fed to 4kV SWGR 23.

Support Functions

The Unit 2 Diesel Generator Cooling Water Pump (DGCWP) will supply cooling water for the Unit 2 Division I RHR Room Cooler (2-5746A). The normal feed from Unit 2 480V SWGR 29 will supply power to the Unit 2 DGCWP (2-3903) and the normal feed from Unit 2 480V MCC 29-2 will supply power to the Unit 2 DGCWP Cubicle Coolers (2-5749A and 2-5749B). Power for the Unit 2 Division I RHR Room Cooler will be supplied by the normal feed from Unit 2 480V MCC 28-1A. 480V MCC 28-2 will supply power for the Unit 2 Division I RHRSW vault room coolers.

The Unit 1 and Unit 2 125V DC systems remain available to supply control power for the required 4kV and 480V SWGR.

Reactor water level and pressure will be monitored using instrumentation available in the Main Control Room.

Cold Shutdown Repairs

There are no Cold Shutdown Repairs required for this Fire Area.

4.4.2 Unit 1 Shutdown Analysis

A Compliance Assessment was performed on this Fire Area to determine the effects of the fire on the non-fire unit. The assessment determined that there is a minimum set of safe shutdown equipment available to safely shutdown the non-fire unit. If required, the non-fire unit will be placed in Cold Shutdown utilizing existing station procedures. For this Fire Area there is not a specific Safe Shutdown Procedure required to achieve and maintain Cold Shutdown.

4.5 Fire Area RB-1/2 – Swing Emergency Diesel Generator Room

Fire Area RB-1/2 consists of Fire Zone 9.3. This Fire Area contains the 1/2 Emergency Diesel Generator and its associated equipment. Evaluation S040-QH-0445 was performed to demonstrate that existing station procedures are adequate to achieve Safe Shutdown for a fire in this Fire Area. Therefore, the need for a specific Safe Shutdown procedure for this Fire Area is not required.

4.6 Fire Area DW-1 – Unit 1 Primary Containment (Drywell)

Fire Area DW-1 consists of Fire Zone 1.2.1. During normal power operation, the Unit 1 Primary Containment is inerted with nitrogen. Due to the lack of oxygen, the chemical reaction required to produce a fire is not possible. Therefore, a fire in the Unit 1 Primary Containment is of no concern.

4.7 Fire Area DW-2 – Unit 2 Primary Containment (Drywell)

Fire Area DW-2 consists of Fire Zone 1.2.2. During normal power operation, the Unit 2 Primary Containment is inerted with nitrogen. Due to the lack of oxygen, the chemical reaction required to produce a fire is not possible. Therefore, a fire in the Unit 2 Primary Containment is of no concern.

4.8 Fire Area TB-I – Turbine Building Northern Zone Group

Fire Area TB-I consists of Fire Zones 8.2.1.B (Unit 2 Condensate Pump Room), 8.2.1.D (Unit 2 Turbine Foundation (Under Hotwell)), 8.2.2.A (Unit 2 Turbine Building Upper Basement (CRD Level)), 8.2.2.B (Unit 2 Radwaste Pipe Tunnel), 8.2.6.D (Unit 2 Turbine Building Ground Floor (Low Pressure Heater Bay)), 8.2.6.E (Unit 2 Turbine Building Ground Floor), 8.2.7.D (Unit 2 Turbine Building Mezzanine Floor (Low Pressure and D Heater Bay)), 8.2.7.E (Unit 2 Turbine Building Mezzanine Floor), 11.1.2.A (Unit 2 A RHR Service Water Pump Room), 11.1.2.B (Unit 2 B/C RHR Service Water Pump Room), 11.1.2.C (Unit 2 D RHR Service Water Pump Room), 14.1.2 (Unit 2 Off Gas Recombiner Rooms), 6.2.A (Small Unit 2 DC Panel Room), 6.2.B (Larger Unit 2 DC Panel Room) and 7.2 (Unit 2 Battery Room).

4.8.1 Unit 2 Shutdown Analysis

Alternative shutdown (10 CFR 50 Appendix R III.G.3 compliance) is utilized for this area.

Reactivity Control

Reactivity control is provided by the Reactor Protection System as discussed in Section 3.1.1 of the Safe Shutdown Report.

Inventory Control

The Safe Shutdown Makeup Pump (SSMP) is used to provide reactor water for inventory control. The SSMP will be started and operated from the Main Control Room within 32 minutes to ensure that Reactor level is maintained above top of active fuel. Initial reactor makeup water will be from the Contaminated Condensate Storage Tanks (CCST) and manually transferred to the Fire Water System upon CCST low level. Alignment of the Fire Water System to the SSMP requires manually closing valve ½-2901-1 and manually opening valves ½-2901-2 and ½-2901-3 to establish the flow path for SSMP injection utilizing the Fire Water System. The Fire Water System also provides cooling water to the SSMP Room Cooler if Service Water is not available. To establish the flow path from the Fire Water System to the SSMP Room Cooler requires manually closing valves ½-2901-25 and ½-2999-9 and manually opening valve ½-2901-9. Power to SSMP 4kV SWGR 31 will be supplied by 4kV SWGR 14-1 utilizing Unit 1 offsite power. If Unit 1 offsite power is unavailable, the Unit 1 Emergency Diesel Generator (EDG) will supply AC power to 4kV SWGR 14-1.

Reactor Pressure Control

The Target Rock Safety/Relief Valve (2-0203-3A) acting in the safety mode (mechanical) will control Reactor pressure at approximately 1135 psig. A fire cannot affect the safety mode of the Target Rock Safety/Relief Valve.

Decay Heat Removal

Unit 2 Division I of the Residual Heat Removal (RHR) System will be utilized for Suppression Pool (Torus) Cooling and Alternate Shutdown Cooling. To ensure adequate Net Positive Suction Head (NPSH), due to high Torus temperature, both the 2-1002A and 2-1002B RHR pumps are required to provide additional cooling for the Torus. The RHR pumps (2-1002A and 2-1002B) will be operated locally at 4kV SWGR 23-1. To establish Torus Cooling and Alternate Shutdown Cooling, motor operated valves must be re-aligned to provide a flow path for the required RHR pumps. The cables associated with these motor operated valves are subject to fire-induced damage and potential spurious actuation. Because of the possible cable damage, these valves will be de-energized and manually placed in their required position to achieve Torus and Alternate Shutdown Cooling. Power for the Unit 2 Division I RHR System will be supplied by Unit 2 offsite power to 4kV SWGR 23-1. If Unit 2 offsite power is unavailable, the Unit 1 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 13-1, which in turn, will be cross-tied to 4kV SWGR 23-1.

Unit 2 Division I Residual Heat Removal Service Water (RHRSW) System is unavailable for a fire in Fire Area TB-I due to the power feeds for the RHRSW pumps being routed through the Fire Area. To support the Unit 2 Division I Torus and Alternate Shutdown Cooling modes of RHR, the Unit 1 Division I RHRSW pumps (1-1001-65A and 1-1001-65B) will be used to provide cooling to the Unit 2 Division I RHR heat exchangers. This is accomplished by opening Division I RHRSW crosstie valve ½-1099-1A. The Unit 1 Division I RHRSW Pumps will be started and controlled from Main Control Room Panel 901-3. Power for the Unit 1 Division I RHRSW System will be supplied by Unit 1 offsite power to 4kV SWGR 13. If Unit 1 offsite power is unavailable, the Unit 1 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 13-1, which in turn, will be back fed to 4kV SWGR 13.

Support Functions

The Unit 1/2 Diesel Generator Cooling Water Pump (DGCWP) will supply cooling water for the Unit 2 Division I RHR Room Cooler (2-5746A). The feed from Unit 1 480V SWGR 18 will supply power to the Unit 1/2 DGCWP (1/2-3903) and the Unit 1/2 DGCWP Cubicle Coolers (1/2-5749A and 1/2-5749B). Power for the Unit 2 Division I RHR Room Cooler will be supplied by the alternate feed from Unit 1 480V MCC 18-1A. 480V MCC 18-2 will supply power for the Unit 1 Division I RHRSW vault room coolers.

The Unit 1 125V DC system remains available to supply control power for the required 4kV and 480V SWGR. Unit 1 125V DC Battery Charger 1A remains available to supply power to 125V DC Battery Bus 1.

Reactor water level and pressure, Torus level and temperature, diagnostic instrumentation for shutdown systems and level indication for tanks will be monitored using local instrumentation.

Cold Shutdown Repairs

To ensure that there is no backflow through the Recirculation Pump and injection bypassing the Reactor, motor operated valve 2-0202-5A must be closed when reconfiguring the Unit 2 Division I RHR System for Shutdown Cooling. 480V MCC 28/29-5 supplies power to this motor operated valve which is located inside primary containment and is not readily accessible. Because of the location of valve 2-0202-5A, a repair is required to remotely close valve 2-0202-5A from Unit 1 480V MCC 18/19-5.

A fire in this area may potentially damage the control cables associated with relief valves 2-0203-3B and 2-0203-3C. To prevent spurious actuation during Hot Shutdown, these valves have been manually disabled. Before depressurization of the reactor can be initiated to achieve Cold Shutdown, a repair to relief valves 2-0203-3B and 2-0203-3C is required. This Cold Shutdown repair consists of splicing cables from Unit 1 125V DC Reactor Building Distribution Panel 1 to Drywell penetration X-104A. Once the repair is complete, the reactor vessel will be depressurized by alternating Relief Valves 2-0203-3B and 2-0203-3C as required to maintain depressurization. This is accomplished by opening and closing the appropriate breakers on Unit 1 125V DC Reactor Building Distribution Panel 1.

4.8.2 Unit 1 Shutdown Analysis

A Compliance Assessment was performed on this Fire Area to determine the effects of the fire on the non-fire unit. The assessment determined that there is a minimum set of safe shutdown equipment available to safely shutdown the non-fire unit. If required, the non-fire unit will be placed in Cold Shutdown utilizing existing station procedures. For this Fire Area there is not a specific Safe Shutdown Procedure required to achieve and maintain Cold Shutdown.

4.9 Fire Area TB-II – Turbine Building Central Zone Group

Fire Area TB-II consists of Fire Zones 5.0 (Safe Shutdown Makeup Pump (SSMP) Room), 8.1 (Clean and Dirty Oil Tank Room), 8.2.10 (Off Gas Recombiner Level), 8.2.6.C (Unit 1/2 Turbine Building Ground Floor) and 8.2.7.C (Unit 1/2 Turbine Building Mezzanine Floor).

4.9.1 Unit 1 Shutdown Analysis

Alternative shutdown (10 CFR 50 Appendix R III.G.3 compliance) is utilized for this area.

Reactivity Control

Reactivity control is provided by the Reactor Protection System as discussed in Section 3.1.1 of the Safe Shutdown Report.

Inventory Control

The Unit 1 High Pressure Coolant Injection (HPCI) system will be utilized to provide reactor water for inventory control. The HPCI system will be started and operated from the Main Control Room within 32 minutes to ensure that Reactor level is maintained above top of active fuel. The Motor Gear Unit (MGU) will be used to control HPCI system flow. The HPCI system will initially be lined up to take suction from the Contaminated Condensate Storage Tanks (CCST) and will then auto transfer to the Torus upon receipt of a high Torus level (+5 inches). Power for the Unit 1 HPCI system will be supplied from Unit 1 250V DC MCC 1 and Unit 1 250V DC Battery Charger 1. The Unit 1 HPCI Room Cooler will be powered from 480V MCC 19-1 and will auto start upon HPCI initiation. The Unit 1 Diesel Generator Cooling Water Pump will supply cooling water to the Unit 1 HPCI Room Cooler. Power for the Unit 1 250V DC Battery Charger will be supplied by 480V MCC 19-2.

Reactor Pressure Control

The Target Rock Safety/Relief Valve (1-0203-3A) acting in the safety mode (mechanical) will control Reactor pressure at approximately 1135 psig. A fire cannot affect the safety mode of the Target Rock Safety/Relief Valve.

Decay Heat Removal

Unit 1 Division II of the Residual Heat Removal (RHR) System will be utilized for Suppression Pool (Torus) Cooling and Alternate Shutdown Cooling. To ensure adequate Net Positive Suction Head (NPSH), due to high Torus temperature, both the 1-1002C and 1-1002D RHR pumps are required to provide additional cooling for the Torus. The RHR pumps (1-1002C and 1-1002D) will be started and controlled from Main Control Room Panel 901-3. To start and control the RHR pumps from the Main Control Room, the Fuel Pool Cooling Suction Permissive Switch must be placed in the "OVERRIDE" position. To establish Torus Cooling and Alternate Shutdown Cooling, motor operated valves must be re-aligned to provide a flow path for the required RHR pumps. The cables associated with these motor operated valves are subject to fire-induced damage and potential spurious actuation. Because of the possible cable damage, these valves will be de-energized and manually placed in their required position to achieve Torus and Alternate Shutdown Cooling. To ensure that there is no backflow through the Recirculation Pump and injection bypassing the Reactor, motor operated valve 1-0202-5B must be closed when reconfiguring the Unit 1 Division II RHR System for Shutdown Cooling. This valve can be closed from the Main Control Room. Power for the Unit 1 Division II RHR System will be supplied by Unit 1 offsite power to 4kV SWGR 14-1. If Unit 1 offsite power is unavailable, the Unit 1 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 14-1.

Unit 1 Division II Residual Heat Removal Service Water (RHRSW) System is available for a fire in Fire Area TB-II. To support the Unit 1 Division II Torus and Alternate Shutdown Cooling modes of RHR, the Unit 1 Division II RHRSW pumps (1-1001-65C and 1-1001-65D) will be used to provide cooling to the Unit 1 Division II RHR heat exchangers. Both of these pumps will be started and controlled from Main Control Room Panel 901-3. To start the Unit 1 Division II RHRSW pumps from the Main Control Room, the RHRSW start permissive switch must be placed in the "MANUAL OVERRIDE" position. Power for the Unit 1 Division II RHRSW System will be supplied by Unit 1 offsite power to 4kV SWGR 14. If Unit 1 offsite power is unavailable, the Unit 1 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 14-1 and back fed to 4kV SWGR 14.

Support Functions

The Unit 1 Diesel Generator Cooling Water Pump (DGCWP) will supply cooling water for the Unit 1 Division II RHR Room Cooler (1-5746B). The normal feed from Unit 1 480V SWGR 19 will supply power to the Unit 1 DGCWP (1-3903) and the normal feed from Unit 1 480V MCC 19-2 will supply power to the Unit 1 DGCWP Cubicle Coolers (1-5749A and 1-5749B). Power for the Unit 1 Division II RHR Room Cooler will be supplied by the normal feed from Unit 1 480V MCC 19-1. 480V MCC 19-2 will supply power for the Unit 1 Division II RHRSW vault room coolers.

The Unit 2 125V DC system remains available to supply control power for the required 4kV and 480V SWGR. Unit 2 125V DC Battery Charger 2A remains available to supply power to 125V DC Battery Bus 2.

Reactor water level and pressure, Torus level and temperature, diagnostic instrumentation for shutdown systems and level indication for tanks will be monitored using local instrumentation

Cold Shutdown Repairs

A fire in this area may potentially damage the control cables associated with relief valves 1-0203-3B and 1-0203-3C. To prevent spurious actuation during Hot Shutdown, these valves have been manually disabled. Before depressurization of the reactor can be initiated to achieve Cold Shutdown, a repair to relief valves 1-0203-3B and 1-0203-3C is required. This Cold Shutdown repair consists of splicing cables from Unit 2 125V DC Reactor Building Distribution Panel 2 to Drywell penetration X-100B. Once the repair is complete, the reactor vessel will be depressurized by alternating Relief Valves 1-0203-3B and 1-0203-3C as required to maintain depressurization. This is accomplished by opening and closing the appropriate breakers on Unit 2 125V DC Reactor Building Distribution Panel 2.

4.9.2 Unit 2 Shutdown Analysis

Alternative shutdown (10 CFR 50 Appendix R III.G.3 compliance) is utilized for this area.

Reactivity Control

Reactivity control is provided by the Reactor Protection System as discussed in Section 3.1.1 of the Safe Shutdown Report.

Inventory Control

The Unit 2 Reactor Core Isolation Cooling (RCIC) system will be utilized to provide reactor water for inventory control. The RCIC system will be started and operated locally from the Unit 2 RCIC Room within 32 minutes to ensure that Reactor level is maintained above top of active fuel. The RCIC system will initially be lined up to take suction from the Contaminated Condensate Storage Tanks (CCST). Within 30 minutes of establishing injection, the RCIC pump suction will be transferred to the Unit 2 Torus to preserve CCST volume for the Unit 1 High Pressure Coolant Injection (HPCI) system. Motor operated valve 2-1301-16 (main steam supply valve to RCIC Turbine) is located inside the Unit 2 Drywell. Fire-induced cable damage may cause this valve to spuriously close and isolate the steam supply to the Unit 2 RCIC Turbine. To ensure that motor operated valve 2-1301-16 remains open, the alternate feed from the Unit 2 Station Blackout (SBO) will be used to open the valve at 480V MCC 28-1A. The Unit 2 RCIC Condensate and Vacuum Pumps are required to maintain RCIC Room habitability during local operation of the RCIC system. Power for the Unit 2 RCIC Condensate and Vacuum Pumps will be supplied by the alternate feed from Unit 1 250V DC system. Power for the Unit 2 RCIC Room Cooler (2-5748B) will be supplied by 480V MCC 29-1. Power for the ½ 250V DC Battery Charger will be supplied by 480V MCC 28-2.

Reactor Pressure Control

The Target Rock Safety/Relief Valve (2-0203-3A) acting in the safety mode (mechanical) will control Reactor pressure at approximately 1135 psig. A fire cannot affect the safety mode of the Target Rock Safety/Relief Valve.

Decay Heat Removal

Unit 2 Division I of the Residual Heat Removal (RHR) System will be utilized for Suppression Pool (Torus) Cooling and Alternate Shutdown Cooling. To ensure adequate Net Positive Suction Head (NPSH), due to high Torus temperature, both the 2-1002A and 2-1002B RHR pumps are required to provide additional cooling for the Torus. The RHR pumps (2-1002A and 2-1002B) will be started and controlled from Main Control Room Panel 902-3. To start and control the RHR pumps from the Main Control Room, the Fuel Pool Cooling Suction Permissive Switch must be placed in the "OVERRIDE" position. To establish Torus Cooling and Alternate Shutdown Cooling, motor operated valves must be re-aligned to provide a flow path for the required RHR pumps. The cables associated with these motor operated valves are subject to fire-induced damage and potential spurious actuation. Because of the possible cable damage, these valves will be de-energized and manually placed in their required position to achieve Torus and Alternate Shutdown Cooling. To ensure that there is no backflow through the Recirculation Pump and injection bypassing the Reactor, motor operated valve 2-0202-5A must be closed when reconfiguring the Unit 2 Division I RHR System for Shutdown Cooling. This valve can be closed from the Main Control Room. Power for the Unit 2 Division I RHR System will be supplied by Unit 2 offsite power to 4kV SWGR 23-1. If Unit 2 offsite power is unavailable, the Unit 2 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 23-1.

Unit 2 Division I Residual Heat Removal Service Water (RHRSW) System is available for a fire in Fire Area TB-II. To support the Unit 2 Division I Torus and Alternate Shutdown Cooling modes of RHR, the Unit 2 Division I RHRSW pumps (2-1001-65A and 2-1001-65B) will be used to provide cooling to the Unit 2 Division I RHR heat exchangers. Both of these pumps will be started and controlled from Main Control Room Panel 902-3. To start the Unit 2 Division I RHRSW pumps from the Main Control Room, the RHRSW start permissive switch must be placed in the "MANUAL OVERRIDE" position. Power for the Unit 2 Division I RHRSW System will be supplied by Unit 2 offsite power to 4kV SWGR 23. If Unit 2 offsite power is unavailable, the Unit 2 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 23-1 and back fed to 4kV SWGR 23.

Support Functions

The Unit 2 Diesel Generator Cooling Water Pump (DGCWP) will supply cooling water for the Unit 2 Division I RHR Room Cooler (2-5746A). The alternate feed from Unit 1 480V SWGR 19 will supply power to the Unit 2 DGCWP (2-3903) and the alternate feed from Unit 1 480V MCC 19-2 will supply power to the Unit 2 DGCWP Cubicle Coolers (2-5749A and 2-5749B). Power for the Unit 2 Division I RHR Room Cooler will be supplied by the normal feed from Unit 2 480V MCC 29-1. 480V MCC 28-2 will supply power for the Unit 2 Division I RHRSW vault room coolers.

The Unit 2 125V DC system remains available to supply control power for the required 4kV and 480V SWGR. Unit 2 125V DC Battery Charger 2A remains available to supply power to 125V DC Battery Bus 2.

Reactor water level and pressure will be monitored using instrumentation available in the Main Control Room.

Cold Shutdown Repairs

To ensure that there is no backflow through the Recirculation Pump and injection bypassing the Reactor, motor operated valve 2-0202-5A must be closed when reconfiguring the Unit 2 Division I RHR System for Shutdown Cooling. 480V MCC 28/29-5 supplies power to this motor operated valve which is located inside primary containment and is not readily accessible. Because of the location of valve 2-0202-5A, a repair is required to remotely close valve 2-0202-5A from 480V MCC 28/29-5.

4.10 Fire Area TB-III – Turbine Building Southern Zone Group

Fire Area TB-III consists of Fire Zones 8.2.1.A (Unit 1 Condensate Pump Room), 8.2.1.C (Unit 1 Turbine Foundation (Under Hotwell)), 8.2.3.A (Unit 1 Turbine Building Upper Basement (CRD Pump Level)), 8.2.3.B (Unit 1 Radwaste Pipe Tunnel), 8.2.6.A (Unit 1 Turbine Building Ground Floor), 8.2.6.B (Unit 1 Turbine Building Ground Floor (Low Pressure Heater Bay)), 8.2.7.A (Unit 1 Turbine Building Mezzanine Floor), 8.2.7.B (Unit 1 Turbine Building Mezzanine Floor (Low Pressure and D Heater Bay)), 9.1 (Unit 1 Emergency Diesel Generator Room), 11.1.1.A (Unit 1 D RHR Service Water Pump Room), 11.1.1.C (Unit 1 A RHR Service Water Pump Room), 14.1.1 (Unit 1 Off Gas Recombiner Rooms), 6.1.A (Small Unit 1 DC Panel Room), 6.1.B (Large Unit 1 DC Panel Room) and 7.1 (Unit 1 Battery Room).

4.10.1 Unit 1 Shutdown Analysis

Alternative shutdown (10 CFR 50 Appendix R III.G.3 compliance) is utilized for this area.

Reactivity Control

Reactivity control is provided by the Reactor Protection System as discussed in Section 3.1.1 of the Safe Shutdown Report.

Inventory Control

The Safe Shutdown Makeup Pump (SSMP) is used to provide reactor water for inventory control. The SSMP will be started and operated from the Main Control Room within 32 minutes to ensure that Reactor level is maintained above top of active fuel. Initial reactor makeup water will be from the Contaminated Condensate Storage Tanks (CCST) and manually transferred to the Fire Water System upon CCST low level. Alignment of the Fire Water System to the SSMP requires manually closing valve ½-2901-1 and manually opening valves ½-2901-2 and ½-2901-3 to establish the flow path for SSMP injection utilizing the Fire Water System. The Fire Water System also provides cooling water to the SSMP Room Cooler if Service Water is not available. To establish the flow path from the Fire Water System to the SSMP Room Cooler requires manually closing valves ½-2901-25 and ½-2999-9 and manually opening valve ½-2901-9. Power to SSMP 4kV SWGR 31 will be supplied by 4kV SWGR 24-1 utilizing Unit 2 offsite power. If Unit 2 offsite power is unavailable, the Unit 2 Emergency Diesel Generator (EDG) will supply AC power to 4kV SWGR 24-1.

Reactor Pressure Control

The Target Rock Safety/Relief Valve (1-0203-3A) acting in the safety mode (mechanical) will control Reactor pressure at approximately 1135 psig. A fire cannot affect the safety mode of the Target Rock Safety/Relief Valve.

Decay Heat Removal

Unit 1 Division I of the Residual Heat Removal (RHR) System will be utilized for Suppression Pool (Torus) Cooling and Alternate Shutdown Cooling. To ensure adequate Net Positive Suction Head (NPSH), due to high Torus temperature, both the 1-1002A and 1-1002B RHR pumps are required to provide additional cooling for the Torus. The RHR pumps (1-1002A and 1-1002B) will be operated locally at 4kV SWGR 13-1. To establish Torus Cooling and Alternate Shutdown Cooling, motor operated valves must be re-aligned to provide a flow path for the required RHR pumps. The cables associated with these motor operated valves are subject to fire-induced damage and potential spurious actuation. Because of the possible cable damage, these valves will be de-energized and manually placed in their required position to achieve Torus and Alternate Shutdown Cooling. Power for the Unit 1 Division I RHR System will be supplied by Unit 1 offsite power to 4kV SWGR 13-1. If Unit 1 offsite power is unavailable, the Unit 2 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 23-1, which in turn, will be cross-tied to 4kV SWGR 13-1.

Unit 1 Division I Residual Heat Removal Service Water (RHRSW) System is unavailable for a fire in Fire Area TB-III due to the power feeds for the RHRSW pumps being routed through the Fire Area. To support the Unit 1 Division I Torus and Alternate Shutdown Cooling modes of RHR, the Unit 2 Division I RHRSW pumps (2-1001-65A and 2-1001-65B) will be used to provide cooling to the Unit 1 Division I RHR heat exchangers. This is accomplished by opening Division I RHRSW crosstie valve ½-1099-1A. The Unit 2 Division I RHRSW Pumps will be started and controlled from Main Control Room Panel 902-3. Power for the Unit 2 Division I RHRSW System will be supplied by Unit 2 offsite power to 4kV SWGR 23. If Unit 2 offsite power is unavailable, the Unit 2 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 23-1, which in turn, will be back fed to 4kV SWGR 23.

Support Functions

The Unit 1/2 Diesel Generator Cooling Water Pump (DGCWP) will supply cooling water for the Unit 1 Division I RHR Room Cooler (1-5746A). The feed from Unit 2 480V SWGR 28 will supply power to the Unit 1/2 DGCWP (1/2-3903) and the Unit 1/2 DGCWP Cubicle Coolers (1/2-5749A and 1/2-5749B). Power for the Unit 1 Division I RHR Room Cooler will be supplied by the normal feed from Unit 1 480V MCC 18-1A. 480V MCC 28-2 will supply power for the Unit 2 Division I RHRSW vault room coolers.

The Unit 2 125V DC system remains available to supply control power for the required 4kV and 480V SWGR. Unit 2 125V DC Battery Charger 2 remains available to supply power to 125V DC Battery Bus 2.

Reactor water level and pressure, Torus level and temperature, diagnostic instrumentation for shutdown systems and level indication for tanks will be monitored using local instrumentation.

Cold Shutdown Repairs

To ensure that there is no backflow through the Recirculation Pump and injection bypassing the Reactor, motor operated valve 1-0202-5A must be closed when reconfiguring the Unit 1 Division I RHR System for Shutdown Cooling. 480V MCC 18/19-5 supplies power to this motor operated valve which is located inside primary containment and is not readily accessible. A fire in this Fire Area may damage the control cables associated with 480V MCC 18/19-5. Because of the location of valve 1-0202-5A and the potential cable damage, a repair is required to remotely close valve 1-0202-5A from Unit 1 480V MCC 18/19-5.

A fire in this area may potentially damage the control cables associated with relief valves 1-0203-3B and 1-0203-3C. To prevent spurious actuation during Hot Shutdown, these valves have been manually disabled. Before depressurization of the reactor can be initiated to achieve Cold Shutdown, a repair to relief valves 1-0203-3B and 1-0203-3C is required. This Cold Shutdown

repair consists of splicing cables from Unit 2 125V DC Reactor Building Distribution Panel 2 to Drywell penetration X-100B. Once the repair is complete, the reactor vessel will be depressurized by alternating Relief Valves 1-0203-3B and 1-0203-3C as required to maintain depressurization. This is accomplished by opening and closing the appropriate breakers on Unit 2 125V DC Reactor Building Distribution Panel 2.

4.10.2 Unit 2 Shutdown Analysis

A Compliance Assessment was performed on this Fire Area to determine the effects of the fire on the non-fire unit. The assessment determined that there is a minimum set of safe shutdown equipment available to safely shutdown the non-fire unit. If required, the non-fire unit will be placed in Cold Shutdown utilizing existing station procedures. For this Fire Area there is not a specific Safe Shutdown Procedure required to achieve and maintain Cold Shutdown.

4.11 Fire Area TB-IV – Turbine Operating Floor

Fire Area TB-IV consists of Fire Zones 1.1.1.5.A (Elevation 658' Turbine Building Vent Fan Room), 1.1.1.6.A (Elevation 678' Turbine Building Vent Fan Room) and 8.2.8.E (Turbine Operating Floor). This Fire Area is separated from adjacent Safe Shutdown Fire Areas 13-1 and 24-1 as described in the Fire Hazards Analysis (FHA). This Fire Area does not contain any equipment or cables required for Safe Shutdown. Therefore, a fire in this Fire Area will not affect the ability to achieve or maintain Safe Shutdown. Due to the lack of Safe Shutdown equipment or cables, existing station procedures are adequate to achieve Safe Shutdown for a fire in this Fire Area. Therefore, the need for a specific Safe Shutdown procedure for this Fire Area is not required. (Evaluations S040-QH-0439 and S040-QH-0441)

4.12 Fire Area TB-V – Unit 1 B/C RHR Service Water Vault

Fire Area TB-V consists of Fire Zone 11.1.1.B (Unit 1 B/C RHR Service Water Vault). This Fire Area contains the 1/2 Emergency Diesel Generator Cooling Water Pump (and associated cooling fans), the Unit 1 B RHR Service Water Pump and the Unit 1 C RHR Service Water Pump. A fire in this Fire Area would damage one of the Unit 1, Division I and one of the Unit 1, Division II RHR Service Water Pumps and the 1/2 Emergency Diesel Generator Cooling Water Pump. The cooling fans for this equipment would also be damaged. Although both Division I and Division II RHR Service Water equipment is affected by a fire, one train remains unaffected and is available to achieve plant shutdown. An alternate power feed to the 1/2 Emergency Diesel Generator Cooling Water Pump is also available if the main power feed is damaged by a fire. This alternate power feed is enclosed by a 1-hour fire wrap. This Fire Area also contains complete detection and suppression as described in the Fire Hazards Analysis (FHA). Furthermore, evaluation S040-QH-0444 has determined that for a fire in this Fire Area, existing station procedures are adequate to achieve Safe Shutdown. Therefore, the need for a specific Safe Shutdown procedure for this Fire Area is not required.

4.13 Fire Area 14-1 – Unit 1 4kV SWGR 14-1 Area

Fire Area 14-1 consists of Fire Zone 8.2.8.A. In the event of a fire in this area, only 4kV SWGR 14-1 and the feed from the Unit 1 Station Blackout (SBO) Diesel Generator to 4kV SWGR 13-1 will be exposed. 4kV SWGR 14-1 provides the normal power feed to 4kV SWGR 31 with 4kV SWGR 24-1 providing the alternate feed to SWGR 31. The crosstie breakers between 4kV SWGR 14-1 and 24-1 are normally open. Since these breakers are normally open, a fault at 4kV SWGR 14-1 would not affect 4kV SWGR 24-1. Furthermore, the normally closed feed from 4kV SWGR 14-1 to Safe Shutdown Makeup Pump 4kV SWGR 31 is protected via coordination at breaker 3101. Therefore, Reactor makeup capability exists for this Fire Area to achieve Safe Shutdown. The Reactor Core Isolation Cooling (RCIC) system of both Units is also available to supply Reactor inventory makeup for a fire in this area. Except for cables 13981 and 65315, Unit 1 Division I would not be affected by a fire in this area. Cable 13981 is the normally open reserve 125V DC feed to 4kV SWGR 14-1 and fire damage to this cable would have not impact on Safe Shutdown with Division I. Both Division I and Division II of Unit 2 are unaffected by a fire in this Fire Area and would be available for Safe Shutdown. Therefore, adequate Safe Shutdown capability exists using Quad Cities Emergency Operating Procedures for a fire in this area.

Associated cables routed in this Fire Area include RHR and Core Spray logic circuits that are associated with Unit 1 Division II RHR system automatic functions which are, in turn, associated with the Division II RHR pumps, RHR Service Water pumps, RHR valves and Unit 1 Diesel Generator auxiliary equipment. The Unit 1 Division I equipment would not be affected and existing procedures address Unit shutdown for a loss of 4kV SWGR 14-1. Faults on the associated circuitry will not prevent Safe Shutdown (NDIT S040-QH-0439, NDIT S040-QH-0441).

4.14 Fire Area 13-1 – Unit 1 4kV SWGR 13-1 Area

Fire Area 13-1 consists of Fire Zone 8.2.8.B.

4.14.1 Unit 1 Shutdown Analysis

Alternative shutdown (10 CFR 50 Appendix R III.G.3 compliance) is utilized for this area.

Reactivity Control

Reactivity control is provided by the Reactor Protection System as discussed in Section 3.1.1 of the Safe Shutdown Report.

Inventory Control

The Safe Shutdown Makeup Pump (SSMP) is used to provide reactor water for inventory control. The SSMP will be started and operated from the Main Control Room within 32 minutes to ensure that Reactor level is maintained above top of active fuel. Initial reactor makeup water will be from the Contaminated Condensate Storage Tanks (CCST) and manually transferred to the Fire Water System upon CCST low level. Alignment of the Fire Water System to the SSMP requires manually closing valve ½-2901-1 and manually opening valves ½-2901-2 and ½-2901-3 to establish the flow path for SSMP injection utilizing the Fire Water System. The Fire Water System also provides cooling water to the SSMP Room Cooler if Service Water is not available. To establish the flow path from the Fire Water System to the SSMP Room Cooler requires manually closing valves ½-2901-25 and ½-2999-9 and manually opening valve ½-2901-9. Power to SSMP 4kV SWGR 31 will be supplied by 4kV SWGR 14-1 utilizing Unit 1 offsite power. If Unit 1 offsite power is unavailable, the Unit 1 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 14-1.

Reactor Pressure Control

The Target Rock Safety/Relief Valve (1-0203-3A) acting in the safety mode (mechanical) will control Reactor pressure at approximately 1135 psig. A fire cannot affect the safety mode of the Target Rock Safety/Relief Valve.

Decay Heat Removal

Unit 1 Division II of the Residual Heat Removal (RHR) System will be utilized for Suppression Pool (Torus) Cooling and Alternate Shutdown Cooling. To ensure adequate Net Positive Suction Head (NPSH), due to high Torus temperature, both the 1-1002C and 1-1002D RHR pumps are required to provide additional cooling for the Torus. The RHR pumps (1-1002C and 1-1002D) will be started and controlled from Main Control Room Panel 901-3. To establish Torus Cooling and Alternate Shutdown Cooling, motor operated valves must be re-aligned to provide a flow path for the required RHR pumps. The cables associated with these motor operated valves are subject to fire-induced damage and potential spurious actuation. Because of the possible cable damage, these valves will be de-energized and manually placed in their required position to achieve Torus and Alternate Shutdown Cooling. Power for the Unit 1 Division II RHR System will be supplied by Unit 1 offsite power to 4kV SWGR 14-1. If Unit 1 offsite power is unavailable, the Unit 1 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 14-1.

Unit 1 Division II Residual Heat Removal Service Water (RHRSW) System is unavailable for a fire in Fire Area 13-1 due to the 480V power feeds for the RHRSW pump cubicle coolers being routed through the Fire Area. To support the Unit 1 Division II Torus and Alternate Shutdown Cooling modes of RHR, the Unit 2 Division II RHRSW pumps (2-1001-65C and 2-1001-65D) will be used to provide cooling to the Unit 1 Division II RHR heat exchangers. This is accomplished by opening Division II RHRSW crosstie valve ½-1099-1B. The Unit 2 Division II RHRSW Pumps will be started and controlled from Main Control Room Panel 902-3. Power for the Unit 2 Division II RHRSW System will be supplied by Unit 2 offsite power to 4kV SWGR 24. If Unit 2 offsite power is unavailable, the Unit 1 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 14-1, which in turn, will be cross tied to 4kV SWGR 24-1 and back fed to 4kV SWGR 24.

Support Functions

The Unit 1 Diesel Generator Cooling Water Pump (DGCWP) will supply cooling water for the Unit 1 Division II RHR Room Cooler (1-5746B). The alternate feed from Unit 2 480V SWGR 29 will supply power to the Unit 1 DGCWP (1-3903) and the alternate feed from Unit 2 480V MCC 29-2 will supply power to the Unit 1 DGCWP Cubicle Coolers (1-5749A and 1-5749B). Power for the Unit 1 Division II RHR Room Cooler will be supplied by the alternate feed from Unit 2 480V MCC 29-1. 480V MCC 29-2 will supply power for the Unit 2 Division II RHRSW vault room coolers.

The Unit 2 125V DC system remains available to supply control power for the required 4kV and 480V SWGR. Unit 2 125V DC Battery Charger 2 or 125V DC Battery Charger 2A remain available to supply power to 125V DC Battery Bus 2 (EC 360895).

Reactor water level and pressure, Torus level and temperature, diagnostic instrumentation for shutdown systems and level indication for tanks will be monitored using local instrumentation.

Cold Shutdown Repairs

To ensure that there is no backflow through the Recirculation Pump and injection bypassing the Reactor, motor operated valve 1-0202-5B must be closed when reconfiguring the Unit 1 Division II RHR System for Shutdown Cooling. 480V MCC 18/19-5 supplies power to this motor operated valve which is located inside primary containment and is not readily accessible. A fire in this Fire Area may damage the control cables associated with 480V MCC 18/19-5. Because of the location of valve 1-0202-5B and the potential cable damage, a repair is required to remotely close valve 1-0202-5B from Unit 2 480V MCC 28/29-5.

4.14.2 Unit 2 Shutdown Analysis

A Compliance Assessment was performed on this Fire Area to determine the effects of the fire on the non-fire unit. The assessment determined that there is a minimum set of safe shutdown equipment available to safely shutdown the non-fire unit. If required, the non-fire unit will be placed in Cold Shutdown utilizing existing station procedures. For this Fire Area there is not a specific Safe Shutdown Procedure required to achieve and maintain Cold Shutdown.

4.15 Fire Area 24-1 – Unit 2 4kV SWGR 24-1 Area

Fire Area 24-1 consists of Fire Zone 8.2.8.C.

4.15.1 Unit 2 Shutdown Analysis

Alternative shutdown (10 CFR 50 Appendix R III.G.3 compliance) is utilized for this area.

Reactivity Control

Reactivity control is provided by the Reactor Protection System as discussed in Section 3.1.1 of the Safe Shutdown Report.

Inventory Control

The Safe Shutdown Makeup Pump (SSMP) is used to provide reactor water for inventory control. The SSMP will be started and operated from the Main Control Room within 32 minutes to ensure that Reactor level is maintained above top of active fuel. Initial reactor makeup water will be from the Contaminated Condensate Storage Tanks (CCST) and manually transferred to the Fire Water System upon CCST low level. Alignment of the Fire Water System to the SSMP requires manually closing valve ½-2901-1 and manually opening valves ½-2901-2 and ½-2901-3 to establish the flow path for SSMP injection utilizing the Fire Water System. The Fire Water System also provides cooling water to the SSMP Room Cooler if Service Water is not available. To establish the flow path from the Fire Water System to the SSMP Room Cooler requires manually closing valves ½-2901-25 and ½-2999-9 and manually opening valve ½-2901-9. Power to SSMP 4kV SWGR 31 will be supplied by 4kV SWGR 14-1 utilizing Unit 1 offsite power. If Unit 1 offsite power is unavailable, the Unit 1 Emergency Diesel Generator (EDG) will supply AC power to 4kV SWGR 14-1.

Reactor Pressure Control

The Target Rock Safety/Relief Valve (2-0203-3A) acting in the safety mode (mechanical) will control Reactor pressure at approximately 1135 psig. A fire cannot affect the safety mode of the Target Rock Safety/Relief Valve.

Decay Heat Removal

Unit 2 Division I of the Residual Heat Removal (RHR) System will be utilized for Suppression Pool (Torus) Cooling and Alternate Shutdown Cooling. To ensure adequate Net Positive Suction Head (NPSH), due to high Torus temperature, both the 2-1002A and 2-1002B RHR pumps are required to provide additional cooling for the Torus. The RHR pumps (2-1002A and 2-1002B) will be started and controlled from Main Control Room Panel 902-3. To establish Torus Cooling and Alternate Shutdown Cooling, motor operated valves must be re-aligned to provide a flow path for the required RHR pumps. The cables associated with these motor operated valves are subject to fire-induced damage and potential spurious actuation. Because of the possible cable damage, these valves will be de-energized and manually placed in their required position to achieve Torus and Alternate Shutdown Cooling. Power for the Unit 2 Division I RHR System will be supplied by Unit 2 offsite power to 4kV SWGR 23-1. If Unit 2 offsite power is unavailable, the Unit 2 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 23-1.

Unit 2 Division I Residual Heat Removal Service Water (RHRSW) System is unavailable for a fire in Fire Area 24-1 due to the 480V power feeds for the RHRSW pump cubicle coolers being routed through the Fire Area. To support the Unit 2 Division I Torus and Alternate Shutdown Cooling modes of RHR, the Unit 1 Division I RHRSW pumps (1-1001-65A and 1-1001-65B) will be used to provide cooling to the Unit 2 Division I RHR heat exchangers. This is accomplished by opening Division II RHRSW crosstie valve ½-1099-1A. The Unit 1 Division I RHRSW Pumps will be started and controlled from Main Control Room Panel 901-3. Power for the Unit 1 Division I RHRSW System will be supplied by Unit 1 offsite power to 4kV SWGR 13. If Unit 1 offsite power is unavailable, the Unit 1 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 13-1, which in turn, will be back fed to 4kV SWGR 13.

Support Functions

The Unit 1/2 Diesel Generator Cooling Water Pump (DGCWP) will supply cooling water for the Unit 2 Division I RHR Room Cooler (2-5746A). The feed from Unit 1 480V SWGR 18 will supply power to the Unit 1/2 DGCWP (1/2-3903) and the Unit 1/2 DGCWP Cubicle Coolers (1/2-5749A and 1/2-5749B). Power for the Unit 2 Division I RHR Room Cooler will be supplied by the alternate feed from Unit 1 480V MCC 18-1A. 480V MCC 18-2 will supply power for the Unit 1 Division I RHRSW vault room coolers.

The Unit 1 125V DC system remains available to supply control power for the required 4kV and 480V SWGR. Unit 1 125V DC Battery Charger 1 or 125V DC Battery Charger 1A remain available to supply power to 125V DC Battery Bus 1.

Reactor water level and pressure, Torus level and temperature, diagnostic instrumentation for shutdown systems and level indication for tanks will be monitored using Main Control Room or local instrumentation.

Cold Shutdown Repairs

To ensure that there is no backflow through the Recirculation Pump and injection bypassing the Reactor, motor operated valve 2-0202-5A must be closed when reconfiguring the Unit 2 Division I RHR System for Shutdown Cooling. 480V MCC 28/29-5 supplies power to this motor operated valve which is located inside primary containment and is not readily accessible. A fire in this Fire Area may damage the control cables associated with 480V MCC 28/29-5. Because of the location of valve 2-0202-5A and the potential cable damage, a repair is required to remotely close valve 2-0202-5A from Unit 1 480V MCC 18/19-5.

4.15.2 Unit 1 Shutdown Analysis

A Compliance Assessment was performed on this Fire Area to determine the effects of the fire on the non-fire unit. The assessment determined that there is a minimum set of safe shutdown

equipment available to safely shutdown the non-fire unit. If required, the non-fire unit will be placed in Cold Shutdown utilizing existing station procedures. For this Fire Area there is not a specific Safe Shutdown Procedure required to achieve and maintain Cold Shutdown.

4.16 Fire Area 23-1 – Unit 2 4kV SWGR 23-1 Area

Fire Area 23-1 consists of Fire Zone 8.2.8.D. In the event of a fire in this area, only 4kV SWGR 23-1 and the feed from the Unit 2 Station Blackout (SBO) Diesel Generator to 4kV SWGR 24-1 would be exposed. The crosstie breakers between 4kV SWGR 13-1 and 23-1 are normally open and in the unlikely event the crosstie is closed at the time of the fire, breaker 1329 on 4kV SWGR 13-1 would isolate the fault. A fire in this area does not affect Unit 2 Division II and both Division I and Division II of Unit 1. Therefore, adequate Safe Shutdown capability exists utilizing Quad Cities Emergency Operating Procedures for a fire in this area. The availability of this equipment is demonstrated by an exclusion analysis of the required cables (NDIT S040-QH-0441).

4.17 Fire Area SB-I – Service Building

Fire Area SB-I consists of Fire Zones 2.0 (Main Control Room), 3.0 (Cable Spreading Room), 4.0 (Old Computer Room) and 6.3 (Auxiliary Electrical Equipment Room)

4.17.1 Unit 1 Shutdown Analysis

Alternative shutdown (10 CFR 50 Appendix R III.G.3 compliance) is utilized for this area.

Reactivity Control

Reactivity control is provided by the Reactor Protection System as discussed in Section 3.1.1 of the Safe Shutdown Report.

Inventory Control

The Safe Shutdown Makeup Pump (SSMP) is used to provide reactor water for inventory control. The SSMP will be started and operated locally from the Safe Shutdown Makeup Pump Room within 32 minutes to ensure that Reactor level is maintained above top of active fuel. Control cables for all components of the SSMP system are routed in this Fire Area. The capability to isolate and control all of the components is available in the Safe Shutdown Makeup Pump Room. Initial reactor makeup water will be from the Contaminated Condensate Storage Tanks (CCST) and manually transferred to the Fire Water System upon CCST low level. Alignment of the Fire Water System to the SSMP requires manually closing valve 1/2-2901-1 and manually opening valves 1/2-2901-2 and 1/2-2901-3 to establish the flow path for SSMP injection utilizing the Fire Water System. The Fire Water System also provides cooling water to the SSMP Room Cooler if Service Water is not available. To establish the flow path from the Fire Water System to the SSMP Room Cooler requires manually closing valves 1/2-2901-25 and 1/2-2999-9 and manually opening valve 1/2-2901-9. Power to SSMP 4kV SWGR 31 will be supplied by 4kV SWGR 14-1 utilizing Unit 1 offsite power. If Unit 1 offsite power is unavailable, the Unit 1 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 14-1.

Reactor Pressure Control

The Target Rock Safety/Relief Valve (1-0203-3A) acting in the safety mode (mechanical) will control Reactor pressure at approximately 1135 psig. A fire cannot affect the safety mode of the Target Rock Safety/Relief Valve.

Decay Heat Removal

Unit 1 Division II of the Residual Heat Removal (RHR) System will be utilized for Suppression Pool (Torus) Cooling and Alternate Shutdown Cooling. To ensure adequate Net Positive Suction Head (NPSH), due to high Torus temperature, both the 1-1002C and 1-1002D RHR pumps are required to provide additional cooling for the Torus. The RHR pumps (1-1002C and 1-1002D) will be operated locally at 4kV SWGR 14-1. To establish Torus Cooling and Alternate Shutdown Cooling, motor operated valves must be re-aligned to provide a flow path for the required RHR pumps. The cables associated with these motor operated valves are subject to fire-induced damage and potential spurious actuation. Because of the possible cable damage, these valves will be de-energized and manually placed in their required position to achieve Torus and Alternate Shutdown Cooling. Power for the Unit 1 Division II RHR System will be supplied by Unit 1 offsite power to 4kV SWGR 14-1. If Unit 1 offsite power is unavailable, the Unit 1 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 14-1.

Unit 1 Division II Residual Heat Removal Service Water (RHRSW) System is available for a fire in Fire Area SB-I. To support the Unit 1 Division II Torus and Alternate Shutdown Cooling modes of RHR, the Unit 1 Division II RHRSW pumps (1-1001-65C and 1-1001-65D) will be used to provide cooling to the Unit 1 Division II RHR heat exchangers. Both of these pumps will be started and controlled locally at 4kV SWGR 14. Power for the Unit 1 Division II RHRSW System will be supplied by Unit 1 offsite power to 4kV SWGR 14. If Unit 1 offsite power is unavailable, the Unit 1 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 14-1 and back fed to 4kV SWGR 14.

Support Functions

The Unit 1 Diesel Generator Cooling Water Pump (DGCWP) will supply cooling water for the Unit 1 Division II RHR Room Cooler (1-5746B). The normal feed from Unit 1 480V SWGR 19 will supply power to the Unit 1 DGCWP (1-3903) and the normal feed from Unit 1 480V MCC 19-2 will supply power to the Unit 1 DGCWP Cubicle Coolers (1-5749A and 1-5749B). Power for the Unit 1 Division II RHR Room Cooler will be supplied by the normal feed from Unit 1 480V MCC 19-1. 480V MCC 19-2 will supply power for the Unit 1 Division II RHRSW vault room coolers.

The Unit 1 125V DC system remains available to supply control power for the required 4kV and 480V SWGR. Unit 1 125V DC Battery Charger 1 remains available to supply power to 125V DC Battery Bus 1.

Reactor water level and pressure, Torus level and temperature, diagnostic instrumentation for shutdown systems and level indication for tanks will be monitored using local instrumentation.

Cold Shutdown Repairs

To ensure that there is no backflow through the Recirculation Pump and injection bypassing the Reactor, motor operated valve 1-0202-5B must be closed when reconfiguring the Unit 1 Division II RHR System for Shutdown Cooling. 480V MCC 18/19-5 supplies power to this motor operated valve which is located inside primary containment and is not readily accessible. A fire in this Fire Area may damage the control cables associated with 480V MCC 18/19-5. Because of the location of valve 1-0202-5B and the potential cable damage, a repair is required to remotely close valve 1-0202-5B from Unit 1 480V MCC 18/19-5.

A fire in this area may potentially damage the control cables associated with relief valves 1-0203-3B and 1-0203-3C. To prevent spurious actuation during Hot Shutdown, these valves have been manually disabled. Before depressurization of the reactor can be initiated to achieve Cold Shutdown, a repair to relief valves 1-0203-3B and 1-0203-3C is required. This Cold Shutdown repair consists of splicing cables from Unit 1 125V DC Reactor Building Distribution Panel 1 to Drywell penetration X-100B. Once the repair is complete, the reactor vessel will be depressurized by alternating Relief Valves 1-0203-3B and 1-0203-3C as required to maintain depressurization. This is accomplished by opening and closing the appropriate breakers on Unit 1 125V DC Reactor Building Distribution Panel 1.

4.17.2 Unit 2 Shutdown Analysis

Alternative shutdown (10 CFR 50 Appendix R III.G.3 compliance) is utilized for this area.

Reactivity Control

Reactivity control is provided by the Reactor Protection System as discussed in Section 3.1.1 of the Safe Shutdown Report.

Inventory Control

The Unit 2 Reactor Core Isolation Cooling (RCIC) system will be utilized to provide reactor water for inventory control. The RCIC system will be started and operated locally from the Unit 2 RCIC Room within 32 minutes to ensure that Reactor level is maintained above top of active fuel. The RCIC system will initially be lined up to take suction from the Contaminated Condensate Storage Tanks (CCST). Within 30 minutes of establishing injection, the RCIC pump suction will be transferred to the Unit 2 Torus to preserve CCST volume for the Unit 1 Safe Shutdown Makeup Pump (SSMP) system. Motor operated valve 2-1301-16 (main steam supply valve to RCIC Turbine) is located inside the Unit 2 Drywell. Fire-induced cable damage may cause this valve to spuriously close and isolate the steam supply to the Unit 2 RCIC Turbine. To ensure that motor operated valve 2-1301-16 remains open, the alternate feed from the Unit 2 Station Blackout (SBO) will be used to open the valve at 480V MCC 28-1A. The Unit 2 RCIC Condensate and Vacuum Pumps are required to maintain RCIC Room habitability during local operation of the RCIC system. Power for the Unit 2 RCIC Condensate and Vacuum Pumps will be supplied by the normal 250V DC system lineup. Power for the Unit 2 RCIC Room Cooler (2-5748B) will be supplied by 480V MCC 29-1. The power for 250V DC Battery Charger #2 will be supplied by 480V MCC 29-2.

Reactor Pressure Control

The Target Rock Safety/Relief Valve (2-0203-3A) acting in the safety mode (mechanical) will control Reactor pressure at approximately 1135 psig. A fire cannot affect the safety mode of the Target Rock Safety/Relief Valve.

Decay Heat Removal

Unit 2 Division II of the Residual Heat Removal (RHR) System will be utilized for Suppression Pool (Torus) Cooling and Alternate Shutdown Cooling. To ensure adequate Net Positive Suction Head (NPSH), due to high Torus temperature, both the 2-1002C and 2-1002D RHR pumps are required to provide additional cooling for the Torus. The RHR pumps (2-1002C and 2-1002D) will be operated locally at 4kV SWGR 24-1. To establish Torus Cooling and Alternate Shutdown Cooling, motor operated valves must be re-aligned to provide a flow path for the required RHR pumps. The cables associated with these motor operated valves are subject to fire-induced damage and potential spurious actuation. Because of the possible cable damage, these valves will be de-energized and manually placed in their required position to achieve Torus and Alternate Shutdown Cooling. Power for the Unit 2 Division II RHR System will be supplied by Unit 2 offsite power to 4kV SWGR 24-1. If Unit 2 offsite power is unavailable, the Unit 2 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 24-1.

Unit 2 Division II Residual Heat Removal Service Water (RHRSW) System is available for a fire in Fire Area SB-I. To support the Unit 2 Division II Torus and Alternate Shutdown Cooling modes of RHR, the Unit 2 Division II RHRSW pumps (2-1001-65C and 2-1001-65D) will be used to provide cooling to the Unit 2 Division II RHR heat exchangers. Both of these pumps will be started and controlled locally at 4kV SWGR 24. Power for the Unit 2 Division II RHRSW System will be supplied by Unit 2 offsite power to 4kV SWGR 24. If Unit 2 offsite power is unavailable, the Unit 2 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 24-1 and back fed to 4kV SWGR 24.

Support Functions

The Unit 2 Diesel Generator Cooling Water Pump (DGCWP) will supply cooling water for the Unit 2 Division II RHR Room Cooler (2-5746B). The normal feed from Unit 2 480V SWGR 29 will supply power to the Unit 2 DGCWP (2-3903) and the normal feed from Unit 2 480V MCC 29-2 will supply power to the Unit 2 DGCWP Cubicle Coolers (2-5749A and 2-5749B). Power for the Unit 2 Division II RHR Room Cooler will be supplied by the normal feed from Unit 2 480V MCC 29-1. 480V MCC 29-2 will supply power for the Unit 2 Division II RHRSW vault room coolers.

The reserve 125V DC feed from the Unit 2 SBO system remains available to supply control power for the required 4kV and 480V SWGR.

Reactor water level and pressure, Torus level and temperature, diagnostic instrumentation for shutdown systems and level indication for tanks will be monitored using local instrumentation.

Cold Shutdown Repairs

To ensure that there is no backflow through the Recirculation Pump and injection bypassing the Reactor, motor operated valve 2-0202-5B must be closed when reconfiguring the Unit 2 Division II RHR System for Shutdown Cooling. 480V MCC 28/29-5 supplies power to this motor operated valve which is located inside primary containment and is not readily accessible. A fire in this Fire Area may damage the control cables associated with 480V MCC 28/29-5. Because of the location of valve 2-0202-5B and the potential cable damage, a repair is required to remotely close valve 2-0202-5B from Unit 2 480V MCC 28/29-5.

A fire in this area may potentially damage the control cables associated with relief valves 2-0203-3B and 2-0203-3C. To prevent spurious actuation during Hot Shutdown, these valves have been manually disabled. Before depressurization of the reactor can be initiated to achieve Cold Shutdown, a repair to relief valves 2-0203-3B and 2-0203-3C is required. This Cold Shutdown repair consists of splicing cables from Unit 2 125V DC Reactor Building Distribution Panel 2 to Drywell penetration X-104A. Once the repair is complete, the reactor vessel will be depressurized by alternating Relief Valves 2-0203-3B and 2-0203-3C as required to maintain depressurization. This is accomplished by opening and closing the appropriate breakers on Unit 2 125V DC Reactor Building Distribution Panel 2.

4.18 Fire Area SB-II – Service Building

Fire Area SB-II consists of Fire Zones 19.1 (Service Building Offices (First Floor)), 19.2 (Service Building Offices (Second and Third Floors)), 19.3 (Control Room Air Handling Unit Room) and 23.1 (Central Alarm Station (CAS)). This Fire Area does not contain any Safe Shutdown equipment or cables other than equipment associated with the Main Control Room ventilation system. A fire involving the Main Control Room ventilation system will not affect the ability to achieve and maintain Safe Shutdown. Due to this, existing station procedures are adequate to achieve Safe Shutdown for a fire in this Fire Area. Therefore, the need for a specific Safe Shutdown procedure for this Fire Area is not required.

4.19 Fire Area RW – Radwaste Building

Fire Area RW consists of Fire Zones 14.1 (Radwaste Collection and Handling Area) and 14.3.1 (Maximum Recycle Radwaste Building). This Fire Area does not contain any Safe Shutdown equipment or cables other than cables 08333, 08342, 11434 and 21434 and the manual Torus reject valves. Cables 08333 and 08342 are the power cables to Radwaste Building transformers 1A and 2A respectively. The concern associated with these cables involves a common power supply with 4kV SWGRs 13 and 23. Evaluation EIC-97-008 documents the coordination for the 4kV SWGR and thus this common power supply is not a concern. Control cables 11434 and 21434 are associated with the alternate feeds for the Unit 1 and Unit 2 Diesel Generator Cooling Water Pumps (DGCWP) respectively. Evaluations S040-QH-0439 and S040-QH-0441 have shown that fire damage to these cables cannot affect either the normal or alternate feeds to the DGCWPs. Fire exposure to the manual Torus reject valves does not affect the ability to shutdown either of the units. Due to the above justification, existing station procedures are adequate to achieve Safe Shutdown for a fire in this Fire Area. Therefore, the need for a specific Safe Shutdown procedure for this Fire Area is not required.

4.20 Fire Area CH - Cribhouse

Fire Area CH consists of Fire Zones 11.4.A (Cribhouse Basement) and 11.4.B (Cribhouse Ground Floor). This Fire Area does not contain any Safe Shutdown equipment or cables other than the 1/2A and 1/2B Diesel Fire Pumps and the Diesel Fire Pump Day Tank cross-tie manual isolation valves. The Diesel Fire Pumps and the manual isolation valves are only required for Safe Shutdown when the Safe Shutdown Makeup Pump (SSMP) is utilized for Reactor vessel injection. If a fire was to occur in the Cribhouse, the Reactor Core Isolation Cooling (RCIC) pumps for both Unit 1 and Unit 2 would be available for injection and the SSMP would not be required. Due to the above justification, existing station procedures are adequate to achieve Safe Shutdown for a fire in this Fire Area. Therefore, the need for a specific Safe Shutdown procedure for this Fire Area is not required.

4.21 Fire Area OG – Off Gas Filter Building

Fire Area OG consists of Fire Zone 22.1 (Off Gas Filter Building). This Fire Area does not contain any Safe Shutdown equipment or cables other than cables 60116 and 70116. These cables are the power cables to Off Gas Filter Building transformers 10 and 20 respectfully. The concern associated with these cables involves a common power supply with 4kV SWGRs 13-1 and 23-1. Evaluation EIC-97-008 documents the coordination for the 4kV SWGR and thus this common power supply is not a concern. Due to the above justification, existing station procedures are adequate to achieve Safe Shutdown for a fire in this Fire Area. Therefore, the need for a specific Safe Shutdown procedure for this Fire Area is not required. (S040-QH-0441 and S040-QH-0439)

4.22 Fire Area OUTSIDE – Outside Fire Areas

The OUTSIDE Fire Area consists of numerous Fire Zones located outside of the power block. The only Safe Shutdown equipment or cabling contained in this Fire Area are the cables for the Station Blackout (SBO) Diesel Generators. These cables are routed from the SBO Building along the outside of the Reactor Building to where they enter the Turbine Building (NDIT QDC-97-130). Due to the robust construction of the Reactor and Turbine Building walls, a fire originating in any of the outside Fire Zones would be limited to the OUTSIDE Fire Area and would not affect any Fire Area contained in the power block. Due to the above justification, existing station procedures are adequate to achieve Safe Shutdown for a fire in this Fire Area. Therefore, the need for a specific Safe Shutdown procedure for this Fire Area is not required.

4.23 Fire Area SBO – Station Blackout (SBO Diesel Generator Building)

The SBO Fire Area consists of numerous Fire Zones located in the SBO Building. A fire originating within the SBO Building would only effect equipment associated with the Unit 1 and/or Unit 2 SBO Diesel Generators. Due to the robust construction of the Reactor and Turbine Building walls, a fire originating in any of the SBO Fire Zones would be limited to the SBO Fire Area and would not affect any Fire Area contained in the power block. Due to the above justification, existing station procedures are adequate to achieve Safe Shutdown for a fire in this Fire Area. Therefore, the need for a specific Safe Shutdown procedure for this Fire Area is not required.

4.24 Fire Area CT-1 – Unit 1 Cable Tunnel

Fire Area CT-1 consists of Fire Zone 8.2.4.

4.24.1 Unit 1 Shutdown Analysis

Alternative shutdown (10 CFR 50 Appendix R III.G.3 compliance) is utilized for this area.

Reactivity Control

Reactivity control is provided by the Reactor Protection System as discussed in Section 3.1.1 of the Safe Shutdown Report.

Inventory Control

The Safe Shutdown Makeup Pump (SSMP) is used to provide reactor water for inventory control. The SSMP will be started and operated from the Main Control Room within 32 minutes to ensure that Reactor level is maintained above top of active fuel. Initial reactor makeup water will be from the Contaminated Condensate Storage Tanks (CCST) and manually transferred to the Fire Water System upon CCST low level. Alignment of the Fire Water System to the SSMP requires manually closing valve ½-2901-1 and manually opening valves ½-2901-2 and ½-2901-3 to establish the flow path for SSMP injection utilizing the Fire Water System. The Fire Water System also provides cooling water to the SSMP Room Cooler if Service Water is not available. To establish the flow path from the Fire Water System to the SSMP Room Cooler requires manually closing valves ½-2901-25 and ½-2999-9 and manually opening valve ½-2901-9. Power to SSMP 4kV SWGR 31 will be supplied by 4kV SWGR 24-1 utilizing Unit 2 offsite power. If Unit 2 offsite power is unavailable, the Unit 2 Emergency Diesel Generator (EDG) will supply AC power to 4kV SWGR 24-1.

Reactor Pressure Control

The Target Rock Safety/Relief Valve (1-0203-3A) acting in the safety mode (mechanical) will control Reactor pressure at approximately 1135 psig. A fire cannot affect the safety mode of the Target Rock Safety/Relief Valve.

Decay Heat Removal

Unit 1 Division I of the Residual Heat Removal (RHR) System will be utilized for Suppression Pool (Torus) Cooling and Alternate Shutdown Cooling. To ensure adequate Net Positive Suction Head (NPSH), due to high Torus temperature, both the 1-1002A and 1-1002B RHR pumps are required to provide additional cooling for the Torus. The RHR pumps (1-1002A and 1-1002B) will be started and controlled from Main Control Room Panel 901-3. To establish Torus Cooling and Alternate Shutdown Cooling, motor operated valves must be re-aligned to provide a flow path for the required RHR pumps. The cables associated with these motor operated valves are subject to fire-induced damage and potential spurious actuation. Because of the possible cable damage, these valves will be de-energized and manually placed in their required position to achieve Torus and Alternate Shutdown Cooling. Power for the Unit 1 Division I RHR System will be supplied by Unit 1 offsite power to 4kV SWGR 13-1. If Unit 1 offsite power is unavailable, the Unit 1 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 13-1.

Unit 1 Division I Residual Heat Removal Service Water (RHRSW) System is available for a fire in Fire Area CT-1. To support the Unit 1 Division I Torus and Alternate Shutdown Cooling modes of RHR, the Unit 1 Division I RHRSW pumps (1-1001-65A and 1-1001-65B) will be used to provide cooling to the Unit 1 Division I RHR heat exchangers. The Unit 1 Division I RHRSW Pumps will be started and controlled from Main Control Room Panel 901-3. Power for the Unit 1 Division I RHRSW System will be supplied by Unit 1 offsite power to 4kV SWGR 13. If Unit 1 offsite power is unavailable, the Unit 1 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 13-1 and back fed to 4kV SWGR 13.

Support Functions

The Unit 1/2 Diesel Generator Cooling Water Pump (DGCWP) will supply cooling water for the Unit 1 Division I RHR Room Cooler (1-5746A). The feed from Unit 1 480V SWGR 18 will supply power to the Unit 1/2 DGCWP (1/2-3903) and the Unit 1/2 DGCWP Cubicle Coolers (1/2-5749A and 1/2-5749B). Power for the Unit 1 Division I RHR Room Cooler will be supplied by the normal feed from Unit 1 480V MCC 18-1A. 480V MCC 18-2 will supply power for the Unit 1 Division I RHRSW vault room coolers.

The Unit 1 125V DC system remains available to supply control power for the required 4kV and 480V SWGR. Unit 1 125V DC Battery Charger 1A remains available to supply power to 125V DC Battery Bus 1.

Reactor water level and pressure will be monitored using instrumentation available in the Main Control Room.

Cold Shutdown Repairs

To ensure that there is no backflow through the Recirculation Pump and injection bypassing the Reactor, motor operated valve 1-0202-5A must be closed when reconfiguring the Unit 1 Division I RHR System for Shutdown Cooling. 480V MCC 18/19-5 supplies power to this motor operated valve which is located inside primary containment and is not readily accessible. A fire in this Fire Area may damage the control cables associated with motor operated valve 1-0202-5A. Because of the location of valve 1-0202-5A and the potential cable damage, a repair is required to remotely close valve 1-0202-5A from Unit 1 480V MCC 18/19-5.

4.24.2 Unit 2 Shutdown Analysis

A Compliance Assessment was performed on this Fire Area to determine the effects of the fire on the non-fire unit. The assessment determined that there is a minimum set of safe shutdown equipment available to safely shutdown the non-fire unit. If required, the non-fire unit will be placed in Cold Shutdown utilizing existing station procedures. For this Fire Area there is not a specific Safe Shutdown Procedure required to achieve and maintain Cold Shutdown.

4.25 Fire Area CT-2 – Unit 2 Cable Tunnel

Fire Area CT-1 consists of Fire Zone 8.2.5.

4.25.1 Unit 2 Shutdown Analysis

Alternative shutdown (10 CFR 50 Appendix R III.G.3 compliance) is utilized for this area.

Reactivity Control

Reactivity control is provided by the Reactor Protection System as discussed in Section 3.1.1 of the Safe Shutdown Report.

Inventory Control

The Safe Shutdown Makeup Pump (SSMP) is used to provide reactor water for inventory control. The SSMP will be started and operated locally from the SSMP Room within 32 minutes to ensure that Reactor level is maintained above top of active fuel. Initial reactor makeup water will be from the Contaminated Condensate Storage Tanks (CCST) and manually transferred to the Fire Water System upon CCST low level. Alignment of the Fire Water System to the SSMP requires manually closing valve ½-2901-1 and manually opening valves ½-2901-2 and ½-2901-3 to establish the flow path for SSMP injection utilizing the Fire Water System. The Fire Water System also provides cooling water to the SSMP Room Cooler if Service Water is not available. To establish the flow path from the Fire Water System to the SSMP Room Cooler requires manually closing valves ½-2901-25 and ½-2999-9 and manually opening valve ½-2901-9. Power to SSMP 4kV SWGR 31 will be supplied by 4kV SWGR 14-1 utilizing Unit 1 offsite power. If Unit 1 offsite power is unavailable, the Unit 1 Emergency Diesel Generator (EDG) will supply AC power to 4kV SWGR 14-1.

Reactor Pressure Control

The Target Rock Safety/Relief Valve (2-0203-3A) acting in the safety mode (mechanical) will control Reactor pressure at approximately 1135 psig. A fire cannot affect the safety mode of the Target Rock Safety/Relief Valve.

Decay Heat Removal

Unit 2 Division I of the Residual Heat Removal (RHR) System will be utilized for Suppression Pool (Torus) Cooling and Alternate Shutdown Cooling. To ensure adequate Net Positive Suction Head (NPSH), due to high Torus temperature, both the 2-1002A and 2-1002B RHR pumps are required to provide additional cooling for the Torus. The RHR pumps (2-1002A and 2-1002B) will be operated locally at 4kV SWGR 23-1. To establish Torus Cooling and Alternate Shutdown Cooling, motor operated valves must be re-aligned to provide a flow path for the required RHR pumps. The cables associated with these motor operated valves are subject to fire-induced damage and potential spurious actuation. Because of the possible cable damage, these valves will be de-energized and manually placed in their required position to achieve Torus and Alternate Shutdown Cooling. Power for the Unit 2 Division I RHR System will be supplied by Unit 2 offsite power to 4kV SWGR 23-1. If Unit 2 offsite power is unavailable, the Unit 2 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 23-1.

Unit 2 Division I Residual Heat Removal Service Water (RHRSW) System is unavailable for a fire in Fire Area CT-2 due to the 4kV power feeds for the RHRSW pumps being routed through the Fire Area. To support the Unit 2 Division I Torus and Alternate Shutdown Cooling modes of RHR, the Unit 1 Division I RHRSW pumps (1-1001-65A and 1-1001-65B) will be used to provide cooling to the Unit 2 Division I RHR heat exchangers. This is accomplished by opening Division I RHRSW crosstie valve ½-1099-1A. The Unit 1 Division I RHRSW Pumps will be started and controlled from Main Control Room Panel 901-3. Power for the Unit 1 Division I RHRSW System will be supplied by Unit 1 offsite power to 4kV SWGR 13. If Unit 1 offsite power is unavailable, the Unit 1 Station Blackout (SBO) Diesel Generator will supply AC power to 4kV SWGR 13-1, which in turn, will be back fed to 4kV SWGR 13.

Support Functions

The Unit 1/2 Diesel Generator Cooling Water Pump (DGCWP) will supply cooling water for the Unit 2 Division I RHR Room Cooler (2-5746A). The feed from Unit 1 480V SWGR 18 will supply power to the Unit 1/2 DGCWP (1/2-3903) and the Unit 1/2 DGCWP Cubicle Coolers (1/2-5749A and 1/2-5749B). Power for the Unit 2 Division I RHR Room Cooler will be supplied by the alternate feed from Unit 1 480V MCC 18-1A. 480V MCC 18-2 will supply power for the Unit 1 Division I RHRSW vault room coolers.

The Unit 1 125V DC system remains available to supply control power for the required 4kV and 480V SWGR. Unit 1 125V DC Battery Charger 1 or 125V DC Battery Charger 1A remains available to supply power to 125V DC Battery Bus 1.

Reactor water level and pressure, Torus level and temperature, diagnostic instrumentation for shutdown systems and level indication for tanks will be monitored using local instrumentation.

Cold Shutdown Repairs

To ensure that there is no backflow through the Recirculation Pump and injection bypassing the Reactor, motor operated valve 2-0202-5A must be closed when reconfiguring the Unit 2 Division I RHR System for Shutdown Cooling. 480V MCC 28/29-5 supplies power to this motor operated valve which is located inside primary containment and is not readily accessible. A fire in Fire Zone 1.1.2.2 and/or 1.1.2.3 may damage the power cables, control cables or 480V MCC 28/29-5. Because of the location of valve 2-0202-5A and the potential cable damage, a repair is required to remotely close valve 2-0202-5A from Unit 1 480V MCC 18/19-5.

A fire in this area may potentially damage the control cables associated with relief valves 2-0203-3B and 2-0203-3C. To prevent spurious actuation during Hot Shutdown, these valves have been manually disabled. Before depressurization of the reactor can be initiated to achieve Cold Shutdown, a repair to relief valves 2-0203-3B and 2-0203-3C is required. This Cold Shutdown repair consists of splicing cables from Unit 1 125V DC Reactor Building Distribution Panel 1 to Drywell penetration X-104A. Once the repair is complete, the reactor vessel will be depressurized by alternating Relief Valves 2-0203-3B and 2-0203-3C as required to maintain depressurization. This is accomplished by opening and closing the appropriate breakers on Unit 1 125V DC Reactor Building Distribution Panel 1.

4.25.2 Unit 1 Shutdown Analysis

A Compliance Assessment was performed on this Fire Area to determine the effects of the fire on the non-fire unit. The assessment determined that there is a minimum set of safe shutdown equipment available to safely shutdown the non-fire unit. If required, the non-fire unit will be placed in Cold Shutdown utilizing existing station procedures. For this Fire Area there is not a specific Safe Shutdown Procedure required to achieve and maintain Cold Shutdown.

4.26 Fire Area EDG-2 – Unit 2 Emergency Diesel Generator (EDG) Room

Fire Area EDG-2 consists of the Unit 2 Emergency Diesel Generator (EDG) Room located in the Unit 2 Turbine Building. This Fire Area has been evaluated to establish it as a 3-hour rated Fire Area and is no longer contained in the Unit 2 Turbine Building Fire Area TB-I. A Compliance Assessment was performed on this Fire Area to determine the effects of the fire on both Unit 1 and Unit 2. The assessment determined that there is a minimum set of safe shutdown equipment available to safely shutdown both units. If required, the plant will be placed in Cold Shutdown utilizing existing station procedures. For this Fire Area there is not a specific Safe Shutdown Procedure required to achieve and maintain Cold Shutdown.

Table 4.0-1

Unit 1 Methodology Summary

Fire Area	Injection Method		Torus Cooling Systems						RHR Room Cooling Method		Onsite Power Supply	
			RHR			RHRSW			DGCW P	Power Supply	Injection Method	Torus Cooling
			Unit	DIV	Power	Unit	DIV	Power				
RB-1S	SSMP	OS/U1 EDG	1	I	OS/U1 SBO	1	I	OS/U1 SBO	U1	19	U1 EDG	U1 SBO
RB-1N	SSMP	OS/U2 SBO	1	II	OS/U2 SBO	2	II	OS/U2 SBO	U1	29	U2 SBO	U2 SBO
TB-II	HPCI	250VDC	1	II	OS/U1 SBO	1	II	OS/U1 SBO	U1	19	U1 SBO	U1 SBO
TB-III	SSMP	OS/U2 EDG	1	I	OS/U2 SBO	2	I	OS/U2 SBO	U1/2	28	U2 EDG	U2 SBO
13-1	SSMP	OS/U1 SBO	1	II	OS/U1 SBO	2	II	OS/U1 SBO	U1	29	U1 SBO	U1 SBO
CT-1	SSMP	OS/U2 EDG	1	I	OS/U1 SBO	1	I	OS/U1 SBO	U1/2	18	U2 EDG	U1 SBO
SB-I	SSMP	OS/U1 SBO	1	II	OS/U1 SBO	1	II	OS/U1 SBO	U1	19	U1 SBO	U1 SBO

OS – Offsite power

Table 4.0-2

Unit 2 Methodology Summary

Fire Area	Injection Method		Torus Cooling Systems						RHR Room Cooling Method		Onsite Power Supply	
			RHR			RHRSW			DGCW P	Power Supply	Injection Method	Torus Cooling
			Unit	DIV	Power	Unit	DIV	Power				
RB-2S	SSMP	OS/U1 EDG	2	I	OS/U2 SBO	2	I	OS/U2 SBO	U2	29	U1 EDG	U2 SBO
RB-2N	SSMP	OS/U1 SBO	2	II	OS/U1 SBO	1	II	OS/U1 SBO	U2	19	U1 SBO	U1 SBO
TB-II	RCIC	250VDC	2	I	OS/U2 SBO	2	I	OS/U2 SBO	U2	19	U2 SBO	U2 SBO
TB-I	SSMP	OS/U1 EDG	2	I	OS/U1 SBO	1	I	OS/U1 SBO	U1/2	18	U1 EDG	U1 SBO
24-1	SSMP	OS/U1 EDG	2	I	OS/U2 SBO	1	I	OS/U1 SBO	U1/2	18	U1 EDG	U1 SBO U2 SBO
CT-2	SSMP	OS/U1 EDG	2	I	OS/U2 SBO	1	I	OS/U1 SBO	U1/2	18	U1 EDG	U1 SBO U2 SBO
SB-I	RCIC	250VDC	2	II	OS/U2 SBO	2	II	OS/U2 SBO	U2	29	U2 SBO	U2 SBO

OS – Offsite power

5.0 ASSOCIATED CIRCUIT ANALYSIS

The clarification of Generic Letter 81-12, "Fire Protection Rule," identified three categories of associated circuits of concern: a) common power source, b) spurious operations that would adversely impact safe shutdown, and c) common enclosures. The clarification of Generic Letter 81-12 states, in part, that:

"Associated Circuits of Concern are defined as those cables (safety related, non-safety related, Class 1E, and non-Class 1E) that:

1. Have a physical separation less than that required by Section III.G.2 of Appendix R, and
2. Have one of the following:
 - a. a common power source with the shutdown equipment (redundant or alternative) and the power source is not electrically protected from the circuits of concern by coordinated breakers, fuses, or similar devices, or
 - b. a connection to circuits of equipment whose spurious operation would adversely affect the shutdown capability, or
 - c. a common enclosure (e.g., raceway, panel, junction) with the shutdown cables (redundant and alternative) and,
 - (1) are not electrically protected by circuit breakers, fuses, or similar devices, or
 - (2) will allow propagation of the fire into the common enclosure".

The clarification of Generic Letter 81-12 further states that:

"The shutdown capability may be protected from the adverse effect of damage to associated circuits of concern by the following methods:

1. Provide protection between the associated circuits of concern and the shutdown circuits as per Section III.G.2 of Appendix R, or
2.
 - a. For a common power case of associated circuit: provide load fuse/breaker (interrupting devices) to feeder fuse/breaker coordination to prevent loss of the redundant or alternative shutdown power source.
 - b. For circuits of equipment and/or components whose spurious operation would affect the capability to safely shutdown: (1) provide a means to isolate the equipment and/or components from the fire prior to the fire, or (2) provide electrical isolation that prevents spurious operation; or (3) provide a means to detect spurious operations and then procedures to defeat the maloperation of equipment.
 - c. For common enclosure cases of associated circuits: (1) provide appropriate measures to prevent propagation of the fire; and (2) provide electrical protection."

It is important to note that with respect to these guidelines, the clarification of Generic Letter 81-12 states that, "These guidelines do not limit the alternatives available to the licensee for protecting the shutdown capability."

5.1 Common Power Source

Circuits sharing a common power source with safe shutdown equipment are prevented from affecting the power source by either breaker/fuse coordination or by isolating the circuit if coordination does not exist.

5.1.1 Coordination Fault Protection Analysis

Circuit breaker/fuse coordination analyses were performed for 4k VAC, 480 VAC, 208 VAC, 250 VDC and 125 VDC circuits. Where required, cable length and other physical factors were considered in evaluating coordination.

NDIT EIC-97-008 documents the coordination of the 4k VAC switchgear, 480 VAC switchgear, and 480 VAC motor control centers (MCC) at Quad Cities Station. The NDIT also states that S&L Calculation 7923-36-19-1 shows acceptable coordination exists for the 208 VAC motor control centers needed for safe shutdown when the cable impedance to the affected fire area boundary is considered. The SBO Diesel Generator 4k VAC switchgear coordinates with downstream 4k VAC switchgear (Bechtel calculation QC-27Q-E-017). 4k VAC switchgear circuit breakers require 125 VDC for the protective relay circuits to operate. It has been verified that the credited 4k VAC switchgear will have 125 VDC control power available to operate the protective relay circuits when faults occur.

The 480 VAC switchgear and 480 VAC and 208 VAC motor control center breakers have direct-acting trip devices (i.e., no external power source is required for the device to operate). Therefore, even with the loss of control power, 480 VAC and 208 VAC breakers will clear the faults that occur on the system.

Coordination on the 250 VDC system is available for some fire areas. The use of 250 VDC loads for safe shutdown require that the other loads on the associated 250 VDC buses that could be affected by the fire be stripped to prevent a common power supply failure. The post-fire safe shutdown procedures address the actions to ensure 250 VDC power supplies remain available to support safe shutdown.

Calculation QDC-8300-E-0482, documents the review of protective device coordination for the 125 VDC system. Coordination exists for fire related cable faults on the 125 VDC system, including the control power fuses located in the 4k VAC switchgear, with the following exception listed below. In some cases, coordination is achieved by taking into account the cable resistance from the circuit breaker to the fire area boundary that is the closest point that the cable can fault due to fire damage. This reduces the fault current below the instantaneous trip of the upstream breaker. Thus, it has been determined that 125 VDC power will always be available.

The following loads on TB Reserve Bus 1B-2 do not coordinate with the upstream breaker for a fire in fire area SB-I.

Breaker	Service
A03 Ckt 8	Annunciator Input relay cabinet 901-34
A03 Ckt 16	Main generator, panel 901-8

However, loss of 125 VDC power supplies due to a lack of coordination would not adversely impact post-fire safe shutdown for fires in this area. This lack of coordination may cause the loss of 125 VDC to switchgear 12 for a fire in SB-I. However, the power cables supplied by switchgear 12 are not vulnerable to fire damage due to a fire in Fire Area SB-I. Therefore, switchgear 12 protective relays and 125 VDC control power are not required to interrupt a fault for a fire in SB-I.

5.1.2 High Impedance Fault Evaluation

A separate analysis, (TODI QDC-00-068), was performed for the 480 VAC system. Where necessary, post-fire manual actions are used to isolate 480 VAC loads that present a high impedance fault concern. Multiple high impedance faults are not evaluated for the 208 VAC system. Post-fire manual actions are used to isolate the only 208 VAC shutdown loads from all potential fire damage. NDIT EIC-99-009-1 documents the position that high impedance faults are not a concern for the 4k VAC, 250 VDC and the 125 VDC systems

4k VAC loads required for safe shutdown are manually connected to the buses when the fire affects the control logic.

480 VAC circuit protection is provided by circuit breakers operated by direct acting trip devices. The trip devices for MCC feed breakers are provided with selective tripping (short time delay element). The time delay is provided to allow downstream circuit breakers to clear faults prior to operation of the upstream circuit breaker. Fire-induced faults are each cleared by the associated circuit breakers before the upstream circuit breaker operates.

125 VDC circuit protection is provided by fuses and circuit breakers. To evaluate the affect of multiple faults, the fault current for each circuit entering a fire area is determined. The total current at the upstream device from simultaneous faults was determined and compared to the tripping characteristics of that protective device. Multiple faults on coordinated 125 VDC circuits are each cleared by the associated protective device before the upstream protective device operates.

In each of the above systems, the magnitude of high impedance fault current is established by considering cable impedance and sustainable arcing ground faults. Arbitrary high impedance fault current just below the trip point of the associated protective device is not assumed. Instead, the fault current for each circuit is calculated based on cable lengths to the fire area boundary. (References: NDIT EIC-99-009-1 and calculation QDC-8300-E-0482). The results indicate that credible high impedance faults would either self-extinguish or rapidly develop into bolted faults such that coordination would be maintained.

5.2 Spurious Operation Analysis

In order to ensure that fire-induced failures of equipment and cables will not adversely impact the post-fire safe shutdown capability, safe shutdown systems and systems that either interface with the primary system or safe shutdown systems, were evaluated. Fire-induced spurious operations such as uncontrolled pump/turbine starting, and valve or breaker repositioning which could occur as a result of fire induced cable damage were evaluated in the area Compliance Assessments. In order to prevent such fire-induced spurious operations from adversely affecting safe shutdown, systems were analyzed and actions specified, when necessary, to ensure the following:

- Reactor water inventory is maintained and is not inadvertently lost due to a fire-induced spurious component operation.
- Makeup water inventory is maintained and not inadvertently lost due to a fire-induced spurious component operation.
- Fire-induced spurious valve operation to an essential system does not prevent the system from performing its function, cause system damage, or provide an inadvertent flow path.
- Fire-induced spurious pump/turbine starting or stopping does not damage an essential pump/turbine or system which is essential to achieving post-fire safe shutdown.
- Fire-induced spurious electrical component operation does not result in loss of power to an essential component or control circuit.

In addition, special consideration was given to the fire-induced spurious operation of valves that form the interface between the high to low pressure interfaces. Fire-induced failures of the valves could potentially lead to rupture of the low pressure piping resulting in a loss of primary coolant.

5.2.1 Fire-Induced System/Component Failures

5.2.1.1 Fire-Induced Valve Failures

The P&IDs for the safe shutdown systems and the systems that either interface with the primary systems or a safe shutdown system, were reviewed for fire-induced spurious valve operations that could adversely affect safe shutdown of the plant. The review considered only electrically operated valve types which include motor operated (MO), solenoid operated (SO), air operated (AO), pressure controlled (PC), and flow control (FC) valves. Fire-induced spurious operation of a valve(s) was not considered to adversely impact safe shutdown if any of the following criteria were met.

- The valve of concern was in an acceptable combination with another valve. A valve combination was considered acceptable defense against adverse spurious operation if any of the following conditions were met: (a) there was at least one normally closed, manually operated valve in series; (b) there was a mechanically operated check valve in the line which would prevent flow in the undesirable direction; or (c) the impact of the adverse valve operation would not degrade safe shutdown capability.
- The control and/or power cables for the valve or valve combination was independent of any fire area where credit was taken for a system which included the valve as a component.
- Manual operation of the valve was acceptable for safe shutdown, and spurious operation of the valve would not result in a loss of inventory or equipment damage.

- The power for at least one normally closed valve in series was de-energized at the power supply during normal operation, and the valves did not constitute a HI-LO pressure interface.
- Fire affects could not cause the valve torque switch circuit to be bypassed and cause valve damage in the open or closed position, such that the valve cannot be repositioned to achieve safe shutdown (IN 92-18).

5.2.1.2 Fire-Induced Pump Failures

Fire-induced spurious pump operation could potentially result in damage to both the pump and the system, or result in a loss of reactor or makeup water inventory. Therefore, to ensure that required systems are operational and able to perform their required function for post-fire safe shutdown, any pump that could affect a safe shutdown system, was required for safe shutdown, or could result in a loss of inventory from a system was evaluated for fire-induced spurious operation.

5.2.1.3 Fire-Induced Electrical Component Failures

For major loads connected to the safety-related 4 kV switchgear, but not required for safe shutdown, procedures require observation of the breaker status prior to manually loading the diesel onto the bus. Any unwanted load that is closed will be manually tripped and its closing circuit will be disconnected. This same action will be taken as a precautionary measure for all other unwanted loads that could conceivably overload the diesel if the loads were to operate coincidentally with the required safe shutdown loads.

5.2.1.4 Fire-Induced System/Component Failure Evaluation Methodology

The following procedure was used to identify a means of preventing spurious operation, defeating spurious operation, or demonstrating that spurious operation could not occur.

- Review P&IDs to determine all essential equipment for all safe shutdown systems, per the above criteria .
- Determine the initiation signals/conditions for components of concern. This included all signals initiated normally by an automatic or manual action which could cause component operation.
- Review schematics and wiring diagrams as necessary and list any cables associated with the initiation signals/conditions.
- Document routing of any associated cable through each fire area.
- Review electrical schematics, using the assumptions of Section 3.0 to identify all fire areas which could cause the unwanted effect as a result of cable routings.
- Consider possible pre-fire actions to prevent spurious operation. These may entail a prescribed combination of control switch settings or the tripping of a breaker when not in use. Any recommended pre-fire action must not interfere with the automatic operation of an engineered safety feature.
- If there are no acceptable pre-fire actions, consider post-fire actions. Post-fire actions include manually re-aligning valves and tripping pumps/turbines.
- Where no pre-fire nor post-fire action was satisfactory, appropriate modifications were implemented to resolve the issue (prevent the spurious operation or allow a post-fire action).

5.2.1.5 Fire-Induced System/Component Failure Results

Since components whose spurious operation were included as safe shutdown components, their potential spurious operation was evaluated in the development of the compliance assessments.

A subset of the fire-induced system/component failure evaluation is isolation of the reactor pressure vessel (RPV). RPV isolation is required to maintain reactor inventory, to control reactor pressure, and to prevent exposing low pressure systems to reactor pressure in excess of its design pressure that could result in a LOCA. The primary components are valves which serve to isolate the RPV from other plant systems which may perform other post-fire safe shutdown functions as well (i.e., the RCIC system must be in use or the RCIC steam line must be isolated). To aid in this review and to ensure all potential spurious operations were considered, Reactor Inventory was evaluated as its own safe shutdown system. In addition, the potential loss of CCST inventory to the suppression pool due to spurious valve operations was also considered. The following sections summarize the results for the valves and systems that were evaluated for vessel inventory and pressure control, CCST inventory.

5.2.1.5.1 Main Steam Isolation Valves (MSIVs)

Each of the four main steam lines in each unit contain an inboard and outboard MSIV. The inboard valves are designated AO1(2)-0203-1A, B, C and D, while the outboard valves are AO1(2)-0203-2A, B, C, and D. One of the two valves in each steam line must close to insure the main steam lines are isolated. Each MSIV contains two solenoid valves (one ac, one dc), either of which can supply air to keep the valve open. A fire-induced spurious energization of one of the two solenoids would prevent closing one of the MSIVs. A fire-related spurious signal in the MSIV control logic cannot prevent at least one of the MSIVs in any one steam line from closing (see NDIQ QDC-97-133 and NDIQ QDC-97-130). The MSIVs are closed from the control room for a fire in all fire areas except the control room. For a fire in the control room, an attempt will be made to close the MSIVs from the control switches. Since the fire is in the control room, this action may not be possible and therefore, is not credited. Actions outside the control room are taken to assure MSIV closure (QDC-0000-E-1038).

5.2.1.5.2 Automatic Depressurization System (ADS)

The five ADS valves (one safety relief and four relief) operate on automatic or manual signals to reduce RPV pressure. Spurious opening of one or more of these valves can result in an uncontrolled loss of RPV pressure and inventory, and could potentially result in the core being uncovered. To preclude ADS from initiating, the Auto Blowdown switch in the control room is placed in the "INHIBIT" position. A redundant Auto Blowdown inhibit switch located in the auxiliary electrical equipment room will be utilized. Also, one of the immediate actions, if required, will be to deenergize both the normal and reserve power supplies to the ADS valves independent of the control room.

5.2.1.5.3 Reactor Feed System

Check valves in the main feed lines prevent a loss of reactor inventory via back flow through the feed water system. To prevent a potential RPV overfill condition, immediate actions are taken in the control room to secure reactor feedwater. Actions include securing the reactor feed pumps, condensate pumps, and closing the reactor feed valves. Multiple failures would be required to keep both the condensate and feed pumps running and preventing closure of the feed valves.

5.2.1.5.4 RCIC Steam Line

If RCIC is not being used for reactor water makeup, then steam flow to the RCIC turbine must be secured to preclude a loss of inventory from the vessel to the suppression pool. The inventory loss through the 3" RCIC steam line is bounded by the loss through a stuck-open ADS valve which provides an open 8" line. A post-fire manual action is used to secure the RCIC turbine. Tripping the RCIC turbine will also prevent the potential overfill of the RPV.

5.2.1.5.5 RCIC Steam Line Drain Valves

RCIC steam line drain valves AO1(2)-1301-32, 34 and 35 are not considered a HI-LO pressure interface since these valves are exposed to reactor pressure during normal operations. However, these valves are considered an inventory loss path. A post-fire manual action is used to ensure drain line is closed.

5.2.1.5.6 HPCI Steam Line

When HPCI is not relied upon to achieve post-fire safe shutdown, its steam line should remain closed. A spurious initiation of HPCI will result in steam flow through the 10" HPCI steam supply line to the HPCI turbine and then to the suppression pool. A post-fire manual action is used to secure the steam supply to the HPCI turbine.

5.2.1.5.7 HPCI Steam Line Drain Valves

HPCI steam line drain valves AO1(2)-2301-29 and -30 are not considered a HI-LO pressure interface since these valves are exposed to reactor pressure during normal operations. However, these valves are considered an inventory loss path. A post-fire manual action is used to ensure the drain line is closed.

5.2.1.5.8 Recirculation Sample Valves

Flow through normally open recirculation sample valves AO1(2)-0220-44 and AO1(2)-0220-45 could result in a loss of inventory through the sample lines. This pathway is not a HI/LO interface since the piping downstream is normally exposed to reactor water pressure. An action taken in the control room is to give the valve a close signal. No follow up action is taken to isolate this path due to the insignificant amount of reactor makeup that would be lost (approximately 1 liter per minute).

5.2.1.5.9 Draining CCST

For the fire areas where the CCST volume is relied on, an analysis was performed to identify valves that could spuriously operate and divert flow away from the system requiring that volume. The assessment identified valves in the HPCI and RCIC system, which may require manual actions to isolate the drain-path. The valves may be in the fire area and cannot be isolated until the fire is extinguished. Calculation QDC-3300-M-0542 demonstrates that adequate CCST volume is maintained if the actions to stop the inadvertent draining are complete within four hours.

5.2.1.5.10 Recirc Pumps

These pumps are a concern due to heat addition to the reactor vessel when operating during the event. Actions are taken in the control room to ensure pumps are tripped or where the control circuit may be damaged local manual actions are taken. (NDIT QDC-98-121) (QDC-0000-E-1038)

5.2.2 High-Low Pressure Interfaces

The spurious operation of MOVs, due to fire-related damage, that form the interface between the primary coolant boundary and low pressure piping systems, could cause a rupture of the low pressure boundary resulting in loss of primary coolant. To assure that valves that form these HI-LO pressure interfaces are adequately protected from the effects of a single fire, these interfaces are identified below and more stringent circuit failure considerations applied for spurious operation of these valves. HI-LO pressure interface valves are defined as any number of valves in series that could spuriously operate to expose low pressure piping to pressures higher than designed, such that a loss of reactor inventory could occur. All piping systems and valves that interface with the reactor vessel were reviewed to determine if they met the criteria defined for a HI-LO pressure interface. The piping systems and valves discussed in the following subsections, were determined to form an interface between low pressure piping and reactor pressure.

5.2.2.1 Reactor Water Cleanup System (RWCU)

One of the purposes of the reactor water cleanup (RWCU) system is to discharge water from the reactor coolant system during startup and shutdown. During startup, excess reactor inventory due to control rod drive inflow and swell in water level, is routed to the main condenser or to radwaste. The RWCU system is a high pressure system that is pressurized to reactor pressure. The discharge piping to the main condenser and radwaste is low pressure piping. If the interface valves between this low pressure piping and high pressure system were to spuriously open due to fire related damage, while the reactor is at pressure, the low pressure piping downstream of this interface could rupture and cause an uncontrolled loss of reactor inventory and possibly damage safe shutdown equipment.

The discharge line from the RWCU system goes through a restricting orifice that is designed to limit discharge flow. In parallel with the restricting orifice is MO1(2)-1201-76. This valve is only opened when flow greater than the flow allowed by the restricting orifice is required. MO1(2)-1201-76 is normally closed. Downstream of MO1(2)-1201-76 and the parallel restricting orifice is FCV1(2)-1239. This valve is an air-operated flow control valve that is normally closed and designed to control the discharge flow from RWCU. Downstream of FCV1(2)-1239 the discharge line splits. One discharge line goes through MO1(2)-1201-77 to radwaste, and the other discharge line goes through MO1(2)-1201-78 to the main condenser. Both of these valves are normally closed. The low pressure piping is downstream of valves MO1(2)-1201-77 and -78.

All of these valves are normally closed and only one valve in a series of valves has to remain closed to protect the low pressure piping from high reactor pressures. All the valves are physically located in the RWCU room and are exposed to the same fire. The power and control cables to the valves are generally routed in the same fire areas from the control room to the reactor building. All the valves are exposed to fire-related damage from the same fires in the fire areas that they are routed through

Applying these circuit failure modes to valves MO1(2)-1201-76, -77, and -78 could result in all these valves spuriously opening due to fire-related damage. Due to the potential spurious opening of the valves, they are not relied on to maintain the boundary between high reactor pressure and the downstream low-pressure piping. However, these circuit failure modes will not cause FCV1(2)-1239 to spuriously open due to fire-related damage. Since fire-related circuit failures cannot cause FCV1(2)-1239 to spuriously open, this valve is relied upon to maintain the boundary between high reactor pressure and downstream low-pressure piping during the design basis fire.

FCV1(2)-1239 has two functions. One function is to serve as a flow control valve to control inventory discharge from the RWCU system. The other function is to close when high or low pressure is sensed in the discharge line.

The high-pressure isolation function of FCV1(2)-1239 operates by a pressure switch downstream of this valve that senses high pressure in the discharge line. The purpose of the pressure switch is to protect the downstream low pressure piping from overpressurization. The low-pressure isolation function of FCV1(2)-1239 operates by a pressure switch in the discharge line that senses low pressure in the discharge line. The purpose of this pressure switch is to prevent draining of the RWCU system through the discharge line. If either of the pressure switches sense high or low pressure in the discharge line, the activated switch opens to deenergize a solenoid that releases the air on the air operator that causes FCV1(2)-1239 to fail closed. The loss of 120 Vac power to the solenoid will cause the solenoid valve to fail in the open position which releases the air to the air operator on FCV1(2)-1239 that causes the valve to fail closed. The only failure mode that will keep the solenoid valve energized is to impose a 120 Vac hot short to the conductors of the solenoid cable or short the contacts of both pressure switches. The cable for the solenoid coil is enclosed in conduit from the pressure switch to the solenoid. The pressure switches are located on the RWCU instrument rack outside the RWCU room. The solenoid cable goes to a junction box at the instrument rack that has other cables that may be energized during a fire event. A fire at the rack could cause one of the failure modes listed above that would result in keeping the solenoid energized and therefore disable the high- and low-pressure isolation feature of FCV1(2)-1239.

The flow control function of this valve is controlled by a milliamp (ma) signal from a potentiometer mounted on a control room panel; that connects to an E/P converter on the valve via cable 17298 (27298). The E/P converter controls the amount of air pressure to the air operator that will either open or close FCV1(2)-1239. If the 4-20 ma signal is lost to the E/P converter, the valve will fail in the closed position. Therefore, an open in one of the two conductors in the control cable or a short between two conductors in the control cable will cause FCV1(2)-1239 to fail closed. The only failure mode that could possibly keep the valve open is to impose a hot short from another cable with a 4-20 ma signal. The control cable for FCV1(2)-1239 is a 2/C shielded cable. The shield around the two conductors with the 4-20 ma signal will prevent any adjacent cable with a 4-20 ma signal from shorting at these conductors and keeping FCV1(2)-1239 in the open position. In addition, any cable that could provide the 4-20 ma signal would also be shielded due to the fact that it is an instrument cable used to transmit this sort of signal.

A fire at the valve controller can only fail the valve closed. Any fire-related damage will release air from the controller which will fail the valve closed if it is open or will prevent the valve from opening if it is closed.

In summary, even though MO1(2)-1201-76, -77, and -78 are normally closed valves, and the high- and low-pressure isolation function for FCV1(2)-1239 will cause the valve to fail closed on a loss of power, the only feature credited with maintaining the high pressure RWCU system isolated from low-pressure piping, in the event of a fire, is the flow control function of FCV1(2)-1239. The flow control functions of FCV1(2)-1239 will fail the valve in the closed position for all fire-related circuit failures. FCV1(2)-1239 will remain closed to isolate the high pressure of the RWCU system from downstream low-pressure piping. (Reference NDIT QDC-98-105)

5.2.2.2 Residual Heat Removal (RHR) System

Valves MO1(2)-1001-47 and -50 are normally closed primary containment isolation valves located in series, between high pressure reactor vessel and low-pressure piping in the RHR system. If MO1(2)-1001-47 and -50 were to spuriously open, the low pressure piping downstream of MO1(2)-1001-47 would be overpressurized and could rupture, causing a loss of reactor coolant.

A review of the circuits and cable routings for these valves revealed that the above circuit failures could result in each valve spuriously opening in any fire area where the power cables and control cables for the valve are routed. Since the power and control cables for these valves are generally routed in the same fire areas, a single fire could cause both valves to spuriously open.

To avoid the possibility of both valves opening due to fire related failures in their control circuits, MO1(2)-1001-47 and -50 have been deenergized at their respective MCCs during normal operations. Failures in the control circuits of these valves will no longer cause the valves to open. A hot short on the power cable between the valve and the MCC is required before either of the valves will open.

MO1(2)-1001-50 is located in the drywell and has a 480 Vac motor operator. MO1(2)-1001-47 located in the turbine building and has a 250 Vdc motor operator. Since the power cable to both valves are routed through the reactor building, a fire in this area could cause the deenergized power cables to the valves to hot short to other energized power cables and cause both valves to open.

To prevent this unlikely event from occurring for Unit 1 and 2, disconnect switch 1(2)-1001-47-DS to MO 1(2)-1001-47 has been placed in open position procedurally during normal operation, so that a fire induced hot short to the power cable in the reactor building will not energize the valve motor. MO 1(2)-1001-47 and disconnect switch 1(2)-1001-47 DS are located in the turbine building and, therefore, will not be exposed to the fire in the reactor building. The power has been disconnected to the valve by placing disconnect switch 1(2)-1001-47-DS in the open position. During reactor shutdowns, the disconnect switch will be placed in the closed position and the MCC breaker re-energized prior to opening the valve. This assures that the safety function of the valve, which is to close on a primary containment isolation signal, can be achieved when the valve is in the open position. Closing the disconnect switch to the valve is not a concern during reactor shutdowns since reactor pressure is less than 100 psig when the valve is opened to enter the shutdown cooling mode of RHR.

The LPCI injection lines are protected for valves spuriously opening and subjecting low pressure piping to reactor pressure by check valve AO 1(2) 1001-68A(B).

5.2.2.3 Main Steam Drain System

The main steam line drain piping provides a path to expose low-pressure piping to high reactor pressures. Valves MO1(2)-0220-1, -2 are primary containment isolation valves in the main steam line drain system. Located between MO1(2)-0220-1, -2 and the main condenser is MO1(2)-0220-4. MO1(2)-0220-4 is normally closed and in parallel with a restricting orifice that reduces reactor pressure and flow rates to the main condenser to acceptable levels. The orifice bypass is provided around MO1(2)-0220-4 to the main condenser to permit continuous draining of the steam line low points. The piping downstream of MO1(2)-0220-4 is low-pressure piping. If MO1(2)-0220-1, -2, and -4 were to spuriously open, low pressure piping downstream of MO1(2)-0220-4 would be overpressurized and could be damaged. If any one of the three valves in series remain closed, the low-pressure piping downstream of MO1(2)-0220-4 will not be overpressurized.

To resolve the issue of all three valves spuriously opening due to fire-induced hot shorts on the control circuits or power cables to the valves, the power cable to MO1(2)-0220-4 has been permanently disconnected at the valve by design change packages 9800078 (9800079). The valve is maintained in the normally closed position, and is operated as a manual valve. Since MO1(2)-0220-4 is no longer electrically operated, the valve cannot spuriously open due to fire-related damage.

Since there is an orifice bypass line around normally closed valve MO1(2)-0220-4, if valves MO1(2)-0220-1 and -2 both open there will be an inventory loss through the orifice to the Main Condenser (Reference NDIT QDC-98-083). However, this inventory loss is inconsequential and will be well within the capability of the plants makeup system should both drain valves spuriously open.

5.2.2.4 Reactor Head Vents

AO1(2)-0220-46 and -47 are normally closed air-operated valves in the reactor head vent line that form a boundary between high reactor pressure and low-pressure piping. These valves are 1/2 inch valves, arranged in series in the head vent line, and will fail closed on the loss of power or loss of air. AO1(2)-0220-46 is the outboard valve, and the piping class change to low- pressure piping is downstream of this valve. The piping from the head vent line discharges into the drywell equipment drain sump. The air to the air operator is controlled by a 120 Vac solenoid valve that is controlled by a control switch on control room panel 901(2)-4. The valves do not receive any automatic open or close signals, and are manually opened or closed by the operator as required.

These valves are failed closed valves. Isolating air to the air operator by a manual isolation valve or isolating power to the air solenoid valve will cause the valves to close and remain closed. Since there are two valves in series, only one valve must be protected against spurious operation.

Spurious opening of the head vent lines are prevented by isolating power to the air solenoid valve associated with AO 1(2)-0220-47(46). Power is isolated by a key operated isolation switch that is located near the drywell penetration. Cabling between the switch and the penetration is protected from a spurious hot short by a fire proof insulating sleeve. The switch is placed in the isolating (Open) position in accordance with operating procedures during plant startup.

5.2.3 Impact of Hot Shorts on the Operability of Motor-Operated Valves

In 1992, the NRC issued Information Notice 92-18 (IEN 92-18) to alert licensees of possible self-induced structural or mechanical damage to MOVs resulting from fire-induced control cable damage (hot short damage). Specifically, the IEN identified postulated hot shorts that could bypass the torque/limit protective devices such that the actuator would continue to drive the valve, even after the valve is fully closed or open. If the valve or actuator structural limits are exceeded, such a situation could adversely affect the ability to achieve post-fire safe shutdown if the valve is required to be repositioned during performance of the safe shutdown procedures. The presence of a thermal overload (TOL) is not expected to preclude damage to the valve or actuator. The IEN specifically addressed the affects of a control room fire. However, the concern exists for any fire where the plant is vulnerable to fire-induced spurious actuation of valves required to achieve safe shutdown.

In order to address this concern for the Quad Cities Appendix R Safe Shutdown Analysis (SSA), all MOVs required to achieve safe shutdown (as identified on the required equipment lists) were reviewed for the impact of valve damage due to hot shorts. The types of failures assumed for the circuit analysis that was conducted is described in Section 3.0. The effects of opens, grounds, shorts and hot shorts were reviewed to determine when the open or close contactor would energize without the limit and torque switches in the circuit. Initiation signals that are expected to occur due to fire-related transients, such as a low reactor water level (0"), low-low reactor water level (-59"), high drywell pressure (+2.5 psig) and high torus level (+5") were taken into consideration.

Each MOV required to achieve post-fire safe shutdown was evaluated for potential hot short damage, and either modified to eliminate the possibility of damage, or justification was provided as to why a modification was not required. The valves listed in Tables 5.2-3 were evaluated and dispositioned as shown. (Reference: NDIT QDC-98-016)

5.2.4 Actions to Mitigate the High Drywell Pressure and Low-Low Water Level Initiation Signals

High drywell pressure (+2.5 psig) and low-low reactor water level initiation signals (-59") will be present in the control logic of certain systems due to the fire-related transient and a possible loss of off-site power. The initiation signals will cause spurious operation of components within those systems that are initiated by these signals. Listed below are the safe shutdown systems that are impacted by a high drywell or low-low reactor water level signal, and the actions that are being taken to mitigate those signals. These actions have been incorporated into the compliance assessments for the applicable fire areas.

ADS

In the event the initiation signals lead to automatic blowdown of ADS, the Auto Blowdown switch in the control room will be placed in the INHIBIT position. These actions effectively prevent initiation of ADS or terminate an automatic blowdown. If control room evacuation is required, a redundant Auto Blowdown inhibit switch located in the auxiliary electrical equipment room will be utilized. Also, the 125 VDC supply breakers to the ADS will be opened to close any single ADS valve that might have opened due to spurious operation.

HPCI

In the event the initiation signals lead to a start of the HPCI system, the HPCI turbine will be tripped from the control room or locally in the HPCI room. Tripping the turbine locally has been evaluated for Unit 1(2). The evaluation concluded that the 1-2301-4 valve can be closed from the control room if the fire is in the Unit 1(2) HPCI Room. (Q-ECDS-00-167)

RCIC

In the event the initiation signals lead to a start of the RCIC system, the RCIC turbine will be secured. RCIC will be secured by either tripping the trip throttle valve on the RCIC turbine or closing the steam supply valve, MO1(2)-1301-16, depending on the location of the fire.

RHR

In the event the initiation signals lead to a start of the RHR system, depending on the location of the fire, the RHR pump Main Control switches are placed in pull to lock or tripped locally at the 4Kv bus.

The EDGs will automatically start but will not load unless off-site power has also been lost.

In addition, as noted above in Section 5.2.3, these initiation signals were taken into consideration in evaluating the effects of fire-induced hot shorts on motor-operated valves (MOVs). The actions and/or modifications to address these initiation signals are included in the Fire Area Compliance Assessments.

5.2.5 Resolution of Concerns of NRC Inspection Report 50.458/97.201 Relative to ADS System Spurious Operation

The ADS system has been reviewed for circuit failures and hot shorts that could cause one or more of the valves to spuriously open. It has been determined that, with the exception of the ADS Automatic Initiation Logic, fire related circuit failures and a single hot short can cause only one of the ADS valves to spuriously operate. The results of this evaluation are documented in NDIT QDC-97-130 for Unit 1, NDIT QDC-97-133, Rev. 1 for Unit 2, and Q-ECDS-00-172.

5.3 Common Enclosure

Circuits associated by common enclosure are those circuits that have an enclosure (e.g., raceways, panels, junction boxes or other structures used to contain electrical cables) in common with safe shutdown cables. This poses the potential for fire damage to safe shutdown cables due to overheating of the associated cables under fault conditions and/or the propagation of the fire into the common enclosure.

5.3.1 Electrical Protection

Electrical circuits have been provided with appropriate protection from overcurrent conditions. Overheating of electrical cables due to fire-induced faults is not of concern as long as the function of the short circuit and overload current interrupting devices at the power source is not disabled due to the fire. Trip devices on all power supplies below the 4 kV level, including fuses and breakers, will function without an external power source to operate the trip device. As discussed above, it has been determined that 125 VDC control power will be available for all credited 4 kV buses.

Some fire-induced failures have been identified in the 250 VDC system that could possibly cause secondary fires (reference NDI EIC-97-014). Motors that are fed from the 250 VDC system have the control circuits fed directly from the supply breaker at the bus without any separate fuses between the control circuit and the breaker. The circuit breaker is sized to clear a fault at the motor or the power cable feeding the motor and not necessarily the control cable. Each of the unfused 250 VDC control circuits was evaluated for fire-induced faults. Fuses were added to control circuits where associated circuit damage could occur in less than two hours. Control circuits where associated circuit damage could occur in greater than two hours are isolated by tripping the circuit breaker. The remaining 250 VDC control circuits are adequately protected by the associated circuit breakers.

Another failure considered is fire-induced faults between cables of different voltages causing either secondary fires or damage to cables in the same enclosure as the affected cable. The failure mechanism postulated is that a fire-induced hot short causes the energization of a cable of a lower voltage with a cable of a higher voltage without either of the cables shorting to ground. The conductor to conductor contact causes an elevated current that may possibly start a fire in a secondary fire area or may damage safe shutdown circuits in other fire areas because they are in the same enclosure as the affected cable. S&L calculation 7923-06-19-2 evaluates this failure mechanism and concludes either that the hot short is not a credible event or that the short will clear before damage will occur.

5.3.2 Fire Protection

Circuits that share a common enclosure with essential circuits will not provide a path for fire propagation out of a fire area or zone group since the areas are generally enclosed by substantial barriers to fire which have all electrical penetrations sealed or the circuits are clearly separated from the other zone groups due to other features. On the ground floor of the turbine building, no physical boundary exists along the access corridor between TB-I, TB-II and TB-III. In this part of the plant, automatic fire detection, automatic suppression, and physical distance provide assurance that the fire will not propagate via the cable.

5.3.3 Current Transformers/Control Power Transformers Analysis

5.3.3.1 Control Power Transformers

A concern was raised about the possibility of a secondary fire starting in a motor control center due to a short circuit on a control power transformer's secondary. The secondaries of Quad Cities motor control center control transformers are unfused and ungrounded. Field experience with shorted MCC control circuits indicates that considerable smoke is produced, but the primary winding shorts and trips the circuit breaker before any flame can erupt. It is unreasonable to assume that such a fire can propagate beyond an individual MCC bucket. Therefore, safe shutdown can still be achieved.

As the burden resistance increases, so does the voltage that the CT must produce to maintain the desired current. In an open circuit (infinite resistance), the CT secondary voltage will theoretically become infinite. In practice, due to core saturation, the CT secondary voltage will be limited to some value ranging from 2 kV to approximately 25 kV. The exact value depends on the CT ratio and design.

Because the open-circuit voltage varies with the CT design, no broad generalization can be made regarding the range of CT ratios for which concern is warranted. Therefore, the consequences of a current transformer circuit insulation breakdown were investigated with respect to continued functional integrity of nearby safe shutdown cables and equipment.

The investigation concluded that any conceivable insulation breakdown will result in a carbon track having a resistance on the order of 2 ohms. The CT secondary current will pass harmlessly through the carbon track, dropping the voltage to its normal range (approximately 10 volts). The integrity of adjacent safety related circuits is not threatened. This analysis is documented by LaSalle calculation 6731-EAD-1. Even though this calculation was prepared for LaSalle, the type of current transformers referenced in the calculation are the type of current transformers used at Quad Cities.

In the Quad Cities Nuclear Power Station, Units 1 and 2 NRC Evaluation of Changes, tests, or Experiments and Permanent Plant Modifications Baseline Inspection Report, the NRC issued Unresolved items (URI) 05000254(265)/2005007-02 due to concerns related to the lack of a formal analysis evaluating the potential secondary fire effects of non-fused 480-120V AC control power transformers (CPTs). Of primary concern was the potential failure of a CPT in a Motor control cabinet (MCC) cubicle. To address these concerns, Engineering Analysis QDC-7800-E-1564, "Effect of a Range of Short Circuit Current on the Connected Cables of the Unfused and Ungrounded Control Transformer Secondary Side," was generated. This analysis demonstrated that if a fault occurred in a non-fused CPT circuit, the weak link in the circuitry would be the CPT. The analysis concluded that even though the CPT would fail, a fire would not occur in the MCC breaker bucket. To support the analysis, an extensive operating experience review was closed in the Letter from M. Ring to C. Crane, "Quad Cities Nuclear Power Station Units 1 and 2 NRC Integrated report 05000254/2007004; 05000265/2007004," dated October 31, 2007.

Table 5.2-3
EVALUATION OF POTENTIAL HOT SHORT DAMAGE TO MOTOR OPERATED VALVES

Unit 1 and 1/2 MOVs		Unit 2 MOVs	
Valve EPN	Resolution Note	Valve EPN	Resolution Note
SSMP			
MO1/2-2901-06	19		
MO1/2-2901-07	1		
MO1-2901-08	1	MO2-2901-08	1
RCIC			
MO1-1301-16	1	MO2-1301-16	1
MO1-1301-17	16	MO2-1301-17	16
MO1-1301-22	1	MO2-1301-22	1
MO1-1301-25	1	MO2-1301-25	1
MO1-1301-26	1	MO2-1301-26	1
MO1-1301-48	1	MO2-1301-48	1
MO1-1301-49	1	MO2-1301-49	1
MO1-1301-53	1	MO2-1301-53	1
MO1-1301-60	17	MO2-1301-60	17
MO1-1301-61	1	MO2-1301-61	1
MO1-1301-62	17	MO2-1301-62	17
RHR			
MO1-1001-7A	1	MO2-1001-7A	1
MO1-1001-7B	1	MO2-1001-7B	1
MO1-1001-7C	1	MO2-1001-7C	1
MO1-1001-7D	1	MO2-1001-7D	1
MO1-1001-16A	5	MO2-1001-16A	5
MO1-1001-16B	15	MO2-1001-16B	15
MO1-1001-18A	8	MO2-1001-18A	8
MO1-1001-18B	8	MO2-1001-18B	8

Table 5.2-3 (continued)
EVALUATION OF POTENTIAL HOT SHORT DAMAGE TO MOTOR OPERATED VALVES

MO1-1001-19A	1	MO2-1001-19A	1
MO1-1001-19B	1	MO2-1001-19B	1
MO1-1001-20	20	MO2-1001-21	20
MO1-1001-20	20	MO2-1001-21	20
MO1-1001-23A	4	MO2-1001-23A	4
MO1-1001-23B	4	MO2-1001-23B	4
MO1-1001-26A	4	MO2-1001-26A	4
MO1-1001-26B	4	MO2-1001-26B	4
MO1-1001-28A	1	MO2-1001-28A	1
MO1-1001-28B	15	MO2-1001-28B	15
MO1-1001-29A	1	MO2-1001-29A	1
MO1-1001-29B	15	MO2-1001-29B	15
MO1-1001-34A	1	MO2-1001-34A	1
MO1-1001-34B	15	MO2-1001-34B	15
MO1-1001-36A	1	MO2-1001-36A	1
MO1-1001-36B	15	MO2-1001-36B	15
MO1-1001-37A	7	MO2-1001-37A	7
MO1-1001-37B	7	MO2-1001-37B	7
MO1-1001-43A	1	MO2-1001-43A	1
MO1-1001-43B	1	MO2-1001-43B	1
MO1-1001-43C	1	MO2-1001-43C	1
MO1-1001-43D	1	MO2-1001-43D	1
MO1-1001-47	3	MO2-1001-47	3
MO1-1001-50	3	MO2-1001-50	3

Table 5.2-3 (continued)
EVALUATION OF POTENTIAL HOT SHORT DAMAGE TO MOTOR OPERATED VALVES

RHRWS			
MO1-1001-4A	2	MO2-1001-4A	2
MO1-1001-4B	2	MO2-1001-4B	2
MO1-1001-5A	1	MO2-1001-5A	1
MO1-1001-5B	1	MO2-1001-5B	1
MO1-1001-185A	2	MO2-1001-185A	2
MO1-1001-185B	2	MO2-1001-185B	2
MO1-1001-186A	2	MO2-1001-186A	2
MO1-1001-186B	2	MO2-1001-186B	2
MO1-1001-187A	2	MO2-1001-187A	2
MO1-1001-187B	2	MO2-1001-187B	2
HPCI			
MO1-2303-3	9	MO2-2303-3	9
MO1-2301-8	18		
MO1-2301-9	18		
MO1-2301-14	10	MO2-2301-14	10
MO1-2301-5	12	MO2-2301-5	12
MO1-2301-6	18	MO2-2301-6	6
MO1-2301-4	18		
MO1-2301-10	18		
MO1-2301-15	18		
MO1-2301-35	18		
MO1-2301-36	18		
MO1-2301-48	18		
MO1-2301-49	18		
MO1-2301-40	18		
MO1-2301-41	18		

Table 5.2-3 (continued)
EVALUATION OF POTENTIAL HOT SHORT DAMAGE TO MOTOR OPERATED VALVES

RECIRC, MAIN STEAM, RWCU			
MO1-0202-5A	11	MO2-0202-5A	11
MO1-0202-5B	1	MO2-0202-5B	1
MO1-0202-6B	14	MO2-0202-6B	14
MO1-0202-9B	14	MO2-0202-9B	14
MO1-0220-1	13	MO2-0220-1	13
MO1-0220-2	13	MO2-0220-2	13
MO1-1201-76	3	MO2-1201-76	3

Resolution Notes:

1. Modifications have been performed to these valves to eliminate the vulnerability of hot short damage resulting from a single fire-induced spurious signal. The modification consisted of electrically relocating the contactor between initiation logic and the torque/limit switches in the control circuit of the valve.
2. Valves MO1(2)-1001-4A(B), MO1-(2)-1001-185A(B), MO1(2)-1001-186A(B), MO1(2)-1001-187A(B) constitute a set of valves that enables the direction of flow through the RHR heat exchanger to be reversed. Operating personnel have the option of selecting the direction of flow through the heat exchanger that accommodates the failure direction of one of these valves. The ability to achieve safe shutdown would not be affected by each of these valves' vulnerability to hot short damage because the RHR function would be unaffected.
3. A weak link analysis has been performed to document that bypassing the torque switch will not cause damage to the pressure-retaining boundary. Therefore, the ability to achieve safe shutdown is not impacted by a hot short on the torque switch for this valve.
4. MO1(2)-1001-23A(B) and MO1(2)-1001-26A(B) are in-series and maintained in the closed position during normal plant operation. The ability to achieve safe shutdown would not be affected by each of these valves' vulnerability to hot short damage because no single spurious signal could open both valves simultaneously. Flow through the line is required to be isolated throughout the shutdown event. Where both valves are subject to spurious operation, manual action is taken to verify at least one of the two valves closed.
5. No postulated hot short bypassing the torque/limit switch can disable MO1(2)-1001-16A in a fire area where the valve is required to be operable.
6. MO2-2301-6 is required to be open to enable the CCST level to be monitored, and the operation of HPCI for RPV level control. However, the closing contactor in the control circuit of this valve is located between the initiation logic to close and the torque switch. Therefore, the ability to achieve safe shutdown given a fire, would not be affected since a single fire-induced spurious signal cannot simultaneously actuate this valve closed and bypass the torque switch.

Table 5.2-3 (continued)
EVALUATION OF POTENTIAL HOT SHORT DAMAGE TO MOTOR OPERATED VALVES

7. In the event that MO1(2)-1001-37A(B) is damaged in the open position during the torus cooling mode of RHR, a fraction of the water being returned to the torus would be diverted to the torus via the spray header. No steam is postulated to be present in the torus during the safe shutdown event. The ability to achieve safe shutdown would not be affected by these valves' vulnerability to spurious actuation and hot short damage because the torus cooling function of RHR would be unaffected. These valves were removed from the safe shutdown equipment list during this revision to the safe shutdown analysis.
8. In the event MO1(2)-1001-18A(B) spuriously actuates and damages in the closed position, RHR pump minimum flow can be achieved by aligning a flow path to the vessel or torus such that a flow path is established upon initial pump start. In the event that MO1(2)-1001-18A(B) spuriously actuates and damages in the open position, the line can be isolated by closing 1(2)-1001-141A&B(C&D). The ability to achieve safe shutdown would not be affected by these valves' vulnerability to spurious actuation and hot short damage because RHR is unaffected by the position of these valves.
9. MO1(2)-2301-3 was not evaluated for hot short analysis and is not used to isolate steam to the HPCI turbine when it is susceptible to spuriously opening. In fire areas where MO1(2)-2301-3 will spuriously open, the HPCI turbine is manually tripped to secure operation.
10. MO1(2)-2301-14 is a normally closed valve that prevents draining of the CCST to the torus during a safe shutdown event. Positive isolation of flow through the line is ensured by closure of valves 1(2)-2301-22 and 1(2)-2301-80. The ability to achieve safe shutdown is not affected by this valve's vulnerability to spurious actuation and hot short damage in either direction because flow through the line is isolated regardless of the position of this valve.
11. The control circuitry of MO1-0202-5A and MO2-0202-5A are configured such that the valves are vulnerable to hot short damage for fire within Fire Area RB-1N only and RB-2N only, respectively. However, these valves are not relied upon for a fire in RB-1N or RB-2N. The ability to achieve safe shutdown would not be affected by these valves' vulnerability to hot short damage in RB-1N and RB-2N since safe shutdown can be achieved regardless of the position of these valves.
12. MO1(2)-2301-5 is not required to be available to secure the HPCI turbine due to spurious starts in areas where it is susceptible to spurious operation.
13. MO1(2)-0220-4 has been modified to a normally closed manual valve by permanently disconnecting the power cable to the motor operator. MO1(2)-0220-1 or MO1(2)-0220-2 must be available for SSD to preclude the loss of inventory through this line.
14. MO1(2)-0202-6B and MO1(2)-0202-9B are normally closed valves and are required to remain closed to support the shutdown cooling mode of RHR by preventing RHR coolant from short circuiting the core. The feed breakers to these valves are maintained in the "OFF" position to eliminate vulnerability to spurious opening and hot short damage.
15. The torque switch circuit of this valve has been protected from fire-related shorts by rerouting one conductor of the torque switch in a rigid steel conduit in the fire area where the torque switch is susceptible to a hot short and the valve is used to achieve safe shutdown. This modification assures that the valve can be manually operated to achieve safe shutdown.

Table 5.2-3 (continued)
EVALUATION OF POTENTIAL HOT SHORT DAMAGE TO MOTOR OPERATED VALVES

16. MO1(2)-1301-17 required to be closed to isolate RCIC for a fire in RB-IN(RB-2N) where the valve is also prone to hot short damage. A fire protection engineering evaluation (NDIT QDC-98-137 and -138) has been performed that demonstrates accessibility to the RCIC turbine if the torque switch cable to MO1(2)-1301-17 is hot short damaged due to a fire.
17. These valves are required to be operable to isolate a drain down path from the CCST to the torus. These valves could be hot short damaged in the open position. The hot short damage is acceptable because RCIC and SSMP will not take long-term suction from the CCST.
18. These valves are free of fire damage for areas that they are credited.
19. MO1/2-2901-06 cannot be hot short damaged in the fire areas that this valve is being used for safe shutdown.
20. MO1(2)-1001-20 and MO1(2)-1001-21 are in-series and maintained in the closed position during normal plant operation. The ability to achieve safe shutdown would not be affected by each of these valves' vulnerability to hot short damage because no single spurious signal could open both valves simultaneously. Where both valves are subject to spurious operation, manual action is taken to verify at least one of the two valves closed. Spurious operation of both valves would result in a small flow diversion to the opposite train of RHR that could effectively be isolated if necessary.

6.0 SAFE SHUTDOWN TIMELINES AND MANUAL ACTIONS

6.1 Introduction

The methods of achieving hot and cold safe shutdown analyzed at Quad Cities 1&2 are discussed in Section 4. Credit is taken for manual control of pumps, manual operation of valves, and electrical equipment. Procedures have been implemented to direct the operators in performing these actions as required by 10 CFR 50 Appendix R, Sections III.L.3 and III.L.5. These procedures are available at the station. Procedures to achieve safe shutdown are delineated in Tables 6.3-1 and 6.3-2 on a fire area/zone basis and by the type of manual action described in Section 6.4. Onsite materials necessary to make these repairs are also delineated in Section 6.4.

Emergency lighting, in the form of 8-hour battery packs, are provided in areas where local operations occur and along access and egress paths, as described in Section 6.5.

Time data generated to support local manual actions are documented in Section 6.2. Quad Cities 1&2 personnel have walked down the procedures required for the shutdown paths to ensure adequate manpower is available to accomplish the necessary manual actions in the time available. The minimum manpower available at the station is described in Section 6.2.

6.2 Timelines and Manpower Requirements

6.2.1 Timelines

The safe shutdown methods employed at Quad Cities Station Units 1 and 2 are designed to meet Appendix R, Section III.L.2 performance criteria. A calculation was performed by General Electric Company (GE-NE-A22-00103-56-01-Q) which determined the amount of time available to achieve high pressure injection before the water level reaches the top of active fuel as 32 minutes.

6.2.1.1 Immediate Actions

Credit is taken for the ability to perform the following immediate actions within the control room:

- scram (for all fire areas)

The following are considered immediate actions to be performed in the control room to prevent adverse spurious actuation. Additional actions, when necessary, will be performed outside the control room to ensure that these actions are effective:

- close main steam isolation valves
- turn auto blowdown inhibit switch to "INHIBIT".
- secure feedwater
- trip HPCI
- trip RCIC

See Section 5.2 for a discussion of the rationale for these actions. These actions are taken to place the reactor in a shutdown condition (scram) and prevent major loss of reactor inventory (ADS, MSIV, RCIC and HPCI).

6.2.1.2 Additional Actions Outside the Control Room to Prevent or Mitigate Maloperations of Components

Additional actions are required to prevent or mitigate the consequences of maloperations which could:

- Cause loss of reactor inventory
- Damage safe shutdown pumps
- Cause loss of reactor water inventory makeup
- Cause valves to fail to perform their function
- Cause loss of power to an essential component or control circuit

These actions are taken outside the control room after it is determined that an Appendix R design basis fire is occurring. Section 5.2 describes each of these actions and the time limit for performing them.

6.2.1.3 Reactor Water Makeup Time Consideration (32 Minutes)

Credit is taken for operation of the HPCI, RCIC and SSMP systems to provide reactor water makeup.

Calculation GE-NE-A22-00103-56-01-Q, Rev. 0 was performed to determine the time to establish reactor water makeup. The calculation demonstrates that the active fuel will remain flooded if high pressure injection is established within 32 minutes after the scram. This calculation conservatively assumes that the safety/relief valve was open for the first 10 minutes of the event.

For the case in which all turbine bypass valves spuriously open at event initiation and MSIV closure is initiated at the main steam line (MSL) low pressure setpoint or low-low water level setpoint, time available for establishing reactor water makeup is longer than the case with an open relief valve.

Therefore, the case with an open relief valve is considered the limiting case.

Conservatively, the core level in this report is defined as the average channel level above the top of active fuel.

6.2.1.4 Suppression Pool Cooling Time Consideration (3 Hours)

During HPCI, RCIC or SSMP operations, the steam generated by reactor decay heat will cause a rise in suppression pool water temperature. RCIC operation with suction from the suppression pool is considered the limiting case since suppression pool water is recirculated through the vessel via the RCIC turbine and the safety/relief valve. Calculations GE-NE-A22-00103-56-01-Q and QDC-2300-M-1034 were performed to establish the time available to initiate suppression pool cooling. For the initial conditions of the event, the reactor is assumed to be at full power, normal water level, and normal steady-state conditions. At the start of the event, a scram is assumed to occur and a relief valve is assumed to be open for 10 minutes. The open relief valve is the main source of vessel inventory loss for the short-term response in this event. In addition, the MSIVs are assumed to close coincident with the loss-of-offsite power for the calculation. Therefore, additional energy is added to the vessel and ultimately the suppression pool.

The system pressure initially decreases due to the open relief valve. After 10 minutes, it is assumed that the operators are able to close the open relief valve, and at this point, the reactor begins to repressurize. The reactor pressurizes up to the combined safety/relief mechanical safety setpoint and the SRV relieves pressure down to the SRV reset pressure. The SRV will continue to cycle open and closed in this fashion as the SRV is the only means of decay heat energy removal from the reactor. The SRV cycling frequency will decrease as the decay heat energy decreases throughout the event. The reactor will undergo alternating periods of SRV cycling and reactor water makeup operation.

The calculation for the reactor vessel water level response shows a nearly constant rate of level decrease for the first 10 minutes with the open relief valve. After 10 minutes, when the relief valve closes, the rate of water level decrease begins to level off. Thereafter, the reactor water level is further decreased due to the relief valve cycling. Prior to the water level reaching the TAF, credit is taken that the operators have achieved injection with the SSMP, RCIC or HPCI system to recover level.

The relief valve cycling discussed above is postulated to continue for 69 hours. During this time, RCIC is assumed to operate and maintain the reactor water level between +30 and -30 inches and HPCI between -59 and +48. The continuous SRV cycling to remove the decay heat results in a heatup in the suppression pool. It is assumed that at 3 hours, suppression pool cooling is initiated to mitigate the pool heatup. These calculations resulted in a peak pool temperature of less than 160°F.

6.2.1.5 Suppression Pool Drain-Down Time Consideration (4 Hours)

Calculation QDC-2300-M-1034 also addressed the suppression pool loading due to the additional mass deposited in the pool. This extra mass is postulated to be injected to the reactor vessel via the injection pumps, where these systems take suction from an outside source (CCST or fire header). This calculation shows that a peak level of 10 inches was achieved at 4 hours. It is assumed that at 4 hours the operators would have aligned the RHR system to reject suppression pool water to the condenser hotwell at a rate of 250 gpm. At this rate, the torus level is returned to the nominal level in approximately 3 hours. At this point, the operator will control the torus discharge flow to maintain the torus level between the center (0 inches) and the top of the band of the sightglass (+7 inches). No operator action is required until after blowdown to reject mass from the suppression pool. However, the automatic transfer of HPCI suction from the CCST to the Torus will occur within 4 hours resulting in a lower peak Torus level. Therefore, this calculation provides conservative results by assuming that suction is continuously aligned to the CCST.

These calculations are continued to the time at which the equipment necessary to achieve cold shutdown is assumed to become available. This equipment primarily consists of one or more relief valves to depressurize the vessel and the ability to line up the RHR system to shutdown cooling mode. These calculations assume that a single relief valve is used to perform vessel depressurization. The number of relief valves used to depressurize the vessel does not affect this calculation since the total mass deposited in the suppression pool to depressurize the vessel is the same. In addition, actions will be taken to prevent CCST drain-down to the suppression pool due to spurious operations. These actions are identified in Section 5.2.

6.2.2 Manpower

The Quad Cities Appendix R Procedures (QCARP) for achieving hot shutdown require the following personnel for each unit which is not already in cold shutdown:

- 1 Senior Reactor Operator (SRO)
- 2 Reactor Operators (RO)
- 2 Non-Licensed Operators (NLO)

Areas where only one unit requires entry into the QCARP procedures the extra operator on that unit can be utilized for manual actions.

These required personnel are in addition to the Fire Brigade manning requirements. These personnel are required by station administrative procedures to be onsite whenever the unit is not in a cold shutdown condition.

The hot shutdown manning requirements were derived based on:

- number of manual actions to be performed
- time period within which actions had to be performed
- actual time validation walkdowns
- skills required to perform the action

Operating personnel have been trained to perform specific fire-related activities when required.

While the operating crew is achieving hot shutdown, the station will begin staff augmentation as required by the Emergency plan. Appendix R procedures for achieving cold shutdown include steps to perform repairs such as cable splicing and wiring. Qualified maintenance personnel will be called to the site in accordance with the Emergency plan, if necessary, to perform repairs such as cable splicing and wiring.

6.3 Procedures Relevant to Hot Shutdown

In addition to the "FIRE/EXPLOSION" QCOA 0010-12, there are fourteen individual QUAD CITIES APPENDIX R PROCEDURES (QCARP) for each alternative shutdown fire area. Variations of equipment line-ups exist in each of the procedures to accommodate the specific fire location and fire effects. Tables 6.3-1 and 6.3-2 list the Appendix R safe shutdown procedures that prescribe a method of bringing the reactor to cold shutdown. For each fire area, the listed procedures specify all actions required to accomplish safe shutdown. Furthermore, procedures were written such that all required actions can be performed within the timeline constraints specified by the calculations discussed in Section 6.2.1.

6.4 Repairs Relevant to Cold Shutdown

The repairs and materials needed to achieve cold shutdown are listed in this section. The cold shutdown methodology is described in Section 3.1.5.

6.4.1 Cold Shutdown Repairs

Tables 6.4-1 and 6.4-2 list, by area, the repairs needed to reach cold shutdown for each unit.

6.4.2 Materials Needed

Table 6.4-3 lists the materials required for safe shutdown repair. Other equipment is required and is controlled by station procedures. This equipment includes items such as ladders, safety equipment and keys.

6.5 Emergency Lighting

A fire at Quad Cities Station could cause the loss of feeds to various emergency lighting cabinets concurrent with the loss of offsite power to regular lighting cabinets. According to the requirements of Section III.J of Appendix R, 8-hour battery emergency lighting is provided for all access and egress routes and in all areas where safe shutdown equipment needs to be accessed or operated, including prestaged safe shutdown equipment locations.

As part of the original Appendix R compliance effort, a full lighting blackout walkdown was performed at the station to determine emergency lighting needed to satisfy the Appendix R requirements. This walkdown was performed for primary and alternate access routes for each operator action. Emergency lighting unit locations are shown on F drawings. The F-drawings indicate (1) the pathway lighting providing access to equipment, (2) the placement of the battery packs and beams, and (3) the specified equipment requiring lighting for safe shutdown actions.

Revisions to the safe shutdown analysis and procedures were reviewed to assure that lighting is available for operator actions affected by the revision.

6.6 Communications Capabilities

The existing communications systems at Quad Cities Station are as follows:

- Public address (PA)
- Dial telephones (PBX) code call
- Sound power phones
- Emergency phone system
- Radio

Normal plant communications are conducted by a variety of methods. Most communications systems, including the radio base stations and repeaters, are vulnerable to fire damage. However, the battery-powered portable radios are known to be available regardless of fire location or availability of offsite power. There are two sets of radios dedicated to plant emergencies: one is kept in the control room and the other is in the nearby operations communications center, located within a separate fire area from the control room.

Since the base stations and repeaters may not be available under fire conditions, the portable radios are used in talk-around mode. This mode bypasses the repeaters and allows the portable radios to communicate directly with each other. Multiple talk-around channels are available, so that the two unit supervisors may utilize specific frequencies for each unit, if they desire.

Radio communication capability has been verified for all areas of the plant where timely operator actions are required to establish reactor coolant injection (ECR 47555). Where point-to-point communication was not found possible, guidance is provided in the QCARPs for ensuring that communication is available either by relay or by sending the operator to an area known to have clear communications. For longer term actions to establish torus cooling or shutdown cooling, timely radio communications is not considered critical since a runner or relay point would be available to communicate if required.

Revisions to the safe shutdown analysis and procedures have been reviewed to ensure that communication is available for the operator actions affected.

In addition, as part of the installation of the 900 MHz radio system, tests were performed to determine the areas of the plant that contain equipment susceptible to electromagnetic interferences and radio frequency interference. These locations are clearly posted, and no communications from these areas are required to perform the Appendix R procedures.

6.7 Access to Safe Shutdown Equipment

6.7.1 Door Control

In the event of a fire accompanied by a total loss of offsite power, electrically controlled doors and other locked doors must not prevent personnel from performing the tasks described in the Appendix R safe shutdown procedures. By implementing the proper procedures and control of certain keys, access to safe shutdown equipment can be achieved in a timely manner.

The doors of concern fall into three major categories:

- Secondary containment airlocks
- Security doors
- Radiation area doors

6.7.1.1 Secondary Containment Airlocks

The secondary containment airlocks will not impede safe shutdown operations. The airlock doors are powered by both the 125 Vdc station battery system and 120 Vac station auxiliary power. Since these doors have both magnets that deenergize to release and door strikes that energize to release, a loss of either 125 Vdc or offsite power will not cause the doors to open. In the event that a door will not open in response to its own control button, a press of the Emergency Bypass button will deenergize the magnets and enable the operator to push or pull the door open using the crash bar or door handle, which defeats the door strike.

The ½ Trackway air locks have an exception to the above, as an additional door strike is present that will remain latched in the event offsite power is lost. The door strikes are defeated by a door handle or crash bar. The Emergency Bypass button will deenergize the magnetic latches and the door handle or crash bar may be used to open the door.

6.7.1.2 Security Doors

The security doors, powered by the security diesel generator, will also continue to operate normally during a loss of offsite power. If the circuitry is unaffected by the fire, key-card entry may be used as normal. However, to expedite manual action in the plant, tailgating through key-card controlled doors may be performed.

Information withheld in accordance with 10 CFR 2.390

6.7.1.3 Radiation Area Doors

Information withheld in accordance with 10 CFR 2.390

If the QCARPs are entered, radiation protection swing gates, rad-ropes and step-off pads may be bypassed as radiation area control boundaries. Personnel executing the QCARPs are responsible for minimizing their own dose and the spread of contamination.

6.7.2 Accessibility Effects Due to Fire Locations

Locations where manual actions are required before a given fire is extinguished were all evaluated to be outside of the fire area of concern, unless a fire protection evaluation justifies the specific action that must be performed in the fire areas of concern. Once the fire is extinguished, accessibility is no longer a concern. However, various locations of the plant may become inaccessible to operators because of the absence of an egress path independent of the fire area. Such a situation gives rise to so-called "islands" that are a result of a lack of accessibility to zones without requiring personnel to traverse the fire area being evaluated. In other words, to gain access to certain non-fire-affected zones, personnel may be required to traverse a fire-affected zone. Table 6.7-1 lists, for all fire areas, the non-fire-affected zones that may be inaccessible due to the fire. All egress routes must be illuminated with emergency light packs per Section 6.5 of this report. None of the identified fire areas or zones require access to implement the safe shutdown analysis prior to having a fire extinguished (NDIT QDC-98-043).

Table 6.3-1

APPENDIX R SAFE SHUTDOWN IMPLEMENTATION PROCEDURES FOR UNIT 1

Fire Area	Procedure	INJECTION/RHR/RHRWSW
RB-1N	QCARP 0020-01	SSMP/U1 RHR DIV II /U2 RHRWSW DIV II
RB-1S	QCARP 0010-01	SSMP/U1 RHR DIV I /U1 RHRWSW DIV I
TB-II	QCARP 0030-03	HPCI/U1 RHR DIV II /U1 RHRWSW DIV II
TB-III	QCARP 0030-01	SSMP/U1 RHR DIV I /U2 RHRWSW DIV I
13-1	QCARP 0040-01	SSMP/U1 RHR DIV II /U2 RHRWSW DIV II
SB-I	QCARP 0050-01	SSMP/U1 RHR DIV II /U1 RHRWSW DIV II
CT-1	QCARP 0060-01	SSMP/U1 RHR DIV I /U1 RHRWSW DIV I
RB-1/2	Normal shutdown (Section 4.5)	
Crib House (CH)	Normal shutdown (Section 4.20)	
14-1	Normal shutdown (Section 4.13)	
TB-IV	Normal shutdown (Section 4.11)	
SBO	Normal shutdown (Section 4.23)	
Outside, OG	Normal shutdown (Sections 4.22, 4.21)	
DW-1, DW-2	No shutdown required (Sections 4.6, 4.7)	
RW	Normal shutdown (Section 4.19)	
SB-II	Normal shutdown (Section 4.18)	
TB-V	Normal shutdown (Section 4.12)	

Table 6.3-2

APPENDIX R SAFE SHUTDOWN IMPLEMENTATION
PROCEDURES FOR UNIT 2

Fire Area	PROCEDURE	INJECTION/RHR/RHRSW
RB-2N	QCARP 0020-02	SSMP/U2 RHR DIV II /U1 RHRSW DIV II
RB-2S	QCARP 0010-02	SSMP/U2 RHR DIV I /U2 RHRSW DIV I
TB-I	QCARP 0030-02	SSMP/U2 RHR DIV I /U1 RHRSW DIV I
TB-II	QCARP 0030-04	RCIC/U2 RHR DIV I /U2 RHRSW DIV I
24-1	QCARP 0040-02	SSMP/U2 RHR DIV I /U1 RHRSW DIV I
SB-I	QCARP 0050-02	RCIC/U2 RHR DIV II /U2 RHRSW DIV II
CT-2	QCARP 0060-02	SSMP/U2 RHR DIV I /U1 RHRSW DIV I
RB-1/2	Normal shutdown (Section 4.5)	
Crib House (CH)	Normal shutdown (Section 4.20)	
23-1	Normal shutdown (Section 4.16)	
TB-IV	Normal shutdown (Section 4.11)	
SBO	Normal shutdown (Section 4.23)	
Outside, OG	Normal shutdown (Sections 4.22, 4.21)	
DW-1, DW-2	No shutdown required (Sections 4.6, 4.7)	
RW	Normal shutdown (Section 4.19)	
SB-II	Normal shutdown (Section 4.18)	
EDG-2	Normal shutdown (Section 4.26)	

Table 6.4-1

UNIT 1 REPAIRS REQUIRED TO REACH COLD SHUTDOWN

<u>Fire Area</u>	<u>Repair</u>
RB-1N	<ol style="list-style-type: none">1. Provide temporary power feed from the Unit 2 dedicated 125 Vdc power supply to the drywell penetration to open the RV 1-0203-3B and RV 1-0203-3C ADS valves.2. Provide temporary power feed from MCC 28/29-5 to the drywell penetration to close valve MO1-0202-5B.
TB-III	<ol style="list-style-type: none">1. Provide temporary power feed from the Unit 2 dedicated 125 Vdc power supply to the ADS panel to open the RV 1-0203-3B and RV 1-0203-3C ADS valves.2. Replace control power transformer if required and jumper the controls at MCC 18/19-5 to close MO1-0202-5A.
TB-II	<ol style="list-style-type: none">1. Provide temporary power feed from the Unit 2 dedicated 125 Vdc power supply to the ADS panel to open the RV 1-0203-3B and RV 1-0203-3C ADS valves.
13-1	<ol style="list-style-type: none">1. Provide temporary power feed from MCC 28/29-5 to the drywell penetration to close valve MO1-0202-5B
CT-1	<ol style="list-style-type: none">1. Replace control power transformer if required and jumper the controls at MCC 18/19-5 to close MO1-0202-5A.
SB-I	<ol style="list-style-type: none">1. Provide temporary power feed from the Unit 1 dedicated 125 Vdc power supply to the ADS panel to open the RV 1-0203-3B and RV 1-0203-3C ADS valves.2. Replace control power transformer if required and jumper the controls at MCC 18/19-5 to close MO1-0202-5B.

Table 6.4-2

UNIT 2 REPAIRS REQUIRED TO REACH COLD SHUTDOWN

<u>Fire Area</u>	<u>Repair</u>
RB-2N	<ol style="list-style-type: none">1. Provide temporary power feed from the Unit 1 dedicated 125 Vdc power supply to the drywell penetration to open the RV 2-0203-3B and RV 2-0203-3C ADS valves.2. Provide temporary power feed from MCC 18/19-5 to the drywell penetration to close valve MO2-0202-5B.
TB-I	<ol style="list-style-type: none">1. Provide temporary power feed from the Unit 1 dedicated 125 Vdc power supply to the ADS panel to open the RV 2-0203-3B and RV 2-0203-3C ADS valves.2. Provide temporary power feed from MCC 18/19-5 to drywell penetration to close valve MO 2-0202-5A
TB-II	<ol style="list-style-type: none">1. Replace control power transformer if required and jumper the controls at MCC 28/29-5 to close MO 2-0202-5A.
24-1	<ol style="list-style-type: none">1. Provide temporary power feed from MCC 18/19-5 to drywell penetration to close valve MO 2-0202-5A.
CT-2	<ol style="list-style-type: none">1. Provide temporary power feed from the Unit 1 dedicated 125 Vdc power supply to the ADS panel to open the RV 2-0203-3B and RV 2-0203-3C ADS valves.2. Provide temporary power feed from MCC 18/19-5 to drywell penetration to close valve MO 2-0202-5A
SB-I	<ol style="list-style-type: none">1. Provide temporary power feed from the Unit 2 dedicated 125 Vdc power supply to the ADS panel to open the RV 2-0203-3B and RV 2-0203-3C ADS valves.2. Replace control power transformer if required and jumper the controls at MCC 28/29-5 to close MO2-0202-5B.

Table 6.4-3

MATERIALS REQUIRED FOR COLD SHUTDOWN REPAIRS

Materials and supplies to perform required actions to achieve safe shutdown are staged in locations where accessibility is commensurate with the urgency of the required use. For this reason, various staging locations have been specified in station surveillance procedures.

Cold Shutdown Repairs

1. The following cables are precut to the indicated lengths and staged to perform actions in the Appendix R safe shutdown procedures. This equipment is the minimum required to support dual unit shutdown.
 - A. 350 feet of 3/c #10 AWG, 600 V Cable No. 67842 for realignment of the following valves by connection to the corresponding drywell electrical penetrations. The intent is to connect this cable to a valve circuit to position the valve, disconnect, then proceed to the next valve until all required valves are positioned for safe shutdown:

MO 1(2)-0202-5A
MO 1(2)-0202-5B
 - B. Two 300-foot lengths of 6/c #10 AWG, 600 V cable for use on the ADS valves. The length of this cable is sufficient to connect this cable from the opposite unit's dedicated 125 Vdc power supply to the drywell penetration or ADS panel to open the desired relief valves to depressurize the reactor.
2. One 480/120-V control power transformer and one 40-A breaker are staged for realignment of the following valves:

MO 1(2)-0202-5A
MO 1(2)-0202-5B

Table 6.7-1

ACCESS TO SAFE SHUTDOWN EQUIPMENT STUDY

<u>Fire Area Experiencing Fire</u>	<u>Fire Zones Within Non-Fire-Affected Areas That May Be Inaccessible During Fire</u>
TB-I	None
TB-II	14.1.1 (Unit 1 off gas recombiner room) 14.1.2 (Unit 2 off gas recombiner room)
TB-III	11.1.1.B (Unit 1 B/C RHRSW vault)
TB-IV	8.2.8.A (Bus 14-1 area) 8.2.8.D (Bus 23-1 area)
TB-V	None
14-1	None
13-1	None
24-1	1.1.1.5.A (vent fan room) 1.1.1.6.A (vent fan room)
23-1	None
SB-I	None
SB-II	Direct access from SB-I to TB-I and TB-III is possible only through the auxiliary electric room floor hatches. The auxiliary electric room may not be accessible from the control room.
CH	None
RW	None
OG	None
OUTSIDE	11.4.A (Crib house basement) 11.4.B (Crib house ground level) 22.1 (Off gas filter building) SBO (SBO diesel building)
DW-1	None
DW-2	None

Table 6.7-1 (continued)

ACCESS TO SAFE SHUTDOWN EQUIPMENT STUDY

<u>Fire Area Experiencing Fire</u>	<u>Fire Zones Within Non-Fire-Affected Areas That May Be Inaccessible During Fire</u>
RB-1N	RB-1S (Unit 1 reactor building basement, south half) DW-1 (Unit 1 primary containment)
RB-1S	None
RB-2N	DW-2 (Unit 2 primary containment)
RB-2S	None
RB-1/2	None
SBO	None

7.0 References

7.1 Regulatory Documents

- 10 CFR 50.48, Fire Protection
- 10 CFR 50 Appendix R, Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979
- Branch Technical Position (BTP) APCS 9.5-1, Guidelines For Fire Protection In Nuclear Power Plants
- Generic Letter 81-12, Fire Protection Rule (45 FR 76602, 11/19/80)
- Generic Letter 83-33, NRC Positions on Certain Requirements of Appendix R to 10 CFR 50
- Generic Letter 85-01, Fire Protection Policy Steering Committee Report
- Generic Letter 86-10, Implementation of Fire Protection Requirements
- Generic Letter 86-10 Supplement 1, Fire Endurance Test Acceptance Criteria for Fire Barrier Systems Used to Separate Redundant Safe Shutdown Trains Within the Same Fire Area
- Information Notice (IN) 84-09, Lessons Learned From NRC Inspections of Fire Protection Safe Shutdown Systems (10 CFR 50, Appendix R)
- Information Notice (IN) 85-09, Isolation Transfer Switches and Post-Fire Shutdown Capability
- Information Notice (IN) 87-50, Potential LOCA at High- and Low-Pressure Interfaces from Fire Damage
- Information Notice (IN) 88-45, Problems in Protective Relay and Circuit Breaker Coordination
- Information Notice (IN) 90-69, Adequacy of Emergency and Essential Lighting
- Information Notice (IN) 91-51, Inadequate Fuse Control Programs
- Information Notice (IN) 91-53, Failure of Remote Shutdown System Instrumentation Because of Incorrectly Installed Components
- Information Notice (IN) 92-18, Potential for Loss of Remote Shutdown Capability During a Control Room Fire
- Information Notice (IN) 94-12, Insights Gained From Resolving Generic Issue 57: Effects of Fire Protection System Actuation on Safety-Related Equipment
- Information Notice (IN) 95-36, Potential Problems with Post-Fire Emergency Lighting
- Information Notice (IN) 95-36 Supplement 1, Potential Problem in Post-Fire Emergency Lighting
- Information Notice (IN) 97-01, Improper Electrical Grounding Results in Simultaneous Fires in The Control Room And The Safe- Shutdown Equipment Room

- D. Hills to C. Crane, "Quad Cities Nuclear Power Station, Units 1 and 2 NRC Evaluation of Changes, Tests, or Experiments and Permanent Plant Modifications Baseline Inspection Report 05000254/2005007; 05000265/2005007(DRS)," dated November 7, 2005
- Letter from M. Ring to C. Crane, "Quad Cities Nuclear Power Station Units 1 and 2 NRC Integrated Inspection Report 05000254/2007004; 05000265/2007004," dated October 31, 2007

7.2 Calculations

- QDC-0000-E-1038, Quad-Cities 10CFR50 Appendix R Criteria Document
- QDC-3300-M-0542, Determination of Usable Volume In CCSTs For SSMP Following An Appendix R Fire Event
- QDC-4100-M-0537, Quad Cities Station Design Basis Hydraulic Calculations
- QDC-2300-M-1034, 10CFR50 Appendix R Safe Shutdown Torus Temperature Using HPCI
- QDC-5280-M-1553, SBO DG Run-Time and Fuel Consumption At Worst Case Appendix R Load
- QDC-8300-E-1716, Use of the 250VDC Systems for Appendix R.
- QDC-0020-M-0551, Reactor Building Post-LOCA Temperature Analysis
- QDC-1500-M-1156, Habitability In Torus Compartment During An EPU Appendix R Event
- QDC-3300-M-0500, Evaluation Of Instrument PI 2-2381 As A Means Of Establishing the Level In the CCST Tanks
- QDC-3300-M-1763, Evaluation of Instrument PI 2-1360-20 As A Means of Establishing The Level In The CCST Tanks.
- QDC-8300-E-0482, Evaluation Of 125 Volt DC System Coordination For Appendix R
- QDC-7800-E-1564, Effect Of A Range Of Short Circuit Current On The Connected Cables Of The Unfused And Ungrounded Control Transformer Secondary Side
- GE-NE-A22-00103-56-01-Q, Task T0611: Appendix R Fire Protection (Quad Cities Station)
- BSA-Q-96-07, HPCI Room Thermal Response With Loss Of HPCI Room Cooler At Quad Cities Station
- QC-27Q-E-017, SBO Bus Ties Relay Settings And Coordination Study
- 7923-36-19-1, Safe Shutdown Ac Systems Coordination For Appendix R
- 7923-06-19-2, Appendix R Hot Shorts Between Medium And LV Cables In Common Enclosures
- LaSalle 6731-EAD-1, Effect Of CT Secondary Open Circuit On Safety Related Switchgear

7.3 Evaluations

- NDIR QDC-97-130, Appendix R Maloperation Reviews

- NDIT QDC-97-133, Appendix R Maloperation Reviews – Unit 2
- NDIT QDC-98-016, Information Notice IEN 92-18 Evaluation Into Appendix R Safe Shutdown Analysis Report
- NDIT QDC-98-058, Appendix R ECCS and RHRSW Vault Room Cooler Start Times
- NDIT QDC-98-060, Reactor Pressure Instruments Available For Fire Related SSD
- NDIT QDC-98-073, Incorporate Redundant Fusing Evaluation For Unit 2 Into Appendix R SSD
- NDIT QDC-98-083, HI-LO Pressure Interface Valve MO 1(2)-0220-4
- NDIT QDC-98-086, Assessment of Turbine Building Ventilation System For Safe Shutdown of Plant During An Appendix R Event
- NDIT QDC-98-105, HI-LO Pressure Interface Valve FCV 1(2)-1239
- NDIT QDC-98-121, Appendix R Maloperation Of Recirc. Pump Control Room Trip Signal
- NDIT QDC-98-137, Appendix R Fire Protection Evaluation Isolate/Trip RCIC Turbine – Unit 1
- NDIT QDC-98-138, Appendix R Fire Protection Evaluation Isolate/Trip RCIC Turbine – Unit 2
- NDIT S040-QH-0391, SCRAM Capability For An Appendix R Fire Outside of Fire Area SB-I
- NDIT S040-QH-0439, Analysis of Cable Function For Cables In Various Fire Areas
- NDIT S040-QH-0441, Identification of Safe Shutdown Cables In Fire Zones Using Normal Shutdown
- NDIT S040-QH-0444, Report-Evaluation of Turbine Building (TB) Fire Area TB-V Fire Zone 11.1.1.B
- NDIT S040-QH-0445, Report-Evaluation of Reactor Building (RB) Fire Area RB-1/2 Fire Zone 9.3
- NDIT MSD-98-026, Operator Access Evaluation Reactor Pressure Instrumentation
- NDIT EIC-97-008, AC Auxiliary Power System Coordination Quad Cities Appendix R Concerns
- NDIT EIC-97-014, 250 VDC Control Circuits Requiring Isolation For Appendix R Events
- NDIT EIC-99-009-1, ComEd Position on Multiple High Impedance Faults (MHIF)
- Q-ECDS-00-167, Separation of Fire Zones 11.1.3 and 11.2.3 From Cables In Fire Area RB-1N Associated With Valves MO 1-2301-4 and MO 1-1301-16 Respectively
- Q-ECDS-00-172, Licensing Basis For ADS Cable Separation
- TODI QDC-00-068, Multiple High Impedance Fault Study For Appendix R

- ECR 47448, Appendix R Repair of MO 1-1001-50 For QCARP Procedures
- ECR 47479, Appendix R Repair Method For the 1-202-5A Valve
- ECR 47486, Appendix R Fire Repair Method For MO 1-202-5B
- ECR 47488, Appendix R Fire Repair For MO 1-202-4B
- ECR 47555, Verification of 900 Mhz Radios For Unit 1 QCARP Procedures
- EC 360895, Evaluate 125 VDC System Configuration As Described in QCARP 0040-01

7.4 Modifications

- DCP 9700393, Penetration's X-100B and X-104F Fireproofed Per Appendix R
- DCP 9700399, Penetrations X-100F and X-104A Fireproofed Per Appendix R
- DCP 9800063, RCIC Rm Temp/Condensate Pump Local Control, Appendix R
- DCP 9800076, Re-Locate Feeder XFR Switches For RHR Rm Coolers, Appendix R
- DCP 9800077, Re-Locate Feeder XFR Switches For RHR Rm Coolers, Appendix R
- DCP 9900027, Upgrade U1 Battery/Charger Room Penetrations For Appendix R
- DCP 9900059, Upgrade Doors/Penetrations In Cable Tunnel, Appendix R
- DCP 9900060, Move SSMP Injection Pt Downstream Of 1-2301-7 Vlv, Appendix R
- DCP 9900061, Revise Injection Point Downstream Of 2-2301-7 Valve
- DCP 9900174, Upgrade Doors/Penetrations In Cable Tunnel, Appendix R
- DCP 9900175, Upgrade U2 Battery/Charger Rm Penetrations For Appendix R
- EC 331679, Reroute SSMP Line To Allow Access