3.0 **APPENDIX R, SECTION III.G. EVALUATION**

The purpose of the Appendix R, Section III.G evaluation was to ensure the capability to achieve safe shutdown in the event of a fire. The equipment and its associated cables required to bring the plant to a hot/cold shutdown condition including those which are protected from fire damage are presented in Attachments 3-1 through 3-6.

The component matrixes show the availability of components in a fire area/ zone. The equipment list not only includes the required equipment, but also includes additional equipment whose failure or inadvertent actuation could impede safe reactor shutdown or induce a transient as a result of a fire. Circuits associated with the equipment are evaluated in the same manner as the required equipment. All cables requiring protection from fire damage are compiled and listed in Attachment 3-1, which describes, in detail, how these cables have been protected in each fire area/zone.

Section 3.10 discusses all valves whose operation is required for shutdown in the plant.

Section 3.11 provides a listing of the safe shutdown systems available to support the hot/cold shutdown functions.

Section 3.12 describes alternative shutdown capability utilized for fire areas where the control room must be evacuated or the remote shutdown system must be utilized (i.e. III.G.3 fire areas).

Section 3.13 discusses the corrective actions taken to prevent or mitigate the spurious operation of the components that could adversely affect the safe shutdown of the plant.

Section 3.14 outlines the TMI-1 exemption requests and exemptions.

3.1 Reactor Building - Deleted

3.2 Auxiliary Building - Deleted

3.3 Intermediate Building - Deleted

3.4 Control Building - Deleted

3.5 Diesel Generator Building - Deleted

3.6 Intake Screen and Pump House - Deleted

3.7 Fuel Handling Building - Deleted

3.8 Turbine Building - Deleted

3.9 Air Intake Tunnel - Deleted

3.10 VALVES

Attachment 3-3 includes the series valves in the high-low pressure boundary interfaces. One of the valves in each boundary interface is protected from spurious opening by removing the ac power supply or by modifying the control schemes. In some instances, the consequence of spurious opening of series valves in any one high-low pressure interface has been evaluated and found acceptable for achieving safe shutdown.

All manually operated valves required for safe shutdown are indicated on Attachment 3-3. The time available to operate the manually operated valves is sufficient to assure safe shutdown capability. (See Section 3.14-2)

The valves required for cold shutdown will also be manually operated. The valves required to support safe shutdown may be located in the fire areas/zones where the fire is burning. These valves will be manually operated after the fire is extinguished. The fusing of valves as a result of a fire in these fire areas/zones such that valves cannot be operated is not considered realistic, because of low fire loading and water filled pipes. An exemption is requested for each fire area/zone where such manual operation is required.

It is also assumed that fire damage to motor operators, pneumatic operators, and their air lines and solenoid valves will not prevent manual operation. Fire effects on air lines have been evaluated, and no design changes were found to be necessary to assure operation of valves which require air to operate after a fire in the area.

3.11 Safe Shutdown Equipment and Circuits

The Appendix R evaluation started with the establishment of the basic functions required to maintain safe hot shutdown and to achieve and maintain cold safe shutdown (see Section 2.3.1). Systems and equipment necessary for these functions were also identified along with components, which can prevent operation or cause maloperation of required equipment due to spurious actuation caused by fire damage of cables. A detailed listing of the safe shutdown equipment is given in Attachment 3-3. Components with an active function in support of safe shutdown are identified as FSSD “Yes”. Components which are otherwise not required but spurious operation could adversely affect safe shutdown are identified as FSSD “No (S)”. Some components with an apparent role to support safe shutdown but evaluation has shown they are not required are listed on Attachment 3-3 but identified as FSSD “No”.

Attachment 3-4 provides a listing of flow diagrams for safe shutdown required systems.

Cables required for the operation of safe shutdown equipment or those which could cause spurious operation of equipment adverse to safe shutdown (from Attachment 3-3) were traced through each fire areas/zone of TMI Unit 1, and were analyzed for

compliance with the separation requirement of Section III.G.2 of Appendix R. A complete matrix showing the location of each associated cable for safe shutdown or spurious components in each fire area/zone is given in Attachment 3-6. Symbols used are similar to those used in Attachment 3-5 (as described below) except the symbol "E" indicates the component location. Some circuits in Attachment 3-6 are for historical information only, as the components are no longer required for safe shutdown per the discussion in Attachment 3-3.

The evaluation determined if redundant safe shutdown circuits and equipment, or associated circuits, were present in a specific individual fire area/zone. When cables or components of redundant trains of systems necessary to achieve shutdown were located in the same fire area/ zone, the fire area/zone was considered to be in noncompliance with the separation requirements. Cables and components of one train of the system were protected from fire damage, (by use of fire barrier wraps or Rockbestos fire resistant cable or rerouting out of the fire area/zone) in order to achieve the availability of required shutdown components. When redundant components or cables were in separate fire areas, it was considered that adequate separation exists and no protection is required. When in separate fire zones, this determination was based on the fire zone boundary analysis.

The availability of each safe shutdown component (Attachment 3-3 FSSD “Yes”) or the potential for adverse operation of spurious components (Attachment 3-3 FSSD “No (S)”) is described for each fire zone/areas on Attachment 3-5.

Attachment 3-5, which describes the availability of components that may be used to achieve safe shutdown, provides the following information.

A component is available when the square is blank or “P”. The “P” indicates that the component was made available by protecting cables. The fire will not affect a component when the square is blank. Spurious operation of a component has been prevented by modifying the control scheme if the square is marked “D” or by de-energizing the ac power or dc control power if the square is marked “O”. A letter "X” indicates that the component or one of its unprotected cables is located in the fire area/zone. A letter "S" in the matrix square indicates that a support system (cooling water, electric power supply, or another component that is relied upon for operation) is not available.

When a component could be used to perform the required function, but manual action is required to make the component available the following codes were marked:

“M” indicates the valve can be positioned manually
"RSD" indicates control can be restored using a remote shutdown function.
“R” indicates cable repairs* would be required to make the component available

*These refer to component specific procedures that specify the identified

cables or control wires to be disconnected or cut and/or jumpers to be installed to restore the required function.

Attachment 3-7 describes manual actions and repairs used to achieve safe shutdown. It is broken into the following sub-attachments:

- Attachment 3-7A: Describes the required manual actions performed outside the control room to achieve hot shutdown for fires in III.G.2 fire areas/zones
- Attachment 3-7B: Describes the required manual actions to achieve hot shutdown for fires in III.G.3 fire areas/zones
- Attachment 3-7C: Describes the required manual actions and repairs outside the control room to achieve cold shutdown for fires in all fire areas/zones

3.12 Alternative Shutdown Capability

References:

1. Technical evaluation 817422-12, “Time between fire detection and cable failure in CB-FA-3d and CB-FA-4b”
2. 86-9101191, Rev 1, “TMI-1 Appendix R Transient Evaluation Summary”
3. C-1101-202-E620-471, “TMI-1 Cycle Specific Shutdown margin Verification during Emergency Cooldown”. NOTE: This analysis is performed for each core reload as required by NF-AP-100-8000.
4. ECR 08-00816, “Technical Evaluation: DESIGN INPUTS FOR APP R CONTROL ROOM EVAC ANALYSIS”
5. TM-MISC-10, Rev 2, “MAAP Analysis of Long Term Containment response to 94 GPM Seal LOCA”, Erin Engineering [Attached to Tech Eval 352410-33]
6. UFSAR Section 9.8.1.1, “Control Building Ventilation System Design Basis”
7. UFSAR Section 9.8.3.5, “Auxiliary Building Ventilation System Evaluation”
8. UFSAR Section 9.8.6.5, “Intermediate Building Ventilation System Evaluation”
9. UFSAR Section 9.8.7.5, “Diesel Generator Building System Evaluation”
10. UFSAR Section 9.8.8.5, “Intake Screen and Pump House Ventilation System”
11. C-1101-911-E610-001, "Time to Reach Cold shutdown and required condensate inventory”
12. Technical evaluation 352410-33, “FSSD Evaluation Summary for Loss of all RCP Seal Cooling”
13. Technical evaluation 352410-36, “Evaluate impact of RB environment on FSSD components”

The safe shutdown capability provided at TMI-1 meets the protection criteria of Appendix R, Section III.G.2 (with consideration for the exemptions requested and granted) in all fire areas/zones except the following three areas:

CB-FA-3c ES Actuation Cabinet Room
CB-FA-3d Relay Room (Cable Spreading Room)
CB-FA-4b Control Room

These three areas were identified as fire areas/zones where the requirements of Appendix R, Section III.G.2 cannot be achieved. An alternative shutdown capability per Appendix R III.G.3 is provided by the remote shutdown system (RSD) for these

fire areas.

The actions required to achieve safe shutdown for a fire in any of these areas are listed in Attachment 3-7. Attachment 3-7B describes the actions required to achieve hot shutdown. Attachment 3-7C describes the actions required to achieve cold shutdown.

3.12.1 Remote Shutdown System

The remote shutdown system design is described in UFSAR section 7.4.6 and System Design Description document SDD-T1-614 Div. II. The three RSD panels (RSP-A, RSP-B, AUX RSP-B) are located in CB-FA-2c (CB 322: RSD Area). The remote shutdown transfer switch panels (RSTSP) are located as follows: RSTSP-C in CB-FA-2c, RSTSP-B in CB-FA-2b (CB 322: 1S 480V Swgr room), and RSTSP-A in CB-FA-3c.

In case of a fire in the relay room or control room, the operators will leave the control room after the reactor is shutdown. In the case of a fire in the ESAS room (CB-FA-3c), a senior reactor operator (SRO) will remain in the control room. The operators will take control of safe shutdown equipment from the RSP locations, 1E 4160-Volt switchgear room, and 1S 480-Volt switchgear room. The mitigation strategy for a fire in CB-FA-3d or CB-FA-4b is described in section 3.12.4. The mitigation strategy for a fire in CB-FA-3c is described in section 3.12.5.

RSTSP-A is not available for a fire in CB-FA-3c. Although remote shutdown facilities are provided for some of the "A" channel equipment, because access to RSTSP-A is restricted for a fire in CB-FA-3c and on site power to 1D 4160V bus is not protected, the control functions on RSP-A may not be available for any Appendix R III.G.3 fire area. "A" RSD channel equipment will be utilized when RSP-A, RSTSP-A, and the "A" channel power supplies are available.

3.12.2 Associated Circuits

It is recognized that a number of circuits routed through the ES actuation room, relay room, and control room share a common source of electrical power, or share a common enclosure with shutdown circuits. Appendix R concerns over associated circuits are essentially for spurious actuation of equipment due to fire induced failures of the associated circuits. The circuits for spurious operation were analyzed individually with the required safe shutdown circuits for the consequence of fire damage. A comprehensive circuit review of the entire plant electrical distribution systems was made to insure that the circuits associated by common power and the circuits associated by common enclosure are of no concern to the safe shutdown capability, including the remote shutdown system (see section 2.3.1.4).

3.12.3 Guidelines for Alternate Shutdown

The following requirements were applied to the development of the mitigation

strategy for a fire that requires alternate shutdown capability:

1. Actions taken in the control room prior to control room evacuation and credited in analysis satisfy the guidelines of GL 86-10 section 3.8.4.

2. Safe shutdown is achieved with or without offsite power available. Loss of offsite power may occur at anytime.

3. Any or all automatic signals may fail to actuate.

4. A single spurious actuation (i.e. due to a hot short) may occur at anytime during the evolution.

5. There are at least five available operations personnel independent of the fire brigade:
   a. One senior reactor operator
   b. Two reactor operators
   c. Two non-licensed auxiliary operators

6. Analysis (Reference 2) was performed to demonstrate that performance criteria of 10CFR50 Appendix R Section III.L were satisfied. This includes clarification of these requirements provided in NRC memo dated February 10, 2005 from Sunil Weerakkody, “Chief of Fire Protection and Special Projects Section, Division of Systems Safety and Analysis, Office of Nuclear Reactor Regulation”.

7. Adequate emergency lighting is available for all required hot shutdown actions.

8. Emergency communication capability is available between the RSD station, the auxiliary building and the intermediate building.

9. Protected instrumentation is adequate to identify the need for condition-based actions, to control plant parameters, and to ensure the reactor remains in a safe shutdown condition.

10. Access to the fire area is not required. There are no limitations on access to other plant areas (radiation levels or otherwise) except SCBA is required for access to CB 338 areas adjacent to the relay room until air samples confirm O_2 concentration is acceptable.

11. Repairs are not credited to maintain hot shutdown conditions.

12. The mitigation strategy must be capable of placing the reactor in cold shutdown conditions within 72 hrs.

3.12.4 CB-FA-3d & CB-FA-4b Mitigation Strategy

The mitigation strategy for a fire in the control room or relay room is broken down into five distinct time periods in the event chronology.

(1) PRE-EMPTIVE
Control room operators perform actions when a fire is identified in either the control room or relay room. Operators will shutdown the reactor and take other actions to improve the reliability of the mitigation strategy. The following actions are taken upon confirmation of a fire and are completed before fire damage could prevent completion of these actions from the control room.

- TRIP Reactor
- TRIP Main Turbine
- TRIP all Reactor Coolant Pumps
- CLOSE RC-V-2 (PORV Block valve)
- CLOSE MS-V-8A and MS-V-8B (Turbine Bypass Isolation Valves)
- OPEN MU-V-14A and MU-V-14B (BWST to MU Pumps Isolation Valves)

NOTE: Emergency Feedwater (EFW) will actuate automatically when the Reactor Coolant Pumps (RCP) are tripped. All three EFW pumps will start and the EFW regulating valves will open to raise OTSG levels toward 50% operating range. Operators will ensure MS-V-13A & MS-V-13B are open.

If these actions are completed within 2.5 minutes of detection of a fire (observation or relay room smoke alarm), then these actions can be expected to be successful. Two independent instruments and alarm windows (PRF-5-1 "RELAY ROOM FIRE" and HVB-4-10 “CONTR. BLDG. RELAY ROOM DAMPER TBL FIRE-SMOKE” would actuate if a valid condition (i.e. smoke) was detected in the relay room. Evaluation of the detection capability and progress of a fire established that with worst case assumptions there would be a minimum duration of 2.5 minutes between detection and failure (and that a more realistic assessment places the time at greater than 10 minutes) [Reference 1].

Each of these actions has been evaluated in accordance with GL 86-10 section 3.8.4. The six steps described above are performed without further diagnosis. These actions are performed from the main control console. Validations have repeatedly demonstrated these actions can be completed in less than one minute. The action does not include the stroke time for MS-V-8A or MS-V-8B. The operator confirms valve travel has been initiated. Once these actions have been completed, the fire may still affect these components. A fire induced failure that could withdraw control rods, open both a turbine stop and control valve, or start a RCP is not credible. It would take multiple hot shorts to cause any of those events. The PORV (RC-RV-2) and PORV Block (RC-V-2) are both closed. A single hot short could not cause both valves to open. Therefore, the flow path remains isolated once RC-V-2 is closed. Once RSD control is established, RC-V-2 control is isolated from the fire area and the valve is CLOSED. MU-V-14A and MU-V-14B are both OPEN. A single hot short could not cause both valves to close. Therefore, the flow path remains available

once both valves are open. Once RSD control is established, MU-V-14B control is isolated from the fire area and the valve is OPEN. A single hot short could open MS-V-8A or MS-V-8B. Such an occurrence is accounted for in the transient analysis (Reference 2). The analysis assumes that one set of turbine bypass valves (TBV) (3 valves) is causing an uncontrolled OTSG depressurization during the transition from the control room to RSD control. Once control is available at the RSD panel, the spurious opening of one valve will be addressed.

(2) FAILURES

The operating staff will respond to equipment failures as a result of the fire in accordance with alarm response and emergency procedures. If a control room or relay room fire should occur, failures of safe shutdown equipment may occur but the need for a control room evacuation is unlikely. The reactor would be maintained in hot shutdown conditions.

(3) EVACUATION

If the control room SRO determines that the fire is challenging the ability to maintain safe shutdown conditions from the control room, operators evacuate the control room and establish control at the RSD stations.

Upon determination that evacuation is required and prior to leaving the control room the following actions are performed:

- TRIP both Main Feedwater (MFW) Pumps
- TRIP all condensate and condensate booster pumps
- PLACE EFW control valves in manual. EF-V-30A and EF-V-30C will be closed. EF-V-30B and EF-V-30D will be throttled to 15 to 25% open.

All of these actions are closely related and are performed from the main control console. These actions can be reliably performed in less than 75 seconds.
Main Feedwater is terminated because MFW cannot be controlled from the RSD station and excessive feedwater flow could overfill an OTSG. Automatic control should prevent undesired MFW flow, but it is not assumed to function. MFW, Condensate and booster pumps are all tripped to provide redundant methods to prevent an OTSG overfill, prevent any feed from MFW as OTSG pressure is reduced during cooldown, and initiate the process to break vacuum. Condensate pump shutdown will be confirmed after RSD control is established and before OTSG pressure is reduced below 200 psig. These actions are credited with successfully terminating MFW. It would take more than one hot short to establish the pump combination required to provide adequate pressure to feed the OTSG.

EF-P-2A and/or EF-P-2B may be lost. EF-P-1 will continue to operate. A single hot short could close MS-V-13A or MS-V-13B, but not both.

One or more of the EF-V-30 valves may fail CLOSED. In AUTO, all EFW regulating valves could fail open. In manual, a single hot short could cause a single EF-V-30 to fail OPEN. The potential failures are limited by placing the valves in manual with two valves throttled open. Loss of all EFW flow or excessive EFW flow are both

accounted for in the analyzed events. EF-P-1 operation and a minimum flow to each OTSG are credited as soon as the RSTSP B EFW transfer switch is operated.

A fire in the relay or control room has the potential to affect any or all functions controlled from those locations. The effects may be evident before or after the operators have left the control room. In order to provide a reliable strategy to mitigate the many and varied potential consequence of this event, the strategy was developed to address the limiting event sequences. Appendix R Section III.L provides performance criteria for fire areas where alternate shutdown capability is utilized (i.e. Appendix R III.G.3 fire areas). The limiting combinations of failures which could (1) challenge the ability to maintain adequate RCS inventory, (2) challenge the ability to remove core decay heat or (3) challenge the integrity of the RCS were determined by systems analysis and performance based on the plant replica simulator and thermal hydraulic computer models. Walkdowns and simulations of operator actions were used to develop credible performance times for operator actions. These inputs (limiting failure sequences and performance times for operator actions) were used to analyze system performance and verify Appendix R III.L performance criteria were satisfied (Reference 2). The actions credited for success in that analysis are listed in Attachment 3-7B "Manual Actions Required for Hot Shutdown in Appendix R III.G.3 Fire Areas".
The analysis in reference 2 includes the effects of loss of all RCP Seal Cooling with the Westinghouse RCP Seals. With the Flowserve N-9000 RCP Seals the challenge to RCS inventory control is significantly reduced. Therefore the analysis conclusion remains conservative.

(4) HOT SHUTDOWN
Operations are directed from the RSD station to provide a stable hot shutdown configuration and to prepare for cooldown.

The actions required to reach and maintain hot shutdown conditions are listed in Attachment 3-7B "Manual Actions Required for Hot Shutdown in Appendix R III.G.3 Fire Areas".

(5) COLD SHUTDOWN
The reactor coolant system pressure is reduced and temperature is cooled to cold shutdown conditions.

The actions required to reach cold shutdown conditions are listed in Attachment 3-7C "Manual Actions and Repairs Required for Cold Shutdown".

The mitigation strategy is designed to ensure cold shutdown is achieved within 72 hours. Without all of the potential failures, cooldown will be accomplished much sooner. RCS cooldown and RCS depressurization via pressurizer ambient heat loss is initiated within 4 hours. During cooldown, CF-V-1A and CF-V-1B are closed. Additional pressurizer venting (using RC-V-49 & 50) can be used if required to reach Decay Heat Removal initiation conditions within 66 hours.

Appendix R III.L performance criteria review
The following review describes the potential effects of a fire in the Relay Room (CB-FA-3d) or Control Room (CB-FA-4b) and how hot shutdown and cold shutdown will be achieved. Each Appendix R III.L performance criteria and each time period above is addressed. The required actions to achieve and maintain hot shutdown and to achieve cold shutdown are described on Attachments 3-7B and 3-7C. This review also describes actions taken for additional "defense in depth". Preparations (i.e. procedures, material staging, etc) are completed to perform these "defense in depth" actions. These actions are not required for safe shutdown. All design requirements for reliable performance are not satisfied.

Appendix R III.L.2.a.*The reactivity control function shall be capable of achieving and maintaining cold shutdown reactivity conditions.*

Upon confirmation of fire, the reactor will be tripped. This action is performed before the fire could have damaged critical circuits to ensure the reliability of this action. All control rods will fully insert, shutdown the reactor and maintain the reactor at hot shutdown.

The borated water storage tank (BWST) is the primary makeup water source after the reactor is shutdown. MU-V-14A or MU-V-14B will remain open. An RCS injection path from the BWST is available using controls isolated from the fire area. Reference 3 demonstrates that the reactor will remain shutdown at 70°F assuming all rods fully inserted, no xenon, no injection from the boric acid mix tank (BAMT), and BWST makeup only as required to account for RCS density change during cooldown (i.e. maintain pressurizer level).

The following actions are taken to provide defense in depth. Performance of these actions is dependent upon the extent of fire damage and resources available.

(1) Injection of concentrated boric acid solution from the BAMT to the makeup tank (MUT) will be initiated. As MUT level and pressure rise, this source will be injected in parallel with BWST water. This will raise the boron concentration above that determined in Reference 3.

(2) Letdown and a bleed path to a reactor coolant bleed tank (RCBT) may be used to ensure additional injection of borated water from the BWST or BAMT.

Appendix R III.L.2.*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. Provide the means to maintain the core covered with sub-cooled water.*

Upon confirmation of fire, the PORV block valve (RC-V-2) is CLOSED and the BWST supply valves (MU-V-14A & MU-V-14B) are opened. These actions are performed before the fire could have damaged critical circuits to ensure the reliability of these actions.

MU-V-5 may fail open and automatic protection to close MU-V-2A and MU-V-2B or MU-V-3 may fail. Loss of RCS inventory through this path was assumed in the control room evacuation transient analysis (Reference 2). MU-V-3 will be closed from the RSD panel as soon as RSD control is enabled.

The fire may cause a loss of RCS makeup or seal injection. Loss of makeup until RSD control is established was assumed in the control room evacuation transient analysis (Reference 2). MU-P-1C will be started after RSD control is established. An RCS injection path from the BWST is available using controls isolated from the fire area. MU-V-14B, MU-V-37, MU-P-1B, MU-P-1C, MU-V-16C and MU-V-16D all have protected power supplies (ES train B) and can be controlled from the RSD panel. Adequate RCS inventory is available in the BWST to achieve cold shutdown.

Both methods of RCP seal cooling may be lost. Seal injection will be restored. MU-P-1C will be aligned to supply seal injection by locally opening MU-V-76A and MU-V-76B. MU-V-20 will be opened using RSD controls. Seal injection flow will be controlled by bypassing MU-V-32, i.e. by closing MU-V-89A and locally throttling MU-V-90.

MU-P-1B can also be used for RCS makeup and seal injection, if the pump and support systems are available.

The Core Flood tank (CFT) injection flow path is not susceptible to fire effects. If RCS pressure were reduced below CFT pressure, core flood would occur. CFT instrumentation and controls are not protected from the fire. CF-V-1A and CF-V-1B will be closed before RCS pressure Is lowered below 600 psig.

An overcooling event would aggravate a condition without makeup available. The effect of potential overcooling on maintaining hot leg sub-cooling was addressed (Reference 2). Excessive steam flow or excessive feedwater flow could be induced by failures as a result of a relay or control room fire.

A fire could induce Turbine Bypass Valves failures. MS-V-8A and MS-V-8B are closed to minimize the risk of overcooling. No steam flow through this line is postulated unless a hot short causes MS-V-8A or MS-V-8B to open. The limiting failure scenario is failure of all TBVs 50% open and a single open MS-V-8 (Reference 4). This condition was assumed in the control room evacuation transient analysis (Reference 2) until MS-V-8A and MS-V-8B are CLOSED under RSD control.

An Atmospheric Dump Valve (MS-V-4A/B) could fail open. The valves will close as soon as the RSD transfer switch is operated. These potential failures were assumed in the control room evacuation transient analysis Reference 2).

Cases where EFW flow is excessive before RSD control is established were evaluated in the transient analysis (Reference 2). The limiting hot short was associated with the reopening of the turbine bypass valve isolation valve (MS-V-8A

or MS-V-8B).

Appendix R III.L.2.c: *The reactor heat removal function shall be capable of achieving and maintaining decay heat removal.*

RCS pressure and inventory control must be adequate to support natural circulation. To ensure this capability, hot leg sub-cooling must be maintained. The transition from the control room to RSD has been analyzed using the limiting combination of potential fire effects. This analysis demonstrates pressurizer level may drop below the range of the level indication, but the hot legs remain sub-cooled and pressurizer level can be restored to within the indicated range. These conditions support natural circulation throughout the event. Natural circulation may be interrupted due to loss of feedwater as described below (Reference 2).

EFW provides feedwater flow and the ability to maintain OTSG level to support natural circulation and reduce RCS temperature to allow initiation of decay heat removal (DHR). The following Emergency Feedwater components are available using controls isolated from the fire area and have protected power supplies: EF-P-2B, EF-V-30A, EF-V-30B, EF-V-30C, and EF-V-30D.

EF-P-1 will be started prior to fire induced failures. Potential effects of fire on steam supply (MS-V-2A/B or MS-V-13A/B) or pump flow path (EF-V-2A/B) would not disable the ability to feed at least one OTSG.

Main Steam Safety Valves (MSSV) provide an initial OTSG steam flow path to achieve hot shutdown. MS-V-4A and MS-V-4B will be available from RSD. When RSD control is established, the ADVs will be used to stabilize the plant at hot shutdown conditions. One ADV is required to maintain hot shutdown.

Both OTSGs (EFW and ADV) will be used for cooldown to DHR initiation conditions. Instrument Air (IA) will be available to support remote operation of both trains of EF-V-30s and ADVs to support cooldown. Local operations to realign one of EF-V-1A/B, EF-V-2A/B or MS-V-2A/B may be required prior to cooldown.

EF-P-2B will be operating to support the cooldown.
The following action provides additional defense in depth and is not required to meet Appendix R requirements. During the cooldown, if EF-P-1 steam supply is insufficient as OTSG pressure is reduced, MS-V-10A or MS-V-10B may be throttled open locally.

DHR will be used to complete the cooldown to cold shutdown conditions, and maintain cold shutdown. Local operation of DH-V-1, DH-V-2, DH-V-3, DH-V-4B, DH-V-19B, DC-V-2B and DC-V-65B and DC flow indication DC-FS-27 will be used, as necessary, to initiate and control decay heat removal operation.

Main feedwater is not protected from fire effects. A relay or control room fire could cause the MFW regulating valve (FW-V-17A/B) or startup regulating valve (FW-V-

16A/B) to fail open, and result in an overfeed condition. To prevent a potential OTSG overfill into steam lines, the MFW pumps, condensate and booster pumps are tripped when the decision is made to evacuate the control room. A failure of MFW regulating valves, MFW discharge isolation valves, and TBV failed open could reduce OTSG pressure and allow a condensate booster pump to overfeed an OTSG. To prevent this potential, the condensate booster pumps are also tripped before evacuating the control room. In addition, to preclude uncontrolled feed from condensate pumps during plant cooldown, operators will confirm the condensate pumps are shutdown prior to reducing OTSG pressure below 200 psig.

EF-V-2A or EF-V-2B could spuriously close (hot short) due to fire effects on control circuitry, which could cause a loss of EFW flow to the A OTSG. If this occurs, the valve will be manually opened to enable use of both OTSGs for cooldown. MS-V-2A or MS-V-2B may spuriously close (hot short) due to the fire. If this occurs, the valve will be manually opened to restore the steaming path and enable use of both OTSGs for cooldown. MS-V-13A or MS-V-13B may spuriously close (hot short) due to the fire. Only one of these two steam flow paths is required for EF-P-1 to perform its hot shutdown function.

The minimum condensate storage tank (CST) volume of 214,320 gallons per tank (i.e. 428,640 gallons) will provide sufficient condensate for decay heat removal for at least 72 hours at hot shutdown conditions (Reference 11). The condenser hotwell and million gallon demineralized water storage tank (DW-T-2) are defense in depth options which can be lined up to the EFW suction header within 24 hours.
Additional defense in depth is provided by the reactor building emergency cooling river water system which can supply river water to the EFW suction header.

The Atmospheric Dump Valves have sufficient capacity to cool the RCS to the conditions for initiating Decay Heat Removal such that the time from the event to cold shutdown would be less than 24 hours (Reference 11).

IfCO-V-111A spuriously opens concurrent with CO-V-7 or CO-V-8 failing open, CST inventory drains to the hotwell. The water in the hotwell is not available for EFW suction until condenser vacuum is broken. CO-V-8 and CO-V-108 will be locally closed to ensure adequate condensate inventory until vacuum is broken. Both EF-V-1A and EF-V-1B will be opened to allow any EFW pump to use any EFW condensate source during cooldown.

RCS Pressure control is necessary to maintain sub-cooled conditions for natural circulation and to ensure the ability to initiate DHR and complete RCS cooldown within 72 hours. Normal RCS pressure control (pressurizer heaters and spray) may be affected by the fire, and is not available from the RSD stations. The Reactor Coolant Pumps are shutdown. Pressurizer spray is not available. There are no RSD controls for normal pressurizer heaters.

Pressurizer heater MCC 1A & 1B will be de-energized and pressurizer heater group 9 will be transferred to 1P 480V Bus. Group 9 pressurizer heaters are not affected

by a control room or relay room fire. The remaining heaters will be de-energized to permit control with group 9. Therefore a solid ops cooldown is not required. Ambient heat loss from the pressurizer will provide a steady reduction in RCS pressure. If additional pressurizer cooldown rate is necessary, then RC-V-49 and RC-V-50 can be opened.

During the control room evacuation, pressurizer level may go outside the range of pressurizer level indication. When RSD control is established, RCS makeup will be initiated (MU-V-16C & MU-V-16D). If pressurizer level was below the indicated range, pressurizer level will come back on scale and pressurizer heaters will be energized. RCS pressure will be maintained by slowly raising pressurizer level until a steam bubble is established. If pressurizer level is above the indicated range, operators will throttle RCS makeup flow to control hot leg sub-cooling margin between 50 and 100°F. This condition will be maintained until a steam bubble is established.

A relay or control room fire could result in an ESAS actuation of High Pressure Injection. RCS pressure would be controlled below 2750 psig and the event would be terminated before RCS temperature was reduced to the NDTT limit. This conclusion is based on terminating excessive HPI flow within 41 minutes after control room evacuation and is documented in Reference 2.

The RSD panel controls are isolated from the engineered safeguards actuation system (ESAS) circuits. Once control has been transferred to RSD, component operations are independent of ESAS. Using RSD controls, MU-V-18 can be closed and B train of HPI can be throttled as required to control pressurizer level. HPI train A cannot be controlled at the RSD panel. Excessive train A HPI can be terminated by tripping the A train HPI pump(s) or closing MU-V-16A and MU-V-16B locally.

The following actions are taken to provide defense in depth. Performance of these actions is dependent upon the extent of fire damage and resources available. During cooldown, HPI 1600 psig and LPI 500 psig ES actuations are bypassed by manual actuation of bypass relays in the ESAS relay cabinets. Control of actions required to achieve safe shutdown are independent of ES actuation logic. This will prevent further complication due to ESAS actuation as RCS pressure is reduced.

The PORV block valve is CLOSED under RSD panel control. OTSG heat removal will be maintained for relay room or control room fires. HPI cooling is not required to mitigate the design event. Compliance with Tech Spec 3.1.12 cannot be achieved prior to reducing RCS temperature below 313°F. The intent of this specification is satisfied. Under RSD control, automatic operation of B train of HPI is disabled. Prior to reducing RCS temperature to less than 313°F, HPI train A will be disabled by racking out breaker for MU-P-1A and closing the valves and opening the breakers for MU-V-16A & MU-V-16B.

The capability to restore letdown is provided for defense in depth. Performance of this action is dependent upon the extent of fire damage and resources available. The potential loss of the ability to isolate letdown was addressed earlier as an RCS

inventory concern. Letdown may be isolated due to effects of the fire and will be isolated when control is available at the RSD station. Letdown is isolated promptly when control is available at the RSD station to address potential challenge to maintaining minimum RCS inventory and to minimize the variables affecting RCS inventory. After required actions have been initiated and if resources are available, operators may restore letdown to enhance control of RCS water chemistry.

Appendix R III.L.2
d. The process monitoring function shall be capable of providing direct readings of the process variables necessary to perform and control the above functions.

The instrumentation required for each function above is addressed as that function is discussed above. The instrumentation for all required functions is available to support the function.

Appendix R III.L.2
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.

Communications

To establish control at the RSD station, a transfer switch in RSTSP-B is operated which isolates the M&I Headsets and Gray Page systems from circuits in the fire area. The M&I headsets and Gray Page systems are available at the RSD station, at the EFW area in the Intermediate Building and on 281' elevation in the Auxiliary Bldg. To improve communications (i.e. a defense in depth capability), the "Turbine sys" M&I Headset and "Nuclear Plt" M&I Headset communications channels are tied together (i.e. to make one channel) with a jumper installed in M&I jacks south of 1B ES MCC.

Electrical Power

A potential for a loss of offsite power is assumed. EG-Y-1A & EG-Y-1B may be affected by controls in fire area and may not start or energize the ES power train. 1E 4160V Bus feeder breakers (1SA-E2, 1SB-E2 or T1-E2) could also be affected. Controls isolated from the fire area are available to isolate other sources and energize the 1E 4160V Bus using EG-Y-1B. Remote operated breakers (S1-02, T1-02, 1S-02, 1T-02, 1S-1C (1B ES MCC) or 1T-4C (1B ES SH MCC) could be affected by the fire. Control of these breakers can be established with controls isolated from the fire area at the associated bus or on RSD B for 1T-02 & 1T-4C.

Due to fire affects on control room controls, 1C ESV MCC may be lined up to the 1P 480V bus. 1C ESV MCC can be energized from 1S 480V Bus by isolating the automatic transfer switch (ATS) controls from the fire area and using local ATS controls.

The B train of ES power is used to ensure safe shutdown. The A train of ES power is not protected and cannot be relied upon for safe shutdown.

Vital 120VAC power is not directly affected by the fire, but loss of the A ES power train will deplete the A station battery. To prevent loss of ATB, VBA and VBC, the 1P & 1S 480V cross tie will be closed or the station batteries will be cross tied. Fire damage may prevent operation of the 1P & 1S bus cross tie breakers. The DC panel cross tie procedure minimizes A & B DC loads, ensures system voltage difference is acceptable and then provides power to the A train Vital Bus DC loads (ATB, VBA & VBC) from the B train battery chargers.

<u>Instrument air system</u>

For a fire in the relay room or control room, instrument air compressors IA-P-4, IA-P-1A or IA-P-1B could be adversely affected. The instrument air system is relied upon to provide motive force for remote control of EFW control valves and Atmospheric Dump Valves. The two-hour backup instrument air system provides this function in the short term. Instrument air pressure will be maintained using IA-P-1B RSD controls on 1B ES MCC.

<u>Reactor Building Cooling</u>

RB cooling may be lost and will be restored as described below. Analysis has been completed which demonstrates that with Westinghouse Seals and no seal cooling (RCS flow of 94 GPM into containment) Reactor Building pressure will remain within design (Reference 5). New analysis with Flowserve RCP seals (Reference 13) demonstrates that the Reactor Building will remain accessible for emergency action and fire safe shutdown components in the Reactor Building will continue to function for at least 72 hours.

Operation of Reactor Building emergency cooling provides defense in depth. Performance of this action is dependent upon the extent of fire damage and resources available. The primary mitigation strategy depends upon cooldown, but Reactor Building emergency cooling will be initiated. RSD controls isolated from the fire area are available to start Reactor Building Emergency Cooling pump B and control RR-V-1B. Local breaker and valve manipulations (RR-V-3 and RR-V-4) can be performed to lineup Reactor River water flow through the B cooler. Circuit repairs will be performed (if required) to restore operation of AH-E-1B from 1B ES MCC.

<u>NR, NS & ICCW Component Cooling Water</u>

Nuclear River Water (NR), Nuclear Services Closed Cooling Water (NS) & ICCW system operation provides defense in depth but are not relied upon for safe shutdown for a fire in the relay or control room.

ICCW is desired (1) to maintain RCP seal cooling and (2) to provide an option to restore letdown. ICCW will be promptly restored using RSD controls for IC-P-1B, IC-

V-2, IC-V-3 and IC-V-4.

NSCCW can be used for cooling of MU-P-1B and area ventilation cooling. NS-P-1A and NS-P-1C may be shutdown as a consequence of the control room or relay room fire. NS flow can be restored from RSD panel by starting NS-P-1C. NSCCW provides cooling for the following components: MU-P-1B, seal return coolers, Reactor Building fan motor coolers, control building chillers, EFW pump area coolers, and Decay Closed & NSCCW pump area coolers. RSD capability (controls or repairs) is available for each of these functions except the DC & NS pump area cooler. These components are not required for the following reasons:

- o MU-P-1B relies upon NS for pump & motor cooling. MU-P-1B is a backup component. MU-P-1C is the primary makeup pump.
- o Analysis and testing has been performed to demonstrate the ventilation (Control bldg, EFW Area, and DC/NS pump area) is not required to achieve safe shutdown.
- o The reactor building fans can be operated without NS flow for motor cooling.

As a consequence of the fire, NR pumps may shutdown, pump discharge valves may close, or CW flume makeup valve (NR-V-4A) may spuriously open. RSD control for NR-P-1C and NR-V-1C provides a reliable water supply. RSD control of NR-V-15B will used to supply NR flow through an ICCW cooler. Local action is required to confirm NR-V-4A is closed, and ensure a flow path through a NS cooler and ensure NR header pressure support reliable NR system operation. The capacity of ICCW and NSCCW provides a buffer until this action can be completed.

DR & DCCW Component Cooling Water

Decay Heat Closed Cooling (DC-P-1A/B, DC-V-2A/B & DC-V-65A/B) and Decay Heat River Water (DR-P-1A/B & DR-V-1A/B) Systems may be affected by the fire. RSD controls for DC-P-1B, DR-P-1B and DR-V-1B provide the capability to restore DC system cooling for MU-P-1C. DC Train B and DR Train B will be placed into operation when control is established at the RSD panel.
Local control of DC-V-2B and DC-V-65B is required for controlled cooling using the B DHR train to reach cold shutdown. Local DC train B flow indicator DC-FS-27 will be used to maintain DC system flow when DC-V-2B and DC-V-65B are operated.

Control Building Ventilation:

A fire in the control room or relay room may cause a loss of control building ventilation and cooling. Testing and analysis have been completed which demonstrate that acceptable equipment operating conditions for safe shutdown can be maintained by opening the doors between inverter rooms and battery rooms (Door # C212 & C213) within 24 hours (Reference 6). Restoration of control building ventilation is not required to achieve safe shutdown.

Repair actions will be initiated to provide defense in depth if resources are available, once required safe shutdown actions have been initiated. Control building ventilation

and cooling can be restored as follows:

1. If control bldg IA pressure is low, then circuit repair will isolate fire- affected circuits and restore automatic operation of AH-P-9A/B.
2. AH-C-4B control circuits can be isolated from the fire area and started using local controls. (CB 295: B Chiller room)
3. AH-P-3B control circuits can be isolated from the fire area and started using local controls. (CB 322: 1B ES MCC Unit 6D)
4. AH-E-18B circuit repair will isolate affected control circuits, opens fan discharge damper and establishes manual control of fan from MCC using breaker handle ON/OFF to start/stop fan. (CB 322: 1B ES MCC UNIT 6E)
5. AH-E-19B circuit repair will isolate affected control circuits, opens fan discharge damper and establishes manual control of fan from MCC using breaker handle ON/OFF to start/stop fan. (CB 322: 1B ES MCC UNIT 6C)

EFW Area Ventilation:

A fire in the control room or relay room may cause a loss of the Emergency Feedwater Area Cooler (AH-E-24A/B). Testing and analysis have been completed which demonstrate that acceptable equipment operating conditions for safe shutdown can be maintained without these cooling units (Reference 8). Restoration of EFW area ventilation is not required to achieve safe shutdown.

Repair actions may be initiated to provide defense in depth if resources are available, to restore B train of ventilation and cooling (AH-E-24B).

DC/NS Pump Area Ventilation:

A fire in the control room or relay room may cause a loss of the Decay Closed & Nuclear Services Pumps Area Cooler (AH-E-15A/B). Testing and analysis have been completed which demonstrate that acceptable equipment operating conditions for safe shutdown can be maintained without these cooling units (Reference 7). Restoration of DC/NS pump area ventilation is not required to achieve safe shutdown.

Intake Screen and Pump House (ISPH) Ventilation

A fire in the control room or relay room may cause a loss of ISPH ventilation and cooling. Testing and analysis have been completed which demonstrate that acceptable equipment operating conditions for safe shutdown can be maintained by establishing portable ventilation capable of maintaining ISPH temperature below 120°F within 4 hours after the loss of ventilation (Reference 10).

EG-Y-1A/B Area Ventilation:

A fire in the control room or relay room may cause a loss of EG-Y-1A/B area ventilation and cooling (AH-E-29A/B). Testing and analysis have been completed which demonstrate that acceptable equipment operating conditions for EG-Y-1B can

be maintained by opening doors, which allows the EDG radiator fan to draw sufficient air to maintain room ambient temperature less than 120°F (Reference 9).

3.12.5 CB-FA-3c Mitigation Strategy

The remote shutdown system controls are isolated from an ESAS room fire (CB-FA-3c) as well as relay room or control room area fires. Although the remote shutdown system controls may be used for a fire in CB-FA-3c, an SRO will remain in the control room and direct the event mitigation using the process instrumentation and controls available in the control room and not affected by the ESAS room fire. Operators will be dispatched to the RSD stations and will manually operate safe shutdown required components after isolating the ESAS circuits at RSTSP-B. They will have direct communication with the control room and will follow SRO instructions.

The main reason for using the remote shutdown system for a CB-FA-3c fire is to gain control of ESAS actuated components (HPI, LPI and RBI) assuming an inadvertent ESAS actuation and loss of control room capability to defeat ESAS control. For B train shutdown equipment associated with HPI, LPI and RBI functions, the spurious initiation is mitigated by isolating the ESAS output circuits (initiation circuits) along with other control circuits from the relay room at RSTSP-B. RSTSP A is located in the ESAS room. RSD panel A controls are not available for an ESAS room fire. Attachment 3-5 describes the availability of safe shutdown components for a fire in each fire area/zone, including CB-FA-3c.

The mitigation strategy for a fire in the ESAS room is discussed in the context of the three locations operators are performing actions to achieve hot shutdown and all actions required for cold shutdown.

If a smoke or trouble alarm (HVB-1-10 "CONTROL BLDG ESAS ROOM DAMPER TBL FIRE-SMOKE) is actuated or if fire is confirmed, then an operator goes immediately to the 338 elevation of the control tower, and a second control room operator goes immediately to the 322 elevation of the control tower. A Senior Reactor Operator remains in the control room. All operations are directed from the control room.

If any significant damage to safe shutdown equipment is evident, then the reactor shutdown sequence will be initiated and proactive actions will be performed to establish a stable hot shutdown configuration and to prepare for cooldown.

In order to provide a reliable strategy to mitigate the many and varied potential consequence of this event, the strategy was developed to address the limiting event sequences. Appendix R Section III.L provides performance criteria for fire areas where alternate shutdown capability is required (i.e. Appendix R III.G.3 fire areas). The transient analysis performed for control room evacuation (Reference 2) provides a bounding assessment for the ESAS room fire. In reference 2, the limiting

combinations of failures which could (1) challenge the ability to maintain adequate RCS inventory, (2) challenge the ability to remove core decay heat or (3) challenge the integrity of the RCS were determined by systems analysis. The analysis in reference 2 includes the effects of loss of all RCP Seal Cooling with the Westinghouse RCP Seals. With the Flowserve N-9000 RCP Seals the challenge to RCS inventory control is significantly reduced. Therefore the analysis conclusions are conservative.

The actions required to reach and maintain hot shutdown conditions are listed in Attachment 3-7B “Manual Actions Required for Hot Shutdown in Appendix R III.G.3 Fire Areas”. For CB-FA-3C, Attachment 3-7B lists the actions taken in the control room to initiate use of RSD controls and all actions required outside the control room to reach a hot shutdown condition. Control room actions in response to failures in CB-FA-3C are not listed in Attachment 3-7B.

(1) Actions performed in the Control room (to achieve HOT Shutdown)
If damage to SSD equipment is evident, then:

- TRIP Reactor
- TRIP Main Turbine
- OPEN MU-V-14A and MU-V-14B (BWST to MU Pumps Isolation Valves)
- CLOSE MS-V-8B
- OPEN MU-V-76A and MU-V-76B

If both thermal barrier cooling and seal injection are lost, then operators will ensure all Reactor Coolant Pumps are shutdown. Emergency Feedwater (EFW) will actuate automatically if main feedwater is affected or the Reactor Coolant Pumps (RCP) are tripped. All three EFW pumps will start and the EFW regulating valves will open to raise OTSG levels toward 50% operating range. Operators will ensure EFW operation. EF-P-1, EF-V-30D and EF-V-30B are all unaffected by ESAS room fire. If OTSG turbine bypass valves fail open, then MS-V-8A will be closed.

RSD panel “A” controls and the following RSD panel “B” controls are not transferred and are maintained in the Control Room.

- “Reactor Coolant” (RC-V-2 & RC-V-3). Allow control room to mitigate PORV failure. RC-V-2 is not affected by an ESAS room fire.
- “Comm. System”. Maintain control room communications. The red page system is available for a fire in the ESAS room.
- “Emergency Feedwater”. (EF-V-30B & EF-V-30D) EF-V-30B & EF-V-30D are not affected by ESAS room fire.

RSD Control initially maintained in the Control Room (but may be transferred to RSD later in the event).

- “Nuc Serv Closed Cyc Clg” (NS-P-1C) - fire could cause inadvertent start of NS-P-1C, but cannot cause direct trip (i.e. other than loss of power) and

would not prevent restart from CR.

- “Nuc Serv River Water” (NR-P-1C, NR-V-1C, NR-V-15B & NR-V-18) – fire could cause NR-P-1C to start, but cannot cause direct trip (i.e. other than loss of power) and would not prevent restart from CR. NR-V-1C, NR-V-15B and NR-V-18 are unaffected.
- “RB Emergency Clg River Water” (RR-V-1B)

(2) Actions performed in the Control Bldg 338’ elevation (to achieve HOT Shutdown)

If fire was not yet confirmed, then the operator will confirm the presence of fire in the ESAS room and notify the control room.
When directed by the control room, the operator will place EG-Y-1B and 1E 4160V switchgear breakers under RSD control. If de-energized, then the operator will start EG-Y-1B and energize 1E 4160V bus.

(3) Actions performed in the Control Bldg 322’ elevation (to achieve HOT Shutdown)

The operator will disable the relay room CO2 system and notify the control room. This is required to ensure access to 1E 4160V switchgear room is maintained. The relay room CO2 system control power will be de-energized before an ESAS room fire could cause an inadvertent actuation of the system.

When directed by the control room, the operator will transferthe following controls to RSD control:

RSTSP B

- “Intermediate Clg.” (control of IC-P-1B, IC-V-2 and IC-V-4)
- “Makeup & Purif.” (MU-P-1C, MU-V-14B, MU-V-16C, MU-V-16D, MU-V-37, MU-V-18, MU-V-20, MU-V-2A/B, …)
- “Main Steam” (MS-V-4B, MS-V-8A & MS-V-8B)
- “Feeder to 1T 480V SWGR”
- “Feeder to 1B Screenhouse MCC”
- “DH Clsd Cyc Clg Pump DC-P-1B”
- “DH River Water” (DR-P-1B, DR-V-1B)

OTHER Transfer Switches:

- “Makeup & Purif. MU-P-1B”

The operator will then establish communications with the control room and await further direction.

(4) COLD SHUTDOWN

The reactor coolant system pressure is reduced and temperature is cooled to cold shutdown conditions.

The actions required to reach cold shutdown conditions are listed in Attachment 3-7C "Manual Actions and Repairs Required for Cold Shutdown".

The mitigation strategy is designed to ensure cold shutdown is achieved within 72 hours. Without all of the potential failures, cooldown will be accomplished much sooner. RCS cooldown and RCS depressurization via pressurizer ambient heat loss is initiated within 4 hours. During cooldown, CF-V-1A and CF-V-1B are closed. Additional pressurizer venting (using RC-V-49 & 50) can be used if required to reach Decay Heat Removal initiation conditions within 66 hours.

Appendix R III.L performance criteria review
The following review describes the potential effects of a fire in the ESAS Room (CB-FA-C3c) and how hot shutdown and cold shutdown will be achieved. Each Appendix R III.L performance criteria and each time period above is addressed. The required actions to achieve and maintain hot shutdown and to achieve cold shutdown are described on Attachments 3-7B and 3-7C.
This review also describes actions taken for additional "defense in depth". Preparations (i.e. procedures, material staging, etc) are completed to perform these "defense in depth" actions. These actions are not required for safe shutdown. All design requirements for reliable performance are not satisfied.

Appendix R III.L.2.a.*The reactivity control function shall be capable of achieving and maintaining cold shutdown reactivity conditions.*

When required, the reactor will be tripped. All control rods will fully insert, shutdown the reactor and maintain the reactor at hot shutdown.

The borated water storage tank (BWST) is the primary makeup water source after the reactor is shutdown. MU-V-14A or MU-V-14B will remain open. An RCS injection path from the BWST is available using controls isolated from the fire area. Reference 3 demonstrates that the reactor will remain shutdown at 70°F assuming all rods fully inserted, no xenon, no injection from the boric acid mix tank (BAMT), and BWST makeup only as required to account for RCS density change during cooldown (i.e. maintain pressurizer level).

The following actions are taken to provide defense in depth. Performance of these actions is dependent upon the extent of fire damage and resources available.
(1) Injection of concentrated boric acid solution from the BAMT to the makeup tank (MUT) will be initiated. As MUT level and pressure rise, this source will be injected in parallel with BWST water. This will raise the boron concentration above that determined in Reference 3.
(2) Letdown and a bleed path to a reactor coolant bleed tank (RCBT) may be used to ensure additional injection of borated water from the BWST or BAMT.

Appendix R III.L.2.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. Provide the means to*

maintain the core covered with sub-cooled water.

When the reactor is tripped, the BWST supply valves (MU-V-14A & MU-V-14B) are opened. The fire may cause a loss of RCS makeup or seal injection. Loss of makeup until RSD control is established was assumed in the control room evacuation transient analysis (Reference 2).After RSD control is established, an RCS injection path from the BWST is available using controls isolated from the fire area. MU-V-14B, MU-V-37, MU-P-1B, MU-P-1C, MU-V-16C and MU-V-16D all have protected power supplies (ES train B) and can be controlled from the RSD panel. Adequate RCS inventory is available in the BWST to achieve cold shutdown.

Both methods of RCP seal cooling may be lost. Seal injection will be restored. MU-P-1C will be aligned to supply seal injection by locally opening MU-V-76A and MU-V-76B. MU-V-20 and MU-V-32 remain operable from the control room.

MU-P-1B can be used for RCS makeup or seal injection.

The PORV block valve (RC-V-2) is not affected by a fire in the ESAS room. A fire induced failure could cause the PORV to open. RSD control of RC-V-2 and RC-V-3 is maintained in the control room to ensure prompt response to a failure of the PORV.

The Core Flood tank (CFT) isolation valves (CF-V-1A & CF-V-1B) are not susceptible to fire effects. These valves will be closed before RCS pressure is lowered below 600 psig.

An overcooling event would aggravate a condition without makeup available. The effect on maintaining hot leg sub-cooling of an even more significant overcooling condition was addressed in Reference 2. Excessive steam flow or excessive feedwater flow could be induced by failures as a result of an ESAS room fire. The following failures which would cause or aggravate on overcooling could be caused by an ESAS room fire.

- If one or more of OTSG “A” Turbine Bypass Valves fails to 50% open, then MS-V-8A will be closed. MS-V-8A is not affected by an ESAS room fire.
- MS-V-8B is closed, but could be affected by the fire. If MS-V-8B spuriously opens AND MS-V-3A,B, or C has failed open, then operators will stop feeding the B OTSG until the affected TBVs or MS-V-8B is locally closed.
- Failures which may affect automatic control of MS-V-4A or MS-V-4B can be mitigated with control room manual control. If MS-V-4A or MS-V-4B fails open under automatic control an operator action will close the valve from the control room.
- A hot short could cause either MS-V-4A or MS-V-4B to fail open. MS-V-4B will close as soon as the RSD transfer switch is operated. MS-V-4A will be controlled locally if required.
- A hot short could cause either EF-V-30A or EF-V-30C to fail open. These failures can be mitigated by closing these valves locally. EFW flow is maintained using EF-V-30B & D.

- Control of Main feedwater is not protected from ESAS room fire effects. Main FW pump trip control, OTSG A regulating valves (FW-V-16A/17A) and OTSG B regulating (FW-V-16B/17B) and block valves (FW-V-5B /92B) are all available from the control room to prevent an overfeed condition.

As discussed above, a hot short could cause one of MS-V-8B, MS-V-4A, MS-V-4B, EF-V-30A or EF-V-30C to fail open. The affect of any one of these failures is an overcooling impact of much less significance than the limiting case evaluated in Reference 2. Cases performed in reference 2 demonstrated that an ADV or EFW regulating valve failure produced a smaller effect on RCS temperature. An undesired cooldown at a rate within Tech Spec limits would eventually occur if an ADV remained open. A failed open EF-V-30 would not cause a significant overcooling. If EF-V-30A, EF-V-30C or MS-V-4A was failed in the open position by the fire, an operator will locally close or isolate the failed valve.

The control room evacuation analysis (Reference 2) demonstrates that restoration of makeup capability within 16 minutes satisfies the Appendix R performance requirement. In the case of the ESAS room fire, that analysis is bounding and conservative. In the ESAS room fire, the control room retains the ability to mitigate an overcooling and the Flowserve RCP seals significantly reduced (from ~84 GPM to ~10 GPM) the potential RCS losses compared with the analysis. Based on these analyses and the Flowserve RCP seals a requirement to restore makeup capability within 30 minutes will ensure Appendix R performance requirements are satisfied.

Appendix R III.L.2.c: *The reactor heat removal function shall be capable of achieving and maintaining decay heat removal.*

RCS pressure and inventory control must be adequate to support natural circulation. To ensure this capability, hot leg sub-cooling must be maintained. The transition from the control room to RSD for fires in CB-FA-3d or CB-FA-4b has been analyzed using the limiting combination of potential fire effects. That analysis provides a bounding assessment for the ESAS room fire. This analysis demonstrates pressurizer level may drop below the range of the level indication, but the hot legs remain sub-cooled and pressurizer level can be restored to within the indicated range. These conditions support natural circulation throughout the event (Reference 2).

EF-P-1, EF-V-2A, EF-V-2B, EF-V-30B and EF-V-30D are unaffected by an ESAS room fire. Manual control of EFW (from control room) may be required to maintain OTSG level. EFW flow will be maintained and OTSG level will be raised above 50% in the operating range to maintain natural circulation if RCPs are shutdown. EF-P-2B will be operated under RSD control.

Main Steam Safety Valves (MSSV) provide an initial OTSG steam flow path to achieve hot shutdown. MS-V-4B will be available from RSD. Local control of MS-V-4A will be required if control of the valve is damaged by the fire. When RSD control is established, MS-V-4B will be used to stabilize the plant at hot shutdown

conditions. One ADV has sufficient capacity to maintain hot shutdown.

Both OTSGs (EFW and ADV) will be used for cooldown to DHR initiation conditions. Instrument Air (IA) will be available to support remote operation of both trains of EF-V-30s and ADV to support cooldown. Local operations to realign open MS-V2B may be required prior to cooldown.

EF-P-2B will be operating to support the cooldown. The following action provides additional defense in depth and is not required to meet Appendix R requirements. During the cooldown, if EF-P-1 steam supply is insufficient as OTSG pressure is reduced, MS-V-10A or MS-V-10B may be throttled open locally.

DHR will be used to complete the cooldown to cold shutdown conditions, and maintain cold shutdown.

- B Train of DH, DC & DR will be utilized for DHR operation.
- Local operation of DH-V-1, DH-V-2, DH-V-3, DH-V-4B and DH-V-19B may be required.
- Remote control of DC-V-2B and DC-V-65B are not affected by ESAS room fire.

The minimum condensate storage tank (CST) volume of 214,320 gallons per tank (i.e. 428,640 gallons) will provide sufficient condensate for decay heat removal for at least 72 hours at hot shutdown conditions (Reference 11). The condenser hotwell and million gallon demineralized water storage tank (DW-T-2) can be lined up to the EFW suction header for additional defense in depth. Additional defense in depth is provided by the reactor building emergency cooling river water system which can supply river water to the EFW suction header.

The Atmospheric Dump Valves have sufficient capacity to cool the RCS to the conditions for initiating Decay Heat Removal such that the time from the event to cold shutdown would be less than 24 hours (Reference 11).

Both EF-V-1A and EF-V-1B will be opened to allow any EFW pump to use any EFW condensate source during cooldown.

RCS Pressure control is necessary to maintain sub-cooled conditions for natural circulation and to ensure the ability to initiate DHR and complete RCS cooldown within 72 hours. Normal RCS pressure control (pressurizer heaters and spray) may be affected by the fire, and is not available from the RSD stations. The Reactor Coolant Pumps are shutdown. Pressurizer spray is not available.

There are no RSD controls for normal pressurizer heaters. Pressurizer heater MCC 1A & 1B will be de-energized and pressurizer heater group 9 will be transferred to 1S 480V Bus. Group 9 pressurizer heaters are not affected by an ESAS room fire. The remaining heaters will be de-energized to permit control with group 9. Therefore a solid ops cooldown is not required. Ambient heat loss from the pressurizer will provide a steady reduction in RCS pressure. If additional pressurizer cooldown rate

is necessary, then RC-V-49 and RC-V-50 can be opened.

The potential consequences of an ESAS room are bounded by the relay room and control fire events. Before RSD control is established, pressurizer level may go outside the range of pressurizer level indication. When RSD control is established, RCS makeup will be initiated (MU-V-16C & MU-V-16D). If pressurizer level was below the indicated range, pressurizer level will come back on scale and pressurizer heaters will be energized. RCS pressure will be maintained by slowly raising pressurizer level until a steam bubble is established. If pressurizer level is above the indicated range, operators will throttle RCS makeup flow to control hot leg sub-cooling margin between 50 and 100°F. This condition will be maintained until a steam bubble is established.

An ESAS room fire could result in an ESAS actuation of High Pressure Injection. RCS pressure would be controlled below 2750 psig and the event would be terminated before RCS temperature was reduced to the NDTT limit. This conclusion is based on terminating excessive HPI flow within 41 minutes after ESAS actuates and is documented in Reference 2.

The RSD panel controls are isolated from the engineered safeguards actuation system (ESAS) circuits. Once control has been transferred to RSD, component operations are independent of ESAS. Using RSD controls, MU-V-18 can be closed and B train of HPI can be throttled as required to control pressurizer level. HPI train A cannot be controlled at the RSD panel. Excessive train A HPI can be terminated by tripping the A train HPI pump(s) or closing MU-V-16A and MU-V-16B locally.

The following actions are taken to provide defense in depth. Performance of these actions is dependent upon the extent of fire damage and resources available. During cooldown, HPI 1600 psig and LPI 500 psig ES actuations are bypassed by manual actuation of bypass relays in the ESAS relay cabinets. Control of actions required to achieve safe shutdown are independent of ES actuation logic. This will prevent further complication due to ESAS actuation as RCS pressure is reduced.

OTSG heat removal will be maintained for an ESAS room fire. HPI cooling is not required to mitigate the design event. Compliance with Tech Spec 3.1.12 cannot be assured prior to reducing RCS temperature below 313°F. The intent of this specification will be satisfied. Under RSD control, automatic operation of B train of HPI is disabled. Prior to reducing RCS temperature to less than 313°F, HPI train A will be disabled by racking out breaker for MU-P-1A and closing the valves and opening the breakers for MU-V-16A & MU-V-16B.

The capability to restore letdown is provided for defense in depth. Performance of this action is dependent upon the extent of fire damage and resources available. The potential loss of the ability to isolate letdown was addressed earlier as an RCS inventory concern. Letdown will be isolated when a fire is confirmed. Letdown is isolated promptly to address the potential challenge to maintaining minimum RCS inventory and to minimize the variables affecting RCS inventory. After required

actions have been initiated and if resources are available, operators may restore letdown to enhance control of RCS water chemistry.

Appendix R III.L.2 d. *The process monitoring function shall be capable of providing direct readings of the process variables necessary to perform and control the above functions.*

The instrumentation required for each function above is addressed as that function is discussed above. The instrumentation for all required functions is available to support the function.

Appendix R III.L.2 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.*

<u>Communications</u>

Operators will use the most convenient means of communications available. During the initial response (2.5 minutes), radios and cell phones will be available before fire damage could affect communications systems.
Throughout the event, the Red page phone system is available in the control room, at the RSD station, at the EFW area in the Intermediate Building and on 281' elevation in the Auxiliary Bldg for a fire in the ESAS room.

<u>Electrical Power</u>

A potential for a loss of offsite power is assumed. EG-Y-1A & EG-Y-1B may be affected by controls in fire area and may not start or energize the ES power train. Controls isolated from the fire area are available to isolate other sources and energize the 1E 4160V Bus using EG-Y-1B. Remote operated breakers (S1-02, T1-02, 1S-02, 1T-02, 1S-1C (1B ES MCC) or 1T-4C (1B ES SH MCC) could be affected by the fire. Control of these breakers can be established with controls isolated from the fire area at the associated bus or on RSD B for 1T-02 & 1T-4C.

The most immediate need for restoration of AC power is the restoration of RCS makeup capability.

Due to fire affects on control room controls, 1C ESV MCC may be lined up to the 1P 480V bus. 1C ESV MCC can be energized from 1S 480V Bus by isolating the automatic transfer switch (ATS) controls from the fire area and using local ATS controls.
The B train of ES power is used to ensure safe shutdown. The A train of ES power is not protected and cannot be relied upon for safe shutdown.

Vital 120VAC power is not directly affected by the fire, but loss of the A ES power train will deplete the A station battery. To prevent loss of ATB, VBA and VBC, the 1P & 1S 480V cross tie will be closed or the station batteries will be cross tied. Fire

damage may prevent operation of the 1P & 1S bus cross tie breakers. The DC panel cross tie procedure minimizes A & B DC loads, ensures system voltage difference is acceptable and then provides power to the A train Vital Bus DC loads (ATB, VBA & VBC) from the B train battery chargers.

Instrument Air

For a fire in the ESAS room, instrument air compressors IA-P-4 and IA-P-1A could be adversely affected. The instrument air system is relied upon to provide motive force for remote control of EFW control valves and Atmospheric Dump Valves. The two-hour backup instrument air system provides this function in the short term. Instrument air pressure will be automatically maintained by IA-P-1B when power is restored to 1B ES MCC.

Reactor Building Cooling

RB cooling may be lost and will be restored as described below. Analysis has been completed which demonstrates that with Westinghouse Seals and no seal cooling (RCS flow of 94 GPM into containment) Reactor Building pressure will remain within design (Reference 5). New analysis with Flowserve RCP seals (Reference 13) demonstrates that the Reactor Building will remain accessible for emergency action and fire safe shutdown components in the Reactor Building will continue to function for at least 72 hours.

Operation of Reactor Building emergency cooling provides defense in depth. Performance of this action is dependent upon the extent of fire damage and resources available. The primary mitigation strategy depends upon cooldown, but Reactor Building emergency cooling will be initiated. RSD controls isolated from the fire area are available to start Reactor Building Emergency Cooling pump B and control RR-V-1B. Local breaker and valve manipulations (RR-V-3 and RR-V-4) can be performed to lineup Reactor River water flow through the B cooler. Circuit repairs will be performed (if required) to restore operation of AH-E-1B from 1B ES MCC.

Component Cooling Water
ICCW, NSCCW & NR systems

Nuclear River Water (NR), Nuclear Services Closed Cooling Water (NS) & ICCW system operation provides defense in depth but are not relied upon for safe shutdown for a fire in the ESAS room.

ICCW is desired (1) to maintain RCP thermal barrier cooling and (2) to provide an option to restore letdown. ICCW will be promptly restored using RSD controls for IC-V-2 and IC-V-4.

NSCCW and NR systems can be maintained from the control room after an ESAS room fire. The only NR or NS FSSD equipment affected by an ESAS room fire are the pump controls and NR-V-4A & B. NS-P-1C is normally operating. The only

circuits affected are in the pump start circuits. An ESAS room fire would not cause loss of NS-P-1C unless the fire caused a short in the start circuit to blow the fuse between the time a LOOP occurred and NS-P-1C start was attempted. NR-P-1C and NR-P-1B are both available from B train ES power. The only circuits affected are in the pump start circuits. An ESAS room fire affect on these circuits could not cause the pump to trip.
The RSD controls may be used later in the event to operate NS-P-1C or NR-P-1C.

As ESAS room fire could cause NR-V-4A or B to close or could cause the control power fuse to open. Neither failure would adversely affect the ability to provide NR flow.

Component Cooling Water
DR & DCCW systems

DC-P-1B & DR-P-1B are started under RSD control. This will ensure decay closed cooling water to MU-P-1C in the short term, and support DHR operation when required.

Control Building Ventilation

A fire in the ESAS room may cause a loss of control building ventilation and cooling. Testing and analysis have been completed which demonstrate that acceptable equipment operating conditions for safe shutdown can be maintained by opening the doors between inverter rooms and battery rooms (Door # C212 & C213) within 24 hours (Reference 6). Restoration of control building ventilation is not required to achieve safe shutdown.

Repair actions will be initiated to provide defense in depth if resources are available, once required safe shutdown actions have been initiated. Control building ventilation and cooling can be restored as follows:
1. If control bldg IA pressure is low, then circuit repair will isolate fire- affected circuits and restore automatic operation of AH-P-9A/B.
2. AH-C-4B control circuits can be isolated from the fire area and started using local controls. (CB 295: B Chiller room)
3. AH-P-3B control circuits can be isolated from the fire area and started using local controls. (CB 322: 1B ES MCC Unit 6D)
4. AH-E-18B circuit repair will isolate affected control circuits, opens fan discharge damper and establishes manual control of fan from MCC using breaker handle ON/OFF to start/stop fan. (CB 322: 1B ES MCC UNIT 6E)
5. AH-E-19B circuit repair will isolate affected control circuits, opens fan discharge damper and establishes manual control of fan from MCC using breaker handle ON/OFF to start/stop fan. (CB 322: 1B ES MCC UNIT 6C)

EFW Area Ventilation

A fire in the ESAS room may cause a loss of the Emergency Feedwater Area Cooler

(AH-E-24A/B). Testing and analysis have been completed which demonstrate that acceptable equipment operating conditions for safe shutdown can be maintained without these cooling units (Reference 8). Restoration of EFW area ventilation is not required to achieve safe shutdown.

Repair actions may be initiated to provide defense in depth if resources are available, to restore B train of ventilation and cooling (AH-E-24B).

DC/NS Pump Area Ventilation

A fire in the ESAS room may cause a loss of the Decay Closed & Nuclear Services Pumps Area Cooler (AH-E-15A/B). Testing and analysis have been completed which demonstrate that acceptable equipment operating conditions for safe shutdown can be maintained without these cooling units (Reference 7). Restoration of DC/NS pump area ventilation is not required to achieve safe shutdown.

Intake Screen and Pump House (ISPH) Ventilation

A fire in the ESAS room may cause a loss of ISPH ventilation and cooling. Testing and analysis have been completed which demonstrate that acceptable equipment operating conditions for safe shutdown can be maintained by establishing portable ventilation capable of maintaining ISPH temperature below 120°F within 4 hours after the loss of ventilation (Reference 10).

EG-Y-1A/B Area Ventilation

A fire in the ESAS room may cause a loss of EG-Y-1A/B area ventilation and cooling (AH-E-29A/B). Testing and analysis have been completed which demonstrate that acceptable equipment operating conditions for EG-Y-1B can be maintained by opening doors, which allows the EDG radiator fan to draw sufficient air to maintain room ambient temperature less than 120°F (Reference 9).

3.13 Spurious Operation of Components

Spurious operation of components that could adversely affect the safe shutdown of the plant have been evaluated and mitigated. This is accomplished by manual actions, removal of power, and control modifications.

Manual actions used to mitigate adverse spurious operations are listed by fire area/fire zone in Attachments 3-7A, 3-7B, and 3-7C along with the time available to perform the manual action.

Potential spurious operation of other components is outlined below. The mitigating method is also provided as follows:

a. The spurious operation of the following valves has been prevented by removing the 480-volt AC power supply.

DH-V-2
NR-V-3
NR-V-5
NR-V-6
NR-V-8A
NR-V-10A
NR-V-10B
NR-V-16A
NR-V-18
MU-V-12
CO-V-10A
CO-V-10B

b. The control scheme of the following solenoid operated valves in the high low pressure interface has been modified by replacing the existing control switch with a switch having a normally closed contact which will short both leads of the valve solenoid to ground under normal position.

RC-V-44
RC-V-41A
RC-V-41B
RC-V-43

This modification prevents spurious opening of these valves due to fire-induced cable faults.

c. The control circuits for the following valves were rewired so that the torque and limit switch assembly is located electrically below the valve operating coil for the portion of the circuit indicated in parenthesis (opening or closure). This modification prevents spurious operation of the valve on the modified portion of the circuit in fire zones/areas where the cable from the valve's motor control center to the valve is the only cable present for the valve. This modification also prevents a single hot short on the modified portion of the circuit from spuriously operating the valve and bypassing its torque and limit switches.

CO-V-14A	(closure)
DH-V-4B	(closure)
IC-V-2	(closure) – NOT PREVENTED in AB-FZ-5, AB-FZ-6A, or RB-FZ-1C
NR-V-4A	(opening)
NR-V-4B	(opening)
NR-V-15A	(closure)
NR-V-15B	(closure)
NR-V-18	(closure)
MU-V-36	(closure)

MU-V-37	(closure)
DH-V-6A	(opening)
DH-V-6B	(opening)
MU-V-16A	(opening or closure)
MU-V-16B	(opening or closure)
MU-V-217	(opening)

d. The following five high-low pressure interfaces that use two redundant electrically controlled devices to isolate or preclude rupture of the primary coolant boundaries were identified:

1.	DH-V-1 and DH-V-2	-	Decay Heat Removal Suction
2.	RC-V-28 and RC-V-44	-	Pressurizer Vent
3.	RC-V-40A and RC-V-41A	-	Loop A High Point Vent
4.	RC-V-40B and RC-V-41B	-	Loop B High Point Vent
5.	RC-V-42 and RC-V-43	-	Reactor Vessel Vent

Opening of both valves in any one RC vent path above (i.e. 2,3,4,5) was found acceptable since it does not preclude plant safe shutdown.
The pressurizer relief valve RC-RV-2 and the pressurizer relief block valve RC-V-2 may be considered as another high-low interface. Adequate protection from a fire is provided to the electrical cables of one valve for fire areas/zones outside the Reactor Building and for both valves in the Reactor Building. The letdown line may also be considered high-low interface. This line includes several valves in series that are capable of isolating letdown from the Control Room during a fire anywhere in the plant.

e. The control logic for the following pumps was modified to isolate interlocking logics.

1) IC-P-1A
2) NR-P-1A
3) NS-P-1A

IC-P-1A control scheme was modified at EE-MCC-ES-1A by the installation of a control switch to isolate an interlocking circuit with redundant pump IC-P-1B.

NR-P-1A control scheme was modified at EE-SWG-480V-1R by the installation of a control switch to isolate interlocking circuits with redundant pumps NR-P-1B and NR-P-1C.

NS-P-1A control scheme was modified at EE-SWG-480V-1P by the installation of a control switch to isolate interlocking circuits with redundant pumps NS-P-1B and NS-P-1C and ES Diesel Sequencer #3 logic.

f. Isolation conditioners were installed to isolate the steam generator pressure signals PT 950 and PT 951 between the signal conditioning cabinets A1 and B1 and the HSPS panels.

g. Signal isolator was installed in the NNI/ICS panel to isolate the pressurizer level signal (RC1-LT-1 and RC1-LT-3) going between the NNI/ICS panel and the patch board panel.

h. Control scheme modification to the automatic transfer switch for EE-MCC-ESV-1C was performed to insure that this MCC will be powered from an available bus during shutdown. This modification also included the installation of a manual transfer switch in the remote shutdown transfer switch panel for the 1C ESV MCC 480V transfer switch for remote shutdown.

i. Control scheme for IC-P-1B, NS-P-1C and NR-P-1C was modified to isolate interlocking circuits with redundant pumps from Remote Shutdown Panel, and isolate control from the Control Room.

j. Control scheme for RC-GRP-9 was modified to provide a transfer switch at EE-SWG-480V-1S switchgear that isolates the ES trip contact and provides a back up power supply.

3.14 Exemptions

Specific exemptions to 10CFR50, Appendix R were requested and subsequently approved by the NRC. The following is a summary of the currently submitted and approved exemptions to 10CFR50, Appendix R.

3.14.1 <u>Previously Approved Exemptions - NRC letter dated June 4, 1984</u>

3.14.1.1 <u>Reactor Building Outside Secondary Shield, North (Fire Zone RB-FZ-1a)</u>

An exemption was granted to eliminate the installation of radiant energy heat shields between the Reactor Building Emergency Cooling Units. This exemption is no longer required since further evaluation (Calculation C-1101-244-5450-003) has shown that loss of reactor building cooling will not result in unacceptable temperatures; therefore, safe shutdown can be achieved and maintained without these units and their associated cabling. This exemption is no longer required. NRC acknowledged in letter dated December 30, 1986.

3.14.1.2 <u>Heat Exchanger Vault (Fire Zone AB-FZ-1)</u>

An exemption was granted from the required area wide detection/ suppression and to rely on manual operation of valves in lieu of fire barriers. Modifications have been proposed to eliminate the need for manual action in this zone. Exemption is no longer required. NRC acknowledged in letter dated December 30, 1986.

3.14.1.3 Valve Gallery (Fire Zone AB-FZ-3) and Engineered Safeguards Motor Center B (Fire Zone AB-FZ-6a)

An exemption was granted from the required automatic fire suppression system. One hour fire rated protection for cable is adequate based on the fire detection provided, low combustible load and fire brigade response to limit fire severity and duration. This exemption remains valid.

3.14.1.4 Penetration Area (Fire Zone AB-FZ-4), IR Switchgear Area (Fire Zone ISPH-FZ-1), and IT Switchgear Area (Fire Zone ISPH-FZ-2)

An exemption was granted from the required installation of one hour fire rated barriers based on the capability to re-enter these zones after a fire is extinguished and perform manual operation of valves.

There are no longer manual valve operations in ISPH-FZ-1 and 2 as a result of a fire in these zones. Re-entry of AB-FZ-4 to perform manual valve operations after a fire is extinguished is now covered in exemption 3.14.2. This exemption is therefore superseded.

3.14.1.5 Control Building Health Physics and Lab Area (Fire Zone CB-FA-1)

An exemption was granted from the required area wide automatic fire suppression system. One hour fire rated protection for cable above suspended ceiling is adequate based on the fire detection system above the ceiling, automatic sprinkler system below the ceiling, low combustible load and fire brigade response to limit fire severity and duration. This exemption remains valid.

3.14.1.6 General Area - Elevation 281 Feet (Fire Zone AB-FZ-5)

An exemption was granted from the required automatic fire suppression system and area-wide fire detection. One hour fire rated protection for cable is adequate based on the fire detection system installed over and 20 ft. on either side of protected cables, low combustible load and fire brigade response to limit fire severity and duration. This exemption remains valid.

3.14.1.7 Demineralizers and MCC A (Zone AB-FZ-6), Valve Galley and Penetration Room (Fire Zone IB-FZ-1), and Motor Driven Emergency Feedwater Pump Area (Zone - IB-FZ-3)

An exemption was granted from the required automatic suppression system and the installation of one hour fire barriers based on the capability to re-enter these zones after a fire is extinguished and perform manual operation of valves. There are no longer manual valve operations in IB-FZ-1 as a result of a fire in this zone. Re-entry of AB-FZ-6 and IB-FZ-3 to perform manual valve operations after a fire is

extinguished is now covered in exemption 3.14.2. This exemption is superseded.

3.14.1.8 Decay Heat Removal and Nuclear Service Closed Cycle Cooling Pump Area (Fire Zone AB-FZ-7)

An exemption was granted from the required automatic fire suppression system and the installation of 1 hour fire barriers. One hour fire rated protection for cable and partial reinforced concrete barriers between redundant pumps is adequate based on the fire detection provided, low combustible load and fire brigade response to limit fire severity and duration. This exemption remains valid.

3.14.1.9 Fuel Handling Building Elevation 305' (Fire Zone FH-FZ-2)

An exemption was previously requested (GPUN letter #5211-82-156 dated July 1, 1982) from the requirement to provide an area wide fire detection system. In subsequent discussions with the staff, it was stated the exemption would be granted and was inadvertently omitted from the NRC's SER dated June 4, 1984. Approval of this exemption was provided by NRC letter dated December 30, 1986. Additionally, exemption was requested for partial automatic sprinkler protection in lieu of area-wide coverage. One hour fire rated protection for cable is adequate based on partial sprinkler coverage in locations containing most of the combustibles in this fire zone and in locations where transient combustibles would most likely be found. Actuation of the suppression system, and fire brigade response to the alarm transmitted to the Control Room limit fire severity and duration. By letter dated March 19, 1987 the NRC acknowledged the clarification that this exemption included partial sprinkler protection and that the clarification does not alter the previous NRC acceptance of this exemption.

3.14.2 Exemptions for Manual Actions

3.14.2.1 Manual actions required for hot shutdown in III.G.2 fires Areas/zones are shown in Attachment 3-7A. For these manual actions (except those not credited for maintaining the safe shutdown success path per Reg. Guide 1.189), exemptions were requested from the requirements of 10CFR50, Appendix R, section III.G.2. in lieu of fire barrier protection for cables and components. Attachment 3-7 has been reformatted and completely re-written for this revision of the FHAR. Some previously approved manual action exemptions may no longer be required due to incorporation of new information and Appendix R fire strategies. These are noted following a discussion of the approved exemption.

The original Attachment 3-7 provided a tabular listing, by fire zone, of valves that might require manual operation to reach a safe shutdown condition in the event of a fire. The reformatted version of Attachment 3-7A includes manual actions associated with all components, not just valves, and lists these actions by system function rather than by fire zone (fire zones for each action are still provided). It also contains a list of the exemption and exemption request for each manual action, when required.

Exemptions were requested on the basis that sufficient time is available to perform the required manual actions after the fire is detected and extinguished or the action can be accomplished in locations not involved in the postulated fire. The minimum time available for manual actions where exemption was requested was provided. By letter dated December 30, 1986, the NRC staff expressed several concerns regarding the GPUN position that sufficient time is available to perform the required manual actions:

1. Re-entering a fire area after a fire.

   Resolution - NRC identified one hour as the time to detect, control a fire and recover near ambient conditions to re-enter. This presumes the available fire protection features are maintained. GPUN identifies 2 hours as the minimum time available to perform these manual actions, thus providing a margin of safety. Available protection in zones where re-entry for manual action is required will be maintained.

2. Fire damage to valve operators.

   Resolution – In the SER dated December 30, 1986, the NRC concurred with GPUN's position that fire damage to valve operators will not prevent the valve operators from being manually turned, as stated to NRC by letter 5211-86-2124 dated July 22, 1986. Therefore, this issue was considered closed.

3. Areas physically separated from adjoining locations.

   Resolution – In the SER dated December 30, 1986, the NRC concurred with GPUN's position that where fire area boundaries are not completely fire-rated, the licensee indicates that 1) the areas on one or both sides of the boundary are protected by an automatic fire suppression system, or 2) the boundary wall or floor/ceiling forms a continuous non-combustible barrier to the propagation of fire, or 3) the adjoining area into which fire may spread is not relied upon for safe shutdown. Therefore, this issue was considered closed.

4. Post fire procedures and personnel

   Resolution - Procedures have been prepared. GPUN is committed to adequately staff personnel for the tasks.

5. Manual action required outside of the fire area.

   Resolution - NRC identified 30 minutes as the minimum time to implement these actions. TMI-1 Fire Safe Shutdown strategy requires various response times ranging from 10 minutes to more than 240 minutes. NRC generally accepted actions where the required response time was greater than 30 minutes. When action is required in 30 minutes or less, operators are

proactively (upon confirmation of a fire) dispatched to the area where the action may be required in order to minimize the response time if the action is required. This position was accepted by NRC letter dated March 19, 1987.

Attachment 3-7A and the following items identify the exemptions based on manual actions:

1. Letdown Valves MU-V-4 and MU-V-5 - Approved by NRC letter dated December 30, 1986

   MU-V-4 valve must be closed to establish letdown for reactor pressure control through the letdown control valve MU-V-5. The minimum time available to establish such control is 4 hours and can be further delayed, if necessary, since letdown is not required until reactor depressurization is initiated.

2. Makeup Valves MU-V-14A, MU-V-16A, MU-V-16B, and MU-V-18 - Approved by NRC letter dated December 30, 1986

   An exemption was previously requested and approved in fire zone AB-FZ-4 for manual alignment of these makeup valves following the detection and extinguishment of a fire in this zone. The exemption is still valid, however manual action of MU-V-17 is no longer required and manual action of MU-V-18 now results from a fire in CB-FA-2d or CB-FA-2e instead of AB-FZ-4. Also, for the specific situation of a fire in AB-FZ-6, a separate exemption has been submitted to eliminate the manual operation of MU-V-14A. This exemption was approved by NRC.

3. Letdown Valve MU-V-8 - Approved by NRC letter dated December 30, 1986

   This valve aligns letdown flow to either the makeup tank or the Reactor Coolant Bleed Tanks. In the event letdown is required for shutdown, this valve should be repositioned to restore letdown flow. The minimum time available to operate this valve to restore letdown is 4 hours.

4. Steam Dump Valves MS-V-4A and MS-V-4B and Block Valves MS-V-2A and MS-V-2B. MS-V-4A and 4B Approved by NRC letter dated December 30, 1986. MS-V-2A and 2B Inadvertently Omitted from Revision 7 Submittal to NRC and Approved by NRC letter dated March 19, 1987

   Initially, steam is relieved from the steam generators by the code safety valves until the steam dump valves can be manually controlled. Steam can be relieved through the code safety valves in order to remove decay heat; however, manual control should be established within 3 hours, in order to permit cooldown to begin.

   Manual operation of MS-V-2A/B for hot shutdown is no longer required per ECR 08-00927.

5. Steam Supply Valves MS-V-10A and MS-V-10B - Approved by NRC letter dated December 30, 1986

These valves provide steam to the steam-driven emergency feedwater pump. Since HPI cooling is available for a fire in IB-FZ-3, delayed opening of these valves will not prevent safe shutdown. The valves can be manually opened in fire zone IB-FZ-2 for long term feedwater addition to the steam generators. A minimum of 2 hours is available before feedwater would be required. This time can be further delayed, if necessary, by maintaining HPI cooling.

Manual operation of MS-V-10A/B for hot shutdown is no longer required per ECR 09-00196.

6. Emergency Feedwater Valves EF-V-30A, B, C, and D - Exemption Denied by NRC in letter dated December 30, 1986 - Subsequently Approved by NRC letter dated March 19, 1987

These valves provide emergency feedwater to the steam generators. Time is available to manually control these valves after isolating their control circuitry at the remote shutdown station.

These valves can be controlled from the remote shutdown panel within 20 minutes or less for any fire that does not affect the normal and back-up instrument air systems; however, an operator is dispatched immediately to the physical location of these valves, and direct manual action within 20 minutes. Such manual action is required for shutdown during a fire in IB-FZ-2 and DG-FA-2 due to loss of air supply and back-up instrument air, as well as FH-FZ-5 and CB-FA-2g due to the degradation of HSPS signals. For a fire in FH-FZ-1 or the reactor building, these valves must also be manually controlled, due to the degradation of HSPS input signals. However, remote manual control of the valves from the Control Room is possible for these HSPS cases, by overriding the HSPS auto control, which is not considered an exemption. Since HPI cooling is utilized for IB-FZ-3 and IB-FZ-8 fires, these valves can be manually controlled much later (2 hours or more) for fires in these zones. For the specific situation of a fire in IB-FZ-8, a separate exemption has been submitted and approved by NRC. Additionally, manual control of these valves is required after 2 hours for any fire that causes loss of instrument air, due to the available 2-hour back-up instrument air supply.

7. Control Building Ventilation Fans and Dampers - Exemption denied by NRC in letter dated December 30, 1986

The exemption request for manual operation of the Control Building ventilation system was withdrawn. However, a new exemption was requested for manual tripping of electrical loads to reduce heat loads in the Control Building. Such manual action was required for a fire in CB-FA-1, CB-FA-2a,

CB-FA-2b, CB-FA-2d, CB-FA-2e, CB-FA-2f, CB-FA-3a, CB-FA-4a, CB-FA-4b, and CB-FZ-5a. This exemption was also withdrawn. A separate exemption was required (see 3.14.10).

8. <u>Emergency Feedwater Pump Room Ventilation - Exemption denied by NRC in letter dated December 30, 1986</u>

   The Intermediate Building cooling system provides ventilation of the Emergency Feedwater pump rooms. Time is available to manually establish ventilation with portable fans. Portable ventilation is required for a fire in CB-FA-1. However, this exemption was withdrawn. A separate exemption was requested (see 3.14.10).

9. <u>Intermediate Cooling Pumps - Exemption Denied by NRC in a letter dated December 30, 1986 - Subsequently Approved by NRC letter dated March 19, 1987</u>

   These pumps are required for thermal barrier cooling for the reactor coolant pump seals and for letdown cooling. If an IC pump is required for thermal barrier cooling, the pump must be in operation within 30 minutes with RC pumps stopped. Westinghouse Corp. has documented that the seals in their RC pumps can withstand loss of seal cooling for 30 minutes without unacceptable damage or leak with the pumps stopped. If an IC pump is required for letdown cooling, operation of the pump can be delayed for up to 4 hours. Manual operation of the IC pump, after isolating a control circuit for interlock, is required for RCP thermal barrier cooling during a fire in CB-FA-2a and CB-FA-2b. Manual control of IC-P-1B pump can be established within 10 minutes by isolating control circuitry at the remote shutdown panel for a fire in CB-FA-2a. Similarly, the interlock circuit for IC-P-1A pump can be isolated by a transfer switch at the 1A ES MCC (CB-FA-2a) and IC-P-1A can be manually operated within 10 to 20 minutes for a fire in CB-FA-2b.

   Manual action for thermal barrier cooling is not required per the revised strategy for a loss of all RCP seal cooling per ECR 14-00097.

10. <u>Nuclear Services Cooling Water Pumps - Exemption Denied by NRC in letter dated December 30, 1986</u>

   The exemption request for manual operation of NS pump is withdrawn. These pumps are required to provide cooling water to makeup pump MU-P-1B and to the Control Building chillers. The chillers are required to support Control Building ventilation in the recirculation mode. For fires in zones where the recirculation mode is used (FH-FZ-5), manual operation of the nuclear services closed cycle cooling water pumps is not required.

   Since makeup pump MU-P-1C is used for shutdown for a fire in CB-FA-2a and MU-P-1A for a fire in CB-FA-2b, the NS pump is not needed to operate

for these fires to support MU-P-1B.

11. Diesel Generator Building Ventilation - Exemption Denied by NRC in letter dated December 30, 1986

    Fires in various plant areas (CB-FA-1, CB-FA-2d, CB-FA-2f, CB-FA-3d, CB-FA-4b, DG-FA-2, IB-FZ-3, and IB-FZ-5) may disable the diesel generator building ventilation system. An analysis has been performed which shows acceptable temperatures can be maintained by opening or closing designated doors which allows air flow induced by the radiator fan to provide the ventilation function. This exemption was withdrawn. A separate exemption was requested (see 3.14.10).

12. Nuclear River Cooling Water Pumps - Approved by NRC letter dated March 19, 1987

    These pumps are required to provide cooling water to Nuclear service coolers and intermediate coolers. For a fire in ISPH-FZ-1 one NR pump is needed to support the available makeup pump MU-P-1B for RCP seal injection or to support one IC pump for RCP thermal barrier cooling. Manual operation of NR-P-1C after isolating of a control circuit for interlock, is required for a fire in ISPH-FZ-1. Manual control of NR-P-1C can be established by isolating control circuitry at the remote shutdown panel for a fire in ISPH-FZ-1.

13. Intermediate Cooling Valves IC-V-2, IC-V-3 and IC-V-4 - Approved by NRC letter dated March 19, 1987

    These normally open IC valves are required to remain open during safe shutdown for RCP thermal barrier cooling and letdown cooling. For thermal barrier cooling, any spurious closing of these valves should be corrected within 30 minutes (prior to RC pump seal damage when the pumps are shutdown). A much longer action time, up to 4 hours, is allowed for letdown cooling. Spurious Reactor Building Isolation (RBI) initiation by the ESAS system can lead to spurious closure of IC-V-3 and IC-V-4 for "A" channel and or IC-V-2 and IC-V-4 for "B" channel. Spurious RBI initiation by the ESAS system can be corrected within the required time by isolating the ESAS circuit at the remote shutdown panels or by deenergizing dc power to the solenoid valves. Electrical cables for the valves are normally protected from fire damage in the areas where thermal barrier cooling is required.

    The manual action to support restoration of thermal barrier cooling is no longer required per the revised strategy for a loss of all RCP seal cooling.

14. Nuclear River Valve NR-V-15A, NR-V-15B and NR-V-18 - Approved by NRC letter dated March 19, 1987

    At least one outlet valve NR-V-15A or NR-V-15B must remain open for

IC cooler operation. NR-V-18 must also remain open to allow nuclear river water flow to IC coolers and NS heat exchanger. If the IC system is required for RCP thermal barrier cooling the NR cooling system must be available within 30 minutes (prior to RC pump seal damage when the pumps are shutdown). Otherwise NR cooling can be delayed up to 4 hours for letdown cooling (same as letdown timing). All areas have ample time (4 hours) to manually operate NR-V-15A and NR-V-15B for 1C cooling (letdown cooling).

The manual action for NR-V-18 is no longer required since this valve's breaker is maintained open, which prevents spurious operation.

15. Intake Screen and Pumphouse Ventilation - Approved by NRC letter dated March 19, 1987

Exemption was requested from the requirement of Section III.G.2 of 10CFR50, Appendix R to the extent that it requires separation of redundant ventilation system cables and components required for safe shutdown from a fire for fire zones ISPH-FZ-1 and ISPH-FZ-2 of the Intake Screen and Pumphouse. The locations where separation is not provided are CB-FA-3b, CB-FA-3c, CB-FA-3d, 4b, FH-FZ-1, ISPH-FZ-1, 2 and 3. Manual operations are used to establish portable ventilation.

Justification: Calculation C-1101-838-5360-003 demonstrates that under worst case conditions of 95°F outside air temperature, the loss of ISPH ventilation concurrent with normal operating conditions results in slowly increasing temperatures in the area. The calculation demonstrates that the initial worst case temperature of 108°F inside the ISPH increases to 111°F in 4 hours and to 120°F in 16 hours. The maximum operating temperature for the safe shutdown equipment in the area is approximately 120°F. Loss of ventilation flow in the ISPH is alarmed in the Control Room. The manual actions to establish portable ventilation are initiated upon alarm receipt. Portable ventilation will be provided for ISPH-FZ-1 and 2 within 4 hours after such ventilation loss occur. Dedicated portable ventilation equipment is available to accomplish these actions.

16. Intermediate Cooling Valves IC-V-3, IC-V-4; Letdown Valves MU-V-3, MU-V-4, MU-V-5, MU-V-6A, MU-V-6B, MU-V-11A, MU-V-11B, WDL-V-1, WDL-V-3, WDL-V-4, WDL-V-5; Steam Dump Valves MS-V-4A, MS-V-4B, and Seal Injection Valve MU-V-20 – Approved by NRC letter dated September 7, 1988.

Exemption was requested by GPU letter 5211-87-2175 from the requirements of 10 CFR 50 Appendix R, Section III.G.2 to allow manual operation of valves MS-V-4A and MS-V-4B within 3 hours; and to allow manual correction of spurious operation of valves IC-V-3 and IC-V-4 within 2 hours for thermal barrier cooling and within 4 hours for letdown; MU-V-3, MU-V-4, MU-V-5, MU-V-6A, MU-V-6B, MU-V-11A, MU-V-11B within 4 hours; WDL-V-1, WDL-V-3,

WDL-V-4, WDL-V-5 within 4 hours; and MU-V-20 within 2 hours, for any fire which causes loss of control air.

MS-V-4A or MS-V-4B must be controlled to achieve atmospheric steam dump. If these valves cannot be remotely operated, the steam will be allowed to dump through the code safety valves until the valves can be manually controlled. Manual control may be delayed up to 3 hours before beginning cooldown. IC-V-3 and IC-V-4 are required to remain open during safe shutdown for letdown cooling and for thermal barrier cooling. Manual correction can be delayed up to 2 hours for thermal barrier cooling since these valves have 2 hour backup air supply and manual correction can be delayed up to 4 hours for letdown cooling. MU-V-3, MU-V-4, MU-V-5, MU-V-6A, MU-V-6B, MU-V-11A, MU-V-11B, WDL-V-1, WDL-V-3, WDL-V-4, WDL-V-5 are required to remain open for letdown cooling. MU-V-20 is required to provide seal injection. Manual correction can be delayed up to 2 hours since this valve has 2 hour backup air supply.

The manual actions for IC-V-3 and IC-V-4 for thermal barrier cooling (2 hour actions), for MU-V-20, and for WDL-V-1/3/4/5 are no longer required per the revised strategy for a loss of all RCP seal cooling.

17. RCP Local Trip at 6900V Switchgear and NR-P-1B Transfer to Alternate Power Source- Approved by NRC letter dated March 30, 2009.

Exemption was requested from the requirement of Section III.G.2 of 10CFR50, Appendix R by AmerGen letter dated February 4, 2008 and subsequent Request for Additional Information (RAI) Exelon letter dated January 28, 2009 for two manual actions. The first action is tripping the Reactor Coolant Pumps (RCPs) locally at the 6900V switchgear within 10 minutes on a loss of all RCP seal cooling for a fire in Fire Area CB-FA-1. This manual action is required to maintain seal integrity and thus prevent increased seal leakage from occurring. The second action is transferring NR-P-1B to its alternate power supply for a fire in Fire Area CB-FA-2b. This manual action is required to provide a source of river cooling water to the Intermediate Closed (IC) heat exchangers in order to restore letdown. Both these manual actions were originally included in Revision 9 to the FHAR, but not explicitly approved as a 10 CFR 50 Appendix R III.G.2 manual action. Therefore, an exemption was granted for these manual actions by NRC letter dated March 30, 2009.

The time to complete this manual action to trip the RCPs locally at the 6900V switchgear was revised to 30 minutes based on the modified RCP seal capabilities. (Reference ECR 13-00099 RCP Seal Replacement and ECR 14-00097 FHAR revision for New RCP Seals.

3.14.3 Rockbestos Firezone R Cable - Approved by NRC in letter dated December 30, 1986 and Protection of Structural Steel – Approved by NRC in letter dated March 19, 1987.

Title 10 Code of Federal Regulations Part 50.48 (10CFR50.48) "Fire Protection" and Appendix R to 10CFR50 "Fire Protection Program for Nuclear Power Facilities Operating prior to January 1, 1979" set forth certain specific fire protection features required to satisfy the General Design Criterion for fire protection (GDC 3, Appendix A to 10CFR50).

Section III.G. of Appendix R requires fire protection for equipment important to safe shutdown. Such fire protection can be achieved by various combinations of fire barriers, fire suppression systems, fire detectors, and separation of safety trains (III.G.2) or alternative safe shutdown equipment free of the fire area (III.G.3). The objective of this protection is to assure that at least one train of equipment needed for shutdown would be undamaged (capable of performing its intended function) by fire.

General Public Utilities Nuclear Corporation (GPUNC) and the Rockbestos Company have cooperated in the development of a fire resistant cable to be utilized in lieu of 1 hour fire barriers in meeting the requirements of 10CFR50 Appendix R Section III.G. GPUN has coordinated the development and testing of this cable with the NRC staff in order to obtain regulatory input early in the development process. The Nuclear Fire Proof Cable Development and Test Program was provided to the staff by letter #5211-83-359 dated November 30, 1983, for review and comment. Subsequent testing in February of 1984 included consideration of the NRC staff comments on the testing program. In correspondence dated March 15, 1984, the NRC documented their comments on the test program and provided guidance for requesting exemptions from the regulations with regard to using this cable since the cable did not fully satisfy all NRC concerns regarding Appendix R. However, it was recognized that use of these cables based on acceptable test results, in conjunction with other fire protection features may be equivalent to the protection afforded by the requirements of Section III.G. of Appendix R.

By letter #5211-84-2141 dated June 9, 1984, GPUN provided the test report to the NRC staff, which demonstrated the cable remained functional throughout the 94-hour test period. This correspondence included consideration of all previous comments made by the NRC staff. On July 2, 1984 representatives of GPUN and the NRC staff met to discuss the test results. As a result of this meeting, GPUN developed examples of exemption requests for the use of the fire resistant cable in representative configurations. The examples were provided to the staff for their review in order to determine acceptability.

On August 14, 1984 representatives of GPUN and the NRC staff met to further discuss the use of fire resistant cables and to clarify the staff concerns with the representative exemption requests. The staff concluded that additional information was required in order to evaluate a request for exemption. Since the information needed was dependent on specific characteristics of the area in which exemptions are desired, GPUN was requested to provide a sample exemption for one specific area of the TMI-1 station based on the actual configuration and planned

modifications. By letter dated February 11, 1985, #5211-85-2011, GPUN provided the requested sample exemption request. The NRC staff reviewed the sample request and concluded that using "fire-rated" cable in a fire area with a distributed in-situ fire loading and protected by automatic suppression systems would provide an equivalent level of safety to that achieved by installing 1 hour fire barriers per section III.G.2.C of Appendix R.

GPUN requested exemption from the requirements of 10CFR50, Appendix R Section III.G.2 in order to utilize Rockbestos fire resistant cable in lieu of 1 hour fire barriers since the Rockbestos cable provides an equivalent level of protection. Exemption from the term "free of fire damage" was also requested. Although the Rockbestos fire resistant cable does experience a physical transformation when exposed to fire, the cable retains its ability to function which assures the operability of safe shutdown components. The following sections provide the basis for the exemptions from the requirements of 10CFR50, Appendix R Section III.G. Section 3.14.3.1 provides a summary of the Rockbestos Fire Resistant Cable Test Program and the results obtained. Section 3.14.3.2 provides design criteria which will be utilized during the development of detailed design documents and installation specifications regarding the use of Rockbestos Fire Resistant Cable. Section 3.14.3.3 identifies each fire zone in which the cable was replaced with Rockbestos fire resistant cable and includes a description of the fire zone of concern as well as the fire protection features provided within the zone.

This exemption was based on GPUN's sample exemption request and the subsequent NRC staff review of that request.

3.14.3.1 Rockbestos Fire Resistant Cable Tests

Rockbestos fire resistant cable has been shown to retain its ability to function when subjected to a fire exposure test utilizing the time temperature curve outlined in the ASTM E-119 standard for "Fire Tests of Building Construction and Materials". The test method employed was an adaptation of the test method outlined in the ASTM E-119 test in order to correlate the cable fire test results with those which have been performed on cable raceway fire barrier envelope systems. Underwriters Laboratories, Inc., Report File R10925-1, "Report on Fire Resistant Cables" dated April 10, 1984 provides a detailed description of the tests conducted and the results obtained. GPUN provided this report to the NRC staff by letter #5211-84-2141, dated June 9, 1984. The test configuration was representative of the cable configurations existing at the TMI-1 station and included several hose steam tests over a 93 hour period. During the first hour of the test, other cables within the cable tray were ignited which resulted in direct flame impingement on the Rockbestos cable and required repeated applications of hose streams to extinguish the fire upon removal from the test oven. Throughout the duration of the test the Rockbestos cable retained its ability to function; therefore, exposure to water suppression in post fire conditions will not create shorts or post fire mechanical forces that could affect the operability of hot shutdown equipment.

The testing performed demonstrates the ability of the cable to function during and after exposure to a fire condition including direct flame impingement on the cable. Additionally, the testing included exposure to water hose streams demonstrating that the cable's function will not be adversely affected by water application or mechanical stresses associated with fire suppression activities. Post fire recovery operations will preclude aggravating hot shutdown circuits until the plant is in a cold shutdown condition to assure the cable will not be subjected to mechanical stresses due to handling operations. In conjunction with fixed suppression and detection, sheathed Rockbestos cable in tray and unsheathed Rockbestos cable in conduit provides a practical alternative and an equivalent level of protection for hot shutdown circuits as that provided with the installation of 1 hour fire barriers as required by 10CFR50 Appendix R Section III.G.2C.

3.14.3.2 Rockbestos Fire Resistant Cable Design and Installation Criteria

Rockbestos Fire Resistant cable was utilized in lieu of radiant energy heat shields in containment and in lieu of fire barriers outside containment. Specific installation outside containment included open cable tray routing and routing in conduit in accordance with the following criteria.

Open Cable Trays

1. Only sheathed (stainless steel) Rockbestos cable routed in open cable trays.

2. Rockbestos cable in open cable trays used only in locations where area wide fire detection and automatic fire suppression systems are provided.

3. Rockbestos cable routings in open trays located so as to avoid locations of concentrated combustibles, (i.e., stored combustibles in the area, etc.).

4. The Rockbestos cable in open trays continuous throughout the fire zone with no splices or openings in the protective stainless steel sheath or where joining within the zone was required, splices enclosed in terminal boxes protected by appropriate fire barriers.

Normal Conduits

1. Sheathed or unsheathed Rockbestos fire resistant cable routed in conduit.

2. Rockbestos cable in normal conduits used only in locations where area wide fire detection and automatic fire suppression systems are provided.

3. Conduit routing through the protected area avoids location of concentrated combustibles and located near ceiling level to preclude interaction with other services (i.e., cable trays, pipe, controls, etc.).

4. Rockbestos cables in conduit continuous through the protected area with no

splices or breaks in the conduit or where breaks within the zone are required, terminal boxes provided and protected with appropriate fire barrier.

Electrical Criteria

1. Power and Control Cables evaluated based on the as-designed length of Rockbestos Fire Resistant Cable spliced into the existing cabling. This as-designed length of Rockbestos Fire Resistant Cable had 20 feet heated to 1700 degrees F.

2. Power and Control Cables have capacity derating factors in accordance with IPCEA-P46-426. Ambient temperature of 50 degrees C.

3. Motor Feeder Cables sized for 125% of full load current.

4. Control Cables sized for voltage drop considerations. Switchgear close and trip coils have a minimum of 90 volts and 70 volts, respectively.

5. Maximum Feeder Cable voltage drop of 3%.

6. Electrical resistance characteristics of Rockbestos Power and Control Cable are those published in Rockbestos data sheet RSS-S-144, Rev. 0, dated June 7, 1984.

7. Leakage current values for instrument cables are those established by U. L. Test, Test Record No. 2, dated April 10, 1984.

3.14.3.3 Exemptions by Fire Area/Zone

Those circuits for which exemption was requested are identified by fire area/zone in Attachment 3-1 where Rockbestos firezone R cable is specified. The information provided includes the affected component, the cable identification number, the components function, the cable routing, the cable size and additional clarification where necessary. The following sections in conjunction with Attachment 3-1 delineate all locations where Rockbestos fire resistant cable are utilized in lieu of fire barriers or radiant energy heat shields.

Reactor Building (Containment)

Rockbestos fire resistant cable is equivalent to the radiant energy heat shield specified in 10CFR50, Appendix R, Section III.G.2f. In discussions with the NRC staff it was agreed the Rockbestos cable, sheathed in tray and unsheathed in conduit, is equivalent to a radiant energy heat shield, therefore, providing Rockbestos fire resistant cable for redundant safe shutdown circuits meets the requirements of 10CFR50, Appendix R, Section III.G.2.f and specific exemption for the use of Rockbestos fire resistant cable in the Reactor Building is not required. In order to provide a complete discussion of the Rockbestos fire resistant cable

approach, Attachment 3-1 includes cable identification for Rockbestos fire resistant cable protected circuits in the Reactor Building.

Auxiliary Building Fire Zone AB-FZ-4 Exemption

For those cables itemized in Attachment 3-1, exemption was requested from the requirements of Section III.G.2 of Appendix R to 10CFR50 to the extent that it requires redundant safe shutdown related systems be separated by a 1 hour fire barrier and from the requirement to be free of fire damage. Additionally, exemption from Section III.G.2 was requested to the extent that protection of structural steel associated with supports is required. (steel protection exemption approved by NRC letter March 19, 1987)

Justification

This fire zone is bounded on one side and part of another by walls of reinforced concrete. The remaining sides are open to adjoining fire zones. Specific details of boundary construction are provided in zone boundary analysis. For the purposes of analysis, this fire zone was considered as a separate fire area in accordance with the fire boundary analysis. The principal combustible in this zone is cable insulation in open cable trays which are routed west to east through the zone. Maximum cable tray stacking (4 high) occurs in the east end of the zone. Other combustibles in the zone include concrete coating, two 55 gallon trash cans, and a wooden folding ladder. The total fire loading in this zone is low.

An area wide fire detection system which alarms in the Control Room and an area wide automatic preaction type fire suppression system are provided in this zone. Hose stream protection and portable fire extinguishes are available in adjacent areas for manual fire suppression in this zone.

The fire detection system in conjunction with the suppression system assures rapid extinguishment of a fire in its early stages. Should the automatic suppression system fail to fully extinguish the fire, the detection system assures early response by the plant fire brigade to extinguish the fire manually prior to significant propagation. The use of Rockbestos Fire Resistant Cable assures operability of safe shutdown circuits during and after exposure to the fire. The maximum credible fire in this zone is less severe than the ASTM E-119 test fire conditions which were used in testing the Rockbestos cables as described in Section 3.14.3.1. The use of Rockbestos Fire Resistant Cable in conjunction with the existing fire protection features provides an equivalent level of protection as that provided by 1 hour fire barriers. The fire detection system assures prompt response by the plant fire brigade and rapid manual extinguishment with the manual suppression equipment provided in the zone and surrounding areas. This assures that temperatures within the zone will not rise to levels where the structural integrity of steel supports will be affected even if the automatic suppression system should fail to function as designed. Therefore, supports for open raceways carrying the Rockbestos fire resistant cable, support for conduits and trays protected by 1 hour fire barriers, and supports for services in proximity to these raceways and conduits need not be fire-proofed in this zone.

Auxiliary Building Fire Zone AB-FZ-5

The exemption request for the use of the Rockbestos Firezone R cable in fire zone AB-FZ-5 was withdrawn. Rockbestos Firezone R cable was not used in AB-FZ-5.

Intake Screen and Pump House Fire Zone ISPH-FZ-1 Exemption

For those cables identified in Attachment 3.1 exemption was requested from the requirements of Section III.G.2 of Appendix R to 10CFR50 to the extent that it requires redundant shutdown related systems be separated by a 1 hour fire rated barrier and from the requirement to be free of fire damage. Additionally, exemption from Section III.G.2 was requested to the extent that protection of structural steel associated with supports is required (steel protection exemption approved by NRC letter dated March 19, 1987).

Justification

This fire zone is bounded by walls, floor, and ceiling of reinforced concrete. Specific details of boundary construction are provided in zone boundary analysis. For the purposes of analysis, this fire zone was considered as a separate fire area in accordance with the fire boundary analysis.

The principal combustible in this zone is cable insulation in open cable trays which are routed west to east in the center of the zone. The maximum cable tray stacking (3 high) occurs in the west end of the zone. Transient combustibles are minimal in the zone and consist of one 55 gallon trash can, one 20-foot wooden ladder and a wooden step which accounts for less than 3% of the total fire loading. The total fire

loading is low. Transient combustibles in the zone are minimal and do not represent a concentrated exposure hazard to the cable routings.

An area wide fire detection system and an area wide automatic wet pipe suppression system are provided in this zone. Portable fire extinguishers and fire hose protection from an outside fire hydrant are provided for manual fire suppression by the plant fire brigade.

A fire in this zone would be slow in development due to the lack of concentrated combustibles and the slow burning characteristics of cable insulation. The installed detection system would alert operating personnel of the fire during its early stages and the automatic suppression system would activate to rapidly extinguish the fire or at a minimum significantly retard fire propagation. The rapid response of the plant fire brigade provides further assurance that fire extinguishment would occur prior to significant propagation. The Rockbestos Fire Resistant Cable has been shown to retain its operability during exposure to a 1 hour severity fire as described on the ASTM E-119 time-temperature curve. Any postulated fire in this zone would be of much less severity than the ESTM E-119 test fire utilized in testing the Rockbestos cables.

Therefore, the use of Rockbestos Fire Resistant Cable assures the operability of safe shutdown equipment during a postulated fire in this zone and provides an equivalent level of protection as that provided by 1 hour fire barriers.

The fire detection system assures prompt response by the plant fire brigade and rapid manual extinguishment with the manual suppression equipment provided for the zone. This assures that temperatures within the zone will not rise to levels where the structural integrity of steel supports will be affected even if the automatic suppression system should fail to function as designed. Therefore, supports for open raceways carrying the Rockbestos fire resistant cable, supports for conduits, trays and cable protected by 1 hour fire barriers, and supports for services in proximity to these raceways, conduits and cables need not be fireproofed in this zone.

Intake, Screen and Pump House Fire Zone ISPH-FZ-2 Exemption

For those cables identified in Attachment 3.1, exemption was requested from the requirements of Section III.G.2 of Appendix R to 10CFR50 to the extent that it requires redundant shutdown related systems be separated by a 1 hour fire rated barrier and from the requirement to be free of fire damage. Additionally, exemption from Section III.G.2 was requested to the extent that protection of structural steel associated with supports is required (steel protection exemption approved by NRC letter dated March 19, 1987).

Justification

This fire zone is bounded by walls, floor, and ceiling of reinforced concrete. Specific details of boundary construction are provided in zone boundary analysis. For the purposes of analysis, this fire zone was considered as a separate fire area in accordance with the fire boundary analysis.

The principal combustible in this zone is cable insulation in open cable trays which are routed west to east in the center of the zone. The maximum cable tray stacking (3 high) occurs in the west end of the zone. Transient combustibles in the zone consists of one 55 gallon trash can, one 20-foot wooden ladder and a wooden step which accounts for less than 3% of the total fire loading. The overall fire loading is low. Transient combustibles in the zone are minimal and do not represent a concentrated exposure hazard to the cable routings. An area wide fire detection system and an area wide automatic wet pipe suppression system are provided in this zone. Portable fire extinguishers and fire hose protection from an outside fire hydrant are provided for manual fire suppression by the plant fire brigade.

A fire in this zone would be slow in development due to the lack of concentrated combustibles and the slow burning characteristics of cable insulation. The installed detection system would alert operating personnel of the fire during its early stages and the automatic suppression system would activate to rapidly extinguish the fire or at a minimum significantly retard fire propagation. The rapid response of the plant fire brigade provides further assurance that fire extinguishment would occur prior to significant propagation. The Rockbestos Fire Resistant Cable has been shown to retain its operability during exposure to a 1 hour fire severity as described on the ASTM E-119 time-temperature curve. Any postulated fire in this zone would be of much less severity than the ASTM E-119 test fire utilized in testing the Rockbestos cable. Therefore, the use of Rockbestos Fire Resistant Cable assures the operability of safe shutdown equipment during a postulated fire in this zone and provides an equivalent level of protection as that provided by 1 hour fire barriers.

The fire detection system assures prompt response by the plant fire brigade and rapid manual extinguishment with the manual suppression equipment provided for the zone. This assures that temperatures within the zone will not rise to levels where the structural integrity of steel supports will be affected even if the automatic suppression system should fail to function as designed. Therefore, supports for open raceways carrying the Rockbestos fire resistant cable, supports for conduits, trays and cables protected by 1 hour fire barriers, and supports for services in proximity to these raceways and conduits need not be fireproofed in this zone.

Fuel Handling Building Fire Zone FH-FZ-1 Exemption

For those cables itemized in Attachment 3-1, exemption was requested from the requirements of Section III.G.2 of Appendix R to 10CFR50 to the extent that it requires redundant shutdown related systems be separated by 1 hour fire barriers and from the requirement to be free of fire damage. Additionally, exemption from Section III.G.2 was requested to the extent that protection of structural steel associated with supports is requested (steel protection exemption accepted by NRC letter dated March 19, 1987).

Justification

This fire zone is bounded by walls, floor and ceiling of reinforced concrete construction with the exception of an open passage to fire zone AB-FZ-5 and AB-FZ-4. For specific details of boundary construction refer to zone boundary analysis. For the purpose of analysis, this fire zone was considered as a separate fire area in accordance with the fire boundary analysis.

The principal combustible in this zone is cable insulation in open cable trays. Transient combustibles include laundry cans, trash cans, rope, signs, ladders and miscellaneous plastics. The transient combustibles represent less than 10% of the total fire loading; however, these transients are accumulated in the south and southwest sections of the zone. The total fire loading in this zone is low. The cable trays in the area spread horizontally up to eight trays wide instead of being stacked vertically. The maximum stacking of trays occurs in the northwest section of the zone where three large and two small cable trays are stacked for a short distance. In all locations within this zone, the cable tray arrangement is not considered to be heavily concentrated, congested, or inaccessible for manual fire fighting. All cable trays are located in the upper portions of the rooms and corridors.

This fire zone is protected by an area wide fire detection system and an area wide automatic sprinkler system providing full coverage of the two locations containing transient combustibles as well as all cable trays. Hose stream protection is available from an installed hose station in this zone and also from another hose station in an adjacent zone. Portable fire extinguishers are also available in this zone and in adjacent zones.

A fire in this zone would be slow in development due to the lack of concentrated

combustibles and the slow burning characteristics of cable insulation. The fixed automatic suppression system and the fire detection system assure that fires in this zone will be extinguished during the early stages of development. Due to the low amount of transient combustibles and the slow burning nature of the cable insulation the (major combustible) sufficient time exists for manual suppression by the plant fire brigade.

Cable routings above the accumulated combustibles are such that only one redundant channel of cable trays (B channel) is located above or in the immediate vicinity of the steel drums containing waste in the southwest section and only one redundant channel of cable trays (A channel) is located above or in the immediate vicinity of the maintenance materials in the south section. The Rockbestos Fire Resistant Cable has been shown to retain its operability during exposure to a 1 hour fire severity equivalent to the ASTM E-119 time-temperature curve. The maximum credible fire in this zone would be much less severe than that used in the test configuration; therefore, the Rockbestos Fire Resistant Cable provides an equivalent level of protection as that provided by 1 hour fire barriers.

The automatic suppression system in this zone assures rapid extinguishment of fires in their beginning stages; therefore, preventing any appreciable heat generation. Furthermore, the fire loading in the zone is low, the major combustible is difficult to ignite and slow burning, and transient combustibles in the zone are minimized. Prompt response of the plant fire brigade, due to early warning fire detection, assures manual suppression of the fire prior to heat generation of sufficient magnitude to affect the integrity of structural steel supports even though the automatic suppression system were to fail to function as designed. Therefore, fireproofing of cable raceways and supports is not required in this zone.

3.14.4 Fire Zone FH-FZ-6 (Chiller Room) - Exemption not discussed in NRC letter dated December 30, 1986 - Subsequently Approved by NRC letter dated March 19, 1987

Exemption was requested from the requirement for automatic fire suppression.

The exemption request from the requirement for the separation of Control Building chillers located in this area is withdrawn. The chillers are required to support Control Building ventilation in the recirculation mode. For fires in FH-FZ-6, the recirculation mode is not required. Safe shutdown cables protected in this zone are wrapped with 1 hour fire barriers. An area wide detection system which alarms in the Control Room was installed in this zone.

The fire loading in this zone is minimal. The 1 hour fire barrier wraps provide protection for safe shutdown circuits. The detection system assures rapid response of the plant fire brigade to manually suppress the fire in its early stages to prevent damage to safe shutdown components. The lack of significant combustibles and the modifications provide an equivalent level of protection as that provided in the Appendix R requirements.

3.14.5 Control Room - Approved by NRC in letter dated December 30, 1986

Exemption was requested from the requirements of 10CFR50, Appendix R, Section III.G.3 to the extent that area wide detection and fixed fire suppression is required.

Exemption was also requested from the requirement of emergency lighting units with at least an 8 hour battery power supply in the Control Room.

The Control Room is a continuously manned area. Ionization smoke detection is provided in or above safety related control consoles and panels. Portable CO_2 extinguishers are provided for manual fire suppression. Additionally, hose protection is provided outside the area in FH-FZ-5.

Since this area is continuously manned and fire detection systems are installed within or above the safety related panels, postulated fires would be discovered in their early stages. Fixed suppression in this area would not provide any appreciable increase in the level of fire protection provided.

The Control Room is provided with two redundant lighting units powered by onsite ES power supplies and one separate dc lighting system. Modification was made to reroute one cable so that one lighting system is available to illuminate Control Room for all fire scenarios.

3.14.6 Emergency Lights in Reactor Building - Approved by NRC in letter dated December 30, 1986

Exemption was requested from the requirements of Section III.J for permanently mounted emergency lighting units inside the Reactor Building. A supply of dedicated portable lights, with at least 8 hour power supply, are provided at the Reactor Building air lock, to illuminate access routes and shutdown components which require manual operation within the Reactor Building containment.

Justification

Access to the reactor building containment within 8 hours is required only for a fire which causes spurious operation of one of the normally open valves, located in zone RB-FZ-1c, associated with the reactor coolant letdown cooler in operation. Such a fire could potentially prevent alignment of the redundant valves and letdown cooler in the same fire zone. Manual realignment is required within 4 hours to reestablish reactor coolant letdown. The 4 hours provides sufficient time for trained operators to gain access to and manually realign these valves in an orderly fashion utilizing 8 hour battery powered portable lighting. Portable lights dedicated for this purpose are administratively controlled and maintained at the entrance of the reactor building containment.

Reactor building containment entry would be a planned activity by at least two operators to perform the above task, if required. Therefore, the operators could carry enough lighting units to complete the manual operation. The portable lighting units provide adequate illumination levels at the work station as they could be held by one operator to illuminate the required valve location while the other operator would be able to perform the manual actions with both hands.

In addition, the installation of fixed emergency lighting inside containment would present an undue burden to the plant operators to maintain these units in accordance with the existing preventive maintenance program. Use of portable lighting would eliminate personnel exposures received during maintenance and surveillance of installed fixed emergency lights, which is consistent with ALARA program objectives. Inaccessibility during normal operation reduces the reliability of fixed lighting units inside containment.

Radiation degradation of the battery enclosure installed inside containment could lead to leakage or rupture over a period of time. Also, battery packs are not qualified to postulated accident temperature and pressure inside containment and therefore could introduce hazardous material such as battery acid which would increase hydrogen generation and also pose a potential threat to cables and other components.

Installation of battery powered lighting inside containment does not significantly enhance the level of post-fire shutdown capability and its omission does not endanger the health and safety of the public. In lieu of the permanently mounted emergency lighting units, a group of rechargeable battery powered portable lighting units are provided and dedicated at the entrance of the Reactor Building where the operators could obtain them as they enter. The batteries of these portable lighting units are fully charged at all times and a maintenance and replacement schedule is fully implemented by administrative procedures.

3.14.7 Fire Zone IB-FZ-8 (Intermediate Building - Alligator Pit, Ele. 279') - Approved by NRC letter dated March 19, 1987

Exemption was requested from Section III.G.2 to the extent that the three hour fire rated barrier of fire zone IB-FZ-8 contains two steel plate doors which are not listed for fire service by a recognized testing agency.

Justification

Each steel plate door (Approx. 3ft x 7ft) is used for flood protection and is bolted in place. One door is located in the portion of the wall common to fire zone AB-FZ-4 and the other is in the portion of the wall common to fire zone FH-FZ-1, each of which is provided with an area wide automatic sprinkler system. The combustible load in fire zone IB-FZ-8 is very low which precludes conflagration. The two doors are over 50ft apart, which precludes a fire in fire zone IB-FZ-8 from exposing both fire zones AB-FZ-4 and FH-FZ-1 simultaneously since there is no continuity of combustibles. Based on the fire suppression system installed, the low combustible load in fire zone IB-FZ-8, and the distance between the steel flood doors, replacement with listed fire doors would not materially enhance the ability to achieve safe shutdown in the event of a fire.

3.14.8 Auxiliary Building Fire Zone AB-FZ-4 - Exemption Approved by NRC letter dated December 30, 1986

Exemption was requested from the requirements of Section III.G.2 of 10CFR50, Appendix R to the extent that it requires redundant shutdown related components be separated by 20 ft. with no intervening combustibles.

This fire zone is provided with smoke detection throughout and an automatic pre-action sprinkler system with heat responsive fusible sprinklers. Valves IC-V3 and MU-V14A are separated within the fire zone by a line of sight distance exceeding 33 ft. Cables required for automatic operation of both valves are protected in the fire zone.

The principal combustible in this zone is cable insulation in open cable trays. Combustible load in the fire zone is low. The fire zone is protected by a zone-wide fire detection system and a zone-wide automatic water type suppression system. A fire hose station is provided in the fire zone and additional hose stations and portable fire extinguishers are available in adjacent fire zone AB-FZ-5. A fire in this zone would be slow in development due to lack of concentrated combustibles and the slow burning characteristics of cable insulation. The suppression and detection systems assure that fires in this zone will be extinguished during the early stages of development.

Based on the fire detection features, the slowly developing type of fire, the automatic suppression and availability of manual fire fighting equipment for the fire brigade, it is expected that a fire in fire zone AB-FZ-4 would be detected and extinguished. The protection provided for redundant system cables, and the separation of valves MU-V14A and IC-V3 by distance preclude a conflagration within fire zone AB-FZ-4 capable of causing damage to both valve operators from a single fire.

Therefore we conclude, functionally redundant valves MU-V-14A and IC-V3 are adequately separated by distance, with sufficient mitigating features to compensate for the existence of intervening combustibles to preclude damage to both valve operators. Protection of the valve operators would not augment or materially enhance the safety of the plant.

3.14.9 Intermediate Building Fire Zone IB-FZ-8 - Exemption approved by NRC in letter dated December 30, 1986

The exemption in paragraph 3.14.2.6 to allow manual actions in lieu of fire barrier protection for cables and components was expanded to include cables located in IB-FZ-8.

Justification

Deletion of the formerly proposed fire barrier between fire zones IB-FZ-8 and 8a combines both fire zones into a single fire zone, IB-FZ-8. This single fire zone contains cables RF144, RL56, RL47 and RL57 for Emergency Feedwater Valves EF-V30A, EF-V30B, EF-30C and EF-V30D, respectively. The fire zone contains a low combustible loading. Manual fire fighting is supported by portable fire extinguishers and hose provided outside this zone near access routes as well as outdoor fire hydrants.

Non-combustible seals are provided for openings in the floor slab of IB-FZ-2 which communicate to fire zone IB-FZ-8 to eliminate the possibility of an exposure fire in fire zone IB-FZ-8 from impacting both IB-FZ-2 and IB-FZ-3.

Valves EF-V30A, 30B, 30C and 30D are located in fire zone IB-FZ-3. This fire zone has a low combustible loading and ionization type smoke detection which actuates alarms in the Control Room. The time available before manual operation of the valves is required is two hours. Due to notification of a fire condition from the detection system and the low combustible loading in fire zone IB-FZ-3, fire brigade response and subsequent extinguishment, entrance into the fire zone to accomplish the required manual valve operations after isolating their control circuitry at the remote shutdown station will be accomplished well within the time available.

An exemption was previously approved for manual alignment of valves in IB-FZ-3 to establish Emergency Feedwater.

Based on the low combustible loading and notification of a fire in fire zone IB-FZ-3, fire suppression activity will be rapid, allowing manual operation of valves to establish Emergency Feedwater well within the time available. A fire in IB-FZ-8 which impacts cables required for automatic valve operation will not adversely affect the capability to manually operate valves in IB-FZ-3 to establish Emergency Feedwater. Therefore separation of redundant cables for Emergency Feedwater valves EF-V30A, 30B, 30C and 30D in IB-FZ-8 would not augment or materially

enhance the safety of the plant.

3.14.10 Loss of HVAC - Approved by NRC letter dated March 19, 1987

Exemption was requested from the requirements of Section III.G.2 of 10CFR50, Appendix R to the extent that it requires separation of redundant Control Building, EFW Pump Room, Diesel Generator Building and Decay Heat Removal/NUC Services Closed Cycle Cooling Pump Room (AB-FZ-7) ventilation system cables and components required for safe shutdown from a fire.

A 20 minute roving fire watch was provided for all plant operating modes except cold shutdown conditions in lieu of fire protection for required ventilation system components. By letter C311-88-2010 dated May 5, 1988, GPUN provided test data to support a conclusion that the loss of these ventilation systems due to fire, would not adversely affect safe shutdown systems. The letter was supplemented by letters dated August 5 and 17, 1988. Based on this the exemption is no longer required and the following actions have been proceduralized upon loss of ventilation:

For Diesel Generator Building - within one hour

1. Open Service Building roll-up door and doors SB157 and D101 for the B diesel engine generator room.

2. Open doors D106 and 107 for the A diesel generator room.

For Control Building - within one hour

1. Manually de-energize half of the unprotected normal control room lighting system.

2. Manually open door between inverter room (CB-FA-2d) and battery room (CB-FA-2f).

3. Provide procedural guidance to establish portable ventilation as a prudent measure but not specifically required to achieve safe shutdown.
NRC acknowledged in letter dated September 7, 1988.

3.14.11 Reactor Coolant Pump Seals - Approved by NRC letter dated March 19, 1987

Exemption was requested from the requirements of Section III.G.2 of 10CFR50, Appendix R to the extent that it requires protection of cables in CB-FA-2d and CB-FA-2f required to trip Reactor Coolant Pumps A and C from the Control Room in the event of loss of both seal injection and seal thermal barrier cooling due to a fire. Subsequent to the exemption being requested, the capability to trip the RCPs has been provided independent of these fire areas. Therefore, the exemption has been withdrawn.

3.14.12 Letdown Isolation Valves MU-V-2A/2B, MU-V-3, MU-V-4 and MU-V-5 - Approved by NRC letter dated November 2, 1988

Exemption was requested from the requirements of Section III.G.2 of 10 CFR 50, Appendix R to the extent that it requires redundant shutdown related components be separated by 20 ft. with no intervening combustibles, for fire areas AB-FZ-4 and FH-FZ-1.

Justification

A fire in AB-FZ-4 or FH-FZ-1 could damage circuits for the letdown valves, which would preclude letdown isolation from the control room. Letdown can be isolated by any of the following redundant valves:

a. MU-V-2A and 2B, or
b. MU-V-4 and 5, or
c. MU-V-3

Spurious opening of MU-V-5 concurrent with loss of intermediate cooling to the letdown coolers could result in damage to the low pressure portion of the letdown system. Letdown isolation can be accomplished since there is adequate separation and sufficient mitigating features to compensate for intervening combustibles between redundant valve circuits as described below.

In AB-FZ-4, the circuits associated with MU-V-5 are approximately 40 ft. away from the cable trays used for MU-V-2A and 2B circuits; MU-V-4 and its circuits are located outside of this zone. In FH-FZ-1, the MU-V-3 circuits are separated by approximately 36 ft. from the trays used for MU-V-2A and 2B.

Per MD-G974-001, High Temperature Isolation of Letdown Line, circuits for MU-V-2A/B were routed within 40 feet of the circuit for MU-V-5. This is acceptable since the temperature switch circuit installed has been fused to assure that a fire will not cause a hot short to ground that results in loss of control power for MU-V-2A/B. The details of this installation are addressed in FPE-410036-001.

Both fire zones are provided with area wide smoke detection and automatic suppression systems protecting the entire floor and the cable trays. The intervening space between the valve circuits contains combustible materials primarily in the form of cables in trays. A fire involving cable insulation would initially burn slowly with much smoke but with low heat release. The fire detection system is capable of alarming during the formative stages of the fire before serious damage would result. The fire brigade would be dispatched and would put out the fire using manual fire fighting equipment which includes portable extinguishers and hose lines from nearby hose reel stations. Control of transient combustibles in this area is provided through administrative controls.

If the fire spread rapidly and significant temperature rise occurred, the automatic sprinkler system would actuate to control the fire. Pending actuation of the sprinkler system and/or arrival of the fire brigade, the horizontal distance between the valve circuits in either AB-FA-4 and FH-FZ-1, specified above, provides reasonable assurance that at least one redundant valve combination would be free of fire damage. The presence of combustible materials in the intervening space between the valves is not significant.

Circuits for functionally redundant valves MU-V-2A and MU-V-2B, and MU-V-4 and MU-V-5 in AB-FZ-4; and MU-V-2A and MU-V-2B, and MU-V-3 in FH-FZ-1 are adequately separated by distance with sufficient mitigating features to compensate for the existence of intervening combustibles to preclude damage to redundant valve circuits. Protection of these circuits would not augment or materially enhance the safety of the plant.

3.14.13 Reactor Coolant Pump Lube Oil Collection System - Approved by NRC Letter Dated February 26, 1990

Exemption was requested from the requirements of Section III.0 of 10 CFR 50 Appendix R to the extent that it requires oil collection systems for reactor coolant pumps to be capable of collecting lube oil from all potential unpressurized leakage sites including oil fill lines.

A modification of the TMI-1 RCP lube oil fill lines as designed does not meet the stated capability. The sloped RCP lube oil system remote fill piping is located over drip pans only at its extremities; the remote fill station and its termination at the oil reservoirs. Leakage/spillage contained by the remote fill station drip pan is not directed to the RCP lube oil collection system by connecting piping.

Justification

In order to discontinue handling lube oil containers within the secondary shield walls during lube oil additions with the plant at power, the fill lines from the RCP lube oil reservoirs have been extended to remote fill stations outside the secondary shield walls. This will reduce radiation exposure to personnel and eliminate the need to transport oil over hot pipes and surfaces to the local fill stations.

The added fill line piping/tubing is designed to meet Seismic II Anti-Falldown criteria to prevent damage to other equipment in case of a seismic event. It was also designed to only contain oil for the period required to gravity drain at atmospheric pressure the quantity of oil added.

In the absence of drip pans located below the entire portion of added fill piping/tubing, consideration has been given to minimizing the potential for and controlling leakage/spillage by:

1. Using welded joints at fill piping/tubing connections as much as possible.

2. Prevent oil from standing in piping outside the drip collection system by sloping the piping/tubing to drain completely into the RCP lube oil reservoirs.

3. Locating fill line connections to oil reservoirs above the reservoir's high level alarm set point and overflow line.

4. Extending existing or installing additional drip pans to collect possible leakage from the sight glasses.

5. Confirm after installation that added oil reaches the sump and is not trapped in piping.

6. Based on Start-up and Test data, identify sight glass level change vs. volume of oil added and incorporate that information in oil addition procedures.

7. Revising operating procedures to require wipe-up of any spillage at the remote fill station local drip pans.

Extending drip pans under the entire remote fill piping and piping the remote fill station drip pans to the RCP Lube Oil Collection tank would not augment or materially enhance the safety of the plant.

3.14.14 Thermolag 3 Hour Fire Barriers – 8 of 9 Areas Approved by NRC Letter Dated July 11, 1997.

Exemption was requested from the requirements of Section III.G.2.C for an automatic suppression system in the following fire areas where circuits of redundant safe shutdown equipment in the same fire area are enclosed in a one-hour fire barrier. These barriers were originally installed as three-hour fire barriers. The fire areas/zones are: CB-FA-2B, CB-FA-2C, CB-FA-2D, CB-FA-2E, CB-FA-2F, CB-FA-2G, CB-FA-3A, CB-FA-3B and FH-FZ-5. The request committed to augmenting the HVAC duct detection system for these areas by installing an area wide (incipient) fire detection system. Exemption was granted in all the fire areas except FH-FZ-5.

Justification

All fire areas where the exemption is granted consist of three hour rated fire barriers.

Cable insulation, thermolag, and battery cases are the principal combustibles in these areas. Fire Loading is considered low in these areas. Fire protection consists of portable extinguishers, an HVAC duct smoke detection system which actuates smoke control dampers AH-D-43A, B, C, D and AH-D-30A, B, C, D, E, F, G (Note: AH-D-30E in CH-FA-2C is not subject to this SER) and manual hose stations located outside the area.

Since fire loading is considered low, and most cable insulation in the areas is

qualified to the IEEE 383 flame test, fires would be slow to develop and spread beyond the ignition source. Fires would be detected quickly. The potential exposure to any cable raceway fire barrier is not considered more severe than the exposure of the ASTM E-119 fire test. Since the severity of the exposure does not exceed that of the ASTM E-119 fire test, a sixty (60) minute barrier rating is considered adequate since the fire brigade can be expected to reach the area and commence suppression activities within fifteen (15) minutes of receipt of an automatic fire detection system alarm.

3.14.15 Thermolag 1 Hour Fire Barriers – 6 of 10 Fire Areas Approved by NRC Letter Dated April 20, 1999.

Exemption was requested from the requirements of Section III.G.2.c for one hour fire barriers in the following fire areas/zones where circuits of redundant safe shutdown equipment in the same fire area/zone are enclosed in a 1-hour fire barrier. These barriers were originally installed as 1-hour fire barriers; however, by comparison to accepted tests, the barriers included in the exemption request have fire ratings ranging from 39-50 minutes. The fire areas/zones are: CB-FA-1, ISPH-FZ-1, ISPH-FZ-2, AB-FZ-3, AB-FZ-4, AB-FZ-5, AB-FZ-7, FH-FZ-1 and FH-FZ-6. The request committed to installing a combustible gas detection system above the suspended ceiling in a fire area CB-FA-1 and to installing an automatic wet pipe sprinkler system in fore zone FH-FZ-6. The exemption was granted for fire areas/zones CB-FA-1, ISPH-FZ-1, ISPH-FZ-2, AB-FZ-4, FH-FZ-1 and FH-FZ-6.

Justification

Cable insulation and Thermolag are the principal combustibles in these fire areas/zones. Fires are all postulated to be either a slowly developing cable fire or due to transient combustibles.

Fire area CB-FA-1 is provided with an automatic detection system above the suspended ceiling (includes a combustible gas detection system because of an acetylene line as a condition for the exemption), and with an automatic wet pipe sprinkler system which is below the suspended ceiling which would act to suppress a fire below the ceiling. If necessary, the fire brigade would be dispatched at an estimated response time of 15 minutes. Manual suppression is available inside the area.

Fire zones ISPH-FZ-1 and ISPH-FZ-2 contain both automatic detection and suppression. A fire in either zone would be slow to develop, with electric switchgear as a possible ignition source. If a fire were to occur in either zone, indication would be received in the control room. The automatic suppression or wet pipe sprinkler system is available to suppress the fire. The fire brigade would be dispatched at an estimated response time of 25 minutes. Portable extinguishers are available in or adjacent to these fire zones and a yard hydrant is available.

Fire zone AB-FZ-4 contains both automatic detection and suppression. If a fire

were to occur, indication would be received in the control room. The automatic suppression or preaction system is available to suppress the fire. The fire brigade would be dispatched at an estimated response time of 15 minutes. Manual suppression is available in or adjacent to this fire zone.

Fire zone FH-FZ-1 contains both automatic suppression and detection. If a fire were to occur, indication would be received in the control room. The automatic suppression or wet pipe sprinkler system is available to suppress the fire. The fire brigade would be dispatched at an estimated response time of 15 minutes. Manual suppression is available in or adjacent to this fire zone.

Fire Zone FH-FZ-6 is provided with automatic detection and an automatic wet pipe sprinkler system (the automatic wet pipe sprinkler system is a commitment. Installation was required as a condition for the exemption in this fire zone). Indication of a fire would be received in the control room via the detection system or actuation of the sprinkler system. If necessary, the fire brigade would be dispatched at an estimated response time of 15 minutes.

Since fire loading is considered either low where the Thermolag envelopes are located and most cable insulation is qualified to the IEEE 383 flame test, fires would be slow to develop and spread beyond the ignition source. Fires would be detected quickly. Each of the areas is provided with an automatic suppression system which would act to suppress a fire. The potential exposure to any cable raceway is not considered more severe than the exposure of the ASTM E-119 fire test. A minimum 39 minute fire rating is considered adequate given the automatic detection and suppression systems and since the maximum estimated response time for the fire brigade is 25 minutes for fire zones ISPH-FZ-1 & 2. Even if the automatic suppression systems failed to operate, the fire brigade can be expected to arrive and extinguish or suppress a fire prior to fire exposure in excess of 25 minutes.