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J.E. Pollock
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NL-10-100

September 29, 2010

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Subject: Response to August 11, 2010 Request for Additional Information Regarding Request for Exemption from 10 CFR 50, Appendix R, Paragraph III.G.2 for Use of Operator Manual Actions for Indian Point Unit No. 2 (TAC No. ME0798)
Indian Point Unit No. 2
Docket No. 50-247
License No. DPR-26

References:

1. NRC letter dated August 11, 2010, "Indian Point Nuclear Generating Unit Nos. 2 and 3 – Request for Additional Information Regarding Request for Exemption (TAC Nos. ME0798 and ME0799)"

2. Entergy letter NL-10-042, "Response to January 20, 2010 Request for Additional Information Regarding Request for Exemption from 10 CFR 50, Appendix R, Paragraph III.G.2 for Use of Operator Manual Actions for Indian Point Unit No. 2 (TAC No. ME0798)," dated May 4, 2010

3. NRC letter dated January 20, 2010, "Indian Point Nuclear Generating Unit Nos. 2 and 3 – Request for Additional Information Regarding Request for Exemption (TAC Nos. ME0798 and ME0799)"

4. Entergy letter NL-09-116, "Revision to Request for Exemption from 10 CFR 50, Appendix R, Paragraph III.G.2 for Use of Operator Manual Actions for Indian Point Unit No. 2," dated October 1, 2009

5. Entergy letter NL-09-031, "Request for Exemption from 10 CFR 50, Appendix R, Paragraph III.G.2 for Use of Operator Manual Actions for Indian Point Unit No. 2," dated March 6, 2009

A0006
NRR

Dear Sir or Madam:

By letter dated March 6, 2009 (Reference 5), Entergy Nuclear Operations, Inc, (Entergy) requested exemptions from the requirements of 10 CFR 50, Appendix R in accordance with the guidance contained in NRC Regulatory Issue Summary 2006-010 (Regulatory Expectations with Appendix R Paragraph III.G.2 Operator Manual Actions), and in accordance with 10 CFR 50.12, "Specific exemptions." A revision to the exemption request was submitted by letter dated October 1, 2009 (Reference 4). Responses to the Request for Additional Information contained in letter dated January 20, 2010 (Reference 3) were provided by letter dated May 4, 2010 (Reference 2). The purpose of this letter is to provide responses to the Request for Additional Information contained in letter dated August 11, 2010 (Reference 1). Note that Reference 1 indicated that a response would be provided within 45 days – an extension until September 29, 2010 was granted based on a discussion with the NRC Senior Project Manager.

As explained in the "Summary of Required Changes to May 4, 2010 Letter" in Enclosure 1, it has been determined that the operator manual action involving the operation of 22 Auxiliary Feedwater Pump flow control valves to align Auxiliary Feedwater Flow to selected Steam Generator(s) does not require an exemption from the requirements of Appendix R, Paragraph III.G.2 for Fire Area J. This operator manual action is herein withdrawn from the Request for Exemption.

Subsequent to the submittal dated May 4, 2010, corrections to a number of pages in that submittal have been determined to be required - the revised pages are included in Enclosure 1, along with the summary table.

There are no new commitments being made in this submittal. If you have any questions or require additional information, please contact Mr. Robert W. Walpole, IPEC Licensing Manager at (914) 734-6710.

Sincerely,

JEP/gd

Attachment:

1. Response to August 11, 2010 Request for Additional Information Regarding Request for Exemption from 10 CFR 50, Appendix R, Paragraph III.G.2 for Use of Operator Manual Actions

Enclosure:

1. Required Changes to May 4, 2010 Entergy Letter NL-10-042

cc: Mr. John P. Boska, Senior Project Manager, NRC NRR DORL
Mr. Marc Depas, Acting Regional Administrator, NRC Region I
NRC Resident Inspector's Office, Indian Point Energy Center
Mr. Paul Eddy, New York State Department of Public Service
Mr. Francis J. Murray, Jr., President and CEO, NYSERDA

ATTACHMENT 1

Response to August 11, 2010 Request for Additional Information Regarding
Request for Exemption from 10 CFR 50, Appendix R, Paragraph III.G.2 for
Use of Operator Manual Actions

ENTERGY NUCLEAR OPERATIONS, INC.
Indian Point Nuclear Generating Unit No. 2
Docket No. 50-247
License No. DPR-26

Response to August 11, 2010 Request for Additional Information Regarding Request for Exemption from 10 CFR 50, Appendix R, Paragraph III.G.2 for Use of Operator Manual Actions

RAI-01.1

Provide additional information to clarify the intent of the request with regard to LCV-112C. Specifically, if the request is seeking NRC staff approval of only those OMAs required to align the RWST [Refueling Water Storage Tank] in the event of fire damage that causes LCV-112C to fail in the open position (i.e., by closing LCV-112C and opening LCV-112B), describe the fire protection features which prevent a fire from causing LCV-112C to fail in the closed position. If the request is seeking staff approval of the use of OMAs as a means of mitigating all potential failure modes of LCV-112C (including spurious closure), more detailed information is needed. Specifically, for each Fire Zone where cables associated with VCT [Volume Control Tank] supply valve LCV-112C are located, provide information which describes:

1. the specific cables that could cause LCV-112C to fail in an undesired manner for safe shutdown (e.g., spuriously close, remain open).

2. the type of cable, its construction and insulation; how the cables are routed in the area [trays or conduit]; and circuit failure modes [conductor-to-conductor shorts in a single cable or two separate cables, cable-to-cable faults etc.].

3. the specific cable failure scenarios required to cause LCV-112C to fail in an undesired manner for safe shutdown (e.g., short to ground, conductor-to-conductor [intra-cable] fault in multi-conductor cable, cable-to-cable [inter-cable] fault between two separate cables).

4. separation distance (in feet or inches) between cables having the potential to cause LCV-112C to fail in an undesired manner and any ignition sources located within the fire zone (Table RAI-06.1-1 states that cables associated with LCV-112C are located on the south end of Fire Zone 6 and the charging pump is located at the "mid-point" of the zone but does not provide a specific distance).

5. the features provided to prevent or mitigate each undesired failure mode (fire barriers, OMAs, etc.) and a technical justification to support the adequacy of those features.

6. a summary of the evaluation including critical details and assumptions performed to demonstrate that OMAs relied on to mitigate the effects of spurious closure of LCV-112C have been demonstrated to be feasible and reliable and are capable of being performed within required time frames identified in the supporting thermal-hydraulic analysis.

7. an analysis or technical justification including critical details and assumptions that demonstrates that the ability to detect a fire is sufficient to provide notification of a postulated event before damage to charging pumps occurs or provide an analysis or

technical justification to evaluate scenarios where LCV-112C spuriously closes before a fire has been reported.

RAI 01.1 RESPONSE

1. Potential fire-induced failures of normally-open VCT outlet valve LCV-112C are summarized as follows:

LCV-112C failure mode	Status of redundant charging suction valve LCV-112B	Comments
Spuriously closes	Automatically opens per design	Charging pump suction source remains unaffected.
Spuriously closes	Fails to open per design	All charging pump suction is isolated; a running positive displacement charging pump may experience damage due to loss of suction, within a relatively short time. If, however, the required/credited charging pump has been shut down proactively, no damage to the pump will occur, and up to 75 minutes are available to restore charging flow to the Reactor Coolant System (RCS), after aligning a reliable suction flow path.
Remains open, despite a command signal to close	Remains closed (normal status) or spuriously opens	If charging system letdown has been isolated and other makeup sources to the VCT have been isolated, the VCT inventory will be drawn down, and gas binding of the running charging pump (if any) may occur as hydrogen cover gas from the tank vapor space is drawn into the pump suction.

The following cables, as shown on schematic IP2—S-000255, Rev. 2, present the potential for spurious operation or maloperation of LCV-112C, in areas outside the Control Building (i.e., in III.G.2 fire areas):

CK1-YP3: Cable interfacing with LCV-112C operator, providing three-phase power as well as connections to the motor operator limit and torque switches. Fire-induced failures of this cable may render the LCV-112C operator nonfunctional, or could cause

spurious movement of the operator, in the unlikely event of a three-phase, inter-cable hot short. This cable is routed through III.G.2 Fire Area F, Fire Zones 7A, 22A, and 27A. Both Fire Zones 7A and 27A contain widely spaced ignition sources and low fixed combustible loading content, consisting primarily of electrical cables in trays, and both zones are provided with ionization smoke detection systems.

YZ1-JB5: Interlock cable that interfaces with RWST outlet valve LCV-112B. Fire-induced failures of this cable present the potential to present a spurious "close" signal to LCV-112C. This cable is routed through III.G.2 Fire Area F, Fire Zones 6 and 7A. The credible ignition source and combustible in Fire Zone 6 is the 22 charging pump motor, and within Fire Zone 7A, ignition sources are widely spaced, with a low fixed combustible content in the zone, consisting primarily of electrical cables in trays. Both zones are provided with ionization smoke detection systems.

CK1-JB5/1: control cable between Central Control Room (CCR) control panel and motor control center 26A, located in the PAB. Fire-induced failures of this cable present the potential for spurious opening or closing of LCV-112C, or blowing the control power fuse in MCC26A, Compt. 1HR, thereby rendering LCV-112C inoperable. It can be expected, however, that ground faults causing the MCC control power fuse to be blown would result in LCV-112C remaining open, on a loss of power to this normally-open motor-operated valve. This cable is routed through III.G.2 Fire Area F, Fire Zones 7A and 27A. Both of these zones contain widely spaced ignition sources and low fixed combustible loading content, consisting primarily of electrical cables in trays, and both zones are provided with ionization smoke detection systems.

2. **CK1-YP3**: Cable Mark Number VGVA04; 9/C # 12 AWG; PVC-insulated conductors, with an asbestos-glass braid outer jacket.

   YZ1-JB5: Cable Mark Number VGVA14; 7/C # 12 AWG; PVC-insulated conductors, with an asbestos-glass braid outer jacket.

   CK1-JB5/1: Cable Mark Number VGVA04; 12/C # 12 AWG; PVC-insulated conductors, with an asbestos-glass braid outer jacket.

   All three of the above cables are routed in cable trays throughout most of their route through the III.G.2 fire zones of concern, transitioning to conduit at the endpoints of the route. Consequently, these cables can be expected to be in contact with or in proximity to other energized cables in the cable tray routes, at similar operating voltages, and with similar insulation and jacket characteristics. The specific potential fire-induced failure modes and effects are discussed in the response to question (3) below.

3. Cable **CK1-JB5/1,** as shown on schematic IP2—S-000255 Rev. 2, is the control cable between the controls on CCR panel "SF" and the MCC compartment serving LCV-112C (480V MCC 26A, Compt. 1HR).

   During normal plant operation, with LCV-112C fully open, cable CK1-JB5/1 contains two normally energized (120VAC) conductors, W and G as shown on the referenced

schematic. The potential failures include conductor-to-conductor, open circuit, and conductor to ground. As this cable contains normally energized conductors, the effects of the conductor-to-conductor shorts as discussed below are considered to bound the application of inter-cable hot shorts to this cable. The range of failures of the conductors includes:

1. Short to ground on R conductor, or short between R and BL conductors; MCC compartment control power fuse blown, LCV-112C remains OPEN.

2. W and/or G conductor short to R conductor: LCV-112C CLOSE contactor is energized, moving LCV-112C toward CLOSED position. Conversely, W and/or G conductor short to W-BK conductor: LCV-112C OPEN contactor is energized, moving LCV-112C toward OPEN position.

3. All conductors fused together and/or shorted to ground – control power fuse blown as in (1). LCV-112C remains OPEN.

4. Short between W and/or G conductor to O conductor: LCV-112C remains open.

Cable **CK1-YP3** as shown on schematic IP2—S-000255, Rev. 2 is (in part) the three-phase power cable between 480V MCC 26A, Compt. 1HR and the motor operator of LCV-112C. The three 480VAC phase conductors of this cable are normally deenergized other than while LCV-112C is traveling in the open or close direction. Therefore, during normal plant operation, all three conductors are normally deenergized, with LCV-112C in the full open position. The balance of the conductors in this cable provide the 120VAC control connections between MCC26A and the valve operator limit and torque switches. At least two conductors of this cable are energized at all times; the conductor providing 120VAC line power from the MCC control power transformer, and one conductor from the limit switch reflecting the current valve position, which enables the position indicating light on the main control board in the CCR.

A properly phase-oriented three-phase hot short resulting from contact with exposed conductors (due to fire damage) of a cable in the same tray containing an energized three-phase circuit could cause the LCV-112C operator to be energized, and move in either the open or close direction. Per Regulatory Guide 1.189, Rev. 2, Section 5.4.2, the likelihood of such a circuit failure is exceedingly small, and does not require consideration except in cases of high-to-low pressure interfaces. LCV-112C is not part of a high-to-low pressure interface, and therefore the inter-cable three-phase hot short failure mode is excluded from consideration.

Credible conductor-to-conductor faults within this cable do not present the potential to energize the MCC close or open contactor, given the normal position of the valve control switch in the CCR (AUTO). Similarly, an external 120VAC hot short to any of these conductors will not present an effect different from that caused by an internal conductor-to-conductor hot short. The most significant failure mode for this cable would be a ground fault, which would result in the blowing of the control power supply fuse in the MCC

compartment, rendering the valve circuitry deenergized, and LCV-112C left in the open position and unable to close on command.

Given the above, the potential fire-induced failure modes of cable CK1-YP3 do not present a significant potential for spurious repositioning of LCV-112C.

Cable **YZ1-JB5** as shown (in part) on schematic IP2—S-000255, Rev. 2 provides the interlock circuit between the redundant charging suction valve LCV-112B limit switch and the LCV-112C auto-close circuit. A conductor-to-conductor short within the two conductors of this cable connected to the LCV-112C control circuit would have no effect on LCV-112C position, unless VCT level controller LC-112C presents a "close" signal to LCV-112C concurrently. In the absence of a valid LC-112C "close" signal, the circuit can only be completed by a concurrent fire-induced fault on control cable JB5-JJ4/1, which is routed within the Control Building (Fire Area A), and does not enter any III.G.2 fire areas. Therefore, under normal plant operating conditions, a conductor-to-conductor short on the two conductors of cable YZ1-JB5 connected to the LCV-112C control circuit will have no effect on the position of LCV-112C. An external cable-to-cable hot short on one conductor of this cable will cause the energization of the MCC close contactor and LCV-112C will spuriously close.

An open-circuit failure on either or both of these two conductors of this cable would have no effect on the position of LCV-112C. However, an open circuit on one or both conductors of this cable would disable the ability of LCV-112C to open in response to an auto-open signal. A conductor-to-ground fault will also have no effect on the position of LCV-112C.
Given that each of the above described cables contains one or more energized conductors during normal plant operation, the potential spurious actuation effects that could be caused by inter-cable hot shorts are bounded by the evaluation of the effects of internal conductor-to-conductor and conductor-to-ground faults.

4. Within III.G.2 Fire Area F, the cables associated with valve LCV-112C as discussed above are routed and separated from ignition sources as follows, presented by fire zone location within Fire Area F.

   Fire Zone 6: 22 Charging Pump Room

   Valve LCV-112B is located in the south end of the room approximately 6.9 ft from the floor. The room has a nominal 16.5 ft ceiling and the doorway at the south end of the room is open from floor to ceiling. Cable YZ1-JB5 for valve LCV-112C is routed from valve LCV-112B out the south end of the room in rigid steel conduit. The single ignition source in the room is the 22 Charging Pump motor which is located in the north end of the room separated from LCV-112B by approximately 12 ft horizontally, with no intervening combustibles between the motor and valve/conduit.

   Fire Zone 7A – PAB 80' Corridor

   Cable CK1-YP3 for valve LCV-112C is routed through the zone in cable tray located at varying heights above the floor of approximately 10 to 15 ft. The corridor has a nominal 16

ft ceiling. The cable traverses the southeast quadrant of the zone from south to north then turns west along the south side of the corridor for approximately 28 ft before turning vertically and penetrating the floor of the 98' elevation above. Ignition sources in the zone located less than 20 ft horizontally from the cable consist of six electrical cabinets. Two electrical cabinets are located directly under the cable routing, with one electrical cabinet separated by approximately 8.75 ft vertically and one electrical cabinet separated by approximately 6.1 ft vertically. The remaining four electrical cabinets are separated from the cable by approximately 8.9 ft horizontally or greater. There are no intervening combustibles between the identified ignition sources and the cable/tray.

Cable YZ1-JB5 for valve LCV-112C is routed through the zone in cable tray located approximately 14 ft above the floor. The corridor has a nominal 16 ft ceiling. The cable traverses the southeast quadrant of the zone from east to west in the cable tray and then turns north and is routed in rigid steel conduit across the corridor at approximately 15.8 ft above the floor before penetrating the south wall of the 22 Charging Pump Room (zone 6). Ignition sources in the zone located less than 20 ft horizontally from the cable consist of five electrical cabinets and a welding machine. One electrical cabinet is located under the cable separated by approximately 6.6 ft vertically. The remaining four electrical cabinets are separated from the cable by approximately 11 ft horizontally or greater. The welding machine is separated from the cable by approximately 17.1 ft horizontally. There are no intervening combustibles between the identified ignition sources and the cable/tray.

Cable CK1-JB5/1 for valve LCV-112C is routed through the zone in cable tray located approximately 14 ft above the floor. The corridor has a nominal 16 ft ceiling. The cable traverses the southeast quadrant of the zone from east to west in cable tray. Ignition sources in the zone located less than 20 ft horizontally from the cable consist of five electrical cabinets and a normally de-energized welding machine. The welding machine is separated from the cable by approximately 9.2 ft horizontally. The electrical cabinets are separated from the cable by approximately 7 ft horizontally or greater. There are no intervening combustibles between the identified ignition sources and the cable/tray.

Fire Zone 22A – VCT Valve Corridor

Valve LCV-112C is located in the north end of the room approximately 1.5 ft from the floor. The room has a nominal 14 ft ceiling with a doorway at the south end of the room, which is open from floor to ceiling. Cable CK1-YP3 is routed from LCV-112C vertically to approximately 12.9 ft above the floor and then out the south end of the zone in rigid steel conduit. The ignition sources in the room are two electrical cabinets located in the center of the room. One electrical cabinet is located directly under the conduit containing cable CK1-YP3 separated by approximately 8.2 ft vertically. The second electrical cabinet is separated from the conduit by approximately 4.5 ft horizontally, with no intervening combustibles between the ignition source and conduit.

Fire Zone 27A – PAB 98' Corridor

Cable CK1-YP3 for valve LCV-112C is routed through the zone in cable tray that traverses the zone from the south-center floor vertically to approximately 12 ft above the floor and

then across the corridor to the north-center side then turning west and traversing the north side of the corridor for approximately 25 ft where it enters rigid steel conduit and zone 22A. The corridor ceiling height is nominally 15 ft. Ignition sources in the zone located less than 20 ft horizontally from the cable consist of two 30kVA dry transformers and ten electrical cabinets. The transformers are horizontally separated from the cable as it enters the zone through the floor by approximately 9.5 ft horizontally or greater. The closest electrical cabinet is located under the east end of the cable separated by approximately 7.5 ft vertically. The remaining nine electrical cabinets are separated from the cable by approximately 5.8 ft horizontally or greater. There are no intervening combustibles between the identified ignition sources and the cable.

5. As discussed above in the response to RAI-01.1 (3), only circuits CK1-JB5/1 and YZ1-JB5 present a credible potential for spurious mispositioning of valve LCV-112C, thereby potentially challenging the suction path for a running charging pump, within Fire Area F. Within Fire Area F, these cables are routed only through Fire Zones 6, 7A, and 27A, all of which are equipped with ionization smoke detection systems, which would provide early warning of a fire condition in any of these zones. Physical and spatial separation between the zones, as well as widely spaced ignition sources and concentrations of combustibles, makes migration of a single fire between these zones an unlikely occurrence.

   To reiterate the potential fire-induced failure modes for the cables associated with valves LCV-112B and LCV-112C are routed through III.G.2 Fire Area F:

   - CK1-JB5/1: Control cable; failure can cause LCV-112C to spuriously CLOSE or fail as is (OPEN)

   - YZ1-JB5: Interlock cable with redundant charging suction valve LCV-112B; an inter-cable hot short to this cable may cause LCV-112C to close.

   The features that serve to prevent or mitigate the above described circuit failure modes – that could cause valve LCV-112C to fail in an undesired (closed) position are as follows:

   - Minimal fire hazards and fixed combustibles in each of the fire zones along the cable routing paths

   - Minimal and low-significance ignition sources located within 20 feet of the cable routing paths

   - Ionization smoke detection systems are installed in the fire zones traversed by the subject cables

   A postulated fire in Fire Area F, whether detected and suppressed prior to the occurrence of fire damage to these specific cables, would present the potential for at most incurring prompt damage to one charging pump, as during normal plant operation, only one of three charging pumps is running at any given time. For that damage scenario to occur, valve LCV-112C must be spuriously commanded closed by fire-induced circuit failures, while

redundant, normally-closed charging suction valve LCV-112B simultaneously must fail to automatically open, also due to fire-induced circuit failures.

For damage to be incurred to additional charging pumps as the result of loss of all pump suction capability, additional charging pumps would need to be spuriously started by fire-induced cable faults (Multiple Spurious Operation scenario), to potentially result in damage to more than the single charging pump running at the onset of the scenario.

To provide an additional layer of defense in depth, post-fire safe-shutdown procedure 2-ONOP-FP-001 has been revised to include a CCR preemptive action to secure 21 Charging Pump, which is the pump credited in the event of a Fire Area F fire, to ensure that it is not impacted by a potential loss-of-suction event caused by spurious actuation of LCV-112C as discussed herein. The pump is secured by placing the CCR control switch in OFF and pullout. This action will stop 21 Charging Pump, to protect against any damage that could be caused by a spontaneous loss of all suction paths. Despite placing 21 Charging Pump in OFF/pullout, certain conductors within the 21 Charging Pump control cables routed in Fire Area F will remain energized with 125VDC. Consequently, an internal conductor-to-conductor fault on the 21 Charging Pump control cable(s) could result in a spurious start of 21 Charging Pump, as the conductor-to-conductor fault could cause the 21 Charging Pump circuit breaker closing coil to be energized. However, this spurious actuation would require additional independent cable failures/faults beyond those necessary to cause the spurious closure of LCV-112C.

Later in the Fire Area F recovery, and consistent with the post-fire safe-shutdown timeline, 21 Charging Pump would be placed into service, in accordance with existing procedures, once a reliable suction source is aligned to the pump.

6. Fire-induced circuit failures may cause the spurious closure of LCV-112C and also the failure of redundant charging pump suction valve LCV-112B to automatically open in response to the LCV-112C closure and a VCT level control signal. The credited OMA to manually establish a reliable charging pump suction path by opening manual bypass valve 288 is focused on ensuring that a charging pump can be restored to operation within the nominal 75-minute limit prescribed by the thermal-hydraulic analysis that supports the IP2 post-fire safe-shutdown timeline. The associated OMA has been benchmarked by timed field exercises, which consistently demonstrate that the OMA can be reliably completed within the required time limit. It is this OMA that is the focus of the request for exemption for actions associated with LCV-112C in response to a Fire Area F fire, as enumerated in the Entergy submittals dated March 6, 2009, October 1, 2009, and May 4, 2010.

   However, in the unlikely event of early and undetected closure of LCV-112C during a fire scenario, the single positive-displacement charging pump in operation could be damaged as the result of loss of all suction sources, before any credible operator intervention could be performed. During plant power operation, only one charging pump is selected for operation at any given time. The spontaneous loss of all charging pump suction sources is considered to be of low likelihood, based on the minimal hazards of the area, separation from hazards as discussed herein, and the installed fire detection capability. However, to provide additional assurance of sustained function of at least one charging pump to support

the post-fire shutdown model, a preemptive step has been incorporated into procedure 2-ONOP-FP-001 to provide guidance for shutdown of the appropriate charging pump, in the event of fire detected in Fire Area F. This CCR action does not require any supporting operator field actions, and therefore is not classified as an OMA in the context of SECY 08-0092.

The identified OMA to locally establish an alternate charging pump suction path in response to spurious closure of LCV-112C has been demonstrated to be a feasible manual action, capable of effective and consistent performance within the time available to restore charging (RCS makeup) and comply with Appendix R performance goals. The added aspect of potential LCV-112C spurious closure, i.e., that of a dynamic scenario in which LCV-112C closure occurs while a charging pump is in operation, has been addressed through defense-in-depth measures:

- Minimal hazards and ignition sources in Fire Area F capable of creating a fire condition sufficient to induce the necessary cable-circuit failures to cause the spurious closure of LCV-112C

- Separation between hazards and ignition sources and the cable routes associated with LCV-112C in Fire Area F

- Smoke detection systems in or adjacent to all zones in Fire Area F containing the subject LCV-112C cables ensures rapid detection, supporting prompt manual suppression and extinguishment, limiting the scope and severity of damage to safe-shutdown related SSCs (structures, systems, and components). Smoke detection systems are installed in Fire Zones 6, 7A, and 27A. Fire Zone 22A is open at the entryway to adjacent Fire Zone 27A, which is equipped with smoke detection. There is reasonable assurance that smoke generated by a fire occurring in Zone 27A would be detected by the adjacent zone smoke detectors.

- Preemptive proceduralized CCR action (which is therefore not classified as an OMA in the context of SECY 08-0093) to secure the credited charging pump early in the scenario, to preclude damage in the event that LCV-112C does spuriously close, and normally-closed redundant suction valve LCV-112B concurrently fails to automatically open.

7. In three of the four fire zones (Fire Zones 6, 7A, and 27A) within Fire Area F containing cables associated with VCT outlet (and charging pump suction) valve LCV-112C, ionization smoke detection is installed. In the case of Fire Zone 22A, the entryway is open to adjacent Fire Zone 27A, which is equipped with a smoke detection system. These features provide reasonable assurance of early detection of any fire of sufficient magnitude to challenge the electrical integrity of any of the subject cables.

   The cables, as discussed herein, contain thermoplastic insulated conductors, with an outer asbestos-glass braid jacket. With minimal credible ignition sources and concentrations of fixed combustibles within 20 ft of the cable routing paths, the credibility of an emergent fire event of sufficient heat release rate and geometry to challenge the nominal 400°F cable

damage limit for thermoplastic conductors – without being detected and annunciated by the installed smoke detectors – is exceedingly low.

The ionization smoke detection systems are installed consistent with NFPA 72E selection and spacing guidance, and routine surveillance testing provides assurance of smoke detection functionality. Consequently, there is reasonable assurance that the smoke detection system will detect and annunciate developing fire conditions in a responsive and effective manner, allowing sufficient time for fire brigade response and fire extinguishment before any significant damage is incurred.

In addition, Table 3 of the October 1, 2009, request states that the basis for aligning the charging pump suction to the RWST is to maintain pressurizer level within the indicating range of the level instrumentation. As discussed in the May 4, 2010 letter, fire damage is assumed to occur at the onset of fire but the requested OMAs will not be initiated until operating abnormalities or failures occur.

The analyzed delay in restoration of charging makeup flow to the RCS (of up to approximately 75 minutes as previously stated) is based on the static condition of loss of all charging capability at the start of the fire event. The calculated value of 75 minutes therefore reflects the worst-case time period available before RCS inventory can be expected to decrease to a level that would constitute failure to meet Appendix R performance goals.

The calculated allowable time of approximately 75 minutes to restore charging makeup flow to the RCS, based on prompt loss of charging capability (e.g., loss of power to charging pump, or receipt of spurious stop signal) is contrasted with the more dynamic failure scenario in which the credited charging pump remains in operation, but may be subjected to a spontaneous loss of suction due to spurious closure of redundant suction valve LCV-112C and concurrent failure of LCV-112B to open in accordance with its design function.

During the implementation of post-fire safe-shutdown procedural measures, charging pump suction is aligned to the RWST through a manual bypass valve, before placing the selected charging pump in service. The thermal-hydraulic analysis for the IP2 Appendix R scenario has determined that RCS inventory will be preserved – to the point of remaining within the indicating range of the wide-range pressurizer channel – for approximately 75 minutes from the start of the event. This assumes that at the outset of the event, the reactor is tripped and charging system letdown is isolated a relatively short time thereafter, via actions taken in the CCR. It should be noted that the bounding scenario addressed by the referenced thermal-hydraulic analysis is that for an alternate shutdown event, which anticipates a spurious or manual reactor trip early in the scenario, and the securing of letdown to preserve RCS inventory, pending restoration of a charging pump to service.

RAI-01.2

If OMAs are relied on to mitigate the effects of a spurious closure of LCV-112C, provide an analysis or technical justification that demonstrates the ability to maintain pressurizer level within the indicating range, assuming that LCV-112C has closed at the onset of fire.

RAI 01.2 RESPONSE

Thermal-hydraulic analysis IP-CALC-05-01034 Revision 2 (Appendix R Cooldown and Benchmark and Sensitivity Analysis Using RETRAN-3D) models the post-fire natural circulation shutdown/cooldown scenario. No credit is taken in the model for sustained flow from the VCT, and therefore the effects on pressurizer level of closure of LCV-112C at the outset of the fire event is bounded by the existing model. With the loss of all charging makeup to the RCS, combined with isolation of letdown early in the scenario, the thermal-hydraulic model establishes that pressurizer level will be maintained within the indicating range of the wide-range level channel for approximately 75 minutes. To the extent that charging makeup is restored to the RCS within this time frame, the Appendix R performance goals will be met. The feasibility of performing the required OMA to align an alternate suction source to the charging pump has been verified through timed walkdowns, and can consistently be accomplished within the allotted 75-minute window, as documented in the Entergy letters dated October 1, 2009 and May 4, 2010.

It is noted that loss of charging makeup can be the result of a spurious stop signal or loss of power to the selected charging pump, as well as spurious closure of the charging pump suction path. As noted in the response to RAI-01.1 (5), a preemptive CCR action has been added to the post-fire shutdown procedure (2-ONOP-FP-001) to secure the charging pump credited for the Fire Area F scenario, to protect it against potential damage caused by a spurious loss of suction failure.

However, in the III.G.2 fire zones of concern, i.e., those containing cables associated with valve LCV-112C, fire scenarios capable of causing cable damage sufficient to cause the spurious operation of this valve are considered to be of minimal credibility, and the installed fire detection systems in or immediately adjacent to zones containing LCV-112C cables in Fire Area F provides reasonable assurance of prompt detection of any significant fire condition. Prompt response by the fire brigade provides assurance of control and extinguishment of any credible fire in the area, sharply limiting the zone of influence and potential damage to safe-shutdown related SSCs.

RAI-02.1

Wherever separation distances are provided, indicate specific quantifiable data, (e.g., inches or feet), so the actual separation distances are readily discernable.

RAI-02.1 RESPONSE

Field walkdowns were performed to obtain measurements of the separation distances requested. The focus of these walkdowns was to identify the horizontal, and where applicable, vertical separation distances between ignition sources and the cable trays or conduits containing the cable(s) of concern or the component of concern, where it is located within the fire zone of concern (those zones for which OMAs are required to be implemented). The focus on dimensioning distances from target cables/components to ignition sources was placed predominantly on those ignition sources located 20 ft or less from the target cables/raceways or components, based on clarification received in a telecon between NRR Staff and Entergy staff. As such, the separation distances presented below (which are formulated for each fire zone containing cables and/or components of concern) do not reflect any ignition sources or hazards located greater than 20 ft from the targets of concern.

The information presented below is intended to be used in conjunction with the tabulation of safe-shutdown features presented in Table RAI-06.1-1 of Entergy's May 4, 2010 letter. Several additional clarifications are provided, to help coordinate the review of the material presented in Entergy's May 4, 2010 letter and the plant physical arrangement information presented below.

1. Where reference is made to cables or OMAs associated with "LCV-112C" or "LCV-112B/C," these should be treated interchangeably, since the cable analyses and routing include consideration of the interlock circuits between these valves, and the OMA associated with these valves is the local opening of RWST outlet bypass manual valve 288.

2. Where reference is made to cables or OMAs associated with "HCV-142," "valve 227," or "HCV-142/227," these should be treated interchangeably, since the cable analysis and routing performed by Entergy includes consideration of the cables associated with both valves, where applicable, and focuses on the OMA, which is the local manual opening of HCV-142 bypass valve 227. HCV-142 cables do not route through any of the III.G.2 fire areas of concern, but instrument air is postulated to be lost as the result of damage to instrument air lines or instrument air loads that may spuriously operate and vent/deplete the instrument air supply, causing HCV-142 to spuriously close. Valve 227 is a motor-operated valve, which is locally opened per the OMA to restore the necessary flowpath.

3. Note also that while the Entergy letter dated May 4, 2010 included reference to "cable runs" as ignition sources (referring to cables in trays), no dimensional data is presented for separation of the target cables from "cable run" ignition sources, as these cable runs are generally the very trays or tray stacks in which the target cables are routed.

   The dimensional data provided below focuses principally on the separation of ignition sources from the target cables and/or components associated with the respective OMAs. With respect to the separation between the target cables and/or components and significant combustibles, except as noted below, substantial quantities of combustible materials are generally not located within 20 ft of the target cables/components. A notable exception is "cable runs" as described above as in most fire zones, the dominant combustible is electrical cable insulation in cable trays. The

target cables are, of course, located in cable trays surrounded by cables with flame-retardant insulation, which presents a minimal hazard of self-ignition or sustained combustion capable of challenging the target cables.

Fire Area C / Fire Zone 23 – AFW Pump Room
Power supply cables for 21 and 23 AFW Pumps are located in this fire zone. The cables are routed in rigid steel conduit. The conduit for 23 AFW Pump is wrapped with an Electrical Raceway Fire Barrier System (ERFBS) rated for 30 minutes. The 23 AFW Pump is located in the north end of the room; 21 AFW Pump is located in the north-center of the room south of 23 AFW Pump. A radiant energy shield is installed between the 21 AFW and 23 AFW Pumps. The conduits for 21 AFW Pump motor rise vertically from the motor to approximately 8.9 ft from the floor and then traverse approximately 55 ft to the south end of the zone. The conduit for the 23 AFW Pump is routed underground entering the zone beneath the motor termination box where it is wrapped in an ERFBS rated for 30 minutes. The ceiling of the AFW pump room is nominally 14 ft.

Cables for feedwater regulating valves FCV-405A/B/C/D are located in this fire zone. The FCV-405 valves are located in the south end of the room. Cable JB1-LV1 for valve FCV-405A, JB1-LV2 for valve FCV-405B, JB1-LV3 for valve FCV-405C, and JB1-LV4 for FCV-405D rise vertically to a tray approximately 10.8 ft above the floor and then exit through the ceiling to the elevation above. The ignition sources in the zone located less than 20 horizontally from the cables are a transfer switch (alternate power supply for 23 AFW Pump) and two electrical cabinets in the south end of the room. The cables are separated from the transfer switch by approximately 3.3 ft horizontally or greater and from the electrical cabinets by approximately 6 ft horizontally or greater.

Cables for feedwater regulating valves FCV-406A/B/C/D are located in this fire zone. The FCV-406 valves are located in the northeast quadrant of the room. Cables ELZ27-YN6 and JF5-YN6 for valve FCV-406A, ELZ28-YN8 and JF5-YN8 for valve FCV-406B, ELZ29-YN7 and JF9-YN7 for valve FCV-406C, and ELZ30-YN5 and JF9-YN5 for valve FCV-406D rise vertically to approximately 10.8 ft above the floor and traverse west approximately 12 ft across the room to a cable tray. The cables then run approximately 55 ft to the south end of the room where they exit through the ceiling to the elevation above. The ignition sources in the zone less than 20 horizontally from the cables are the two AFW pump motors in the north end of the room, and a transfer switch (alternate power supply for 23 AFW Pump) and two electrical cabinets in the south end of the room. The cables for FCV-406A/B/C/D are separated from the 21 AFW and 23 AFW Pump motors by approximately 1 ft horizontally or greater and 7.4 ft vertically. The cables are separated from the transfer switch by approximately 3.5 ft horizontally and from the electrical cabinets by approximately 7.1 ft horizontally or greater.

Cables LL8-JF5 for FCV-406B and LL9-JF9 for FCV-406C are located in this fire zone. The cables rise vertically to approximately 10.8 ft above the floor and traverse west approximately 8 ft across the room to a cable tray. The cables are then routed approximately 52 ft to the south end of the room where they exit through the ceiling to the elevation above. The ignition sources in the zone located less than 20 ft horizontally from the cables are the two AFW pump motors in the north end of the room, and a transfer switch (alternate power circuit for 23 AFW Pump) and two electrical cabinets in the south end of the room. Cable LL8-JF5 for FCV-406B is separated

from the 21 AFW Pump motor approximately 7.4 ft horizontally and from 23 AFW Pump motor by greater than 20 ft horizontally. Cable LL8-JF5 for FCV-406B is separated from the transfer switch approximately 3.5 ft horizontally and from the electrical cabinets by approximately 7.1 ft or greater. Cable LL9-JF9 for FCV-406C is separated from the 21 AFW Pump motor by approximately 2.0 ft horizontally and from the 23 AFW Pump motor by approximately 7.4 ft horizontally. The cables separated from the transfer switch by approximately 3.5 ft horizontally and from the electrical cabinets by approximately 7.1 ft or greater.

Cables PU9-JG2 for FCV-406A, PU9-JH1 for FCV-406B, PU9-JF2 for FCV-406C, and PU9-JF9 for FCV-406C are located in this fire zone. The cables rise vertically from Instrument Rack #5 and exit through the ceiling to the elevation above. The ignition sources in the zone located less than 20 ft horizontally from the cables are a transfer switch (alternate power circuit for 23 AFW Pump) and two electrical cabinets in the south end of the room. The cables are separated from the transfer switch by approximately 17 ft horizontally and from the electrical cabinets by approximately 0.7 ft or greater and approximately 0.0ft vertically.

Cables JB1-PT1/3, PT1-RH7, and PT1-YL4 for valve PCV-1139 are routed through this zone. The cables originate in the southeast quadrant of the zone rising vertically to approximately 12 feet above the floor and traverse west approximately 12 ft across the room to a cable tray. The cables then run approximately 35 ft to the south end of the room where cables PT1-RH7 and PT1-YL4 terminate at the AFW Pump control panel and cable JB1-PT1/3 exits the zone through the ceiling at approximately 14 ft above the floor to the elevation above. The ignition sources in the zone located less than 20 ft horizontally from the cables are one AFW pump motor in the north end of the room, and a transfer switch (alternate power circuit for 23 AFW Pump) and two electrical cabinets in the south end of the room. The cables are separated from the 21 AFW Pump motors by approximately 12.2 ft horizontally or greater. The cables are separated from the electrical cabinets by approximately 6.9 ft horizontally or greater. The cables are separated from the transfer switch by approximately 1.0 ft horizontally 0.0 ft vertically.

Cables EWZ64-ENX2, JB1-YP1, S95-EWZ64, S95-S92, and S95-YP1 for valve PCV-1310B are routed through this zone. Cables S95-YP1 and JB1-YP1 originate in the northeast quadrant of the zone at approximately 4 feet above the floor and are routed west approximately 12 ft across the room to a cable tray. Cable JB1-YP1 traverses the zone to the south end for approximately 55 ft and exits the zone through the ceiling at approximately 14 ft above the floor to the elevation above. Cable S95-YP1 traverses the zone for approximately 30 ft south to junction box S95. From junction box S95 cable S95-S92 traverses east across the zone and exits the through the ceiling at approximately 14 ft above the floor to the elevation above. Also from junction box S95 cable S95-EWZ64 traverses approximately 6 ft to junction box EWZ64. From junction box EWZ64 cable EWZ64-ENX2 terminates at instrument ENX2. The ignition sources in the zone located less than 20 ft horizontally from the cables are two AFW pump motors in the north end of the room, and a transfer switch (alternate power circuit for 23 AFW Pump) and two electrical cabinets in the south end of the room. The 21 AFW Pump motor is located under the cables separated by approximately 7.6 ft vertically. The 23 AFW Pump motor is separated from the cables by approximately 1.0 ft horizontally and 7.6 ft vertically. The cables are separated from the electrical cabinets by approximately 6.9 ft horizontally or greater. The cables are separated from the transfer switch by approximately 3.5 ft horizontally and 4.3 ft vertically.

Cables EWZ63-ENX1, JB1-YN9, S94-EWZ63, S94-S93, and S94-YN9 for valve PCV-1310A are routed through this zone. The cable S94-YN9 and JB1-YN9 originate in the northeast quadrant of the zone at approximately 12 feet above the floor and are routed west approximately 12 ft across the room to a cable tray. Cable JB1-YN9 traverses the zone to the south end for approximately 55 ft and exits the zone through the ceiling at approximately 14 ft above the floor to the elevation above. Cable S94-YN9 traverses the zone for approximately 45 ft south to junction box S94. From junction box S94 cable S94-S93 is routed east across the zone and exits the through the ceiling at approximately 14 ft above the floor to the elevation above. Also from junction box S94 cable S94-EWZ63 traverses approximately 6 ft to junction box EWZ63. From junction box EWZ63 cable EWZ63-ENX1 terminates at instrument ENX1. The ignition sources in the zone located less than 20 ft horizontally from the cables are two AFW pump motors in the north end of the room, and a transfer switch (alternate power circuit for 23 AFW Pump) and two electrical cabinets in the south end of the room. The 21 AFW Pump motor is separated from the cables by approximately 2.0 ft horizontally and 7.6 ft vertically or greater. The 23 AFW Pump motor is separated from the cables by approximately 1.0 ft horizontally 7.6 ft vertically or greater. The cables are separated from the electrical cabinets by approximately 6.2 ft horizontally or greater. The cables are separated from the transfer switch by approximately 3.5 ft horizontally and 4.3 ft vertically.

Cables ELA73-YL4, ELA74-YL4, EVA67-YL4, EVA68-YL4, EVA69-YL4, EVA70-YL4, and EVA77-YL4 associated with 22 AFW Pump are routed through this zone. They originate in the southeast quadrant of the zone and are routed approximately 6 ft to junction box YL4. The ignition sources in the zone located less than 20 ft horizontally from the cables are two electrical cabinets in the south end of the room. The cables are separated from the electrical cabinets by approximately 6.5 ft horizontally or greater.

Fire Area F / Fire Zone 6 – 22 Charging Pump Room

Cable YZ1-JB5 for valve LCV-112C is routed in the zone in rigid steel conduit. The cable originates at LCV-112B located in the south end of the room approximately 6.9 ft from the floor rising vertically to the ceiling and then traversing the zone from north to south for approximately 9 ft exiting the south end of the zone. The room has a nominal 16.5 ft ceiling and the doorway at the south end of the room is open from floor to ceiling. The single ignition source in the room is the 22 Charging Pump motor which is located in the north end of the room separated from the cable by approximately 12 ft horizontally with no intervening combustibles between the motor and cable.

Cable PL2-M42, which is associated with Instrument Buses 23 and 23A, is routed through the zone in rigid steel conduit. The conduit enters the zone from the outside corridor (zone 7A) at the ceiling approximately 16 ft above the floor and terminates in the zone at the 22 Charging Pump. The single ignition source in the zone is the 22 Charging Pump motor which is located in the north end of the room separated from the cable by approximately 6.8 ft horizontally with no intervening combustibles between the motor and cables.

Cable PL2-M41, which is associated with Instrument Buses 23 and 23A, is routed through the zone in rigid steel conduit. The conduit enters the zone from the outside corridor (zone 7A) at the ceiling approximately 16 ft above the floor. Cable PL2-M41 is routed from east to west

through zone 6 at the doorway, then exiting into the adjacent zone. The single ignition source in the room is the 22 Charging Pump motor which is located in the north end of the room separated from the cable by approximately 15.6 ft horizontally with no intervening combustibles between the motor and cables.

Fire Area F / Fire Zone 7A – PAB 80' Corridor
Cable CK1-YP3 for valve LCV-112C is routed through the zone in cable tray located at varying heights above the floor of approximately 10 to 15 ft. The corridor has a nominal 16 ft ceiling. The cable traverses the southeast quadrant of the zone from south to north then turns west along the south side of the corridor for approximately 28 ft before turning vertically and penetrating the floor of elevation 98' above. Ignition sources in the zone located less than 20 ft horizontally from the cable consist of six electrical cabinets. Two electrical cabinets are located directly under the cable routing, with one electrical cabinet separated by approximately 8.75 ft vertically and one electrical cabinet separated by approximately 6.1 ft vertically. The remaining four electrical cabinets are separated from the cable by approximately 8 ft horizontally or greater. There are no intervening combustibles between the identified ignition sources and the cable.

Cable YZ1-JB5 for valve LCV-112C is routed through the zone in cable tray located approximately 14 ft above the floor. The corridor has a nominal 16 ft ceiling. The cable traverses the southeast quadrant of the zone from east to west in the cable tray and then turns north and is routed in rigid steel conduit across the corridor at approximately 15.8 ft above the floor before penetrating the south wall of the 22 Charging Pump Room (zone 6). Ignition sources in the zone located less than 20 ft horizontally from the cable consist of five electrical cabinets and a welding machine. One electrical cabinet is located under the cable separated by approximately 6.6 ft vertically. The remaining four electrical cabinets are separated from the cable by approximately 11 ft horizontally or greater. The welding machine is separated from the cable by approximately 17.1 ft horizontally. There are no intervening combustibles between the identified ignition sources and the cable.

Cable CK1-JB5/1 for valve LCV-112C is routed through the zone in cable tray located approximately 14 ft above the floor. The corridor has a nominal 16 ft ceiling. The cable traverses the southeast quadrant of the zone from east to west in cable tray. Ignition sources in the zone located less than 20 ft horizontally from the cable consist of five electrical cabinets and a welding machine. The welding machine is separated from the cable by approximately 9.2 ft horizontally. The electrical cabinets are separated from the cable by approximately 7 ft horizontally or greater. There are no intervening combustibles between the identified ignition sources and the cable.

Cables AG5-PL2 and PL2-JA2/1, which are associated with Instrument Buses 23 and 23A, are routed from the charging pump control panel through this zone. The cable rises from the control panel in rigid steel conduit to a cable tray located approximately 14 ft above the floor. The corridor has a nominal 16 ft ceiling. The cable traverses the southeast quadrant of the zone from north to south in conduit and cable tray for approximately 25 ft. Ignition sources in the zone located less than 20 ft horizontally from the cable consist of four electrical cabinets. Two electrical cabinets are located under the cable routing separated by approximately 7.7 ft vertically or greater. The remaining 2 electrical cabinets are separated from the cable by

approximately 1.8 horizontally and 7.4 ft vertically or greater. There are no intervening combustibles between the identified ignition sources and the cable.

Cables AI5-PL2, PL2-JA2/2, AI4-PT2, and PT2-JA2, which are associated with Instrument Buses 23 and 23A, are routed from the charging pump control panel through this zone. The cables rise from the control panel in rigid steel conduit to a cable tray located approximately 14 ft above the floor. The corridor has a nominal 16 ft ceiling. The cables traverse the southeast quadrant of the zone from north to south in conduit and cable tray for approximately 17 ft. Ignition sources in the zone located less than 20 ft horizontally from the cable consist of four electrical cabinets. Two electrical cabinets are located directly under the cable separated by approximately 6.7 ft vertically. The remaining two electrical cabinets are separated from the cable by approximately 1.8 ft horizontally and 7.4 ft vertically or greater. There are no intervening combustibles between the identified ignition sources and the cable.

Cables PL2-M41 and PL2-M42, which are associated with Instrument Buses 23 and 23A, are routed through this zone in rigid steel conduit. The cables rise from the charging pump control panel to the ceiling at approximately 16 ft above the floor. The conduit then traverses the area from east to west for approximately 16 ft turning west and entering zone 6 (22 Charging Pump Room). Ignition sources in the zone located less than 20 ft horizontally from the cables consist of four electrical cabinets. The electrical cabinets are separated from the cables by approximately 3.5 ft horizontally or greater. There are no intervening combustibles between the identified ignition sources and the cable.

Fire Area F / Fire Zone 22A – VCT Valve Corridor
Cable CK1-YP3 for valve LCV-112C is routed through this zone. LCV-112C is located in the north end of the room approximately 1.5 ft from the floor. The room has a nominal 14 ft ceiling with a doorway at the south end of the room open above the door to the ceiling. The cable rises vertically to approximately 12.9 ft above the floor and then routes for approximately 23 ft out the south end of the zone in rigid steel conduit. The ignition sources in the zone are two electrical cabinets located in the center of the zone. One electrical cabinet is located directly under the cable separated by approximately 8.2 ft vertically. The second electrical cabinet is separated by approximately 4.5 ft horizontally. There are no intervening combustibles between the identified ignition sources and the cable.

Fire Area F / Fire Zone 27A – PAB 98' Corridor
Cable ECD3-EXF6/2 for valve MOV-227 is routed through the zone in cable tray that traverses the area approximately 16 ft from the southeast-center to northeast-center and then turns west traversing the north side of the corridor to the far west end of the zone for approximately 69 ft. The cable traverses through the zone with a varying distance from the floor of approximately 9 to12 ft. The corridor ceiling is nominally 15 ft. Ignition sources in the zone located less than 20 ft horizontally from the cable consist of two dry transformers and eleven electrical cabinets. One transformer (the closest) is located directly under the east end of the cable/tray separated from the cable by approximately 9 ft vertically. The second transformer is separated from the cable by approximately 10.5 ft horizontally. The closest electrical cabinet is located directly under the east end of the cable separated by approximately 4 ft vertically. A second electrical cabinet is located under the west end of the cable separated by approximately 1 ft horizontally and 6.7 ft vertically. The remaining nine electrical cabinets are separated from the cable by

approximately 5.8 ft horizontally or greater. There are no intervening combustibles between the identified ignition sources and the cable.

Cable CK1-YP3 for valve LCV-112C is routed through the zone in cable tray that traverses the zone from the south-center floor vertically to approximately 12 ft above the floor and then across the corridor for approximately 16 ft to the north-center side then turning west and traversing the north side of the corridor for approximately 25 ft where it enters rigid steel conduit and zone 22A. The corridor ceiling is nominally 15 ft. Ignition sources in the zone located less than 20 ft horizontally from the cable consist of one dry transformer and ten electrical cabinets. The transformer is horizontally separated from the cable as it enters the zone through the floor by approximately 9.5 ft horizontally. The closest electrical cabinet is located under the east end of the cable separated by approximately 7.5 ft vertically. The remaining nine electrical cabinets are separated from the cable by approximately 5.8 ft horizontally or greater. There are no intervening combustibles between the identified ignition sources and the cable.

Cable CK1-JB5/1 for valve LCV-112C originates in this zone in MCC 26A and is immediately routed from the bottom of the MCC through the floor to the zone below. The zone ceiling is nominally 15 ft. Ignition sources in the zone located less than 20 ft horizontally from the cable consist of a lighting bus and an MCC. The lighting bus is separated from the cable by approximately 3.4 ft horizontally. The MCC is separated from the cable by approximately 9.6 ft horizontally. There are no intervening combustibles between the identified ignition sources and the cable.

Fire Area F / Fire Zone 33A – PAB 98' MCC Room
Cable ECD3-EXF6/2 for valve MOV-227 is routed through the zone in cable tray located approximately 11 ft above the floor. The room does not have a ceiling and is open to the nominal 15 ft ceiling of zone 27A. The cable originates in MCC 26BB and rises vertically into a tray approximately 11 ft above the floor. The cable traverses the south side of the zone from west to east for approximately 20 ft then turns north traversing the zone from south to north for approximately 16 ft and exiting the north end of the zone. Ignition sources in the zone located less than 20 ft horizontally from the cable consist of two 45KVA dry transformers, an MCC, a lighting power cabinet, and five electrical cabinets. One transformer is separated from the cable by approximately 1.5 ft horizontally and 7.5 ft vertically, and one transformer is separated from the cable by approximately 0.8 ft horizontally and 7.7 ft vertically. The MCC is separated from the cable by 3.2 ft horizontally. The lighting power cabinet is separated from the cable by approximately 1.6 ft horizontally and 2.8 ft vertically. The closest electrical cabinet is separated from the cable by approximately 3.3 ft horizontally and 4.6 ft vertically. The remaining four electrical cabinets are separated from the cable by approximately 9.8 ft horizontally or greater. There are no intervening combustibles between the identified ignition sources and the cable.

Fire Area F / Fire Zone 59A – Fan House
Cable ECD3-EXF6/2 for valve MOV-227 is routed through the zone in rigid steel conduit located approximately 24 ft above the floor with a nominal 28 ft ceiling. The cable enters the north side of the zone traversing straight across and exiting the south side of the zone. Ignition sources in the zone located less than 20 ft horizontally from the cable consist of four electrical cabinets. One electrical cabinet is located under the cable separated by approximately 5.3 ft vertically. The remaining three electrical cabinets are separated from the cable by approximately 7 ft

horizontally or greater. There are no intervening combustibles between the identified ignition sources and the cable.

Fire Area H – Zones 70A, 71A, 72A, 75A, 77A, 84A, 85A, and 87A – Vapor Containment
Cable YI5-H50 for valve 204B enters zone 75A (Vapor Containment Annulus) through an electrical penetration and traverses clockwise to the west around the annulus in a cable tray and enters zone 71A inside the crane wall at approximately elevation 56 ft. In zone 71A the cable rises to approximately elevation 69 ft near 21 Reactor Coolant Pump (RCP) and is routed in rigid steel conduit horizontally until turning down to approximately elevation 46 ft and terminating at valve 204B. Ignition source in the zone located less than 20 ft horizontally from the cable consists of 21 RCP motor located approximately 7 ft above the cable separated by approximately 7 ft horizontally.

Cable YI7-H55 for valve 204A enters zone 75A through an electrical penetration and traverses clockwise around the annulus to the west in a cable tray and enters zone 71A inside the crane wall at approximately elevation 56 ft. In zone 71A the cable rises to approximately elevation 86 ft near 21 RCP and is then routed horizontally until turning down in rigid steel conduit to approximately elevation 46 ft and terminating at valve 204A. Ignition sources in the zone located less than 20 ft horizontally from the cable consist of 21 RCP motor separated from the cable by approximately 6 ft horizontally and 22 RCP motor separated from the cable by approximately 10 ft horizontally. RCP lube oil is eliminated as a fire hazard by the oil collection systems for each RCP.

Cables and components associated with redundant trains of normal instrumentation required to support post-fire safe shutdown operation are located in these zones and they are not separated at all points by 20 ft free of intervening combustibles. These zones also contain alternate safe-shutdown system (ASSS) instrument channels, and their associated cables and pneumatics (discussed below), for the same parameters, which in certain zones are protected by radiant energy shields per Appendix R Paragraph III.G.2.f but in other zones are separated by less than 20 ft from their counterpart "normal" safe-shutdown instrument transmitters and/or cables. As such, in the event of a fire within Fire Area H that may disable the redundant trains of normal SSD instrumentation, an OMA may be necessary to deploy the alternate safe-shutdown instruments, for a fire area that is otherwise considered to be a III.G.2 area.

The ASSS instrument channels and local displays are credited features of the IP2 Appendix R compliance basis, under Paragraph III.G.3, for several fire areas outside reactor containment. For fire events occurring within reactor containment, the radiant energy shield protection provided for the electronic ASSS instrument channels, and the diversity of function (pneumatic vs. electronic) provided by the pneumatic ASSS instrument channels affords the functionality of a "third train" of key primary and secondary system instrumentation. Inasmuch as the ASSS instrument train is not independent of the area of concern (Fire Area H), it is Entergy's belief that it is appropriate to consider the use of the ASSS instrument channels, for a Fire Area H fire only, to be subject to the constraints of Appendix R Paragraph III.G.2, and hence, this request for exemption seeks approval for the use of the subject OMA to place the alternate safe-shutdown instrument channels in service.

Cables for normal safe-shutdown instruments located in containment enter the containment building through electrical penetrations located in Fire Zone 75A, on Elevation 46'. The cables then route though the containment outer annulus area, which is the space between the outer containment wall and the inner bioshield wall (also known as the "crane" wall, in that it provides the support for the containment polar crane). The instrument cables ultimately terminate at discrete local process transducers, or at instrument racks, located on El. 68', in Fire Zone 87A. Located within Fire Area H, the normal instrument channels credited in support of the post-fire safe-shutdown model include the following:

Steam generator wide range level: LT-417D, LT-427D, LT-437D, LT-447D
Pressurizer level: LT-459, LT-460, LT-461, LT-462
Source-range neutron monitoring: N-31, N-32
RCS loop hot and cold leg temperatures: TE-411A/1, TE-413, TE-422A/1, TE-423, TE-431A/1, TE-433, TE-440A/1, TE-443

Combustible loading in the outer annulus area consists of predominantly electrical cables in trays. Ignition sources consist of the cable trays themselves, and several valve motor operators with actuators rated at ≥5 HP. The outer annulus area at El. 46' includes Fire Zones 75A, 72A, 76A, and 77A.

Some of the safe-shutdown instrument cables are routed to instrument/rack locations in the outer annulus area on El. 68', which includes Fire Zones 84A, 85A , and 87A. Principal instrument rack locations for primary and secondary system parameters are located on El. 68', in Fire Zone 87A and adjacent Fire Zone 71A (which is located inside the bioshield wall). Combustibles throughout the El. 68' fire zones are minimal (containment fan cooler units located on this elevation originally contained charcoal filter beds, which have been removed, thereby reducing combustible loading to low levels). In Fire Zone 87A, combustibles are negligible, but ignition sources in the zone consist of two 480VAC MCCs.

Inside the bioshield wall, Fire Zones 70A and 71A comprise the northern and southern halves of the enclosed space. Within these zones, the combustible loading is comprised of electrical cables in trays, and the RCPs. The fire hazard presented by the RCPs is the onboard lubricating oil inventories, which present a potential fire challenge in the event of a lube oil system leak with subsequent runoff onto hot surfaces, potentially resulting in a significant fire. However, all four RCPs are equipped with RCP lube oil collection systems, which capture any leakage from credible leak sites, per Appendix R Paragraph III.O, and conduct any leakage to collection tanks located outside the bioshield wall in Fire Zone 77A. As a result, the RCP lube oil inventories are not considered to present a realistic fire challenge to any SSCs located in Fire Zones 70A or 71A. Ignition sources in Fire Zones 70A and 71A consist of the RCP motors and the motors associated with several motor-operated valves. The RCP areas are equipped with smoke detection systems.

Alternate safe-shutdown instrument channels located in Fire Area H consist of RCP Loop 21 and 22 hot and cold leg temperature (TE-5139, 5140, 5141, 5142), steam generator 21 and 22 level (LT-5001, 5002), pressurizer level (LT-3101), pressurizer pressure (PT-3105), and source-range neutron monitoring (NE-5143). Cables associated with Loop 21 and 22 hot and cold leg temperature channels TE-5139, 5140, 5141, 5142, and source-range channel NE-5143 are

routed into containment through penetration H20, and are protected with a radiant energy shield throughout the annulus area, where they are in proximity to cable trays or conduits containing the corresponding normal RCS loop temperature channels. There are no cables associated with the balance of the alternate safe-shutdown instruments (LT-5001, LT-5002, PT-3105, LT-3101), since these channels utilize pneumatically-operated transducers and corresponding indicators (which are located outside containment and replicated inside containment, at the 80' elevation personnel airlock location). Instrument tubing interfacing the pneumatic alternate safe-shutdown instruments in Fire Zone 87A with the corresponding indicators located outside containment are routed through Fire Zone 72A in the annulus area, and out though piping penetration "Z" to indicators located outside containment. Piping penetration "Z" is located more than 20 ft – free of intervening combustibles --away from the electrical penetration area, which contains all cables associated with all normal SSD instrument channels.

The normal and alternate instrument channels are separated by less than 20 ft in Fire Zone 75A, which is the high-density cable spreading area at the containment electrical penetration location. As noted above, the alternate instrument cables are protected by a radiant energy shield in this area. This zone is provided with a smoke detection system. The normal instrument channel cables and the alternate instrument channel pneumatic transducers and tubing are separated by less than 20 ft in Fire Zone 87A. This area contains negligible combustibles, as discussed above, with the exception of two totally enclosed, non-ventilated MCCS, which are also separated from the normal and alternate instrument cables, transmitters, transducers, and tubing by less than 20 ft.

Given the credible ignition sources within containment, the separation between the normal and alternate safe-shutdown instrument channels in most locations within containment, and the lack of significant combustibles in the locations where separation is less than 20 ft, a Fire Area H fire scenario of sufficient severity and duration to cause cable and/or component damage, requiring the OMA to deploy the alternate safe-shutdown instrument channels, is considered to be a low-likelihood event.

In the NRC Fire Protection SER dated January 31, 1979, the separation of the alternate pneumatic instruments and the normal electrical instruments for pressurizer pressure and level and steam generator level were determined to be adequate to satisfy a BTP 9.5-1 Section 2.2 objective to "maintain the capability to safely shut down the plant if fires occur."

Fire Area J / Fire Zones 43A & 46A – Turbine Bldg 15'
Cable ECE19-MN3/01, which is associated with valve LCV-112B, is routed through the zone. The cable originates in zone 46A at MCC 24A, which is located in the northeast quadrant of the zone. The cable rises vertically from the MCC to cable tray located approximately 13 ft above the floor and traverses the zone in tray from zone 46A and into zone 43A from north to south for approximately 68 ft. The cable then turns east and exits the east side of the zone. Ignition sources in the zones located less than 20 ft horizontally from the cable consist of an MCC, an air dryer skid, 6.9KV Switchgear, a portable Duraline power station, and an electrical cabinet. The MCC is separated from the cable by approximately 3.2 ft horizontally and 0 ft vertically. The air dryer skid is separated from the cable by approximately 7.7 ft horizontally and 2.6 ft vertically. The electrical cabinet is separated from the cable by approximately 2 ft horizontally and 7.3 ft vertically. The 6.9KV Switchgear is separated from the cable by approximately 0.7 ft

horizontally and 5.8 ft vertically. The Duraline power station is separated from the cable by approximately 19.5 ft horizontally. There are no intervening combustibles between the identified ignition sources and the cable.

Cable AD1-BA8, which is associated with Instrument Buses 23 and 23A and Buses 5A and 6A, is routed through zone 43A in tray located approximately 14 ft above the floor. The cable originates from 6.9KV Switchgear 21 in the southeast quadrant of the zone and rises vertically to the cable tray which traverses the zone for approximately 15 ft from west to east across the 6.9KV Switchgear and exits the east side of the zone. Ignition sources in the zone located less than 20 ft horizontally from the cable consist of 6.9KV Switchgear and an electrical cabinet. The 6.9KV Switchgear is separated from the cable by approximately 0 ft horizontally and 5.6 ft vertically. The electrical cabinet is separated from the cable by approximately 6 ft horizontally. There are no intervening combustibles between the identified ignition sources and the cable.

Cable AC4-BA6, which is associated with Buses 5A and 6A, is routed through zone 43A in tray located approximately 12 ft above the floor. The cable originates from 6.9KV Switchgear 21 in the southeast quadrant of the zone and rises vertically to the cable tray which traverses the zone for approximately 22 ft from west to east across the 6.9KV Switchgear and exits the east side of the zone. Ignition sources in the zone located less than 20 ft horizontally from the cable consist of 6.9KV Switchgear and an electrical cabinet. The 6.9KV Switchgear is separated from the cable by approximately 0 ft horizontally and 3.7 ft vertically. The electrical cabinet is separated from the cable by approximately 6 ft horizontally. There are no intervening combustibles between the identified ignition sources and the cable.

Cable JC2-YA9, which is associated with Buses 5A and 6A, is routed through zone 43A in tray located approximately 15 ft above the floor. The cable enters the zone in the southeast quadrant routed in cable tray which traverses the zone from south to north for approximately 75 ft into zone 46A. The cable then turns vertical and exits the zone to the elevation above. Ignition sources in the zone located less than 20 ft horizontally from the cable consist of two MCCs, an air dryer skid, 6.9KV Switchgear, and an electrical cabinet. The MCCs are located under the cable routing separated from the cable by approximately 7.7 ft vertically or greater. The air dryer skid is separated from the cable by approximately 6.1 ft horizontally. The electrical cabinet is separated from the cable by approximately 2 ft horizontally and 9.2 ft vertically. The 6.9KV Switchgear is separated from the cable by approximately 0.7 ft horizontally and 7.7 ft vertically. There are no intervening combustibles between the identified ignition sources and the cable.

Cable AA3-BA5, which is associated with Instrument Buses 23 and 23A, is routed through the zone 43A in tray located approximately 14 ft above the floor. The cable originates in 6.9KV Switchgear 22 in the southeast quadrant of the zone and rises vertically to the cable tray which traverses the zone for approximately 35 ft from north to south across the 6.9KV Switchgear turning east for approximately 12 ft exiting the east side of the zone. Ignition sources in the zone located less than 20 ft horizontally from cable consist of 6.9KV Switchgear and an electrical cabinet. The 6.9KV Switchgear is separated from the cable by approximately 0 ft horizontally and 5 ft vertically. The electrical cabinet is separated from the cable by approximately 3 ft horizontally and 7 ft vertically. There are no intervening combustibles between the identified ignition sources and the cable.

Fire Area J / Fire Zones 19, 39A, 45A, & 50A – Turbine Bldg 15' & 36'-9"
Cable AG5-XA5, which is associated with Instrument Buses 23 and 23A and Buses 5A and 6A, is routed through these zones. The cable enters zone 39A in the southeast quadrant routed in cable tray located approximately 11 ft above the floor which traverses the zone from east to west for approximately 98 ft. The cable then turns north for approximately 146 ft entering zone 50A. From zone 50A the cable then turns down and enters zone 45A below. In zone 45A the cable turns west for approximately 24 ft and enters zone 19. Ignition sources in the zones located less than 20 ft horizontally from cable AG5-XA5 consist of seven electrical cabinets, a 150KVA dry transformer, three motors, and an MCC. Three electrical cabinets are located under the cable separated by approximately 3 ft vertically or greater. The remaining four electrical cabinets are separated from the cable by approximately 2 ft horizontally or greater. The 150KVA dry transformer is separated from the cable by approximately 1.6 ft horizontally and 6.7 ft vertically. The motors are separated from the cable by approximately 4.6 ft horizontally or greater. The MCC is separated from the cable by approximately 7.5 ft horizontally. There are no intervening combustibles between the identified ignition sources and the cable.

Cables PC9-XA5/1 and PC9-XA5/2, which are associated with Instrument Buses 23 and 23A and Buses 5A and 6A, route between two junction boxes in zone 19 for approximately 2 ft. Ignition sources in the zones located less than 20 ft horizontally from the cable consist of three motors. The motors are all separated from the cable by approximately 4.6 ft horizontally or greater. There are no intervening combustibles between the identified ignition sources and the cable.

Cable XA5-WU9, which is associated with Instrument Buses 23 and 23A and Buses 5A and 6A, is routed in zone 19 from east to west terminating at the Station Air Compressor. Ignition sources in the zones located less than 20 ft horizontally from the cable consist of two motors. The motors are separated from the cable by approximately 4.6 ft horizontally or greater.

Fire Area J / Fire Zones 17, 47A, & 50A – Turbine Bldg 15' & 36'-9"
Cable JC2-YA9, which is associated with Buses 5A and 6A, is routed through these zones. The cable enters zone 50A in the southeast quadrant routed in cable tray located approximately 9.5 ft above the grating/floor. The cable traverses the zone from south to north for approximately 117 ft where it turns down and enters zone 47A below. In zone 47A, the cable is routed from south to north in cable tray located approximately 8 ft above the floor for approximately 30 ft before turning west for approximately 11 ft and entering zone 17. In zone 17 the cable turns vertical for approximately 11.5 ft and then turns west for approximately 41 ft. Ignition sources in the zones located less than 20 ft horizontally from cable JC2-YA9 consists of three electrical cabinets, seven motors, and two MCCs. The electrical cabinets are separated from the cable by approximately 3.8 ft horizontally and 1.9 ft vertically or greater. A single motor in zone 50A is located under the cable separated by approximately 5.2 ft vertically. In zone 17, six motors are located above the cable routing separated from the cable by approximately 2.1 ft horizontally or greater. In zone 47A, the MCCs are located under the cable separated by approximately 0.2 ft vertically. The Turbine Lube Oil Reservoir is located in zone 17 and the Clean and Dirty Oil Storage Tanks are located in nearby zone 16. There are no intervening combustibles between the identified ignition sources and the cable.

Fire Area J / Fire Zone 25 and 270 – U1 Superheater Building 33'
Cables EDB8-EPB3, EGA9-EDB8/4, and EGA9-EDB8/5, which are associated with Instrument Buses 23 and 23A, are routed through this zone in rigid steel conduit. Cables EGA9-EDB8/4 and EGA9-EDB8/5 originate and route out of zone 25 (Battery Room 23) located in the northwest corner of zone 270. Cable EDB8-EPB3 is then routed from zone 25 through zone 270 rising vertically to approximately 11.3 ft from the floor and traversing from south to north for approximately 35 ft exiting the north end of zone 270. Since cables EGA9-EDB8/4 and EGA9-EDB8/5 originate inside the battery room at the batteries, there is no separation between the cables and the batteries. Ignition sources in the zone located less than 20 ft horizontally from cable EDB8-EPB3 consist of an MCC, a 45KVA dry transformer, and two electrical cabinets. The MCC is separated from the cable by approximately 18.5 ft horizontally. The transformer is separated from the cable by approximately 13.6 ft horizontally. One electrical cabinet is separated from the cable by approximately 12.8 ft horizontally. The second electrical cabinet is separated from the cable by approximately 5.5 ft horizontally. There are no intervening combustibles between the identified ignition sources and the cable.

Fire Area K / Fire Zone 60A – AFW Pump Building Elev 32'-6"
Cables PU9-JF9 for FCV-406D, PU9-JH1 for FCV-406B, PU9-JG2 for FCV-406A, and PU9-JF2 for FCV-406C are routed through this zone in rigid steel conduit and tray. The cables originate in the elevation below in zone 23 (AFW Pump Room) and enter through the floor in the south end of zone 60A. The cables are routed from the floor in rigid steel conduit vertically to approximately 7.5 ft above the floor. The ceiling is a nominal 8.5 ft. The cables are then routed in tray from north to south for approximately 8 ft entering conduit and then route vertically to the elevation above (zone 65A). Ignition sources in the zone located less than 20 ft horizontally from the cables consist of two electrical cabinets and four motors. The electrical cabinets are separated from the cables by approximately 7 ft horizontally or greater. The motors are separated from the cables by approximately 1.6 ft horizontally. There are no intervening combustibles between the identified ignition sources and the cable.

Cables LL8-JF5 for FCV-406A, LL9-JF9 for FCV-406C, JB1-YN9 for FCV-1121, and JB1-PT1/2 and PT1-AI6 associated with 21 AFW Pump are routed through this zone in rigid steel conduit. The cables originate in the elevation below in zone 23 (AFW Pump Room) and enter through the floor in the south end of zone 60A. The cables are routed from the floor in rigid steel cable vertically to the nominal 8.5 ft ceiling exiting to the zone above (zone 65A). Ignition sources in the zone located less than 20 ft horizontally from the cables consist of one electrical cabinet and four motors. The electrical cabinet is separated from the cables by approximately 7 ft horizontally. The motors are separated from the cables by approximately 5.5 ft horizontally or greater. There are no intervening combustibles between the identified ignition sources and the cable/conduit.

Fire Area K / Fire Zone 65A – AFW Pump Building Elev 43'
Cables PU9-JF9 for FCV-406D, PU9-JH1 for FCV-406B, PU9-JG2 for FCV-406A, PU9-JF2 for FCV-406C, LL8-JF5 for FCV-406A, LL9-JF9 for FCV-406C, JB1-YN9 for FCV-1121, and JB1-PT1/2 and PT1-AI6 associated with 21 AFW Pump are routed through this zone in rigid steel conduit. The cables are routed from the elevation below (zone 60A) and enter through the floor in the south end of the zone. The cables are routed from the floor in rigid steel conduit vertically to approximately 6.5 ft to 8.5 ft above the floor and then turn south and exit the south

end of the zone. The ceiling is a nominal 43 ft. Ignition sources in the zone located less than 20 ft horizontally from the cables consist of two switches that are separated from the cables by approximately 2.5 ft horizontally or greater. There are no intervening combustibles between the identified ignition sources and the cable/conduit.

Fire Area P / Fire Zone 1 – CCW Pump Room
Power supply cables for 21, 22, & 23 Component Cooling Water (CCW) pumps are located in this zone. The cables are routed in rigid steel conduit for each motor and the conduit for 23 CCW Pump is wrapped with an ERFBS rated for 30 minutes. The 21 CCW Pump is located at the south end of the zone, the 22 CCW Pump is located in the center of the zone, and 23 CCW Pump is located at the north end of the zone. The pumps are separated by approximately 10 ft. The ceiling of the CCW pump room is grating open to the PAB 80' corridor above. A radiant energy shield is installed between the 22 CCW and 23 CCW Pumps. The ignition sources in the room are the three CCW pump motors and two electrical cabinets. The conduits for 21 and 22 CCW Pumps are both routed out the south end of the room rising vertically from the motors to approximately 8.8 ft from the floor and are separated by approximately 0.5 ft horizontally. The conduit for the 22 CCW Pump crosses over the 21 CCW Pump. The electrical cabinets are separated from the 21 & 22 CCW Pump power cables by approximately 19.5 ft horizontally or greater. The cable for 23 CCW Pump rises vertically from the motor to approximately 9.5 ft from the floor and then runs west under the ceiling grating to the west wall of the CCW pump room and then runs vertically out of the room to the zone above. One of the electrical cabinets is located directly under the 23 CCW Pump power cable separated by approximately 5.2 ft vertically. The other electrical cabinet is separated from the 23 CCW Pump power conduit by approximately 3.8 ft horizontally and 4.1 ft vertically. There are no intervening combustibles between the identified ignition sources and the cables.

Fire Area YD – Zone 900 - Yard
Cable ECD3-EXF6/2 for valve MOV-227 is routed outside through rigid steel conduit from the east end of the PAB 98' approximately 12 ft and above the floor elevation of 98' which is also the roof of 80'elevation. The cable traverses the area from south to north across the PAB roof and enters the Fan House at approximately elevation 104'. There are no ignition sources located less than 20 ft horizontally from the cable.

RAI-03.1

Describe the evaluation performed to support the assertion that fire damage can be expected to be confined to the zone of origin, despite the lack of a door enclosing the room. In addition, provide a more detailed explanation of why fires occurring in the adjacent fire zone are not expected to spread into Fire Zone 6.

RAI-03.1 RESPONSE

Fire Zone 6 (Fire Area F), 22 Charging Pump Room, is located on elevation 80'-0" of the PAB. The room is 282 sq ft (11'-6" x 24'-6") with a 15'-6" ft ceiling. The walls and ceiling are 2'-6" concrete and the floor is 1'-0" concrete. A single 2'-6" wide doorway, open from floor to ceiling elevation, is located at the south end of the room for access to the adjacent corridor (Fire Zone

7A PAB 80' Corridor). A labyrinth entry to the room is formed by a 2'-6" x 11'-6" concrete wall located in the adjoining corridor, 5' south of the open doorway. A 4" curb is provided in the threshold of the open doorway entrance to Fire Zone 6 to preclude the flow of liquids into or out of the fire zone. Area wide ionization type smoke detection is provided in the room. There is no automatic suppression in the room, but manual suppression is available in adjacent Fire Zone 7A.

Fixed combustible materials in the room consist of the lube oil contained in the 22 Charging Pump and approximately 10 lbs of plastic tubing resulting in Total Fixed Combustible Loading of 24,201 BTU/sq ft, which corresponds to a fire severity of 18 minutes. There are no combustibles that penetrate through the open doorway between Fire Zone 6 and Fire Zone 7A.

Based on the types and amounts of combustibles in Fire Zone 6, the anticipated fire is a lubricating oil fire associated with the charging pump. Early warning detection is provided by ionization smoke detectors. Activation of the detection system will result in CCR alarm and subsequent response by the fire brigade to extinguish the fire and maintain safe shutdown capability. Smoke and hot gases can be evacuated via the PAB Ventilation System and portable smoke ejectors.

Fire Zone 7A (Fire Area F) is the Main PAB Corridor at elevation 80'-0". The corridor is 6,000 sq ft with a 16 ft ceiling providing a general open access to the various rooms located off elevation 80'-0".

Fixed combustible materials in the zone include resins, radiation protection supplies, plastic, rubber, cellulose, and electrical cables in trays, resulting in a total fixed combustible loading of 72,439 BTU/sq ft, which corresponds to a fire severity of 54 minutes.

Based on the types and amounts of combustibles in Fire Zone 7A, the anticipated fire is a slow developing cable tray fire. Early warning detection is provided by ionization detectors. Activation of the detection system will result in CCR alarm and subsequent response by the fire brigade to extinguish the fire and maintain safe shutdown capability. Smoke and hot gases can be evacuated via the PAB Ventilation System and ventilation by dedicated fire brigade portable blowers.

Fire Zone 6 and adjacent Fire Zone 7A are administratively controlled as "Level 2" combustible control areas as classified under the Transient Combustible Control Program implemented via procedure EN-DC-161 (Control of Combustibles). Small quantities of combustibles are permitted in these areas, but unattended combustibles exceeding any of the following quantities require formal prior review and approval by Fire Protection Engineering, with imposition of additional compensatory actions or protective measures, as determined to be required:

- 100 lbs of fire-retardant treated lumber
- 25 lbs of loose ordinary combustibles
- 5 gallons of combustible liquid in an approved container
- One pint of flammable liquid in an approved container
- One 20-oz flammable aerosol can

Additionally, with respect to the effects of the proximity of transient combustibles to "secondary combustibles," the guidance of procedure EN-DC-161 includes prior consideration by Fire Protection Engineering of any SSCs or other combustible materials in the affected area that could be impacted by the presence and staging of the transient combustibles. Where the performance of the Transient Combustible Evaluation is indicated, these parameters are reviewed and additional guidance is provided in the Transient Combustible Evaluation, as needed, to protect adjacent combustibles, to provide protection for combustibles located within a defined footprint, to constrain the staging location of the transient combustibles, or to specify other measures as deemed appropriate by Fire Protection Engineering.

Work activities involving secondary ignition sources and Hot Work are subject to controls and guidance provided by procedure EN-DC-127 (Control of Hot Work and Ignition Sources). All hot work requires review and approval by a qualified Hot Work Supervisor and/or Fire Protection Engineering, and a Hot Work Permit issued specifying appropriate supplemental fire protection (i.e., hot work fire watch). Permits are only valid for 24 hours. If required, the activity may be reevaluated by a Hot Work Supervisor and/or Fire Protection Engineering, and the permit may be extended on a daily basis to a maximum valid duration of 31 days.

An NRC SER dated October 16, 1984 granted an exemption from the requirements of Appendix R for Fire Zone 7A and Fire Zone 5. Fire Zone 6 is directly adjacent to Fire Zone 5, and while the SER does not specifically pertain to Fire Zone 6, Entergy believes that the conclusion related to the common Fire Zone 7A corridor is applicable for considering potential fire severity. The SER concluded that "the fire load in the zone is low. Because accessibility is limited in these locations, the quantity of transient combustibles that would be present at any point in time would not be large and would, therefore; not constitute a significant fire hazard. Consequently, we [NRC] do not expect a fire of considerable magnitude or duration to occur. Because of the presence of the smoke detectors in these areas, a fire would be detected in its initial stages before significant damage occurred."

Based on the above, it is reasonable to conclude that a fire originating in Fire Zone 6 would likely be confined to the zone of origin, despite the lack of a door in the open doorway at the south end of the zone. There are no intervening fixed combustibles that penetrate through the open doorway into the adjacent Fire Zone 7A that would permit a fire to propagate out of the zone, nor are there significant fixed combustibles in the adjacent zone, in proximity to the doorway connecting the zones. The curb in the threshold of the open doorway minimizes the potential for combustible liquid (i.e., oil) from migrating out of Fire Zone 6 and into the adjacent zone. Smoke detection is provided in both Fire Zones 6 and 7A such that a fire would be detected in its early stages allowing for Fire Brigade response and extinguishment.

RAI-04.1

Clarify the apparent inconsistency between the RAI-03.1 response text and Table RAI-GEN-3.

RAI-04.1 RESPONSE

The summary discussion of the SER dated March 4, 1987 inadvertently omitted from our RAI response dated May 4, 2010 is as follows:

Fire Area F / Fire Zone 6

SER dated March 4, 1987 approved an exemption from the technical requirements of Paragraph III.G.2 of Appendix R to 10 CFR 50 for the Charging Pump Rooms (Fire Zones 5, 6, and 7), Residual Heat Removal Pump Room, and the Auxiliary Feedwater Pump Room redundant ventilation exhaust fans to the extent that the HVAC circuits are not separated and protected in accordance with requirements. The SER concluded that "Based on our [NRC] review of the licensee's proposed alternative cooling methods, we [NRC] conclude that the level of fire safety in the Charging Pump Rooms, the RHR Pump Rooms and the Auxiliary Boiler Feed Pump Room is equivalent to that achieved by compliance with the technical requirements of Appendix R."

RAI-05.1

Provide a justification for not identifying the potential need for the use of SCBAs in post-fire safe-shutdown procedures.

RAI-05.1 RESPONSE

The potential need for the use of SCBAs for safe-shutdown operator response is identified, on a dynamic and situational basis, by Operations personnel, rather than relying only on static procedural guidance. The Site Fire Brigade is the primary responding group for all fires at the Indian Point Energy Center (IPEC), and it is made up entirely of on-shift qualified Operations personnel. The qualified Fire Brigade Leader (FBL) is required to be a Senior Reactor Operator that holds or has held a license at IPEC in the past three years.

The need for SCBAs is an assumed condition for all fire brigade response. Therefore, all Fire Brigade members are required to respond to the fire scene in full turnout gear including SCBAs.

In accordance with their training, initial entry into a fire or post-fire area will be conducted under the direction of the FBL by the qualified Operations personnel in the Fire Brigade. The FBL at the fire scene assesses area conditions and directs personnel in the continued use of SCBAs if required.

The FBL in command at the scene of a fire is trained to be in constant contact with the CCR, allowing the FBL to communicate his assessment of the field conditions to the CCR and Shift Manager. Based on this, it can be expected that conditions that may require the use of an SCBA (i.e., smoke-filled areas) would be known by the Shift Manager for providing direction to operators that may be dispatched to the field. It can also be expected that the Shift Manager would provide guidance consistent with that of the FBL at the fire scene, including the need to

don SCBAs, if required. CCR staff not responding to the fire are prepared to don breathing apparatus if required.

All operators are required to be trained and qualified in the use of SCBAs; qualified operators are required to be familiar with all areas of the plant and, therefore, Entergy believes they are capable of assessing transient routes to avoid fire/smoke affected areas.

Operators that may be required to re-enter a fire/post fire area that has not been released for unrestricted access are trained to do so under the direction of the FBL at the fire scene, including the direction to don an SCBA if required.

RAI-06.1

The description of OMAs required in the event of fire in Containment, Fire Area H (page 5 of the licensee's May 4, 2010 RAI response) states that Normal reactor coolant makeup air-operated Charging system valves 204A and 204B, must be failed open by deenergizing 125VDC control power in the CCR or by closing pneumatic supply isolation valve IA-501. This statement infers that the actions needed to mitigate a spurious closure of valves 204A and 204B may be performed in the CCR or at pneumatic supply isolation valve IA-501. This statement (ability to open the valves at either location) is not consistent with Table 4 of the October 1, 2009 request, which states that although the control room actions are an 'Allowed" action, they do not meet the OMA screening criteria of IP-RPT-08-00072. Additionally, Table RAI-08.1-3 of the May 4, 2010 response indicates that manual valve IA-501 must be closed locally. With regard to the above, provide:

1. information to clarify the apparent discrepancy regarding where performance of the OMA is credited;

2. information (if available), which illustrates the likelihood of circuit failures needed to cause both valves to spuriously close as a result of fire in Fire Area H. Examples include but are not limited to: the type of cable, its construction and insulation; how the cables are routed in the area [trays or conduit]; separation distance between cables of concern; and circuit failure modes [conductor-to-conductor shorts in a single cable or two separate cables, cable-to-cable faults etc.].

3. information which clarifies the effect of removing DC power in the CCR after the valves spuriously close and if this strategy had been considered in the analysis.

4. Engineering Report IP-RPT-08-00072; which describes the screening criteria that were applied and the resultant tabulation of the OMAs of concern.

RAI-06.1 RESPONSE

1. The discussion of the OMA associated with valves 204A and 204B as presented in the October 1, 2009 letter (Table 4, Fire Area H Credited III.G.2 Operator Manual Actions), was not adequately clear, in that it noted that the operation of two circuit breakers within the CCR would not be considered an "OMA," since these are proceduralized control room actions, not requiring any dispatch of operators to the field, but also discussed the alternate action associated with valves 204A and 204B, which does require a field action, and is therefore classified as an OMA.

   The proceduralized guidance provides operators in the CCR with the alternatives of removing the control power fuses for the subject valves or of tripping the aforementioned circuit breakers. Either action will isolate the power supply to the valve control circuits and ensure that valves 204A and 204B are failed to the full open position. This operator action, performed in the CCR, is not classified as an OMA, which is consistent with Regulatory Guide 1.189, Rev. 2, Position 5.3.1.1. [ADD TO CERTIFICATION]

   The alternative action of securing instrument air to valves 204A and 204B to ensure these valves are failed open is clearly an OMA requiring consideration and approval of an exemption from the requirements of Appendix R Paragraph III.G.2. For conservatism in the request for exemption, since an alternate means of failing valves 204A and 204B open that would involve a field action (isolation of instrument air supply) was identified, Entergy considered that any action associated with ensuring that valves 204A and 204B are placed in the required open position) for safe shutdown may be considered to be a III.G.2 OMA requiring NRC review and approval. This simplified presentation was carried through in the referenced discussion of Fire Area H OMAs in the response to RAI-02.1 in the May 4, 2010 submittal. The primary operator action to fail valves 204A and 204B open by securing DC power to the valves remains part of the IP2 shutdown strategy and procedure. However, since the alternate strategy to fail valves 204A and 204B open requiring a field action to secure instrument air to the valve operators is believed to be the only element of the strategy requiring NRC approval, the OMA was described in the May 4, 2010 submittal as only that element involving the securing of instrument air.

   In summary, the tripping of circuit breakers or the pulling of control power fuses in the CCR to secure power to valves 204A and 204B would not be classified as an OMA, in that no operators are dispatched to perform actions in the field. However, given that the alternate action to secure instrument air to valves 204A and 204B is clearly classified as an OMA, the combined action set appeared to be more appropriately considered as an aggregate OMA when evaluating the acceptability of the actions necessary to ensure a reliable charging makeup path to the RCS is available.

2. The potential for spurious closure of both valves 204A and 204B as the result of fire-induced circuit faults in Fire Area H or other fire areas through which cables for these valves are routed has been acknowledged and addressed in the IP2 Appendix R Safe-Shutdown Analysis and the post-fire safe-shutdown operating procedures. To provide an adequate flow path to accommodate charging makeup flow to the RCS, at least one of valves 204A or 204B is required to be open.

Valves 204A and 204B are air-operated valves that utilize an air-to-close, spring-to-open design. Upon loss of the instrument air supply the valve will fail to the full open position. Conversely, upon loss of electrical power to the pilot solenoid valve that controls the air supply to the valve actuator, the pilot solenoid valve will fail closed, which isolates the air supply to the valve, causing valves 204A and 204B to fail to the full open position. The cables serving valves 204A and 204B are routed within Containment (Fire Area H) in raceways which are not separated by 20 feet at all locations, nor are other separation measures as prescribed by Appendix R Paragraph III.G.2.f provided. Ignition sources along the cable routing paths consist primarily of cable runs in adjacent trays, as well as the trays containing the 204A and 204B cables themselves. An oil collection system is provided for all RCPs, such that the principal fire hazard within Containment – i.e., RCP lubricating oil – is removed from consideration as a fire challenge. The oil collection systems conduct any RCP oil leakage to tanks located in the Containment annulus area in a location remote from any credible ignition sources.

Upon deenergization of the control power circuits (in the CCR) for both valves 204A and 204B, internal (intra-cable) conductor-to-conductor faults are removed from consideration, as all conductors are deenergized within the respective valve cables. The glass-asbestos braid outer cable jacket is expected to afford some level of protection against inter-cable hot shorts, and the likelihood of spurious actuation of the 125VDC pilot solenoid valves is further reduced by the need to consider a proper-polarity inter-cable short from another cable energized by the 125VDC ungrounded power supply system. Two external hot shorts of the proper polarity would be required to cause the spurious energization of the valve 204A or 204B pilot solenoid valve, since the step to deenergize the valve control circuits from the CCR involves pulling the two control power fuses (isolating the positive and negative power inputs), or opening the two-pole molded-case circuit breaker at the respective 125VDC distribution panel in the CCR, which will also isolate both the positive and negative power inputs.

It is noted that neither valve 204A or 204B represents a high-low pressure interface and, as such, consideration of two 125VDC inter-cable hot shorts of the proper polarity is not required. This approach is consistent with the guidance of Generic Letter 86-10, Question 5.3.1 Response, which is echoed by Regulatory Guide 1.189, Rev. 2, Position 5.4.2(b).

As the means of addressing an unrelated IP2-specific fire-induced spurious actuation concern, the instrument air supply to Containment is isolated via existing procedural guidance. Notwithstanding the protective measure taken to deenergize the valve 204A and 204B 125VDC power supply circuits which causes both valves to fail open, the isolation of the instrument air supply to Containment also secures the pneumatic supply to the actuators of both valves 204A and 204B, also causing them to fail open.

3. Valves 204A and 204B, which are the charging system to RCS hot and cold leg injection valves, respectively, are air-operated valves which are air-to-close, spring-to-open. Upon loss of the instrument air supply valves 204A and 204B will fail open. Similarly, the pilot solenoid valves for valves 204A and 204B will admit air to the valve actuator when the respective solenoid is energized. Upon deenergization of the pilot solenoid valve, the air supply to 204A or 204B is isolated, causing the valve to fail open. The mitigation

methodology to ensure that (at least one of) valves 204A and 204B is failed open – to ensure an unimpeded flowpath for charging system makeup to the RCS – is to isolate both the electrical power and air supplies to both valves 204A and 204B. The capacity of either one of valves 204A or 204B and the associated piping is adequate to accommodate the required charging pump makeup flow to the RCS.

This is accomplished by tripping the respective 125VDC control power circuit breakers for the 204A and 204B pilot solenoid valves in the CCR, and closing at least one instrument air isolation valve, either in the PAB or in the Control Building, depending on accessibility in light of the postulated fire location.

4. The screening criteria applied to OMAs via the referenced engineering report are consistent with the guidance of SECY 08-0093 and NEI 00-01 (Draft) Revision 2. At the time of development of IP-RPT-08-00072 Rev. 0, NEI 00-01 Revision 2 had not yet been issued.

   The screening criteria and methodology utilized in the development of Engineering Report IP-RPT-08-00072, which can be made available for review upon request, have been summarized from the report and are as follows:

   Lists of OMAs were generated by running fire area analysis reports for all fire areas using the INDMS/ECRIS Appendix R analysis database application. The "Component Protection" reports were generated, which identify all cases in which the potential fire-induced failure of a given component, in a given fire area, is mitigated by the use of OMA(s). Since the Component Protection reports also identify for some components a credited method of resolution that does not involve OMAs, the Component Protection reports were then filtered to present for each fire area only those components and mitigating actions that credit OMAs.

   The resultant tables presented in the referenced report provide a list of all manual actions that are credited in the IP2 safe shutdown analysis, with the exception of those fire areas that are compliant with Appendix R Paragraph III.G.3, and which therefore credit OMAs only for implementation of alternate shutdown actions. These fire areas were therefore excluded from consideration in the report, as they fall under the classification of category (1) as listed below. Other fire areas that are excluded from consideration are those for which no OMAs are credited.

   In conducting this assessment, the following OMAs were classified as "allowable" manual actions:

   1. Those manual actions that are performed to address equipment spurious operation (other than in the required/credited train), or to support plant safe shutdown for III.G.3 areas.

   2. Operator actions performed from the CCR are not considered to be OMAs. Rather, they are normal actions performed by the Operations staff from the CCR; as such they are considered acceptable for the purpose of compliance to the Rule.

3. Operator actions that are performed to address multiple high impedance faults (MHIF) are also considered allowable manual actions.

4. OMAs performed to line up HVAC systems or to restart an HVAC system are considered allowable manual actions.

5. Reading an instrument from outside of the CCR (e.g., local steam generator level indication) is also considered to be an allowable OMA.

6. Operator actions that are necessary only for initiation or maintenance of cold shutdown conditions.

7. Operator actions that are necessary only to mitigate spurious equipment actuations of components important to safety that could adversely affect safe shutdown (but are NOT part of the flow path and equipment set necessary to achieve and maintain hot shutdown conditions).

Operator actions taken to locally operate a safe shutdown device in the credited safe shutdown train/flowpath necessary to achieve and maintain hot shutdown conditions are considered "not allowed" manual actions; i.e., those OMAs that require NRC review and approval, where they are credited for compliance with Appendix R, Paragraph III.G.2..

Based on the application of the above criteria, the resultant IP2 OMAs of concern associated with valves 204A and 204B are implemented in Fire Area H, and they are summarized on Table RAI-06-1.

Table RAI-06-1

OPERATOR MANUAL ACTIONS ASSOCIATED WITH VALVES 204A AND 204B CREDITED FOR APPENDIX R PARAGRAPH III.G.2 FIRE AREA H

Component	Action	Comments
204A, 204B	Isolation of Instrument Air valve IA-501 will fail 204A and 204B Open while Closing 212. When depressurization of the primary is required, enter Containment and operate these valves per 2-AOP-SSD-1.	Failing open 204A/B as described is required within approximately 70 minutes, to support charging injection to the RCS when a charging pump is started. Both 204A and 204B are failed open via DC control power disconnection in CCR (pull control power fuses or trip breakers 5 and 15 on 125VDC DP 21 and 22, respectively), and backed up by isolating IA to Containment via closure of IA-501 In Fire Area A.
IIP-500, IIP, 501, IIP-502, IIP-503, IIP-504, IIP-505 (Alternate Safe Shutdown System pneumatic instruments for pressurizer pressure and level and steam generator level)	The metal banding has to be cut and the fire protection wrapping has to be removed prior to unlocking the following stops (the banding cutter is located in the emergency cabinet at the alternate shutdown panel on the 90 ft. el. of the Fan Room in the PAB). The stops are located at the penetration near the seal injection lines.	A local manual action is required to access and operate valves IIP-500 through IIP-505. This action then enables the set of ASSS pneumatic SSD instrumentation.
TE-5139, TE-5140, TE-5141, TE-5142 (Alternate Safe Shutdown System electrical instruments for RCS Thot and Tcold) NE-5143 (Alternate Safe Shutdown System electrical instrument for source range)	Close breaker 2B on Bus 12FD3 to energize ASSS electronic instruments listed at left. Close disconnect switch EDH7 at ASSS instrument panel, and install fuses for source range neutron monitoring drawer, also at ASSS instrument panel	Breaker 2B on Bus 12FD3 is operated using the local control switch at the switchgear bus. Dedicated fuses for source range neutron monitoring drawer are stored at the ASSS instrument panel, immediately adjacent to the source range drawer.

RAI-07.1

Provide a technical justification for this time period [75 minutes available to align charging pump suction from the VCT to the RWST], including any assumptions and criteria used in the evaluation.

RAI-07.1 RESPONSE

The time available to align the selected charging pump suction from the normal VCT supply to the alternate RWST supply and to start a charging pump to restore makeup flow to the RCS is approximately 75 minutes, as determined by Calculation IP-CALC-05-01034 Revision 1 (Appendix R Cooldown and Benchmark and Sensitivity Analysis Using RETRAN-3D). This analysis demonstrates the ability to maintain pressurizer level within the indicating range of the wide-range level instrumentation despite interruption of charging system makeup to the RCS for up to 75 minutes. This calculation assumes RCP seal leakage during the evolution, at a maximum value of 21 gpm per RCP, in accordance with Westinghouse Technical Bulletin 04-22 Revision 1. The calculation also assumes that charging system letdown is isolated to further minimize RCS inventory losses during the period in which charging system makeup from the charging pump(s) has been interrupted. As determined by the referenced calculation, if one charging pump is started within approximately 75 minutes of the time of reactor trip, pressurizer level will be maintained sufficient to meet the Appendix R performance goal for RCS inventory control.

The acceptance criteria applied in the referenced calculation are:

1. The RCS should remain subcooled.
2. Pressurizer level should remain on span.
3. Available steam generator wide range level should remain on span.

The assumptions applied (i.e., employed in the RETRAN computer model) in the referenced calculation are as follows:

1. The reactor power was 102% of 3216 MWth (3280.3 MWth) and at the 3F T-avg increase (T-avg = 565F)
2. The decay heat of ANS-1979 with 2-sigma uncertainty was used.
3. A reactor trip initiated the transient (after five minutes of steady-state) and a loss-of all off-site power was coincident.
4. The loss of all off-site power caused a coastdown of all RCPs. The RCP coastdown was conservatively modeled to have greater resistance to the discharge flow [10].
5. The loss of all off-site power resulted in a loss of the charging pumps, but letdown was maintained. Initially 89 gpm of letdown was maintained and decreased to 71.2 gpm (80% of 89 gpm) due to flashing after reactor trip.
6. Pressurizer heater, pressurizer normal spray, or pressurizer power-operated relief valves (PORVs) were not available.
7. Letdown was isolated at 2 minutes after reactor trip.
8. Charging was available at 66 minutes after reactor trip.

9. Only one MD AFW [motor-driven auxiliary feedwater] pump of 400 gpm was available at 30 minutes after reactor trip and supplying two SGs [steam generators].
10. Only two SG ARVs [atmospheric relief valves], which were receiving MD AFW, were available and used to cooldown the RCS.

The above assumptions were further refined by the following set of modified assumptions used in conducting several sensitivity analyses:

1. One of the RCP seal leak-off flow rates was assumed at 5 gpm (vs. 3 gpm) initially and a participative buffer volume of 66 gallons was used. After 13.2 minutes (= 66 gal / 5 gpm) of reactor trip, the RCP seal leak-off increased to 21 gpm instantaneously. The rest of the RCP seal leak-off flows was assumed at 3 gpm per RCP, and increasing to 21 gpm instantaneously after 22 minutes (= 66 gal / 3 gpm) of reactor trip (Reference Westinghouse TB 04-22, Rev. 1).
2. Letdown was isolated at 15 minutes after reactor trip.
3. 50 gpm blowdown per steam generator was assumed and isolated at 20 minutes after reactor trip.
4. Charging was available at 75 minutes after reactor trip.
5. Only one MD AFW pump was available at 30 minutes after reactor trip and delivered 360 gpm to two SGs.
6. Isolation of normal charging was assumed at the time of pressurizer auxiliary spray.
7. Charging was manually increased in order to maintain the pressurizer level at the beginning of cooldown.
8. The total RCS heat loss was modeled as a non-conducting heat exchanger in RETRAN-3D. During the transient, the total RCS heat loss was modeled as proportional to the temperature difference between the average RCS temperature and the containment temperature. For conservatism, the containment temperature was assumed as 130F

It is important to note that the 75-minute figure for restoration of charging system makeup flow to the RCS applies to the manual alignment of the alternate suction supply (RWST), followed by the deliberate starting of one charging pump, to restore charging system makeup to the RCS. During the nominal 75-minute period, the selected charging pump is presumed to not be in operation and, therefore, potential damage to the charging pump resulting from spurious isolation of all suction paths to the pump is not a concern. This is contrasted with the postulated scenario -- discussed in the response to RAI-01.1 -- in which the selected charging pump may be in operation at the onset of the fire event, and fire-induced cable damage could cause the redundant charging pump suction valves (LCV-112C and LCV-112B) to fail closed, thereby isolating all suction sources and leading to potential pump damage within a relatively short time. This potential failure mode is mitigated by procedural guidance to secure the charging pump in the event of a confirmed fire condition and to start another charging pump to support continued operation until the proper response to the fire condition is assessed. In this way, the charging pump will be protected from any damage scenario that may be caused by spurious loss of pump suction sources.

RAI-08.1

For each OMA, identify the specific indicators that trigger the need to initiate the action and provide information to confirm that this instrumentation has been assured to remain free of fire damage.

RAI-08.1 RESPONSE

The consolidated set of OMAs, presented on a fire area basis, was presented in the May 4, 2010 Entergy letter, on Tables RAI-08.1-1 through RAI-08.1-7. The list of OMAs is presented below, consistent with the tabular format presented in the May 4, 2010 Entergy letter, with the diagnostic basis for initiation of each OMA described. Note that specific indicators are identified only where those instrument channels are credited to provide continuous and accurate readings of the associated parameters; i.e., where the credited channel(s) are free of fire damage. Where "loss of indication" is referenced as the operator alert, this reflects that all available CCR indicators for that parameter can be expected to be nonfunctional or unreliable for the specific fire area scenario. Similarly, for pump controls, loss of indicating light operation, and/or unresponsiveness of CCR control switches will serve as the operational trigger to implement the credited OMA(s).

Fire Area C Post-Fire OMAs and Associated Diagnostic Indicators Reference: 05/04/10 Entergy Letter – Table RAI-08.1-1	
Operator Manual Action	**Diagnostic Indicator(s) Triggering Operator Response to Perform OMA**
Implement FR-H.1 if necessary to establish alternate secondary heat sink	Action performed from CCR, and not an OMA, but listed here for completeness. Loss of all CCR control and indication for all three AFW pumps would trigger the entry into FR-H.1.
Operate 22 AFW Pump (turbine-driven) [previously "steam-driven"]	Loss of control and/or indication for 22AFW pump from CCR, OR indication of decreasing level in 21-24 steam generators, as viewed at LR-417, 427, 437, 447. Wide-range level channels LT-417D through 447D have two cables each routed through Fire Area C, to support remote level indicators for each channel. These circuits are isolated by a power supply – repeater - isolator module from the signal path recorded at the listed recorders. Whether the subject signal circuits in Fire Area C are failed open, shorted, shorted to ground, or subject to a hot short of up to 480VAC, the primary channel of level indication for each SG can be expected to

Fire Area C Post-Fire OMAs and Associated Diagnostic Indicators Reference: 05/04/10 Entergy Letter – Table RAI-08.1-1	
Operator Manual Action	**Diagnostic Indicator(s) Triggering Operator Response to Perform OMA**
	remain unaffected and operable in the CCR.
Open/check open 22 AFW Pump steam supply isolation valves	Same as above, or local observation of unavailable steam supply when attempting to start the 22AFW pump locally.
Operate 22 AFW Pump flow control valves to align AFW flow to selected Steam Generator(s)	Same as above, or local observation of unavailable steam supply when attempting to start the 22AFW pump locally.

Fire Area F Post-Fire OMAs and Associated Diagnostic Indicators Reference: 05/04/10 Entergy Letter – Table RAI-08.1-2	
Operator Manual Action	**Diagnostic Indicator(s) Triggering Operator Response to Perform OMA**
Align Charging pump makeup path to RCS	Loss of control and/or indication for all charging pumps from CCR.
Align Charging pump suction source to Refueling Water Storage Tank (RWST)	Loss of control and/or indication for all charging pumps from CCR, and/or loss of CCR control and/or indication for LCV-112C or LCV-112B from CCR.
Transfer Instrument Buses 23 and 23A to alternate power	Per 2-AOP-IB-1 Revision 8, upon loss of these instrument bus indications in the CCR, operators are directed to transfer both buses to their alternate power supply.

Fire Area H Post-Fire OMAs and Associated Diagnostic Indicators Reference: 05/04/10 Entergy Letter – Table RAI-08.1-3	
Operator Manual Action	**Diagnostic Indicator(s) Triggering Operator Response to Perform OMA**
Align Charging pump makeup path to RCS	Loss of, or unreliable, inconsistent, or incongruent indications provided by CCR pressurizer level channels would trigger the need for use of the ASSS instrumentation. In so doing, this would also trigger an entry into safe-shutdown procedure 2-AOP-SSD-1, which includes preemptive actions to establish the charging makeup path, by failing open charging injection valves 204A and 204B.
Activate/enable Alternate Safe Shutdown System (ASSS) pneumatic instruments (Steam Generator level, Pressurizer pressure and level) at Fan House local control panel. Also enable ASSS source-range channel and Loop 21 and 22 hot (Th) and cold leg (Tc) temperature channels	Loss of, or unreliable, inconsistent, or incongruent indications provided by CCR instruments for the parameters listed at left would trigger the need for use of the ASSS instrumentation.

Fire Area J Post-Fire OMAs and Associated Diagnostic Indicators Reference: 05/04/10 Entergy Letter – Table RAI-08.1-4	
Operator Manual Action	**Diagnostic Indicator(s) Triggering Operator Response to Perform OMA**
Trip breakers 52/5A and 52-SAC on Bus 5A and 52/6A and 52/TAO at Bus 6A and remove control power fuses	Conditional OMA, if the subject two breakers are found to be untripped. Loss of power to the affected buses is detected by loss of indication in the CCR. Loss of power to Bus 5A /6A causes operators to immediately enter 2-AOP-480V-1. Step flow directs operators to locally inspect the switchgear, at which time any remaining untripped breakers (i.e., 52/5A, 52-SAC; 52/6A, 52/TAO) would be noted and locally tripped as necessary.

Fire Area J Post-Fire OMAs and Associated Diagnostic Indicators Reference: 05/04/10 Entergy Letter – Table RAI-08.1-4	
Operator Manual Action	**Diagnostic Indicator(s) Triggering Operator Response to Perform OMA**
Transfer Instrument Buses 23 and 23A to emergency power source	Per 2-AOP-IB-1 Revision 8, upon loss of these instrument bus indications in the CCR, operators are directed to transfer both buses to their alternate power supply.
Align Charging pump suction source to RWST	Loss of control and/or indication for all charging pumps from CCR, and/or loss of control and/or indication for LCV-112C or LCV-112B from CCR.
Operate 22 AFW Pump flow control valves to align AFW flow to selected Steam Generator(s)	Loss of control and/or indication for 22AFW pump flow control valves FCV-405A, B, C, D from CCR, OR indication of decreasing level in 21-24 steam generators, as viewed at LR-417, 427, 437, 447. Wide-range level channels LT-417D through 447D have NO cables routed through Fire Area J, and the CCR SG level channels therefore remain unaffected and operable in the event of a Fire Area J fire.

Fire Area K Post-Fire OMAs and Associated Diagnostic Indicators Reference: 05/04/10 Entergy Letter – Table RAI-08.1-5	
Operator Manual Action	**Diagnostic Indicator(s) Triggering Operator Response to Perform OMA**
Transfer 21 AFW Pump to ASSS power source	Loss of control and/or indication for 21AFW pump from CCR, OR indication of decreasing level in 21-24 steam generators, as viewed at LR-417, 427, 437, 447. Wide-range level channels LT-417D through 447D have two cables each routed through Fire Area K, to support remote level indicators for each channel. These circuits are isolated by a power supply – repeater - isolator module from the signal path recorded at the listed recorders.

Fire Area K Post-Fire OMAs and Associated Diagnostic Indicators Reference: 05/04/10 Entergy Letter – Table RAI-08.1-5	
Operator Manual Action	**Diagnostic Indicator(s) Triggering Operator Response to Perform OMA**
Transfer 21 AFW Pump to ASSS power source (cont'd)	Whether the subject 2/C #16 signal circuits in Fire Area K are failed open, shorted, shorted to ground, or subject to a hot short of up to 480VAC, the primary channel of level indication for each SG can be expected to remain unaffected and operable in the CCR.
Open 21 AFW Pump recirculation bypass valve	Operator will be present in the AFW pump room to perform the above listed OMA (transfer 21AFW pump to alternate power source). Therefore, local operator diagnosis (noise, vibration) of FCV-1121 failing closed will trigger the action to open the manual bypass valve, if necessary.
Operate 21 AFW Pump flow control valves to control AFW flow to Steam Generators 21 & 22	Loss of control and/or indication for 21AFW pump from CCR, OR indication of decreasing level in 21-24 steam generators, as viewed at LR-417, 427, 437, 447. Wide-range level channels LT-417D through 447D have two cables each routed through Fire Area K, to support remote level indicators for each channel. These circuits are isolated by a power supply – repeater - isolator module from the signal path recorded at the listed recorders. Whether the subject signal circuits in Fire Area K are failed open, shorted, shorted to ground, or subject to a hot short of up to 480VAC, the primary channel of level indication for each SG can be expected to remain unaffected and operable in the CCR.

Fire Area P Post-Fire OMAs and Associated Diagnostic Indicators Reference: 05/04/10 Entergy Letter – Table RAI-08.1-6	
Operator Manual Action	**Diagnostic Indicator(s) Triggering Operator Response to Perform OMA**
Transfer 23 CCW Pump to ASSS power feed if normal power/control is lost	Loss of control and/or indication for all three CCW pumps in CCR.
Start Appendix R Diesel Generator (ARDG) if normal power and offsite power are lost	Further review has confirmed that Fire Area P presents no impact to cables or components associated with the onsite power supplied by the safety-related EDGs: 21, 22, 23EDG. In the event that it is desired/necessary to utilize the ARDG, this would only be in response to CCR operators observing the loss of indication for power availability to all 480V safety-related buses.

Fire Area YD Post-Fire OMAs and Associated Diagnostic Indicators Reference: 05/04/10 Entergy Letter – Table RAI-08.1-7	
Operator Manual Action	**Diagnostic Indicator(s) Triggering Operator Response to Perform OMA**
Align Charging pump makeup path to RCS	Action to locally open bypass valve 227 is only required if normal flowpath valve HCV-142 fails closed. Spurious isolation of the charging makeup path to the RCS is identified in the CCR by operators confirming that a charging pump is in operation, but pressurizer level is decreasing. No CCR pressurizer level indicating channels have cables routed through Fire Area YD, and therefore the CCR indication of pressurizer level can be expected to remain unaffected and operable in the event of a Fire Area YD fire.

RAI-09.1

Provide a more detailed description of the operational requirements of HCV-142, including the potential impact, if any, that a spurious valve closure could have on an operating charging pump.

RAI-09.1 RESPONSE

HCV-142 is a normally open, fail closed air-operated valve located in the charging line supplying makeup to the RCS via hot leg injection through valve 204A or cold leg injection through valve 204B. HCV-142 is normally operated in throttled mode to control flow distribution between RCS charging makeup and the RCP seal injection paths.

In the event of a fire that causes HCV-142 to spuriously close or fail closed due to fire-induced circuit faults or loss of instrument air while a charging pump is running, the normal charging makeup path to the RCS would be blocked, while the RCP seal injection path would remain open, since the seal injection line branch is upstream of HCV-142. Any excess charging flow, up to the full 98 gpm capacity of the running charging pump, would be diverted through the individual pump's relief valve back to the VCT. As such, no damage to the running charging pump would be incurred, and upon detection of low charging makeup flow or decreasing pressurizer level, the operators would take action to restore the charging flowpath by remotely or locally opening motor-operated bypass valve 227.

As confirmed by the IP2 Appendix R Safe-Shutdown Analysis, valve HCV-142 is in fact vulnerable to fire-induced cable damage only in Fire Area A, which is a III.G.3 fire area; cables for valve HCV-142 remain entirely within Fire Area A. Consequently, NRC approval is not required for the manual action that may be required to manually bypass a spuriously closed HCV-142 in a III.G.3 fire scenario.

However, for the III.G.2 fire areas of concern to this request for exemption (i.e., Fire Areas F and YD) HCV-142 is potentially vulnerable to spurious closure as the result of fire-induced loss of the instrument air supply to the valve positioner. As motor-operated valve 227 provides a bypass path around HCV-142, these valves are considered to represent redundant trains in the context of Appendix R, Paragraph III.G.2.

The IP2 Appendix R Safe-Shutdown Analysis does not credit the availability of the instrument air supply in any analyzed fire scenario. The instrument air supply is assumed to be unavailable in all scenarios given the complexity of instrument air piping and tubing routing, the numerous pneumatic loads, and the variety of connection types. Depending on location, it is assumed that a fire can either disable the associated compressor(s) or cause instrument air tubing and/or connections to be fused open, thereby venting the instrument air supply from all downstream pneumatic loads.

As such, while no cables for valve HCV-142 are routed through III.G.2 fire areas, the loss of instrument air is conservatively assumed to occur in all fire scenarios and, therefore, HCV-142 is assumed to be failed closed. This failure necessitates the use of motor-operated valve 227 to restore the charging makeup path to the RCS, either via use of normal CCR controls or

through the use of an OMA to locally open this valve. This request for exemption, therefore, focuses on those III.G.2 fire areas/zones containing cables associated with valve 227 as fire-induced failure of one or more of these cables would create the need to implement the OMA to locally open valve 227.

Motor-operated valve 227, which is normally closed and with its MCC compartment circuit breaker maintained OPEN (to prevent any spurious opening of this valve), provides a bypass around valves HCV-142 and 226. Fire-induced faults on the valve 227 control circuits, therefore, do not present the potential for spurious operation of the valve. In the unlikely event that valve 227 is spuriously opened as the result of a fire in Fire Area F or Fire Area J, this does not create a flow diversion path that requires timely operator intervention since the required charging system makeup paths will remain in service. Note that valve 227 has been reviewed for susceptibility to the potential MOV failure mode described by Information Notice 92-18, and by virtue of the normally deenergized status of the MCC compartment circuit breaker, spurious actuation of valve 227 caused by control circuit faults has been precluded, thereby also preventing the occurrence of any scenario in which MOV torque and/or limit switches could be bypassed by fire-induced faults to cause potential mechanical damage to the valve.

RAI-10.1

Provide a technical justification (e.g., fire test data, or analysis) to support the assertion that the glass braid jacketed cable should be considered in the same manner as the thermoset cable included in the industry fire tests.

RAI-10.1 RESPONSE

The response to RAI-05.1 in the May 4, 2010 submittal discussed the expectation of original IP2 plant cables with an outer jacket construction of asbestos-glass braid construction to perform similar to thermoset cables during fire exposure. As noted in the RAI-05.1 response, these original plant cables have conductors insulated with thermoplastic (PVC) and, as such, any and all forms of intra-cable faults (conductor-to-conductor, conductor-to-ground, open conductor, etc.) may be experienced upon exposure of these cables to fire conditions. However, it is Entergy's belief that the outer jacket construction can be expected to perform in a manner comparable to a thermoset material, in that the asbestos-glass braid outer covering is not subject to melting and loss of structural integrity during fire exposure. As such, Entergy believes that this cable construction may afford some level of protection against inter-cable hot shorts and potential shorting of internal conductors to ground.

No fire test data (other than flame retardance tests) evaluating insulation performance under fire exposure conditions appears to be available relative to the plant cable types utilizing the asbestos-glass braid outer jacket. Qualitative information exists in the form of legacy specification of the use of asbestos-glass braid jacketed cables for industrial applications involving high-temperature processes or equipment. However, in EPRI-1003326 (Characterization of Fire-Induced Circuit Faults – Results of Cable Fire Testing), Cable Test 1 (Armored Cable in Hot Gas Layer, 350 kW HRR) included a post-test observation regarding the performance of a fiberglass "scrim" layer, which formed an internal jacket between the

conductors and the outer armor. The post-test observation noted that insulation resistance measurements taken following the fire exposure test indicated that the fiberglass scrim layer might act to hinder or delay conductor shorts to the outer armor.

The fiberglass scrim layer of the cable configuration tested in EPRI-1003326 may be compared to the relatively robust asbestos-glass braid outer jacket of the IP2 plant cables, with the reasonable expectation that the asbestos-glass braid jacket of the cables may provide comparable resistance to either internal conductors shorting to ground (e.g., the tray or conduit enclosing the cable), or to external cables/conductors shorting to conductors within the asbestos-glass braid jacketed cables.

However, regardless of the reasonable expectation that the original IP2 plant cables with asbestos-glass braid outer jacket construction may exhibit resistance to the above described fault types, Entergy does not assume or credit in any case that the cable construction will prevent any postulated fault type. Rather, the outer jacket construction is viewed as but one layer of defense in depth, providing some level of protection against the above described fault types.

ENCLOSURE 1

Required Changes to May 4, 2010 Entergy Letter NL-10-042

ENTERGY NUCLEAR OPERATIONS, INC.
Indian Point Nuclear Generating Unit No. 2
Docket No. 50-247
License No. DPR-26

Summary of Required Changes to May 4, 2010 Letter	
Change	**Reason for Change**
REVISE **Table RAI-06.1-1** SSD Feature column to add 22 AFW Pump steam supply isolation valves for Fire Area/Zone **C/23** REVISE **Table RAI-08.1-1** OMA Performance column to add Fire Area/Zone **C/23** as a Performance Zone for the Required OMA of "Open/check open 22 AFW Pump steam supply isolation valves"	Cables associated with 22 AFW Pump steam supply isolation valves PCV-1310A/B and PCV-1139 have been verified to route through Fire Area/Zone **C/23**
REVISE **Table RAI-06.1-1** SSD Feature column to add LCV-112C for Fire Area/Zone **F/7A**	Cables associated with charging suction valve LCV-112C haves been determined by field walkdown to be included in Fire Area/Zone **F/7A**
ADD Fire Area/Zone **F/59A** to **Table RAI-06.1-1** ADD new RAI-GEN table (**RAI-GEN-28**) for Fire Area/Zone **F/59A**. This adds page 106 of 113 to the 5/4/10 letter that originally had 105 pages.	Identified new Fire Area/Zone **F/59A** impact via cable routing and field walkdown
REVISE **Table RAI-08.1-2** OMA Initiator column from Zone 27 (sic – should have read "27A") to Zone **59A** as an Initiator Zone for the Required OMA of "Align Charging pump makeup path to RCS."	Cable EDC3-EXF6/2 for OMA "Align charging path to RCS" found NOT routed through Fire Area/Zone F/27A - actually routed through Fire Area/Zone **F/59A**
REVISE **Table RAI-08.1-4** OMA Initiator column to delete Zone **24** as an Initiator Zone for the Required OMA of "Transfer Instrument Buses 23 and 23A to emergency power source." Note that Zone 24 is in fact a correct part of the routing of the affected circuits, but should not be mentioned here, since it is not a III.G.2 zone.	Incorrect reference is made to Fire Area/Zone **J/24**, which is a III.G.3 zone, and not relevant to the OMA issue

Summary of Required Changes to May 4, 2010 Letter	
Change	**Reason for Change**
REVISE **Table RAI-08.1-4** to **WITHDRAW** the Required OMA of "Operate 22 AFW Pump flow control valves to align AFW flow to selected Steam Generators(s)."	Unnecessary OMA to operate 22 AFW Pump flow control valves (FCVs 405B, C) for Fire Area/Zones **J/19, J/39A, J/43A, J/45A, J/50A**. Failure as determined by Safe-Shutdown Analysis is the failure of the valve power supplies (instrument buses), which are recovered by a separate OMA to transfer the instrument buses to their emergency power supplies. After reenergizing the instrument buses, the valves can be operated from the controls in the CCR, so an OMA is not required.
REVISE **Table RAI-06.1-1** SSD Feature column to delete "LCV-112C" for Fire Area/Zones **J/43A** and **J/46A** REVISE **Table RAI-08.1-4** Comments column to delete "LCV-112C" for the Required OMA of "Align Charging pump suction source to RWST"	Cables associated with LCV-112C have been verified to not be routed in Fire Area/Zones **J/19, J/39A, J/43A, J/45A, J/46A,** or **J/50A**
REVISE **Table RAI-06.1-1** SSD Feature column to delete "FCV-405B, C; FCV-406A" for Fire Area/Zone **J/46A**	Cables associated with valves FCV-405B/C and FCV-406A have been verified to not be routed in Fire Area/Zone **J/46A**
REVISE **Table RAI-08.1-4** OMA Initiator column to delete Zones **19, 39A, 45A**, and **50A** as Initiator Zones for the Required OMA of "Align Charging pump suction source to RWST". Also REVISE Comments column to specify that a cable associated with a supporting component for LCV-112B is the Target	Cables associated with LCV-112B have been verified to not be routed in Fire Area/Zones **J/19, J/39A, J/45A,** or **J/50A**

Summary of Required Changes to May 4, 2010 Letter	
Change	**Reason for Change**
REVISE **Table RAI-06.1-1** to add Fire Area/Zones **H/71A**, **H/72A**, **H/84A**, and **H/85A** and to delete **H/76**A ADD new RAI-GEN tables **RAI-GEN-29** for Fire Area/Zone **H/72A**, **RAI-GEN-30** for Fire Area/Zone **H/84A**, and **RAI-GEN-31** for Fire Area/Zone **H/85A**. This adds pages 107 - 113 of 113 to the 5/4/10 letter that originally had 105 pages.	Fire Area/Zones **H/71A**, **H/72A**, **H/84A**, and **H/85A** have been identified to contain cables/components for the listed SSD features, and it incorrectly identifies Fire Area/Zone **H/76A** as a zone that contains cables/components for the listed SSD features
RAI-GEN-1 (CHARACTERISTICS OF FIRE AREA C / FIRE ZONE 23) Change from "4–Electrical Cabinets" to "2-Electrical Cabinets Add "1-Transfer Switch" RAI-GEN-10 (CHARACTERISTICS OF FIRE AREA H / FIRE ZONE 75A Change Detection field from "No" to "Yes" RAI-GEN-23 (CHARACTERISTICS OF FIRE AREA J / FIRE ZONE 270) Change from "37-Electrical Cabinets" to "51 Electrical Cabinets" RAI-GEN-25 (CHARACTERISTICS OF FIRE AREA K / FIRE ZONE 65A) Add "1-Transformer"	Discrepancies identified in "Ignition Sources" line on RAI-GEN Tables

Table RAI-06.1-1
Proximity of Redundant Safe-Shutdown Cables/Components,
Fire Hazards, and Ignition Sources Within Fire Areas and Fire Zones of Concern

Fire Area / Zone	SSD Feature	Proximity to Significant Fixed Combustibles	Proximity to Ignition Sources	Comments
C / 23	All three AFW pumps, flow control valves, and 22 AFW Pump steam supply isolation valves, and associated cables	Small quantities of cable in overhead trays, with pumps and valves at floor elevation. The trays containing cables serving the AFW flow control valves are also located in the overhead area.	The cable runs and pump motors are the credible ignition sources, in addition to an alternative power transfer switch located at the south end of the room	Nonmechanistic ignition of control or instrument cables in the overhead trays would present an immediate impact on redundant AFW trains, as the trays contain (in part) control cables serving the AFW flow control valves The remaining fixed combustibles, consisting of a minute quantity of lube oil and electrical cabinets, present no credible challenge to the AFW components in the zone The smoke detection system in the zone provides assurance of early warning of a fire condition, enabling fire brigade response prior to significant fire development
F / 5A	Cables associated with Charging suction valves LCV-112C and LCV-112B	The dominant combustible is cable in overhead trays. The cables of concern are located in or adjacent to the trays.	The ignition sources, consisting of cable tray runs, junction boxes, and electrical cabinets, are in direct contact with, or in close proximity to the combustibles (electrical cables)	The flame-retardant characteristics of the cables ensure that any fire would be limited in scope and severity No fire detection is installed in the zone, but given the insignificant ignition sources, the occurrence of a fire of significance in the zone is a low-credibility event. Smoke detection in adjacent Fire Zone 7A may provide annunciation of any smoke that may migrate out of Fire Zone 5A to the main corridor area.

Table RAI-06.1-1
Proximity of Redundant Safe-Shutdown Cables/Components,
Fire Hazards, and Ignition Sources Within Fire Areas and Fire Zones of Concern

Fire Area / Zone	SSD Feature	Proximity to Significant Fixed Combustibles	Proximity to Ignition Sources	Comments
F / 7A	Cables associated with: Charging makeup valves 227/HCV-142; Instrument Buses 23 and 23A; LCV-112C	The dominant combustible material in the zone is cable in overhead trays. The subject cables, in part, are located in or adjacent to these trays.	Ignition sources in the form of electrical cabinets are distributed throughout the zone. Cable trays are oriented directly above electrical cabinets in the primary corridor area of the zone. Secondary combustibles in the area are dispersed, and substantial quantities of these combustibles are not proximate to the ignition sources in the zone	Combustibles other than cables in trays are minimal throughout the zone. The credible fire scenario would involve transient combustibles, which are tightly controlled to "Level 2" limits per administrative control procedure. Combustibles in this large zone are widely distributed, presenting minimal potential for significant involvement in response to initiation by any single ignition source in the zone The smoke detection system in the zone provides assurance of early warning of a fire condition of any significance, enabling fire brigade response prior to significant fire development
F / 22A	Cables associated with Charging suction valve LCV-112C and LCV-112B	The zone contains a negligible quantity of fixed combustibles	The ignition sources, defined as electrical cabinets, do not present the potential for ignition of secondary combustibles, given the insignificant content of the zone	Redundant SSD trains are not located in the zone, but damage to cables associated with LCV-112C requires an OMA to align an alternate Charging suction source, outside this zone No fire detection is installed in the zone, but given the insignificant ignition sources, and the absence of significant combustibles, the occurrence of a fire of significance in the zone is a low-credibility event

Table RAI-06.1-1
Proximity of Redundant Safe-Shutdown Cables/Components,
Fire Hazards, and Ignition Sources Within Fire Areas and Fire Zones of Concern

Fire Area / Zone	SSD Feature	Proximity to Significant Fixed Combustibles	Proximity to Ignition Sources	Comments
F / 27A	Cables associated with Charging suction valve LCV-112C and LCV-112B	The dominant combustible is cable in overhead trays. The cables of concern are located in or adjacent to the trays.	The ignition sources consist of cable tray runs and a significant number of motor control centers, located in the southeast corner of the zone. Cable trays are in overhead proximity to one or more MCCs.	Combustibles other than cables in trays are minimal throughout the zone. The credible fire scenario would involve transient combustibles, which are tightly controlled to "Level 2" limits per administrative control procedure. Combustibles in this large zone are widely distributed, presenting minimal potential for significant involvement in response to initiation by any single ignition source in the zone The smoke detection system provides assurance of early warning of a fire condition, enabling brigade response prior to significant fire development
F / 33A	Cables associated with Charging makeup valves 227/HCV-142	The dominant combustible is cable in overhead trays. The cables of concern are located in or adjacent to the trays	The ignition sources consist of the cable tray runs themselves, as well as a significant number of motor control centers. Cable trays containing the cables of concern are in overhead proximity to one or more MCCs.	While not contained within a rated barrier, the effects of a fire in this zone can be expected to be largely confined to the zone, which is enclosed by a partial-height (10 ft) concrete block wall. In the event of a significant fire in the zone, smoke migration through the open ceiling of the zone to adjacent Fire Zone 27A, the adjacent main corridor area, can be expected to be detected by the smoke detection system in Zone 27A.
F / 59A	Cables associated with HCV-142 bypass valve 227	The dominant combustible is charcoal enclosed in HVAC filter units.	Ignition sources consist of electrical cabinets. Conduit containing the cables of concern is routed directly above one electrical (instrument) cabinet.	The predominant combustible in the zone (charcoal) is enclosed in filter housings equipped with an automatic fire detection and water suppression system.

Table RAI-06.1-1
Proximity of Redundant Safe-Shutdown Cables/Components,
Fire Hazards, and Ignition Sources Within Fire Areas and Fire Zones of Concern

Fire Area / Zone	SSD Feature	Proximity to Significant Fixed Combustibles	Proximity to Ignition Sources	Comments
H / 70A, 71A, 72A 75A, ~~76A,~~ 77A, 84A, 85A, 87A	Charging makeup valves 204A and 204B and associated cables Safe-shutdown instruments (Pressurizer level and pressure, Steam Generator level, RCS loop temperatures, and source-range neutron monitoring)	Significant fixed combustibles are cables in trays located in the annulus area proximate to the electrical penetrations in Fire Zone 75A, and RCP lubricating oil located in Fire Zones 70A and 71A. Combustibles in the balance of containment are minimal, as are ignition sources, during normal plant operation. Cables for valves 204A, 204B, and normal SSD instrument channels are located proximate to ignition source represented by cable tray runs, located principally in Fire Zone 75A. Instrument cables are located in Fire Zones 70A, 71A, where the RCP oil collection systems minimize the potential for a fire of significance, and in Fire Zone 75A, where smoke detectors and minimal ignition sources other than cable runs minimize the potential fire challenge. Cables and instruments are also located in Fire Zones 76A, 77A, and 87A, all of which contain minimal quantities of fixed combustibles.	Cables for valves 204A and 204B and safe-shutdown instrumentation are located within zones containing RCPs and the associated lube oil. However, as noted at right, the oil collection systems are considered to reduce the potential fire hazard to a negligible level. Cables for the normal SSD instrument channels are located proximate to ignition sources in the form of cable tray runs containing these cables	RCP lube oil is not considered to present a credible hazard, in that the RCPs are provided with a lube oil collection system, ensuring that any leakage cannot contact hot surfaces and present an ignition threat Smoke detectors are installed in the annulus – electrical penetration area, where the density of exposed cables is high. Smoke detection is also installed in each of the RCP bays. While the RCP oil collection systems can be expected to minimize the potential for an oil fire in the RCP areas, the smoke detection in each zone can be expected to provide timely annunciation of an oil or electrical fire that may occur.

Table RAI-06.1-1
Proximity of Redundant Safe-Shutdown Cables/Components,
Fire Hazards, and Ignition Sources Within Fire Areas and Fire Zones of Concern

Fire Area / Zone	SSD Feature	Proximity to Significant Fixed Combustibles	Proximity to Ignition Sources	Comments
J / 43A	Cables associated with: 480V Buses 5A and 6A; IBUS23/IBUS 23A; LCV-112B/~~112C~~	Cable trays are the dominant combustibles in the zone, and cables of concern are located in or in proximity to these trays	Ignition sources include 6.9kV switchgear and motors located in the zone, with 6.9kV switchgear also presenting HEAF event potential. Cables of concern are routed through the overhead area of the zone.	No fire detection or automatic suppression systems are provided for this zone, but a fire involving the 6.9kV switchgear can be expected to be promptly detected in the CCR, via annunciation of loss of power to the affected 6.9kV buses. In addition, Zone 43A is a high-traffic area and a developing fire condition can be expected to be detected and reported by personnel in the area.
J / 45A	Cables associated with: 480V Buses 5A and 6A; IBUS23/IBUS 23A	Cable trays are the dominant combustibles in the zone, and cables of concern are located in or in proximity to these trays	Ignition sources include electrical cabinets, MCCs, and motors distributed throughout the zone. Cables of concern are routed through the overhead area of the zone.	The principal fuel source and ignition source exposure to the zone is the Main Boiler Feedwater pump oil equipment located immediately beneath this zone, under a partially-open floor deck. The oil storage/handling area below is provided with an automatic Aqueous Film Forming Foam system.
J / 46A	Cables associated with: 480V Buses 5A and 6A; ~~FCV-405B, C; FCV-406A;~~ LCV-112B/~~112C~~	The dominant combustible considered in this zone is turbine lube oil, which is contained within the lube/control oil piping system. A piping system failure would be required to create a credible fuel loading concern. Other combustibles include cables in trays.	Ignition sources include electrical cabinets and motors, distributed throughout the zone. Cables in trays are located above one or more of the identified ignition sources.	Absent the postulation of a lube oil piping failure, the dominant combustible in the zone is electrical cable in trays. The flame-retardant characteristics of the cables ensure that any fire would be limited in scope and severity.

TABLE RAI-08.1-1
FIRE AREA C
CREDITED III.G.2 OPERATOR MANUAL ACTIONS

Required OMA	Required Time to Complete[1]	Actual Time to Diagnose Need for OMA[2]	Actual Time to Complete OMA[3]	Total Time to Complete and Resultant Margin[4]	OMA Initiator (I) Fire Area/Zone[5] OMA Performance (P) Fire Area/Zone[6]	Comments
Operate 22 AFW Pump (turbine-driven) [previously "steam-driven"]	>1 hr	4.5 m	22 m	TTC: 26.5 m Margin: 33.5 m; 56%	I: Area C, Zone 23 P: Area C, Zone 23	Targets: 21, 22, 23 AFW pumps; Cables associated with AFW pumps and flow control valves FCV-405A, FCV-405B As described in Entergy letter NL-09-031, Att. 2, Table 2 NOTE, reentry to the AFW pump room is credited, following the initial 60 minutes of the fire event
Open/check open 22 AFW Pump steam supply isolation valves	>1 hr	4.5 m	15 m	TTC: 19.5 m Margin: >40.5 m; >67%	I: Area C, Zone 23 P: Area K, Zones 60A and 61A, Area C, Zone 23	Targets: Cables associated with 22 AFW Pump steam supply isolation valves
Operate 22 AFW Pump flow control valves to align AFW flow to selected Steam Generator(s)	>1 hr	4.5 m	22 m	TTC: 26.5 m Margin: >33.5 m; >56%	I: Area C, Zone 23 P: Area C, Zone 23	Targets: Cables associated with 23 AFW Pump flow control valves FCV-405A, FCV-405B

TABLE RAI-08.1-2
FIRE AREA F
CREDITED III.G.2 OPERATOR MANUAL ACTIONS

Required OMA	Required Time to Complete	Actual Time to Diagnose Need for OMA	Actual Time to Complete OMA	Total Time to Complete and Resultant Margin	OMA Initiator (I) Fire Area/Zone OMA Performance (P) Fire Area/Zone	Comments
Operate SGADVs	-	-	-	-	-	**WITHDRAWN** See response to RAI-02.1
Align Charging pump makeup path to RCS	75 m	14 m	14 m (b)	TTC: 28 m Margin: 47 m; 63%	I: Area F, Zone ~~27~~ 59A or 33 P: Area A, Zone 1A	Targets: Cables associated with valve 227 Travel time conservatively taken to be 10 minutes, from CCR to PAB. Travel time is non-critical, since no attempt is made to perform the OMA for the initial 60 minutes of the scenario.

TABLE RAI-08.1-4
FIRE AREA J
CREDITED III.G.2 OPERATOR MANUAL ACTIONS

Required OMA	Required Time to Complete	Actual Time to Diagnose Need for OMA	Actual Time to Complete OMA	Total Time to Complete and Resultant Margin	OMA Initiator (I) Fire Area/Zone OMA Performance (P) Fire Area/Zone	Comments
Trip breakers 52/5A and 52-SAC on Bus 5A and 52/6A and 52/TAO at Bus 6A and remove control power fuses	1 hour	0 (Offsite power assumed unavailable at T=0)	10 m	TTC: 10 m Margin: 50 m; 83%	I: Area J, Zone 17, 19, 39A, 43A, 45A, 46A, 47A, or 50A P: Area A, Zone 14	Targets: Cables associated with Bus 6A supply breakers Actual time to complete in this case is based on equivalent breaker tripping actions in the 480V Switchgear Room that have been previously validated
Transfer Instrument Buses 23 and 23A to emergency power source	30 m	5.5 m	2 m	TTC: 7.5 m Margin: 22.5 m; 75%	I: Area J, Zone ~~24~~, 25, or 270 P: Area A, Zone 11	Targets: Cables associated with IB23, IB23A
Align Charging pump suction source to RWST	75 m	14 m	18 m (f)	TTC: 32 m Margin: 43 m; 57%	I: Area J, Zone 19, 39A, 43A, 45A, 46A, or 50A P: Area F, Zone 6; Area F, Zone 22A	Targets: Cables associated with supporting component for valves LCV-112B~~, LCV-112C~~ Travel time conservatively taken to be 10 minutes, from CCR to PAB
Operate 22 AFW Pump flow control valves to align AFW flow to selected Steam Generator(s)	~~34 m~~	~~4.5 m~~	~~17 m~~	~~TTC: 11.5 m~~ ~~Margin: 22.5 m; 66%~~	~~I: Area J, Zone 19, 39A, 43A, 45A, or 50A~~ ~~P: Area C, Zone 23~~	**WITHDRAWN**~~Targets: Cables associated with AFW flow control valves FCV-405A-D~~

(f) The Total Time to Complete is conservatively revised to 18 minutes, whereas the referenced submittals showed a value of 8 minutes for the Actual Time to Complete

TABLE RAI-GEN-1 CHARACTERISTICS OF FIRE AREA C / FIRE ZONE 23	
Fire Area / Description	C / Auxiliary Boiler Feed Pump Room, Elevation 18'-6" of the Auxiliary Feed Pump Building
Fire Zone / Description	23 / Auxiliary Boiler Feed Pump (ABFP) Room, Elevation 18'-6"
Fire Zone Dimensions	1210 sq ft w/ 14 ft Ceiling
App R III.G.2 Compliance	a) 3-hr Barrier: No b) 20 ft Separation: No c) 1-hr Enclosure: No -- Detection: Yes -- Suppression: No
App R III.G.2 Exemptions	Yes – SERs dated Oct 16, 1984 and March 4, 1987
Fixed Combustible Materials	Cable, lube oil, electrical panels
Cable Insulation Quantity in BTU	3.256E+07 BTU
Total Fixed Combustible Loading / Fire Severity	32,170 BTU/sq ft / 24 minutes
Transient Combustible Materials	Trash, lube oil, paint
Transient Combustible Loading / Fire Severity	1,433 BTU/sq ft / 1 minute
Combustible Loading - Rating	Low (Fixed + Transient loads = < 100,000 BTU/sq ft)
Ignition Sources	Cable run, Junction boxes, 2-Motors & Pumps, 42-Electrical Cabinets, 1-Transfer Switch
Detection Type / Coverage	Ionization / Area Wide
Code of Record	NFPA 72D-1975

TABLE RAI-GEN-10 CHARACTERISTICS OF FIRE AREA H / FIRE ZONE 75A	
Fire Area / Description	H / Containment Building
Fire Zone / Description	75A / Outer Annulus, Elevation 46'-0
Fire Zone Dimensions	1,100 sq ft w/ 22 ft ceiling
App R III.G.2 Compliance	a) 3-hr Barrier: No b) 20 ft Separation: No c) 1-hr Enclosure: No -- Detection: ~~No~~Yes -- Suppression: No
App R III.G.2 Exemptions	None
Fixed Combustible Materials	Cable
Cable Insulation Quantity in BTU	1.165E+08BTU
Total Fixed Combustible Loading / Fire Severity	105,455 BTU/sq ft / 79 minutes
Transient Combustible Materials	None
Transient Combustible Loading / Fire Severity	NA
Combustible Loading - Rating	Moderate (Fixed + Transient loads = 100,000 – 200,000 BTU/sq ft)
Ignition Sources	Cable run, Junction boxes
Detection Type / Coverage	None
Code of Record	NA

TABLE RAI-GEN-23 CHARACTERISTICS OF FIRE AREA J / FIRE ZONE 270	
Fire Area / Description	J / Unit 1 Control Room, Turbine Building, Superheater Building, Nuclear Service Building, Chemical Systems Building, Administration Building, Screenwell House, and Unit 2 Turbine Building
Fire Zone / Description	270 / General Area of the 33' Elev. of the Unit 1 Superheater Bldg
Fire Zone Dimensions	13,000 sq ft w/ 19 ft ceiling
App R III.G.2 Compliance	a) 3-hr Barrier: No b) 20 ft Separation: No c) 1-hr Enclosure: No -- Detection: No -- Suppression: No
App R III.G.2 Exemptions	None
Fixed Combustible Materials	Cable
Cable Insulation Quantity in BTU	7.236E+07 BTU
Total Fixed Combustible Loading / Fire Severity	5,566 BTU/sq ft / 4 minutes
Transient Combustible Materials	Trash, Cardboard drums, Flammable Liquid Cab, Plastic, Wood, Painting
Transient Combustible Loading / Fire Severity	8,037 BTU/sq ft / 6 minutes
Combustible Loading - Rating	Low (Fixed + Transient loads < 100,000 BTU/sq ft)
Ignition Sources	Cable run, junction boxes, 12-Transformers (dry), 4-motors, 3-Battery Charger, 4-MCC vertical panel, ~~37~~51-Electrical Cabinets

TABLE RAI-GEN-25 CHARACTERISTICS OF FIRE AREA K / FIRE ZONE 65A	
Fire Area / Description	K / Auxiliary Feed Pump Building (not including the AFW Pump Room)
Fire Zones / Description	65A / Main Steam and Feedwater Valve Area 43'-0", 65'-0", and 74'-0"
Fire Zone Dimensions	1,210 sq ft w/ 43 ft ceiling
App R III.G.2 Compliance	a) 3-hr Barrier: No b) 20 ft Separation: No c) 1-hr Enclosure: No -- Detection: No -- Suppression: No
App R III.G.2 Exemptions	None
Fixed Combustible Materials	Wood
Cable Insulation Quantity in BTU	None
Total Fixed Combustible Loading / Fire Severity	5,363 BTU/sq ft / 4 minutes
Transient Combustible Materials	Trash, Painting
Transient Combustible Loading / Fire Severity	1,034 BTU/sq ft / <1 minute
Combustible Loading - Rating	Low (Fixed + Transient loads = < 100,000 BTU/sq ft)
Ignition Sources	2-Electrical Cabinets, 1-Transformer
Detection Type / Coverage	None

TABLE RAI-GEN-28 CHARACTERISTICS OF FIRE AREA F / FIRE ZONE 59A	
Fire Area / Description	F / Primary Auxiliary Building and Fan House
Fire Zones / Description	59A / Fan House Elevation 72'-0", 80'-0", and 92'-0
Fire Zone Dimensions	1,400 sqft w/ 29 ft ceiling
App R III.G.2 Compliance	a) 3-hr Barrier: No b) 20 ft Separation: No c) 1-hr Enclosure: No -- Detection: Yes -- Suppression: No
App R III.G.2 Exemptions	None
Fixed Combustible Materials	Charcoal
Cable Insulation Quantity in BTU	None
Total Fixed Combustible Loading / Fire Severity	374,142 BTU/sqft / 281 minutes
Transient Combustible Materials	Trash, Painting, Rad Boundaries
Transient Combustible Loading / Fire Severity	96,154 BTU/sqft / 72 minutes
Combustible Loading - Rating	High (Fixed + Transient loads = >200,000 BTU/sqft)
Ignition Sources	4-Electrical Cabinets
Detection Type / Coverage	Thermistor wire for the Charcoal Filters. Ionization detector outside charcoal filter enclosure on elevation 72'-0"
Code of Record	NFPA 72D-1967

TABLE RAI-GEN-28 CHARACTERISTICS OF FIRE AREA F / FIRE ZONE 59A	
Fixed Suppression Type / Coverage	Deluge water spray systems for the PAB and Containment Ventilation charcoal filters
Code of Record	NFPA 13-1972, NFPA 15-1969
Manual Suppression Type	CO2 extinguishers
Adjacent Zone Manual Suppression	Hose station (water), CO2 and 150 lb DC extinguishers, hydrants outside
Additional FP Features	None
Administrative Controls	Transient Combustibles Control - Level 2 Area Control of Hot Work and Ignition Sources
Other Evaluations (i.e., 86-10)	None

TABLE RAI-GEN-29 CHARACTERISTICS OF FIRE AREA H / FIRE ZONE 72A	
Fire Area / Description	H / Containment Building
Fire Zone / Description	72~~1~~A / Outer Annulus, Elevation 46'-0
Fire Zone Dimensions	1,100 sqft w/ 22 ft ceiling
App R III.G.2 Compliance	a) 3-hr Barrier: No b) 20 ft Separation: No c) 1-hr Enclosure: No -- Detection: No -- Suppression: No
App R III.G.2 Exemptions	None
Fixed Combustible Materials	Cable
Cable Insulation Quantity in BTU	35,900,000 BTU
Total Fixed Combustible Loading / Fire Severity	33,409 BTU/sqft / 25 minutes
Transient Combustible Materials	None
Transient Combustible Loading / Fire Severity	NA
Combustible Loading - Rating	Low (Fixed + Transient loads < 100,000 BTU/sqft)
Ignition Sources	Cable run
Detection Type / Coverage	None

TABLE RAI-GEN-29 CHARACTERISTICS OF FIRE AREA H / FIRE ZONE 72A	
Code of Record	NA
Fixed Suppression Type / Coverage	None
Code of Record	NA
Manual Suppression Type	None
Adjacent Zone Manual Suppression	Hose station (water)
Additional FP Features	ASSS instrumentation cabling protected with a Radiant Energy Shield
Administrative Controls	Transient Combustibles Control - Level 2 Area Control of Hot Work and Ignition Sources
Other Evaluations (i.e., 86-10)	None

TABLE RAI-GEN-30 CHARACTERISTICS OF FIRE AREA H / FIRE ZONE 84A	
Fire Area / Description	H / Containment Building
Fire Zone / Description	84A / 22 Containment Fan Cooler Unit Area, Elevation 68'-0
Fire Zone Dimensions	910 sqft w/ 27 ft ceiling
App R III.G.2 Compliance	a) 3-hr Barrier: No b) 20 ft Separation: No c) 1-hr Enclosure: No -- Detection: No -- Suppression: No
App R III.G.2 Exemptions	None
Fixed Combustible Materials	Cable
Cable Insulation Quantity in BTU	24,800,000 BTU
Total Fixed Combustible Loading / Fire Severity	27,253 BTU/sqft / 21 minutes
Transient Combustible Materials	None
Transient Combustible Loading / Fire Severity	NA
Combustible Loading - Rating	Low (Fixed + Transient loads < 100,000 BTU/sqft)
Ignition Sources	Cable run

TABLE RAI-GEN-30 CHARACTERISTICS OF FIRE AREA H / FIRE ZONE 84A	
Detection Type / Coverage	None
Code of Record	NA
Fixed Suppression Type / Coverage	None
Code of Record	NA
Manual Suppression Type	None
Adjacent Zone Manual Suppression	Hose station (water)
Additional FP Features	None
Administrative Controls	Transient Combustibles Control - Level 2 Area Control of Hot Work and Ignition Sources
Other Evaluations (i.e., 86-10)	None

TABLE RAI-GEN-31 CHARACTERISTICS OF FIRE AREA H / FIRE ZONE 85A	
Fire Area / Description	H / Containment Building
Fire Zone / Description	85A / Incore Detector Drive Area, Elevation 68'-0"
Fire Zone Dimensions	560 sqft w/ 27 ft ceiling
App R III.G.2 Compliance	a) 3-hr Barrier: No b) 20 ft Separation: No c) 1-hr Enclosure: No -- Detection: No -- Suppression: No
App R III.G.2 Exemptions	None
Fixed Combustible Materials	Cable
Cable Insulation Quantity in BTU	44,800,000 BTU
Total Fixed Combustible Loading / Fire Severity	80,000 BTU/sqft / 60 minutes
Transient Combustible Materials	None
Transient Combustible Loading / Fire Severity	NA
Combustible Loading - Rating	Low (Fixed + Transient loads < 100,000 BTU/sqft)
Ignition Sources	None

TABLE RAI-GEN-31 CHARACTERISTICS OF FIRE AREA H / FIRE ZONE 85A	
Detection Type / Coverage	None
Code of Record	NA
Fixed Suppression Type / Coverage	None
Code of Record	NA
Manual Suppression Type	None
Adjacent Zone Manual Suppression	Hose Station (water)
Additional FP Features	None
Administrative Controls	Transient Combustibles Control - Level 2 Area Control of Hot Work and Ignition Sources
Other Evaluations (i.e., 86-10)	None