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NewYorkPower Authority

October 26, 1999
JPN-99-036

United States Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station P1-137
Washington, D.C. 20555

SUBJECT: James A. FitzPatrick Nuclear Power Plant
Docket No. 50-333
Response to May 17, 1999 RAI regarding
FitzPatrick Fire IPEEE and EPRI "Fire PRA Implementation Guide"

References: See below.

Dear Sir:

The Authority's response to the NRC staff's request for additional information (Reference 1) regarding the Individual Plant Examination of External Events (IPEEE) for the Authority's James A. FitzPatrick Nuclear Power Plant is included as Attachment 1.

These questions were associated with the EPRI "Fire PRA Implementation Guide," (Reference 2) which the Authority used in the preparation of the FitzPatrick IPEEE. In Reference 3, the NRC staff documented its review of an EPRI report (Reference 4) which responded on a generic basis to these questions about the use of the EPRI implementation guide.

The Authority used EPRI's new guidance to revise the fire PRA for FitzPatrick. The information in the attached response reflects both the revised FitzPatrick PRA and the new EPRI guidance.

The attached responses fulfill the Authority's commitment (Reference 5) to prepare and submit a report detailing the changes to the FitzPatrick fire PRA and a summary of the results.

A011

PDR ADOCK

There are no commitments made by the Authority in this letter. If you have any questions, please contact Ms. C. Faison.

Very truly yours,

Harry P. Salmon, Jr.
Vice President Nuclear Engineering

cc: Next page

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Attachments:

1. Response To NRC May 17, 1999 RAI Regarding Fitzpatrick Fire IPEEE and EPRI "Fire PRA Implementation Guide"

References:

1. NRC letter, J. F. Williams to J. Knubel dated May 17, 1999 regarding Request for Additional Information regarding Individual Plant Examination of External Events (TAC No. M83622).

2. EPRI TR-105928, "Fire PRA Implementation Guide," Final Report, December 1995.

3. NRC letter, T. L. King to D. Modeen (NEI) dated June 25, 1999 regarding "EPRI Guidance for Development of Response to NRC's Generic Request for Additional Information on the EPRI Fire PRA Implementation Guide."

4. NEI letter, D. Modeen to T. L. King (USNRC) dated May 24, 1999 regarding response to request for additional information on the EPRI Fire PRA Implementation Guide.

5. NYPA letter, J. Knubel to USNRC dated September 17, 1998 (JPN-98-041), regarding " Request for Additional Information Regarding Response to Generic Letter 88-20, Supplement 4, 'Individual Plant Examination of External Events,' (TAC No. M83622)."

Response to NRC May 17, 1999 RAI Regarding
Fitzpatrick Fire IPEEE And EPRI "Fire PRA Implementation Guide"

Introduction

This report is the Authority's response to the NRC staff's request for additional information (Reference 1) regarding the Individual Plant Examination of External Events (IPEEE) for the Authority's James A. FitzPatrick Nuclear Power Plant.

These questions are associated with the EPRI "Fire PRA Implementation Guide," (Reference 2) which the Authority used in the preparation of the FitzPatrick IPEEE. In Reference 3, the NRC staff documented its review of an EPRI report (Reference 4) which responded on a generic basis to several questions about the use of the implementation guide.

The Authority used EPRI's new guidance to revise the fire PRA for FitzPatrick. The information in the attached response reflects both the revised FitzPatrick PRA and the new EPRI guidance.

The attached responses fulfill the Authority's commitment (Reference 5) to prepare and submit a report detailing the changes to the FitzPatrick fire PRA and a summary of the results.

Changes to FitzPatrick Fire PRA

During the Authority's work to resolve issues concerning the use of EPRI Fire PRA methodologies at FitzPatrick, one fire PRA scenario was revised, and seven new scenarios were added. These changes increased fire CDF to 2.56×10^{-5} per year -- a 28.2 percent increase over the original CDF of 2.00×10^{-5} per year.

After the release of the original FitzPatrick IPEEE in 1996, Authority engineers proposed that heat detectors in the Cable Spreading Room (Fire Zone CS-1) be relocated to reduce CDF. This modification would have limited the contribution of fires attributable to transient combustibles to overall fire CDF.

Instead of this modification, the Authority decided to take a more direct approach to the problem of transient combustibles. FitzPatrick Administrative Procedure AP14.02 "Combustible and Flammable Material Control," (Reference 9) was revised on August 10, 1998 to impose strict limitations on the use of unattended combustible materials in the Cable Spreading Room. (AP 14.02, details requirements for the use and storage of combustible and flammable materials within the power block and applicable adjacent areas. Under the provisions of this procedure, transient combustibles in the Cable Spreading Room require the approval of a qualified individual on the fire protection staff.) Although these changes reduce the probability of a transient combustible fire forming a hot gas layer in the Cable Spreading Room, the Authority did not take credit for these improvements in the FitzPatrick fire IPEEE.

A summary of the change in fire CDF based on resolution of the EPRI generic issues, along with the overall net CDF change, is presented in Table 12 "Summary."

Request 1

The response to Question #1 relating to the assumed heat loss factors is not sufficient to justify the use of the relatively high heat loss factor used in the assessment. It is anticipated that the new EPRI guidance will recommend use of a lower heat loss factor in determining the effects of hot gas layers. Thus, hot gas layer damage may become a more significant contributor to the fire core damage frequency (CDF). Previous conclusions may need to be reexamined given the new guidance.

We understand that new EPRI guidance is forthcoming and may be helpful in formulating a new response to these questions where revised assumptions may impact the estimated fire CDF. Please review the new EPRI guidance on heat loss factors and formulate a new response to Question #1.

Response 1

The Authority has reviewed the EPRI response to generic question 2 on heat loss factor (HLF) and applied the guidance as to its selection. In the initial fire PRA (Reference 6) screening process, fire zones were screened-out on factors other than HLF such as conditional core damage probability (CCDP). The revised EPRI guideline suggests that oil and surface-based fires be investigated using a HLF of 0.7. The Authority reviewed fire zones models, which contained scenarios with oil and other surface-based fires, with the following changes to the original submittal.

Reactor Building

For a fire in Reactor Building Fire Zone RB-1B (el. 272 ft.), scenario 10 postulated a 942,353 BTU control rod drive pump oil fire. This scenario may exceed critical conditions when a heat loss factor (HLF) of 0.7 is applied. Using the zone volume (382,172 cu. ft.) and FIVE-methodology (Table 7E, Reference 8), the temperature rise seen from this fire is 44^0 F. In order to form a 700 ^{0} F hot gas layer in this volume using a HLF of 0.7, an additional 8,242,176 BTU must be released from the cable fire. Using a heat release rate of 2,411 BTU/sec for cables, the time to reach critical conditions is approximately 57 minutes. Given the amount of time available, manual suppression was credited and computed, (using Appendix K of the EPRI Fire PRA Methodology, Reference 7), to be 0.89. Therefore, the probability of non-suppression is the complement, or approximately 0.1.

It was conservatively assumed that the fire would result in complete damage to all targets at all elevations in Fire Zone RB-1B. This, in turn, would result in the loss of low-pressure injection systems due to the failure of the injection valve pressure interlocks. Under these conditions, Abnormal Operating Procedure AOP-28 (Attachment 5, Reference 10) directs operations personnel to override these interlocks and open the injection valves.

A human reliability analysis was performed as part of the IPEEE submittal (Reference 6, Section 4.7.2.2, page 4-34) for this operator action. The analysis yielded a non-recovery probability of 0.02 for this bypass switch. Total zone CCDP was calculated applying this non-recovery probability to minimal cut sets containing losses of the interlock only. The resultant CCDP is 4.99 x 10^{-2}. The revised CDF contribution of this scenario is 8.31 x 10^{-7} per year (Case 10a).

When suppression is successful (Case 10b), the revised CDF is reduced from 5.57 x 10^{-7} per year to 5.13 x 10^{-7} per year. See Table 1.

Battery Charger Rooms

Fires in Battery Charger Rooms BR-1 (division I) and BR-4 (division II) formed hot gas layers when a HLF of 0.7 and damage temperature of 700°F was applied. Refer to Table 2.

Battery Room Corridor

Fire in BR-5 (Battery Room Corridor) at transformer 71PT-AC9 formed a hot gas layer when a HLF of 0.7 and damage temperature of 700°F was applied. For fires in the corridor, operations personnel are directed to shutdown the plant using Abnormal Operating Procedure AOP-43 (Reference 6). Note that alternate shutdown DC cabling is not routed through Fire Zone BR-5. Refer to Table 3.

Other Zones

For the remainder of the zones, critical conditions would not develop for surface fires assuming a reduced HLF. This is due to either an insufficient amount of fuel present (primarily stacks of cable tray) or a large enough volume in the fire zone to preclude formation of a hot gas layer.

In cases where a hot gas layer had been postulated to form (such as in the turbine building following an EHC pump oil fire), total zone damage (and consequently maximum CCDP without suppression) had already been accounted for in the original IPEEE submittal. As a result, there is no additional damage attributable to these fires. A summary of screened zones and scenarios is presented in Table 4.

Table 1 – Reactor Building

Zone	Case	Description	Ignition Frequency Per year	Severity Factor	Manual non-suppression	CCDP	Revised CDF Per year
RB-1B	10a	CRD pump oil fire without suppression and formation of HGL	8.33×10^{-4}	0.2	0.1	4.99×10^{-2}	8.31×10^{-7}
RB-1B	10b	CRD pump oil fire with suppression	8.33×10^{-4}	0.2	0.9	3.42×10^{-3}	5.13×10^{-7}

Table 2 – Battery Charger Rooms

Zone	Case	Description	Ignition Frequency Per year	Severity Factor	Manual non-suppression	CCDP	Revised CDF Per year
BR-1	1	Fire at battery charger 71BC-1A forming HGL	6.67×10^{-4}	1	1	1.20×10^{-4}	8.00×10^{-8}
BR-1	2	Fire at battery charger 71IBC-1 forming HGL	6.67×10^{-4}	1	1	1.20×10^{-4}	8.00×10^{-8}
BR-1	2	Fire at battery charger 71IBC-2 forming HGL	6.67×10^{-4}	1	1	1.20×10^{-4}	8.00×10^{-8}
BR-4	1	Fire at battery charger 71BC-1B forming HGL	6.67×10^{-4}	1	1	8.49×10^{-5}	3.45×10^{-8}
Battery Charger Rooms TOTAL							2.75×10^{-7}

Table 3 Battery Room Corridor

Zone	Case	Description	Ignition Frequency Per year	Severity Factor	Auto non-suppression	CCDP	SD Panel Non-recovery	Revised CDF Per year
BR-5	NEW	Fire at battery charger 71PT-AC9 forming HGL	1.73×10^{-4}	0.1	0.02	1	0.056	1.94×10^{-8}

Table 4 – Screening Response to RAI Request 1 on Heat Loss Factor

Zone	Case	Description	Impact	Comments
BR-1 (Train "A" Battery Charger Room)	1-3	Fire in chargers 71BC-1A, 71IBC-1, 71IBC-2	Low.	Fire in charger results in hot gas layer formation using HLF of 0.7.
BR-4 (Train "B" Battery Charger Room)	1-3	Fire in chargers 71BC-1B, 71IBC-3, 71IBC-4	Low.	Fire in charger results in hot gas layer formation using HLF of 0.7.
BR-5 (Battery Room Corridor)	NEW	Fire in transformer 71PT-AC9	Low. Impact of the total is 1.94×10^{-8} per year.	Fire in transformer results in hot gas layer formation using HLF of 0.7.
RB-1A (Reactor Building)	1-9	All Transient Fires	None.	Tractor-trailer oil fire at the track bay elevation 272 ft not considered due to constant attention and removal of tractor from track bay. For cases 2 and 5, there would have to be enough levels of stacked trays to allow for 58 ft of exposed tray starting with a 2 ft exposure on the lowest tray and propagating upward at a 35^{0} angle.
RB-1B (Reactor Building, elevation 272ft)	5,6,7	Various transients	None.	There would have to be enough levels of stacked trays to allow for 90 ft of exposed tray starting with a 2 ft exposure on the lowest tray and propagating upward at a 35^{0} angle.

Table 4 – Screening Response to RAI Request 1 on Heat Loss Factor

Zone	Case	Description	Impact	Comments
RB-1B (Reactor Building, elevation 272ft)	10	CRD pump oil fire	At 0.7, a hot gas layer will form for CRD pump oil fires. CDF contribution increases from 5.57×10^{-7} per year to 8.31×10^{-7} per year.	Credit is taken for manual suppression and override injection valve interlocks.
RB-1C (Reactor Building, elevation 300 ft)	1	RBC Pump 15P-2C oil fire.	None. HGL not formed. Critical conditions will not be met at 0.7	Two pints of oil. Open ceiling hatch nearby to exhaust hot gases.
RB-1C (Reactor Building, elevation 300 ft)	2	Transient fire below trays (vertical riser).	None. Critical conditions still not indicated for HLF of 0.7	Potential surface-based, non-oil fire.
RB-1C (Reactor Building, elevation 300 ft)	3	Transient fire in front of trays (two vertical risers).	None. Critical conditions still not indicated for HLF of 0.7	Potential surface-based, non-oil fire.
RB-1C (Reactor Building, elevation 300 ft)	4	Multiple vertical risers on elevation 300 ft.	None. Critical conditions still not indicated for HLF of 0.7	Potential surface-based, non-oil fire.

Table 4 – Screening Response to RAI Request 1 on Heat Loss Factor

Zone	Case	Description	Impact	Comments
RB-1C (Reactor Building, elevation 300 ft)	5	Fire against the wall - trays at elevation 321+ ft.	None. Outside critical distance	Potential surface-based, non-oil fire.
RB-1C (Reactor Building, elevation 300 ft)	6	Multiple stacked, covered vertical risers.	None. All cables were initially assumed to be damaged without ignition, regardless of HLF.	Potential surface-based, non-oil fire.
RB-1E (Reactor Building East Crescent Area)	1	Core Spray pump B 14P-1B oil fire.	None. Critical conditions still not indicated for HLF of 0.7	Suppression not credited - assumed to fail. Cable tray target is 26 ft above fire with the lowest tray exposure of 5 ft.
RB-1E (Reactor Building East Crescent Area)	2	Core Spray holding pump B 14P-2B oil fire.	None. Critical conditions still not indicated for HLF of 0.7	Suppression not credited - assumed to fail. Cable tray target is 26 ft above fire with the lowest tray exposure of 5 ft.
RB-1E (Reactor Building East Crescent Area)	3	HPCI pump oil spill	None. Targets assumed the same regardless of HLF.	Suppression not credited - assumed to fail. Cable tray target is 26 ft above fire with the lowest tray exposure of 5 ft.
RB-1E (Reactor Building East Crescent Area)	4	RHR Keep Full pump	None. Targets assumed the same regardless of HLF.	Suppression not credited - assumed to fail. Cable tray target is 26 ft above fire with the lowest tray exposure of 5 ft.

Table 4 – Screening Response to RAI Request 1 on Heat Loss Factor

Zone	Case	Description	Impact	Comments
RB-1E (Reactor Building East Crescent Area)	5	RHR Pump B 10P-3B oil fire.	None. Conditions same as Scenario 1.	Suppression not credited - assumed to fail. Cable tray target is 26 ft above fire with the lowest tray exposure of 5 ft.
RB-1E (Reactor Building East Crescent Area)	6	RHR Pump D 10P-3D oil fire.	None. Conditions same as Scenario 1.	Suppression not credited - assumed to fail. Cable tray target is 26 ft above fire with the lowest tray exposure of 5 ft.
RB-1E (Reactor Building East Crescent Area)	7	East Crescent area sump oil fire.	None. Impact the same as Scenario 1.	Suppression not credited - assumed to fail. Cable tray target is 26 ft above fire with the lowest tray exposure of 5 ft.
RB-1E (Reactor Building West Crescent Area)	1	Core Spray pump A 14P-1A oil fire.	None. Critical conditions still not indicated for HLF of 0.7	Suppression not credited - assumed to fail. Cable tray target is 26 ft above fire with the lowest tray exposure of 5 ft.
RB-1E (Reactor Building West Crescent Area)	2	Core Spray holding pump A 14P-2A oil fire.	None. Critical conditions still not indicated for HLF of 0.7	Suppression not credited - assumed to fail. Cable tray target is 26 ft above fire with the lowest tray exposure of 5 ft.
RB-1E (Reactor Building West Crescent Area)	3	RCIC pump oil spill	None. Targets assumed the same regardless of HLF.	Suppression not credited - assumed to fail. Cable tray target is 26 ft above fire with the lowest tray exposure of 5 ft.
RB-1E (Reactor Building West Crescent Area)	4	RHR Keep Full pump	None. Targets assumed the same regardless of HLF.	Suppression not credited - assumed to fail. Cable tray target is 26 ft above fire with the lowest tray exposure of 5 ft.

Table 4 – Screening Response to RAI Request 1 on Heat Loss Factor

Zone	Case	Description	Impact	Comments
RB-1E (Reactor Building West Crescent Area)	5	RHR Pump A 10P-3A oil fire.	None. Conditions same as Scenario 1.	Suppression not credited - assumed to fail. Cable tray target is 26 ft above fire with the lowest tray exposure of 5 ft.
RB-1E (Reactor Building West Crescent Area)	6	RHR Pump C 10P-3C oil fire.	None. Conditions same as Scenario 1.	Suppression not credited - assumed to fail. Cable tray target is 26 ft above fire with the lowest tray exposure of 5 ft.
RB-1E (Reactor Building West Crescent Area)	7	West Crescent area sump oil fire.	None. Impact the same as Scenario 1.	Suppression not credited - assumed to fail. Cable tray target is 26 ft above fire with the lowest tray exposure of 5 ft.
RB-1E (Reactor Building West Crescent Area)	8	66UC-22E Fire.	None. Impact the same as Scenario 1.	Suppression not credited - assumed to fail.
TB-1 (Turbine Building)		All Oil Fires	No impact. All fires result in damage. CCDF computed is for loss of entire zone regardless of heat loss factor used.	

Request 2

The response to Question #2 relating to delays used in modeling fire propagation does not provide a sufficient basis for the assumed delays (5 minutes and 15 minutes). When making fire damage assessments a preferable approach to using assumed delay times (that may preclude damage to nearby targets) is to use damage temperatures or radiant heat flux as damage criteria.

In addition, the response noted characteristics of electrical cabinets which appear to have been credited with the ability to contain fires internal to the cabinets. This can be an optimistic assumption for oil-filled transformers and high-voltage cabinets from which energetic failures may result in damage to nearby targets.

We understand that new EPRI guidance is forthcoming and may be helpful in formulating a new response to these questions where revised assumptions may impact the estimated fire CDF. Please review the new EPRI guidance on propagation of fires from enclosed ignition sources and formulate a new response to Question #2.

Response 2

The Authority has reviewed the EPRI response to generic question 3 on fire propagation in horizontal tray stacks. The EPRI Fire PRA methodology (Reference 7) prescribed five minute delay time for cable tray stack fires was used in modeling fires in the Relay Room (Fire Zone RR-1) and Cable Spreading Room (Fire Zone CS-1).

The revised EPRI guidance continues to allow the five-minute propagation time delay for horizontal tray stack fires providing the following criteria are met:

- The trays are located more than six feet from a wall or ceiling corner.
- Cables in the trays are IEEE-383 qualified.
- The trays are ladder-back or solid steel bottoms (with and without covers).
- Vertical tray separation exceeds 10.5" with greater than 8" separation on the horizontal.
- Fire heat release rate is less than 190 BTU/sec.

The Authority re-evaluated fire zones where the EPRI methodology five-minute tray fire propagation time was used to see whether there was conformation to these criteria with the following changes.

Relay Room

It was found that the dominant fire modeled in Fire Zone RR-1 (Relay Room) scenario 1, case A - a transient fire resulting in ignition and damage to the cable tray stack in the southwest corner of the room was affected. This is due to the location of the trays being less than 6 feet from the wall. In this situation, the EPRI guidance presents a table of heat release rate scale factors as a function of the distance.

As a screening evaluation, the worse case for this scenario was assumed; i.e. the fire would result in damage to surrounding trays before suppression. Refer to Table 6. The CCDP for this scenario is unity. This results in a core damage frequency (CDF) contribution of 3.37×10^{-6} per year or, an increase of 1.48×10^{-6} per year over the reported CDF for this scenario in the original IPEEE submittal.

Cable Spreading Room

The five-minute tray fire propagation time was used for transient initiated fires in the Cable Spreading Room (Fire Zone CS-1). A transient fire is postulated to effect the stack containing 3 trays (1TC067R, 1TC068R, and 1TC073R). These trays are situated within the revised EPRI guideline for considering the propagation time. For the remaining fixed ignition sources in Fire Zone CS-1, a hot gas layer with a resultant CCDP of 1.0 and no possible suppression had already been postulated, rendering the question of propagation time moot.

Other Areas

For fires in zones which contain a concentration of trays such as the cable tunnels (Fire Zones CT-1 and CT-2), the conservative FIVE methodology (Reference 8) was used without utilizing the EPRI five minute tray propagation time.

Other fire zones potentially affected by EPRI's revised guidance were systematically evaluated. The results of this evaluation is presented in Table 6.

Enclosed Ignition Sources – High Voltage Cabinets

The Authority has reviewed the EPRI response to generic question 11 on screening of enclosed ignition sources, particularly oil-filled transformers and higher voltage cabinets. The revised EPRI guidance is not to immediately screen-out such cabinets but to treat them as vented panels.

A review of previously screened 4.16kV and 600V switchgear with station service transformers was conducted. Following the revised EPRI guidance, 600V motor control centers (MCCs) could remain screened-out, if they are unvented and have adequate electrical protection such as two circuit breakers from the source.

The source is considered to be the various 4.16kV: 600V station service transformers, which feed the 600V switchgear. Most 600V MCCs in turn are fed by 600V switchgear. From the transformer to the MCC at the 600V level, there are two circuit breakers; one from the transformer to the switchgear and the other from the switchgear to the MCC. Therefore, only 4.16kV and 600V switchgear with their adjacent associated station service transformers were evaluated for the potential of high-energy fault ignited fires.

Reactor Building

Fire is postulated to occur from ignition in 600V switchgear 71L-13 and 71L-14 with their associated station service transformers in Fire Zone RB-1A at elevation 326 ft. A hot gas layer is postulated to form damaging all cabling at this elevation.

Likewise, a fire in 600V switchgear 71L-15 and associated station service transformer 71T-13 will result in damage to cabling in Fire Zone RB-1B at elevation 300 ft.

A fire in switchgear 71L-16 will result in damage to cabling in Fire Zone RB-1C at elevation 300 ft. Refer to Table 7.

Turbine Building Electric Bays

Fires are postulated to occur from ignition in switchgear in the West and East Turbine Building Electric Bays (Fire Zones SW-1 and SW-2, respectively). It was conservatively assumed that a hot gas layer would form without any suppression. Refer to Table 8.

Emergency Diesel Generator Switchgear Rooms

Fires are postulated from ignition in 4.16kV switchgear in the South division I and North division II EDG Switchgear Rooms (Fire Zones EG-5 and EG-6, respectively). A resulting hot gas layer is postulated to form without suppression or recovery. Refer to Table 9.

Table 5 – Screening Response to Request 2 on Tray Propagation Times

Zone	Case	Description	Impact	Comments
RB-1A (Reactor Building)	All.		None. Horizontal trays were already assumed damaged by transient fires without any regard to timing.	Suppression not credited.
RB-1B (Reactor Building)	All.		None. Horizontal trays were assumed damaged by transient fires without any regard to timing. CRD pump oil fire produces HGL damaging all trays in the vicinity.	Suppression not credited.
CT-1 (West Cable Tunnel)	All	Transient initiated fires impacting trays	None. FIVE methodology employed.	
CT-2 (East Cable Tunnel)	All	Transient initiated fires and a fixed ignition sump pump fire	None. FIVE methodology employed.	
CS-1 (Cable Spreading Room)	1-5	Transient initiated fire failing cable stacks	None. Impacted trays are within the revised EPRI criteria for five minute propagation time	JAF Administrative Procedure AP14.02 now prohibits unattended combustibles in Cable Spreading Room.
CS-1 (Cable Spreading Room)	6-8	Various transformer and unit cooler fixed ignition fires	None. HGL postulated to be formed with a CCDP of 1.0 .	No credit for suppression.
RR-1 (Relay Room)	1	Case A - Horizontal tray stack near column 9 (lines C and E).	Due to the proximity of the wall, re-evaluated with a	First three-tray fire calculation was done using a 932^{0}F-

Zone	Case	Description	Impact	Comments
		One end is against the southwest wall. First three ignite and damage is instantaneous. Damage to the next tray is credited after 5 minutes.	scaling factor (maximum of 5) for the HRR. Overall conservative increase of 3.37×10^{-6} per year.	ignition temperature. Changing to a 700°F-ignition temperature will produce a hot gas layer which will damage everything immediately without suppression. Remove scenario 1b since suppression will not be credited.

Table 6 – Relay Room

Zone	Case	Description	Ignition Frequency Per year	Severity Factor	Area Ratio	CCDP	SD Panel Non-recovery	Revised CDF Per year
RR-1	1	Transient fire in southwest corner.	8.19×10^{-4}	0.29	0.253	1	0.056	3.37×10^{-6}

Table 7 – Reactor Building

Zone	Case	Description	Ignition Frequency Per year	Severity Factor	CCDP	Revised CDF Per year
RB-1A	NEW	Fire at 71L-13	1.00×10^{-4}	0.12	4.75×10^{-6}	5.70×10^{-11}
RB-1A	NEW	Fire at 71L-14	1.00×10^{-4}	0.12	4.75×10^{-6}	5.70×10^{-11}
RB-1B	NEW	Fire at 71L-15	1.04×10^{-4}	0.12	2.3×10^{-4}	2.76×10^{-9}
RB-1C	NEW	Fire at 71L-16	1.04×10^{-4}	0.12	8.4×10^{-5}	1.05×10^{-9}
Reactor Building Total						**3.92×10^{-9}**

Table 8 – Turbine Building Electric Bays

Zone	Case	Description	Ignition Frequency Per year	Severity Factor	CCDP	Revised CDF Per year
SW-1	NEW	Fire at 71H03	3.72×10^{-5}	0.12	1.48×10^{-4}	6.61×10^{-10}
SW-2	NEW	Fire at 71H04	3.72×10^{-5}	0.12	5.30×10^{-5}	2.37×10^{-10}
Turbine Building Electric Bay Total						**8.98×10^{-10}**

Table 9 – Emergency Diesel Generator Switchgear Rooms

Zone	Case	Description	Ignition Frequency Per year	Severity Factor	CCDP	Revised CDF Per year
EG-5	NEW	Fire at 71H05	1.0×10^{-2}	0.12	1.83×10^{-4}	2.20×10^{-7}
EG-6	NEW	Fire at 71H06	1.0×10^{-2}	0.12	8.41×10^{-5}	1.01×10^{-7}
EDG Switchgear Rooms Total						**3.21×10^{-7}**

Request 3

The response to Question #5 relating to the assumed heat release rates (HRRs) from electrical cabinet fires does not respond adequately to the original Question. The assumed HRR appear to be too low and it is not clear whether the assumed properties for the cables are inherent properties or the result of the application of fire retardant. Again, new EPRI guidance is forthcoming and may be helpful in formulating a new response.

Please review the new EPRI guidance on cabinet heat release rates and formulate a new response to Question #5. Please note in the response the assumptions made regarding the properties of the in-cabinet cabling including the effects of fire retardants.

Response 3

A screening evaluation was performed to identify modeled cabinets which would have the greatest impact to increased fire CDF, if a heat release rate (HRR) of 190 BTU/s in lieu of 65 BTU/sec was used. Afterward, these cabinets were further evaluated using the criteria of the revised EPRI guidance whether a higher HRR was justified. These criteria include:

- Cable bundles in the same cabinet are separated by less than 1.5 ft (based on calculation of the critical radiant flux distance using a HRR of 65 Btu/s).
- There is a propagation path such as a diagonal cable between two cable bundles separated by greater than 1.5 feet.
- There is the potential for a mini hot gas layer to develop within the cabinet.
- There are significant amounts of other fuels in the cabinet (e.g. circuit cards) and the fuels are distributed within the cabinet.

Using this new set of criteria, the following changes have been made in the analysis.

Relay Room

Panel fires in the Relay Room (Fire Zone RR-1) have been re-evaluated. In the original IPEEE submittal, scenarios 11 through 19 postulate fixed ignition cabinet fires with some with damage to both adjacent cabinets and overhead cable trays. It was conservatively assumed that overhead trays will be damaged along with the panel despite successful suppression. Failure of suppression (manually initiated CO_2 and fire brigade) is postulated to result in formation of a hot gas layer with a CCDP of unity. A hot gas layer was not originally postulated to form for non-suppression scenarios 14b, 16b, 18, and 19. Therefore, Table 10 details the changes are made in the analysis as a result of the formation of a hot gas layer.

Emergency Diesel Generator Switchgear Rooms

Fires in individual EDG control cabinets releasing 190BTU/sec may result in the formation of a hot gas layer. Therefore, four cases were re-evaluated. Refer to Table 11.

Table 10 – Relay Room

Zone	Case	Description	Ignition Frequency Per year	Severity Factor	Manual non-suppression	CCDP	SD Panel non-recovery	Revised CDF Per year
RR-1	14b	Fire in panel 09-47 igniting overhead trays and forming HGL	1.00×10^{-4}	0.12	0.44	1	0.056	2.96×10^{-7}
RR-1	16b	Fire in panel 09-39 igniting overhead trays and forming HGL	1.00×10^{-4}	0.12	0.44	1	0.056	2.96×10^{-7}
RR-1	18a NEW	Fire in panel RL-1 igniting overhead trays and forming HGL	1.00×10^{-4}	0.12	0.44	1	0.056	2.96×10^{-7}
RR-1	18b	Fire in panel RL-1 igniting overhead trays with successful suppression	1.00×10^{-4}	0.12	0.56	1.0×10^{-3}	0.056	3.76×10^{-10}
RR-1	19a NEW	Fire in panel RL-3 igniting overhead trays and forming HGL	1.00×10^{-4}	0.12	0.44	1	0.056	2.96×10^{-7}
RR-1	19b	Fire in panel RL-3 igniting overhead trays with successful suppression	1.00×10^{-4}	0.12	0.56	1.0×10^{-3}	0.056	3.76×10^{-10}
Relay Room Total								**1.18×10^{-6}**

Table 11 – Emergency Diesel Generator Switchgear Rooms

Zone	Case	Description	Ignition Frequency Per year	Severity Factor	CCDP	Revised CDF Per year
EG-5	2	Fire at 93ECP-A forms HGL	1.50×10^{-2}	0.2	1.83×10^{-4}	5.49×10^{-7}
EG-5	3	Fire at 93ECP-C forms HGL	1.50×10^{-2}	0.2	1.83×10^{-4}	5.49×10^{-7}
EG-6	2	Fire at 93ECP-B forms HGL	1.50×10^{-2}	0.2	8.41×10^{-5}	2.52×10^{-7}
EG-6	3	Fire at 93ECP-D forms HGL	1.50×10^{-2}	0.2	8.41×10^{-5}	2.52×10^{-7}
EDG Switchgear Rooms Total						**1.6×10^{-6}**

Summary

A summary of the change in fire CDF based on resolution of the EPRI generic RAI along with the overall net CDF change is presented in Table 12. As a result of these changes, the total CDF is 5.64 x 10^{-6} per year -- a 28.2 percent increase over the original IPEEE value of 2.00 x 10^{-5} per year.

References

1. NRC letter, J. F. Williams to J. Knubel dated May 17, 1999 regarding Request for Additional Information regarding Individual Plant Examination of External Events (TAC No. M83622).

2. EPRI TR-105928, "Fire PRA Implementation Guide," Final Report, December 1995.

3. NRC letter, T. L. King to D. Modeen (NEI) dated June 25, 1999 regarding "EPRI Guidance for Development of Response to NRC's Generic Request for Additional Information on the EPRI Fire PRA Implementation Guide."

4. NEI letter, D. Modeen to T. L. King (USNRC) dated May 24, 1999 regarding response to request for additional information on the EPRI Fire PRA Implementation Guide.

5. NYPA letter, J. Knubel to USNRC dated September 17, 1998 (JPN-98-041), regarding " Request for Additional Information Regarding Response to Generic Letter 88-20, Supplement 4, 'Individual Plant Examination of External Events,' (TAC No. M83622)."

6. New York Power Authority, "James A. FitzPatrick Nuclear Power Plant Individual Plant Examination of External Events," JAF-RPT-MISC-02211, Rev. 0, June 1996.

7. Parkinson, W. J., "EPRI Fire PRA Implementation Guide," prepared by SAIC for EPRI. EPRI TR-100370, April 1992.

8. Professional Loss Control, Inc., "Fire-Induced Vulnerability Evaluation," prepared for EPRI, EPRI TR-100370, April 1992.

9. FitzPatrick Administrative Procedure, AP 14.02, "Combustibles and Flammable Material Control."

10. FitzPatrick Abnormal Operating Procedures, "Operation During Plant Fires," AOP-28, Rev. 9, August 1999.

11. FitzPatrick Abnormal Operating Procedures, "Plant Shutdown from Outside Control Room," AOP-43, Rev. 23, August 1998.

Table 12 – Summary

Request Number	Issue	Zone	Case	Original CDF Per year	Revised CDF Per year	Change in CDF Per year
1	Heat Loss Factor	RB-1B	10a		8.31×10^{-7}	8.31×10^{-7}
1	Heat Loss Factor	RB-1B	10b	5.57×10^{-7}	5.13×10^{-7}	(4.42×10^{-8})
1	Heat Loss Factor	BR-1	1	Screened Out	8.00×10^{-8}	8.00×10^{-8}
1	Heat Loss Factor	BR-1	2	Screened Out	8.00×10^{-8}	8.00×10^{-8}
1	Heat Loss Factor	BR-1	2	Screened Out	8.00×10^{-8}	8.00×10^{-8}
1	Heat Loss Factor	BR-4	1	Screened Out	3.45×10^{-8}	3.45×10^{-8}
1	Heat Loss Factor	BR-5	NEW		1.94×10^{-8}	1.94×10^{-8}
2	Cable tray fire propagation time.	RR-1	1	1.89×10^{-6}	3.37×10^{-6}	1.48×10^{-6}
2	High energy faults	RB-1A	NEW		1.14×10^{-10}	1.14×10^{-10}
2	High energy faults	RB-1B	NEW		2.76×10^{-9}	2.76×10^{-9}
2	High energy faults	RB-1C	NEW		1.05×10^{-9}	1.05×10^{-9}
2	High energy faults	SW-1	NEW		6.61×10^{-10}	6.61×10^{-10}
2	High energy faults	SW-2	NEW		2.37×10^{-10}	2.37×10^{-10}
2	High energy faults	EG-5	NEW		2.20×10^{-7}	2.20×10^{-7}
2	High energy faults	EG-6	NEW		1.01×10^{-7}	1.01×10^{-7}
3	Heat Release Rate	RR-1	14b	3.65×10^{-9}	2.96×10^{-7}	2.92×10^{-7}
3	Heat Release Rate	RR-1	16b	3.53×10^{-9}	2.96×10^{-7}	2.92×10^{-7}
3	Heat Release Rate	RR-1	18a	1.22×10^{-8}	2.96×10^{-7}	2.84×10^{-7}
3	Heat Release Rate	RR-1	18b		3.76×10^{-10}	3.76×10^{-10}
3	Heat Release Rate	RR-1	19a	1.22×10^{-8}	2.96×10^{-7}	2.84×10^{-7}
3	Heat Release Rate	RR-1	19b		3.76×10^{-10}	3.76×10^{-10}
3	Heat Release Rate	EG-5	2	Screened Out	5.49×10^{-7}	5.49×10^{-7}

Table 12 – Summary

Request Number	Issue	Zone	Case	Original CDF Per year	Revised CDF Per year	Change in CDF Per year
3	Heat Release Rate	EG-5	3	Screened Out	5.49×10^{-7}	5.49×10^{-7}
3	Heat Release Rate	EG-6	2	Screened Out	2.52×10^{-7}	2.52×10^{-7}
3	Heat Release Rate	EG-6	3	Screened Out	2.52×10^{-7}	2.52×10^{-7}
Total Increase in CDF						**5.64×10^{-6}**