APPENDIX A

DEVIATION REQUEST NO. 3

ATTACHMENT 2

APPENDIX A

DEVIATION REQUEST NO. 3

ATTACHMENT 3

TECHNICAL REPORT

EVALUATION OF SELECTED FIRE DOOR AND DOOR FRAME ASSEMBLIES (SUPPLEMENT 2)

By

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June 1986

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APPENDIX A

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TABLE DR3-1

FIRE DOORS – NON-RATED

Wall Between Fire Zones	Unit Number	Door Number	Door Type	FM Report
1-1A/1-1B	1	13	I	1/85
1-1E/1-1F	1	23	I	8/87
1-2A/1-2B	1	111	II	8/85
1-3A/1-3B-N	1	201	II	8/85
1-4A-S/1-4G	1	407	II	6/86
1-5A-W/1-5E	1	515	III	8/85
1-5B/1-5A-N	1	531	III	5/87
2-1A-/2-1B	2	14	I	8/87
2-1E/2-1F	2	24	I	8/87
2-1I/2-6A	2	115-R	III	5/87
2-2A/2-2B	2	112	II	6/86
2-3A/2-3B-N	2	202	II	6/86
2-4A-S/2-4G	2	408	III	5/87
2-5E/2-5A-W	2	514	III	6/86
2-5A-S/2-5B	2	530	III	6/86
2-4G/2-6A	2	711	II	6/86
2-5A-S/2-4G	2	505	II	3/94

APPENDIX R DEVIATION REQUEST NO. 4

WRAPAROUND AREA

DEVIATION REQUEST:

On the east side of each reactor building at elevations 683'-0", 719'-1", and 749'-1", there is no physical fire rated barrier separating the north and south fire areas. To meet the intent of 10CFR50 Appendix R Section III.G, an area 66-feet wide (i.e., 50 foot wide with a plus 8 foot tolerance on either side) has been provided as a spatial separation distance between the north and south fire areas. This area is called the Wraparound Area and it is intended to function in a manner equivalent to a fire barrier having a 3-hour fire rating as required by Appendix R Section III.G.2.a.

The Wraparound Area has a physical volume associated with it and the potential exists for having components and/or cables from both redundant safe shutdown paths contained within it. To provide a level of protection equivalent to that required by Appendix R Section III.G, any one of the following methods may be used to protect the redundant safe shutdown systems within the Wraparound Area:

1. Providing raceway wrap as protection for cables on both redundant paths for a distance of 50 feet, unless damage to the circuits can be justified based on other criteria acceptable under the requirements of Appendix R.

2. Providing a deviation request which specifically justifies the existing conditions.

FIRE ZONES AFFECTED

Unit 1	Unit 2
Elevation 683'-0"	
1-3B-N	2-3B-N
1-3B-W	2-3B-W
1-3B-S	2-3B-S
1-3C-N	2-3C-N
1-3C-W	2-3C-W
1-3C-S	2-3C-S
Elevation 719'-1"	
1-4A-N	2-4A-N
1-4A-W	2-4A-W
1-4A-S	2-4A-S
Elevation 749'-1"	
1-5A-N	2-5A-N
1-5A-W	2-5A-W
1-5A-S	2-5A-S

REASON FOR DEVIATION REQUEST:

The north and south sides of the reactor building, each of which use different redundant shutdown paths in achieving safe shutdown, are not separated by a continuous rated fire barrier on the east side of the building. In order to prevent a single fire from damaging both shutdown paths, the Wraparound Area was created to provide spatial separation between the north and south sides of the reactor buildings. Within the Wraparound Area, both shutdown paths are protected.

EXISTING ARRANGEMENT:

The table below provides a description of each Wraparound Area which includes, the fire zones comprising each Wraparound Area, the fire protection features provided in each Wraparound Area and the presently calculated average combustible loading within each Wraparound Area.

Wraparound Area Elevation	Zones Comprising Wraparound Area	Detection Provided	Automatic Supp. Provided	In-Situ Average Combustible Loading In Each Zone (See Note Below)
Unit 1:				
683'-0"	1-3B-W	YES	YES	6 MIN
	1-3C-W	YES	NO	22 MIN
719'-1"	1-4A-W	YES	YES	14 MIN
749'-1"	1-5A-W	YES	YES	3 MIN
Unit 2:				
683'-0"	2-3B-W	YES	YES	6 MIN
	2-3C-W	YES	NO	28 MIN
719'-1"	2-4A-W	YES	YES	21 MIN
749'-1"	25A-W	YES	YES	5 MIN

Actual in-situ combustible loading durations are provided to document existing arrangement and justify the deviation request. These values are based on the initial combustible loading analysis. Modifications subsequent to this analysis have revised these values with the possibility of future modifications revising them again. The governing criteria for the combustible loading analysis is that the fire resistance rating of the fire area boundaries exceed the combustible loading duration. The combustible loading durations specified in the deviation request will not be updated in the future since program commitments require that all modifications be evaluated to assure that additional combustibles are controlled to remain below the fire area fire resistance rating.

JUSTIFICATION:

In order for a fire originating in either the north or south sides of the reactor buildings to damage equipment located in the opposite fire area, the fire must spread across the Wraparound Area.

The Wraparound Area is a 66 foot wide physical area of the plant. The intent of the area is to provide a minimum 50 foot spatial separation between redundant shutdown paths in adjacent fire areas. To accomplish this, an additional 16 feet was added to the separation distance to conservatively compensate for drawing tolerance of ±8 feet for conduit locations within the Wraparound Area.

It is not considered feasible for a fire to propagate across any of the Wraparound Areas. This conclusion is based on consideration of the following for the two configurations associated with the areas designated as Wraparound Areas:

Configuration #1:

Fire Zones 1-3B-W, 2-3B-W, 1-4A-W, 1-5A-W, 2-4A-W, and 2-5A-W are all provided with automatic sprinkler protection. Additionally, the present calculated average combustible loading (in-situ and transient) in each fire zone is less than 45 minutes. The combination of low combustible load with sprinkler protection precludes a single fire involving both the north and south fire areas.

Configuration #2:

Fire Zones 1-3C-W and 2-3C-W are not provided with automatic sprinkler protection; however, the physical features of these fire zones preclude the need for such protection. These fire zones would not be expected to have transient combustibles present during normal operation as they are high radiation areas and access is limited. Additionally, the physical arrangement of valves, piping, platforms, etc. inhibits the introduction and movement of transient combustibles.

Each fire zone also contains a space approximately 25 feet wide which divides the zone and contains no cable trays. Therefore, there is minimal in-situ combustibles and no available path for a fire to spread between the North and South areas.

Finally, combustible loadings values, which are expected to change throughout the life of the plant, are being programmatically controlled. The original calculated average combustible loading values have been provided above. This Deviation Request remains valid so long as:

- The calculated average combustible loading remains below 1-1/2 hours in the Wraparound Areas.

- The potential for transient combustibles in Fire Zones 1-3C-W and 2-3C-W remains as described.
- The potential for fire spread via in-situ combustibles in Fire Zones 1-3C-W and 2-3C-W remains as described.
- The increase in the average combustible loading is not a result of the addition of a concentration of combustibles which could result in a single fire that could damage redundant equipment and cables in the north, south and wraparound areas.

DEVIATION REQUEST NO. 5 HAS BEEN WITHDRAWN

APPENDIX R DEVIATION REQUEST NO. 6

NON FIREPROOFED STRUCTURAL STEEL

DEVIATION REQUEST:

Exposed structural steel supporting the fire area barriers identified below are acceptable and do not require fireproofing.

FIRE AREA/ZONES AFFECTED:

Tables DR 6-1 and 6-2 provide a list of the affected fire zones. These tables also refer to a series of drawings associated with each fire rated floor slab with non fireproofed structural steel showing the extent of the required fire protection.

REASON FOR DEVIATION REQUEST:

Within the Unit 1 and 2 Reactor Buildings and Control Structure, certain floor/ceiling assemblies are to be upgraded to a 3 hour fire rating, to separate redundant safe shutdown equipment. The structural steel supporting these floors is not protected.

JUSTIFICATION:

UNIT #1 AND #2 REACTOR BUILDINGS:

Structural steel associated with each of the Unit #1 and #2 Reactor Building fire barriers required to be upgraded was examined and the evaluation criteria applied to demonstrate that fire proofing of this structural steel is not required was developed in the "Summary Report for Structural Steel Evaluation". To clearly demonstrate the applicability of this criteria to the fire area barriers in question, a drawing of each area, corresponding to the Fire Zones listed in Table DR 6-1, is attached to this deviation request along with an area unique justification for each drawing. These drawings show the barrier area in question, the structural steel members supporting the barrier and the primary combustibles relevant to each area. Each drawing's corresponding unique justification references the section of the Summary Report for Structural Steel Evaluation that provides the basis for that justification.

CONTROL STRUCTURE:

There are several floor fire barriers in the Control Structure whose structural steel beams are not fireproofed. The extent of each of these barriers vary throughout the building; they are clearly defined in the drawings referenced in Table DR 6-2 of this exemption request.

The following sections provide justification for each upgraded floor barrier where steel beams are not fireproofed.

STEEL BELOW SLAB ELEVATION 676'-0, 686'-0, 698'-0 AND 714'-0

An analysis of the floor fire barriers for these elevations demonstrate that the structural steel beams are adequate for the combustible loading present in Fire Zones 0-21A, 0-22A and 0-24E.

NOTE: Only the steel above Fire Zone 0-24E (below elevation 714' 0) is not fireproofed. The remaining main floor steel below elevation 714'-0 is fireproofed.

The analysis for each of these fire barrier has been done utilizing the criteria developed in the "Summary Report for Structural Steel Evaluation". In particular, Section 3.2 - Energy Balance Method and Section 3.3 - Two Horizontal Cable Tray Criteria were utilized to demonstrate the adequacy of the structural steel beams.

Based on the results of the analysis, steel beams above Fire Zones 0-21A, 0-22A and 0-24E will not be adversely affected as a result of a postulated fire in any of these fire zones.

STEEL BELOW SLAB ELEVATION 754'-0

Automatic detection and protection is provided below the exposed structural steel. The majority of the combustibles in the area below the exposed structural steel are cables. The majority of the cables are located either below the raised (computer type) floor or along the south walls of the Control Structure where only one structural member is effected. There is approximately 20 feet between the raised computer floor and the exposed structural steel supporting elevation 754'-0. Finally, the Control Room comprises the majority of the area beneath this steel and it is continuously staffed.

STEEL INSIDE HVAC CHASES

Structural steel beams inside the HVAC chases do not require fire proofing.

The analysis which considers Fire Zones 0-24I, 0-24K and 0-28S indicate that these fire zones contain minimal amounts of combustibles; therefore, damage to the steel is highly unlikely.

STEEL BELOW SLAB ELEVATION 783'-0

Only the steel above Fire Zones 0-28A-I, 0-28A-II, 0-28B-I, 0-28B-II and 0-28H need justification. This steel (below elevation 783'-0) is considered adequate for the combustible loading present.

1. Fire Zone 0-28H is the Cold Instrument Repair Shop containing minimal combustibles; therefore, damage to steel due to a fire is highly unlikely.

2. All in-situ combustibles in Fire Zones 0-28A-I, 0-28A-II, 0-28B-I and 0-28B-II are due to various electrical panels.

   The reasons for the justification are as follows:

   a) All of the panels are separated by either a block wall, or by distance. If a fire was to occur in one of the panels, it will be delayed or contained within the panel.

   b) All of these fire zones have ionization detection. This will give early indication for site personnel to respond.

Because of the nature and arrangement of the combustibles in these fire zones, it is rather unlikely to ever have a raging fire where all of the panels will be on fire at the same time. This in fact eliminates the possibility of generating sufficient heat to produce structural damage to the steel.

Based on the above justification, steel beams above fire zones 0-28A-I, 0-28A-II, 0-28B-I, 0-28B-II and 0-28H will not be adversely affected as a result of a postulated fire in any of these fire zones.

The structural steel beams above the 125V and 250V Battery Rooms (Fire Zones 0-28C, 0-28D, 0-28E, 0-28F, 0-28G, 0-28I, 0-28J, 0-28K, 0-28L, 0-28M, 0-28N and 0-28T) do not require fireproofing due to the minimal amount of combustibles contained within each battery room. A specific fire hazards analysis was performed to evaluate the impact of the combustible configuration of each fire zone on the overhead structural steel beams. The analysis conservatively evaluated the ideal burning rates of the batteries in each room and calculated the time required to heat the structural steel beams in each room to the assumed failure temperature. Based on this analysis, fireproofing of the overhead structural steel beams is not required.

<u>STEEL BELOW SLAB ELEVATION 806'-0</u>

Steel beams below slab elevation 806'-0 are adequate because there are no combustibles in Fire Zones 0-22B and 0-29A. These fire zones are part of the north and south Control Structure stairwells.

Therefore, steel beams above Fire Zones 0-22B and 0-29A, below elevation 806'-0, can not be adversely affected by a fire because of the lack of combustibles.

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UNIT 1 FIRE RATED FLOOR SLAB
ABOVE FIRE ZONE 1-1F

Reference Drawing C-206006, Sheet 1

DESCRIPTION:

The fire rated floor slab in question is 2'-9" thick and the top of slab is at elevation 683'-0". This reinforced concrete slab acts compositely with the structural steel beams to support this elevation as shown on the reference drawing. The source of combustibles in this area is two horizontal cable trays located approximately 12' beneath the bottom of the structural steel beams.

EVALUATION:

Section 3.3 of the Summary Report for Structural Steel Evaluation provides justification for the adequacy of structural steel for a combustible configuration of two horizontally stacked cable trays. The two cable trays in this fire zone are located approximately 12' beneath the bottom of the structural steel beams whereas the cable trays discussed in Section 3.3 of the report are only one foot below the steel beams. This increased distance adds to the margin of safety already contained in the Section 3.3 analysis.

CONCLUSION:

The fire rated floor slab above Fire Zone 1-1F as shown on Drawing C-206006, Sheet 1, will not be adversely affected by a fire in Fire Zone 1-1F since a postulated fire in Fire Zone 1-1F would not generate sufficient heat to weaken the structural steel beams supporting the fire rated floor slab.

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UNIT 1 FIRE RATED FLOOR SLAB
ABOVE FIRE ZONE 1-1E

Reference Drawing C-206006, Sheet 2

DESCRIPTION:

The fire rated floor slab in question is 2'-9" thick and the top.of slab is at elevation 683'-0". This reinforced concrete slab acts compositely with the structural steel beams to support this elevation as shown on the reference drawing. There are no cable trays in Fire Zone 1-1E located beneath this fire rated floor slab.

EVALUATION:

With no cable trays located beneath this fire rated floor slab, sufficient heat to adversely affect the fire rated floor slab would not be generated. Section 3.3 of the Summary Report for Structural Steel Evaluation provides justification for the adequacy of structural steel for a combustible configuration of two horizontally stacked cable trays. This area has no cable trays.

CONCLUSION:

The fire rated floor slab above Fire Zone 1-1E as shown on Drawing C-206006, Sheet 2, will not be adversely affected by a fire in Fire Zone 1-1E since a postulated fire in Fire Zone 1-1E would not generate sufficient heat to weaken the structural steel beams supporting the fire rated floor slab.

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UNIT 1 FIRE RATED FLOOR SLAB
ABOVE FIRE ZONE 1-3A

Reference Drawing C-206007, Sheets 1 & 2

DESCRIPTION:

The fire rated floor slab in question varies in thickness from 2'-9" to 4'-9" as shown on the reference drawing, Sheet 2. The top of the entire slab is at elevation 719'-1". The source of combustibles beneath this fire rated floor slab is a series of horizontal and vertical cable trays as depicted on the reference drawing. It should be noted that the top two trays are committed to be fire wrapped.

EVALUATION:

A structural analysis was performed on the 4'-9" thick portion of the reinforced concrete slab above the fire zone in question. The analysis demonstrated that this reinforced concrete slab is capable of supporting itself without the W21x127 beams which underlie it. The only required structural steel beams beneath the 4'-9" thick slab are the W21X127 steel beams (with a 2" thick steel plate on the bottom flange) which lie directly under the 4'-6" thick walls.

The required steel beam south of column line 25 is protected from the effects of a fire by the NFPA 13 sprinkler system. Section 3.4 of the Summary Report for Structural Steel Evaluation provides the justification for the NFPA 13 sprinkler system's heat absorption capability with respect to cable tray fires. The combustible configuration beneath this required steel beam is bounded by the analysis in Section 3.4.

The required W21X127 steel beam north of column line 25 was analyzed by the Energy Balance Method as developed in Section 3.2 of the Summary Report. This analysis calculated the ratio of the critical energy needed to heat this structural steel beam to the critical temperature (Ec_t) to the predicted heat release for this combustible configuration (H') to be 1.17 which is greater than the required minimum value of 1.0. This analysis verifies the structural integrity of the required W21X127 steel beam.

A structural analysis was also performed on the 2'-9" thick portion of the reinforced concrete slab above the fire zone in question. This analysis demonstrated that this reinforced concrete slab is capable of supporting itself without the two W24X55 steel beams which underlie it. This slab is supported on the south end by the W21X127 (acceptability as discussed above) and on the north end by the 2'-O" thick concrete wall beneath the slab. Therefore, the heat effect on the W24X55 steel beams is inconsequential since the 2'-9" concrete slab is structurally acceptable without these 2 steel beams.

CONCLUSION:

Based on the above evaluation, the fire rated floor slab above Fire Zone 1-3A will not be adversely affected as the result of a postulated fire in this area.

UNIT 1 FIRE RATED FLOOR SLAB
ABOVE FIRE ZONE 1-3B-W

Reference Drawing C-206021, Sheet 1

DESCRIPTION:

The fire rated floor slab in question is 2'-3" thick with the top of slab at elevation 719'-1". This reinforced concrete slab acts compositely with the structural steel beams which support this floor elevation. The source of combustibles in this area is cable trays.

EVALUATION:

The portion of Fire Zone 1-3B-W located beneath the fire rated floor slab in question is protected by an automatic fire suppression sprinkler system which has been installed in accordance with NFPA 13. In the event of a fire in this portion of Fire Zone 1-38-W, actuation of the automatic sprinkler system would mitigate the heat effect the fire would have on the structural steel beams supporting the fire rated floor slab. The basis for this evaluation is presented in Section 3.4 of the Summary Report for Structural Steel Evaluation. This section of the report provides the justification for the NFPA 13 sprinkler system's heat absorption capability with respect to cable tray fires. The combustible configuration beneath this fire rated floor slab is bounded by the analysis in Section 3.4.

CONCLUSION:

Based on the above evaluation and the specific combustible configuration beneath the fire rated floor slab in question, the existing automatic fire suppression sprinkler system can be expected to protect the structural steel beams with a wide margin of safety in the event of a postulated fire in this area.

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UNIT 1 FIRE RATED FLOOR SLAB
ABOVE FIRE ZONE 1-3B-W

Reference Drawing C-206021, Sheet 2

DESCRIPTION:

The fire rated floor slab in question is 2'-3" thick with the top of slab at elevation 719'-1". This reinforced concrete slab acts compositely with the structural steel beams which support this floor elevation. The source of combustibles in this area is cable trays.

EVALUATION:

The portion of Fire Zone 1-3B-W located beneath the fire rated floor slab in question is protected by an automatic fire suppression sprinkler system which has been installed in accordance with NFPA 13. In the event of a fire in this portion of Fire Zone 1-3B-W, actuation of the automatic sprinkler system would mitigate the heat effect the fire would have on the structural steel beams supporting the fire rated floor slab. The basis for this evaluation is presented in Section 3.4 of the Summary Report for Structural Steel Evaluation. This section of the report provides the justification for the NFPA 13 sprinkler system's heat absorption capability with respect to cable tray fires. The combustible configuration beneath this fire rated floor slab is bounded by the analysis in Section 3.4.

CONCLUSION:

Based on the above evaluation and the specific combustible configuration beneath the fire rated floor slab in question, the existing automatic fire suppression sprinkler system can be expected to protect the structural steel beams with a wide margin of safety in the event of a postulated fire in this area.

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UNIT 1 FIRE RATED FLOOR SLAB
ABOVE FIRE ZONE 1-4A-W

Reference Drawing C-206008, Sheets 1 & 3

DESCRIPTION:

The fire rated floor slab in question is 1'-9" thick south of column line 26.5 and 3'-3" thick north of column line 26.5 as depicted on the reference drawing. The top of the entire slab is at elevation 749'-1". This reinforced concrete slab acts compositely with a series of structural steel beams which support this floor elevation. The source of combustibles in Fire Zone 1-4A-W consist of a number of cable trays located throughout the fire zone.

EVALUATION:

The portion of Fire Zone 1-4A-W located beneath the fire rated floor slab in question is protected by an automatic fire suppression sprinkler system which has been installed in accordance with NFPA 13. In the event of a fire in this portion of Fire Zone 1-4A-W, actuation of the automatic sprinkler system would mitigate the heat effect the fire would have on the structural steel beams supporting the fire rated floor slab. The basis for this evaluation is presented in Section 3.4 of the Summary Report for Structural Steel Evaluation. This section of the report provides the justification for the NFPA 13 sprinkler system's heat absorption capability with respect to cable tray fires. The combustible configuration beneath this fire rated floor slab is bounded by the analysis in Section 3.4.

CONCLUSION:

Based on the above evaluation and the specific combustible configuration beneath the fire rated floor slab in question, the existing automatic fire suppression sprinkler system can be expected to protect the structural steel beams with a wide margin of safety in the event of a postulated fire in this area.

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UNIT 1 FIRE RATED FLOOR SLAB
ABOVE FIRE ZONES 1-4A-W AND 1-4A-N

Reference Drawing C-206008, Sheet 2

DESCRIPTION:

The fire rated floor slab in question is 1'-9" thick and the top of the slab is at elevation 749'-1". This reinforced concrete slab acts compositely with a series of structural steel beams to support this floor elevation as shown on the reference drawing. The primary source of combustibles in this area is two cable trays spaced approximately 12' from each other.

EVALUATION:

The portion of Fire Zones 1-4A-W and 1-4A-N located beneath the fire rated floor slab in question is protected by an automatic fire suppression sprinkler system which has been installed in accordance with NFPA 13. In the event of a fire in this portion of Fire Zones 1-4A-W and 1-4A-N, actuation of the automatic sprinkler system would mitigate the heat effect the fire would have on the structural steel beams supporting the fire rated floor slab system. The basis for this evaluation is presented in Section 3.4 of the Summary Report for Structural Steel Evaluation. This section of the report provides the justification for the NFPA 13 sprinkler system's heat absorption capability with respect to cable tray fires. The combustible configuration beneath this fire rated floor slab is bounded by the analysis in Section 3.4.

CONCLUSION:

Based on the above evaluation and the specific combustible configuration beneath the fire rated floor slab in question, the existing automatic fire suppression sprinkler system can be expected to protect the structural steel beams with a wide margin of safety in the event of a postulated fire in this area.

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UNIT 1 FIRE RATED FLOOR SLAB ABOVE FIRE ZONES 1-4A-W AND 1-4A-S

Reference Drawing C-206008, Sheet 4

DESCRIPTION:

The fire rated floor slab in question is 1'-9" thick with the top of slab at elevation 749'-1". This reinforced concrete floor slab acts compositely with the structural steel beams to support this elevation as shown on the reference drawing. The source of combustibles beneath this fire rated floor slab is two vertical cable trays which are separated from each other by approximately 20'.

EVALUATION:

The portions of Fire Zones 1-4A-W and 1-4A-S located beneath the fire rated floor slab in question are protected by an automatic fire suppression sprinkler system which has been installed in accordance with NFPA 13. In the event of a fire in these portions of Fire Zones 1-4A-W and 1-4A-S, actuation of the automatic fire suppression sprinkler system would mitigate the heat effect the fire would have on the structural steel beams supporting the fire rated floor slab system. The basis for this evaluation is presented in Section 3.4 of the Summary Report for structural steel evaluation. This section of the report provides the justification for the NFPA 13 sprinkler system's heat absorption capability with respect to cable tray fires. The combustible configuration beneath this fire rated floor slab is bounded by the analysis in Section 3.4.

CONCLUSION:

Based on the above evaluation and the specific combustible configuration beneath the fire rated floor slab in question, the existing automatic fire suppression sprinkler system can be expected to protect the structural steel beams with a wide margin of safety in the event of a postulated fire in this area.

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UNIT 1 FIRE RATED FLOOR SLAB ABOVE FIRE ZONES 1-4A-W AND 1-4A-N

Reference Drawing C-206008, Sheet 5

DESCRIPTION:

The fire rated floor slab in question is 1'-9" thick with the top of slab at elevation 749'-1". This reinforced concrete slab acts compositely with the structural steel beams to support this elevation as shown on the reference drawing. The source of combustibles beneath this fire rated floor slab is cable trays.

EVALUATION:

The portions of Fire Zones 1-4A-W and 1-4A-N located beneath the fire rated floor slab in question are protected by an automatic fire suppression sprinkler system which has been installed in accordance with NFPA 13. In the event of a fire in these portions of Fire Zones 1-4A-W and 1-4A-N, actuation of the automatic sprinkler system would mitigate the heat effect the fire would have on the structural steel beams supporting the fire rated floor slab system. The basis for this evaluation is presented in Section 3.4 of the Summary Report for Structural Steel Evaluation. This section of the report provides the justification for the NFPA 13 sprinkler system's heat absorption capability with respect to cable tray fires. The combustible configuration beneath this fire rated floor slab is bounded by the analysis in Section 3.4.

CONCLUSION:

Based on the above evaluation and the specific combustible configuration beneath the fire rated floor slab in question, the existing automatic fire suppression sprinkler system can be expected to protect the structural steel beams with a wide margin of safety in the event of a postulated fire in this area.

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UNIT 1 FIRE RATED FLOOR SLAB
ABOVE FIRE ZONE 1-4G

Reference Drawing C-206009, Sheets 1 & 2

DESCRIPTION:

The fire rated slab in question is 1'-2-1/2" thick with the top of slab at elevation 761'-10". This slab acts compositely with a series of structural steel beams as shown on the reference drawing. The source of combustibles beneath the fire rated slab consist of two cable trays which vary in elevation but are no closer than 18' from the bottom of the floor slab.

EVALUATION:

Section 3.3 of the Summary Report for Structural Steel Evaluation provides justification that two horizontally stacked cable trays will not adversely affect the integrity of the structural steel beams. The two cable trays in this fire zone are located approximately 16' below the overhead structural steel beams whereas the cable trays discussed in Section 3.3 of the report are only one foot below the steel beams. This increased distance adds to the margin of safety already contained in the Section 3.3 analysis. Furthermore, an analysis using the Energy Balance Method as developed in Section 3.2 of the Summary Report showed the ratio of the critical energy needed to heat the minimum required structural steel members to the critical temperature (Ec_t) to the predicted heat release for this combustible configuration (H') to be 6.4 which is much greater than the required minimum value of 1.0. This analysis substantiates the integrity of the structural steel beams above this combustible configuration.

CONCLUSION:

Based on the above evaluation and the specific combustible configuration beneath the fire rated floor slab in question, the structural steel beams supporting elevation 761'-10" above Fire Zone 1-4G will not be adversely affected as the result of a postulated fire in this area.

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UNIT 1 FIRE RATED FLOOR SLAB
ABOVE FIRE ZONE 1-5A-S

Reference Drawing C-206010, Sheets 1 & 2

DESCRIPTION:

The fire rated slab in question is 3'-O" thick approximately 5-1/2' south of column line 27.5 and 1'-9" thick north of this point. The top of the entire slab is at elevation 779'-1". This slab acts compositely with a series of structural steel beams as shown on the reference drawing. The combustibles in Fire Zone 1-5A-S consist of a number of horizontal and vertical cable trays located throughout the fire zone.

EVALUATION:

The portion of Fire Zone 1-5A-S located beneath the fire rated slab in question is protected by an automatic fire suppression sprinkler system which has been installed in accordance with NFPA 13. In the event of a fire in this portion of Fire Zone 1-5A-S, actuation of the automatic suppression system would mitigate the effects of the fire on the structural steel beams supporting this fire rated floor slab. The basis for this evaluation is presented in Section 3.4 of the Summary Report for Structural Steel Evaluation. This section of the report provides the justification for the NFPA 13 sprinkler system's heat absorption capability with respect to cable tray fires. The combustible configuration beneath this fire rated floor slab is bounded by the analysis in Section 3.4.

CONCLUSION:

Based on the above evaluation and the specific combustible configuration beneath the fire rated floor slab in question, the existing automatic fire suppression sprinkler system can be expected to protect the structural steel beams with a wide margin of safety in the event of a postulated fire in this area.

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UNIT 1 FIRE RATED FLOOR SLAB
ABOVE FIRE ZONE 1-5B

Reference Drawing C-206010 Sheets 3 & 4

DESCRIPTION:

The fire rated floor slab in question is 1'-9" thick and the top of the entire slab is at elevation 779'-1". This reinforced concrete slab acts compositely with the structural steel beams to support this elevation as shown on the reference drawing. The combustibles in these fire zones located beneath the fire rated floor slab are cable trays of varying elevation and location as shown on the reference drawing.

EVALUATION:

The fire rated floor slab in question is exposed by only two horizontal cable trays. Section 3.3 of the Summary Report for Structural Steel Evaluation provides a discussion of this configuration and justifies the structural steel for a combustible configuration of two horizontally stacked cable trays not less than one foot beneath the bottom of the steel beam. Although these trays are not stacked, one tray is less than one foot from the bottom of the steel beam.

The W24X68 beams in this area as well as the G309-5 girder were analyzed by the Energy Balance Method as developed in Section 3.2 of the Summary Report for Structural Steel Evaluation. This analysis determined the ratio of the critical energy needed to heat each required structural steel member to the critical temperature (Ec_t) to the predicted heat release for the combustible configuration surrounding each beam (H'). In the bounding case, this ratio (Ec_t/H') was determined to be greater than the minimum value of 1.0. This analysis verifies the integrity of all of the structural steel beams in this area in the event of a postulated fire.

CONCLUSION:

Based on the above evaluation and the specific combustible configuration beneath the fire rated floor slab in question, a postulated fire in Fire Zone 1-5B would not generate sufficient heat to adversely impact the required structural steel beams supporting the fire rated floor slab.

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UNIT 2 FIRE RATED FLOOR SLAB
ABOVE FIRE ZONES 2-1A, 1C, 1D

Reference Drawing C-213472, Sheets 1 & 2

DESCRIPTION:

The fire rated floor slab in question is 2'-2" thick west of Column Line R and is 3'-11" thick east of Column Line R. The top of slab is at elevation 670'-2". This reinforced concrete slab acts compositely with the structural steel beams to support this elevation as shown on the reference drawings. The source of combustibles in this area is two stacked horizontal cable trays (minimum 2'-4" beneath the bottom of the structural steel beams) and a single horizontal tray which is located approximately 7' horizontally from the stacked trays (minimum 1'-0" beneath the bottom of the structural steel beams).

EVALUATION:

Section 3.3 of the Summary Report for Structural Steel Evaluation provides justification for the adequacy of structural steel for a combustible configuration comprised of no more than two horizontal cable trays with no other cable trays within a four foot distance and not less than one foot below the structural steel. The combustible configuration beneath the fire rated floor slab being reviewed here is bounded by the analysis in Section 3.3

CONCLUSION:

The fire rated floor slab above Fire Zones 2-1A, 1C, 1D as shown on Drawings C-213472, Sheets 1 & 2, will not be adversely affected by a fire in Fire Zones 2-1A, 1C, 1D since a postulated fire would not generate sufficient heat to weaken the structural steel beams supporting the fire rated floor slab.

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UNIT 2 FIRE RATED FLOOR SLAB
ABOVE FIRE ZONE 2-1F

Reference Drawing C-206011, Sheet 1

DESCRIPTION:

The fire rated floor slab in question is 2'-9" thick and the top of slab is at elevation 683'-0". This reinforced concrete slab acts compositely with the structural steel beams to support this elevation as shown on the reference drawing. The source of combustibles in this area is two horizontal cable trays located approximately 11' beneath the bottom of the structural steel beams.

EVALUATION:

Section 3.3 of the Summary Report for Structural Steel Evaluation provides justification for the adequacy of structural steel for a combustible configuration of two horizontally stacked cable trays. The two horizontally stacked cable trays in this fire zone are located approximately 11' beneath the bottom of the structural steel beams whereas the cable trays discussed in Section 3.3 of the report are only one foot below the steel beams. This increased distance adds to the margin of safety already contained in the Section 3.3 analysis.

CONCLUSION:

The fire rated floor slab above Fire Zone 2-IF as shown on Drawing C-206011, Sheet 1, will not be adversely affected by a fire in Fire Zone 2-1F since a postulated fire in Fire Zone 2-1F would not generate sufficient heat to weaken the structural steel beams supporting the fire rated floor slab.

UNIT 2 FIRE RATED FLOOR SLAB ABOVE FIRE ZONE 2-1E

Reference Drawing C-206011, Sheet 2

DESCRIPTION:

The fire rated floor slab in question is 2'-9" thick and the top of slab is at elevation 683'-0". This reinforced concrete slab acts compositely with the structural steel beams to support this elevation as shown on the reference drawing. There are no cable trays in Fire Zone 2-1E located beneath this fire rated floor slab.

EVALUATION:

With no cable trays located beneath this fire rated floor slab, sufficient heat to adversely affect the fire rated floor slab would not be generated. Section 3.3 of the Summary Report for Structural Steel Evaluation provides justification for the adequacy of structural steel for a combustible configuration of two horizontally stacked cable trays. This area has no cable trays.

CONCLUSION:

The fire rated floor slab above Fire Zone 2-1E as shown on Drawing C-206011, Sheet 2, will not be adversely affected by a fire in Fire Zone 2-1E since a postulated fire in Fire Zone 2-1E would not generate sufficient heat to weaken the structural steel beams supporting the fire rated floor slab.

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UNIT 2 FIRE RATED FLOOR SLAB
ABOVE FIRE ZONE 2-3B-N

Reference Drawing C-206012, Sheets 1 & 2

DESCRIPTION:

The fire rated floor slab in question is 4'-9" thick and the top of slab is at elevation 719'-1". This reinforced concrete slab acts compositely with the structural steel beams to support this elevation as shown on the reference drawing. The primary source of combustibles in Fire Zone 2-3B-N located beneath the fire rated floor slab consist of a number of horizontal and vertical cable trays. The location of these cable trays are shown on the reference drawing.

EVALUATION:

The entire section of Fire Zone 2-3B-N located beneath the fire rated floor slab in question is protected by an automatic fire suppression sprinkler system which has been installed in accordance with NFPA 13. In the event of a fire in this portion of Fire Zone 2-38-N, actuation of-the automatic fire suppression sprinkler system would mitigate the heat effects of the fire on the structural steel beams supporting the fire rated floor slab. The basis for this evaluation is presented in Section 3.4 of the Summary Report for Structural Steel Evaluation. This section of the report provides the justification for the NFPA 13 sprinkler system's heat absorption capability with respect to cable tray fires. The combustible configuration beneath this fire rated floor slab is bounded by the analysis in Section 3.4.

CONCLUSION:

Based on the above evaluation and the specific combustible configuration beneath the fire rated floor slab in question, the existing automatic fire suppression sprinkler system can be expected to protect the structural steel beams with a wide margin of safety in the event of a postulated fire in this area.

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UNIT 2 FIRE RATED FLOOR SLAB ABOVE FIRE ZONE 2-3B-W

Reference Drawing C-206022, Sheet 1

DESCRIPTION:

The fire rated floor slab in question is 2'-3" thick with the top of slab at elevation 719'-1". This reinforced concrete slab acts compositely with the structural steel beams which support this floor elevation. The source of combustibles in this area is cable trays.

EVALUATION:

The portion of Fire Zone 1-3B-W located beneath the fire rated floor slab in question is protected by an automatic fire suppression sprinkler system which has been installed in accordance with NFPA 13. In the event of a fire in this portion of Fire Zone 2-3B-W, actuation of the automatic sprinkler system would mitigate the heat effect the fire would have on the structural steel beams supporting the fire rated floor slab. The basis for this evaluation is presented in Section 3.4 of the Summary Report for structural steel evaluation. This section of the report provides the justification for the NFPA 13 sprinkler system's heat absorption capability with respect to cable tray fires. The combustible configuration beneath this fire rated floor slab is bounded by the analysis in Section 3.4.

CONCLUSION:

Based on the above evaluation and the specific combustible configuration beneath the fire rated floor slab in question, the existing automatic fire suppression sprinkler system can be expected to protect the structural steel beams with a wide margin of safety in the event of a postulated fire in this area.

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UNIT 2 FIRE RATED FLOOR SLAB
ABOVE FIRE ZONE 2-3B-W

Reference Drawing C-206022, Sheet 2

DESCRIPTION:

The fire rated floor slab in question is 2'-3" thick with the top of slab at elevation 719'-1". This reinforced concrete slab acts compositely with the structural steel beams which support this floor elevation. The source of combustibles in this area is cable trays.

EVALUATION:

The portion of Fire Zone 1-3B-W located beneath the fire rated floor slab in question is protected by an automatic fire suppression sprinkler system which has been installed in accordance with NFPA 13. In the event of a fire in this portion of Fire Zone 2-3B-W, actuation of the automatic sprinkler system would mitigate the heat effect the fire would have on the structural steel beams supporting the fire rated floor slab. The basis for this evaluation is presented in Section 3.4 of the Summary Report for structural steel evaluation. This section of the report provides the justification for the NFPA 13 sprinkler system's heat absorption capability with regards to cable tray fires. The combustible configuration beneath this fire rated floor slab is bounded by the analysis in Section 3.4.

CONCLUSION:

Based on the above evaluation and the specific combustible configuration beneath the fire rated floor slab in question, the existing automatic fire suppression sprinkler system can be expected to protect the structural steel beams with a wide margin of safety in the event of a postulated fire in this area.

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UNIT 2 FIRE RATED FLOOR SLAB
ABOVE FIRE ZONES 2-4A-S AND 2-4A-W

Reference Drawing C-206013, Sheet 1

DESCRIPTION:

The fire rated floor slab in question is 1'-9" thick and the top of slab is at elevation 749'-1". This reinforced concrete slab acts compositely with the structural steel beams to support this elevation as shown on the reference drawing. The combustibles in Fire Zone 2-4A-S and 2-4A-W located beneath this fire rated floor slab consist of two horizontal cable trays stacked on top of each other as shown on the reference drawing.

EVALUATION:

The entire section of Fire Zones 2-4A-S and 2-4A-W located beneath the fire rated floor slab in question is protected by an automatic fire suppression sprinkler system which has been installed in accordance with NFPA 13. In the event of a fire in these portions of Fire Zones 2-4A-W and 2-4A-S, actuation of the automatic fire suppression sprinkler system would mitigate the heat effect of the fire on the structural steel beams supporting this fire rated floor slab. The basis for this evaluation is presented in Section 3.4 of the Summary Report for Structural Steel Evaluation. This section of the report provides justification for the NFPA 13 sprinkler system's heat absorption capability with respect to cable tray fires. The combustible configuration beneath this fire rated floor slab is bounded by the analysis in Section 3.4.

CONCLUSION:

Based on the above evaluation and the specific combustible configuration beneath the fire rated floor slab in question, the existing automatic fire suppression sprinkler system can be expected to protect the structural steel beams with a wide margin of safety in the event of a postulated fire in this area.

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UNIT 2 FIRE RATED FLOOR SLAB ABOVE FIRE ZONE 2-4A-W

Reference Drawing C-206013, Sheets 2 & 3

DESCRIPTION:

The fire rated floor slab in question is 1'-9" thick east of column line T and 3'-3" thick west of column line T. The top of slab elevation for the entire slab is at elevation 749'-1". This reinforced concrete slab acts compositely with the structural steel beams to support this elevation as shown on the reference drawing. The combustibles in Fire Zone 2-4A-W located beneath this fire rated floor slab consist of three horizontal cable trays as depicted on the reference drawing.

EVALUATION:

The entire section of Fire Zone 2-4A-W located beneath the fire rated floor slab in question is protected by an automatic fire suppression sprinkler system which has been installed in accordance with NFPA 13. In the event of a fire in this portion of Fire Zone 2-4A-W, actuation of the automatic fire suppression sprinkler system would mitigate the heat effects on the structural steel beams supporting the fire rated floor slab. The basis for this evaluation is presented in Section 3.4 of the Summary Report for Structural Steel Evaluation. This section of the report provides the justification for the NFPA 13 sprinkler system's heat absorption capability with respect to cable tray fires. The combustible configuration beneath this fire rated floor slab is bounded by the analysis in Section 3.4.

CONCLUSION:

Based on the above evaluation and the specific combustible configuration beneath the fire rated floor slab in question, the existing automatic fire suppression sprinkler system can be expected to protect the structural steel beams with a wide margin of safety in the event of a postulated fire in this area.

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UNIT 2 FIRE RATED FLOOR SLAB ABOVE FIRE ZONES 2-4A-W AND 2-4A-S

Reference Drawing C-206013, Sheet 4

DESCRIPTION:

The fire rated floor slab in question is 1'-9", thick and the top of the slab is at elevation 749'-1". This reinforced concrete slab acts compositely with a series of structural steel beams to support this floor elevation as shown on the reference drawing. The source of combustibles in this area is two horizontal cable trays.

EVALUATION:

The portions of Fire Zones 2-4A-W and 2-4A-S located beneath the fire rated floor slab in question is protected by an automatic fire suppression sprinkler system which has been installed in accordance with NFPA 13. In the event of a fire in these portions of Fire Zones 2-4A-W and 2-4A-S, actuation of the automatic sprinkler system would mitigate the heat effect the fire would have on the structural steel beams supporting this fire rated floor slab. The basis for this evaluation is presented in Section 3.4 of the Summary Report for Structural Steel Evaluation. This section of the report provides the justification for the NFPA 13 sprinkler system's heat absorption capability with respect to cable tray fires. The combustible configuration beneath this fire rated floor slab is bounded by the analysis in Section 3.4.

CONCLUSION:

Based on the above evaluation and the specific combustible configuration beneath the fire rated floor slab in question, the existing automatic fire suppression sprinkler system can be expected to protect the structural steel beams with a wide margin of safety in the event of a postulated fire in this area.

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UNIT 2 FIRE RATED FLOOR SLAB
ABOVE FIRE ZONES 2-4A-W AND 2-4A-N

Reference Drawing C-206013, Sheet 5

DESCRIPTION:

The fire rated floor slab in question is 1'-9" thick and the top of the slab is at elevation 749'-1". This reinforced concrete slab acts compositely with a series of structural steel beams to support this floor elevation as shown on the reference drawing. The source of combustibles in this area is cable trays located throughout the fire zones.

EVALUATION:

The portions of Fire Zones 2-4A-W and 2-4A-N located beneath the fire rated floor slab in question is protected by an automatic fire suppression sprinkler system which has been installed in accordance with NFPA 13. In the event of a fire in these portions of Fire Zones 2-4A-W and 2-4A-N, actuation of the automatic sprinkler system would mitigate the heat effect the fire would have on the structural steel beams supporting this fire rated floor slab. The basis for this evaluation is presented in Section 3.4 of the Summary Report for Structural Steel Evaluation. This section of the report provides the justification for the NFPA 13 sprinkler system's heat absorption capability with respect to cable tray fires. The combustible configuration beneath this fire rated floor slab is bounded by the analysis in Section 3.4.

CONCLUSION:

Based on the above evaluation and the specific combustible configuration beneath the fire rated floor slab in question, the existing automatic fire suppression sprinkler system can be expected to protect the structural steel beams with a wide margin of safety in the event of a postulated fire in this area.

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UNIT 2 FIRE RATED FLOOR SLAB
ABOVE FIRE ZONE 2-4G

Reference Drawing C-206014, Sheets 1 & 2

DESCRIPTION:

The fire rated floor slab in question is 1'-2-1/2" thick with the top of slab at elevation 761'-10". This reinforced concrete slab acts compositely with the structural steel beams to support this elevation as shown on the reference drawing. The source of combustibles in this fire zone is two cable trays located greater than 16' below the structural steel supporting this elevation.

EVALUATION:

Section 3.3 of the Summary Report for Structural Steel Evaluation provides justification that two horizontally stacked cable trays will not adversely affect the integrity of the structural steel beams. The two cable trays in this fire zone are located approximately 14' below the overhead structural steel beams whereas the cable trays discussed in Section 3.3 of the report are only one foot below the steel beams. This increased distance adds to the margin of safety already contained in the Section 3.3 analysis. Furthermore, an analysis using the Energy Balance Method as developed in Section 3.2 of the Summary Report showed the ratio of the critical energy needed to heat the structural steel to the critical temperature (Ec_t) to the predicted heat release for this combustible configuration (H') to be approximately 6.4 which is much greater than the required minimum value of 1.0. This analysis substantiates the integrity of the structural steel beams above this combustible configuration.

CONCLUSION:

Based on the above evaluation and the specific combustible configuration beneath the fire rated floor slab in question, the structural steel beams supporting elevation 761'-10" above Fire Zone 2-4G will not be adversely affected as the result of a postulated fire in this area.

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UNIT 2 FIRE RATED FLOOR SLAB ABOVE FIRE ZONE 2-5A-N

Reference Drawing C-213469, Sheets 1 & 2

DESCRIPTION:

The fire rated floor slab is 1'-9" thick in the area being rated that is west of column line Q (reference Drawing C-213469, Sheet 1). The top of slab elevation for this portion is 779'-1". East of column line Q (Reference Drawing C-213469, Sheet 2) the slab is 6'-3" thick in the area being rated below the surge tanks vault floor (top of slab elevation is 779'-4") and is 6'-4" thick in the area being rated below the fuel shipping cask storage pool floor (top of slab elevation is 777'-5"). The source of combustibles in these areas is cable trays located throughout the fire zone.

EVALUATION:

The portions of Fire Zones 2-5A-N located beneath the fire rated floor slab in question is protected by an automatic fire suppression sprinkler system which has been installed in accordance with NFPA 13. In the event of a fire in these portions of Fire Zone 2-5A-N, actuation of the automatic sprinkler system would mitigate the heat effect the fire would have on the structural steel beams supporting this fire rated floor slab. The basis for this evaluation is presented in Section 3.4 of the Summary Report for Structural Steel Evaluation. This section of the report provides the justification for the NFPA 13 sprinkler system's heat absorption capability with respect to cable tray fires. The combustible configuration beneath this fire rated floor slab is bounded by the analysis in Section 3.4

CONCLUSION:

Based on the above evaluation and the specific combustible configuration beneath the fire rated floor slab in question, the existing automatic fire suppression sprinkler system can be expected to protect the structural steel beams with a wide margin of safety in the event of a postulated fire in this area.

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UNIT 2 FIRE RATED FLOOR SLAB
ABOVE FIRE ZONES 2-5C, 2-5A-S, 2-5B

Reference Drawing C-206015, Sheets 1, 2 & 3

DESCRIPTION:

The fire rated floor slab in question varies in thickness from 1'-9" to 2'-3" as shown on the reference drawing. The top of the entire slab is at elevation 779'-1". This reinforced concrete slab acts compositely with the structural steel beams to support this elevation as shown on the reference drawing. The combustibles in these fire zones located beneath the fire rated floor slab are cable trays of varying elevation and location as shown on the reference drawing.

EVALUATION:

The portion of the fire rated floor slab located north of column line 34.5 has only two horizontal cable trays. Section 3.3 of the Summary Report for Structural Steel Evaluation provides the justification for the adequacy of structural steel for a combustible configuration of two horizontally stacked cable trays. The condition analyzed in the Summary Report bounds this combustible configuration of two side-by-side horizontal cable trays.

The portion of the fire rated floor slab in question located south of column line 34.5 has been structurally evaluated to determine which steel beams are the minimum required to support this entire floor slab area. The results of this analysis concluded that five structural steel beams are necessary to support the floor slab. These steel beams are noted on Sht. 1 of the reference drawing. The other beams are not required since the 2'-9" thick reinforced concrete slab is capable of spanning between these five required members.

These five required steel beams were then analyzed by the Energy Balance Method as developed in Section 3.2 of the Summary Report for Structural Steel Evaluation. This analysis determined the ratio of the critical energy needed to heat each required structural steel beam to the critical temperature (Ec_t) to the predicted heat release for the combustible configuration surrounding each beam (H'). In all five instances this ratio "(Ec_t/H')" was determined to be greater than the required minimum value of 1.0. This analysis verifies the integrity of the required structural steel beams in the area in the event of a postulated fire.

CONCLUSION:

Based on the above evaluation and the specific combustible configuration beneath the fire rated floor slab in question, a postulated fire in Fire Zones 2-5C, 2-5A-S and 2-5B would not generate sufficient heat to adversely impact the required structural steel beams supporting the fire rated floor slab.

UNIT 2 FIRE RATED FLOOR SLAB
ABOVE FIRE ZONE 2-6A

Reference Drawing C-206016, Sheet 1

DESCRIPTION:

The fire rated floor slab in question is 1'-9" thick and the top of slab is at elevation 779'-1". This reinforced concrete slab acts compositely with the structural steel beams to support this elevation as shown on the reference drawing. The source of combustibles in this area is 3 horizontal cable trays stacked on top of each other.

EVALUATION:

The area directly beneath the portion of the floor slab which is fire rated has no cable trays, however, 3 horizontally stacked cable trays are located beneath the W3OX19O structural steel beams which support the area floor slab at elevation 799'-1". These structural steel beams were evaluated by the Energy Balance Method described in Section 3.2 of the Summary Report for Structural Steel Evaluation. This analysis demonstrated that the ratio of the critical energy needed to heat each W3OX19O structural steel beam to the critical temperature (Ec_t) to the predicted heat release for the combustible configuration surrounding each beam (H') to be greater than the required minimum value of 1.0. This analysis verifies the integrity of the required structural steel beams supporting the fire rated floor slab in question.

CONCLUSION:

Based on the above evaluation and the specific combustible configuration beneath this fire rated floor slab as shown on the reference drawing, a postulated fire in Fire Zone 2-6A would not generate sufficient heat to weaken the structural steel beams supporting the fire rated floor slab.

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2

FIRE PROTECTION PROGRAM APPENDIX R DEVIATION REQUEST NO. 6
NON FIREPROOFED STRUCTURAL STEEL

SUMMARY REPORT
FOR
STRUCTURAL STEEL EVALUATION

REVISION 2
10/87

SUMMARY REPORT
FOR
STRUCTURAL STEEL EVALUATION

SUMMARY REPORT FOR STRUCTURAL STEEL EVALUATION UNIT 1 & 2 REACTOR BUILDINGS APPENDIX R DEVIATION REQUEST NO. 6

1.0 INTRODUCTION

Deviation Request No. 6 was submitted to the NRC in September 1985 (PLA-2529) requesting approval of exposed (non-fireproofed) structural steel which supports fire area barriers in the Unit 1 and 2 Reactor Buildings and the Control Structure.

After reviewing the Deviation Request, the NRC requested additional justification. In response to the NRC request, PP&L submitted the Structural Steel Action Plan to the NRC for their concurrence on February 10, 1986 (PLA-2592).

The initial submittal, outlined in Revision 0 to this report, was submitted to the NRC on May 19, 1986.

Subsequent to the initial submittal, a meeting was held in the NRC Office in Bethesda, MD on July 30, 1986 to discuss the submittal. During this meeting the NRC requested that PP&L revise their submittal and provide the following:

- Consideration of the effects of slab openings and the use of a 100% live load criteria.

- Specific details of the areas required to be fire rated.

Our summary report has been revised to respond to the NRC requests. Methodology changes different than those proposed in our action plan submitted with PLA-2592, have occurred as a result of NRC comments. These changes are explained in the report.

This report specifically addresses the fire-rated barriers in the Unit 1 and 2 Reactor Buildings and some barriers in the Control Structure. Fire-rated barriers covered by Deviation Request 06 are located in the Unit 1 and 2 Reactor Buildings and in the Control Structure. The write-up within the body of Deviation Request No. 6 is considered to have adequately addressed the combustible configuration so the subject is not specifically addressed in the report.

Finally, in response to concerns expressed verbally by the NRC staff, we have taken the initiative to review <u>all</u> of the structural steel in the Unit 1 and 2 Reactor Buildings regardless of whether or not the structural steel was part of a fire-rated barrier.

2.0 METHODOLOGY

The methodology outlined below, which differs from the methodology outlined in PLA-2592, was used in performing our updated analysis.

All structural steel in both the Unit 1 and Unit 2 Reactor Buildings was reviewed. The structural steel framing plan for each floor elevation on each Reactor Building was reviewed and the minimum set of structural steel framing members required to insure structural integrity was selected. This minimum set of structural steel framing members was selected on the premise that the thick reinforced concrete slabs used in the construction of the Reactor Buildings are able to span significantly longer distances than the normal beam to beam span required by other design basis accident scenarios. Since these other design basis accident scenarios need not be considered in conjunction with a fire, much of the structural steel installed in the Reactor Building is not necessary to maintain structural integrity for the fire scenario. In selecting the minimum set of required structural framing members, the following restrictions were applied:

- The reinforced concrete slab must be able to support 100% of the allowable live load shown on the existing structural framing plan drawings. The loss of structural continuity as a result of hatch openings and penetrations must be considered.

- The selected structural steel framing beams must be capable of carrying any increased loadings caused by the elimination of adjacent members to the building girders and/or columns. Similarly, the building girders and/or columns must be capable of supporting any increased loading.

Each specific concrete slab section was evaluated to assure that the first criteria outlined above was met. Each required structural steel framing member was reviewed for the effects of any additional load imposed on the member and for the effects of the combustible configuration near each member.

Any required structural steel framing member with a maximum of two horizontal cable trays in its vicinity was evaluated to be acceptable. (See Section 3.3 - Two Horizontal Cable Tray Criteria for an explanation of and justification of this criteria.)

Any required structural steel framing member located in areas protected by an NFPA 13 sprinkler systems was evaluated to be acceptable. (See Section 3.4 – NFPA 13 Sprinkler Criteria, for an explanation of and justification for this criteria.)

All remaining required structural steel framing members were evaluated with respect to fire protection on a case-by-case basis. By reviewing each member and the combustible configuration in the vicinity of the member, the fire protection evaluation determined that structural steel temperatures could not be raised above 1000EF. The case-by-case fire protection evaluation is explained in Section 3.5.

3.0 CRITERIA AND JUSTIFICATION

3.1 General Criteria

In the past it has been common to calculate the average combustible loading by distributing all calculated combustibles uniformly over the entire floor area and comparing the results with the fire rating of the structure. While this method provides a room-to-room comparison, it fails to consider such parameters as combustible concentration, fuel arrangement, and burning rates. These average combustible loadings have traditionally been compared to fire-rated components tested to the Standard Time Temperature Curve (Ref. 2). More recently, this approach has come under attack as being unconservative in certain applications because it fails to address the condition where the majority of the combustibles in an area are concentrated in a small portion of the area.

PP&L based the structural steel evaluation on a comparison of combustible configuration in each area using actual cable tray fire test data. Cable trays are the predominant fire hazard in the Reactor Buildings. The cable tray fire tests referenced take into account the actual fuel arrangement within the cable tray, combustible configuration, and burning rates.

The critical steel failure temperature used in the evaluation criteria was based on the 1000°F average temperature acceptance criteria found in the National Fire Protection Association's standard used for testing fireproofing for structural steel (NFPA-251). Since fireproofing materials are designed to maintain structural steel temperatures below this level, we can conclude that fires which do not heat the structural steel to this critical temperature will not result in loss of structural integrity.

This conclusion is further substantiated by information provided by the American Institute of Steel Construction. The American Institute of Steel Construction Manual (Ref. 8) states that steel maintains approximately 63% of its yield strength at 1000°F and approximately 37% of its yield strength at 1200°F. The normal A.I.S.C. allowable stress in bending is in the range of 60 to 66% of its yield strength. Since it is reasonable to classify the fire condition as an extreme environmental loading combination, it should follow that for this loading combination the allowable stress should be permitted to approach the yield strength of the material. Therefore, by restricting structural steel temperature to 1000°F, we are assuring that approximately 63% of the yield strength of the material is preserved. As a result, when we evaluate the structural members for 100% live and dead load and use the normal A.I.S.C. allowable stresses, we are, in fact, satisfying the conditions which would be imposed by a loading combination consistent with the fire scenario.

In Section 3.2 of this report, the Energy Balance Method outlined in the previous revision has been expanded to include the heat absorption capability of the concrete. In the development of the method it has been assumed that an equilibrium temperature is reached between the structural steel and the first inch of depth of concrete. The assumption of equilibrium concrete heat up to a depth of one inch is considered a reasonable assumption since in actuality the rapid transfer of heat through the air would cause a much larger area than assumed to be heated up. From a structural standpoint heating of the lower 1" of concrete will have a negligible effect on the concrete structural properties since the cover on the reinforcing steel is approximately 4" and in the structural evaluation for slab span capability, the concrete on the underside of the slab is in tension. Tensile concrete is not considered for structural properties.

The following combustibles were generically evaluated, and it was determined that a specific analysis on a case-by-case basis was not required. The remaining combustibles which are represented solely by cable trays are the dominant factor leading to potential high temperatures which would affect structural steel.

3.1.1 Combustible Liquids

Combustible liquids could present fire exposure to structural steel. The most probable location for heat released, however, would be at the floor level and the heat would be released very quickly. The analysis of all fire zones containing combustible liquids, except Fire Zones 1-1G and 2-1G, are bounded by the analysis of Fire Zone 1-1C. Fire Zone 1-1C contains the largest in-situ quantity of oil (155 gallons) in the smallest room (1374 square feet). This oil is associated with the HPCI and RCIC Turbines.

The Susquehanna SES Fire Protection Report (Rev. 2), page 4.1-2. indicated a 4 mm per minute burning rate for oil. Assuming the in-situ 155 gallons and a transient allowance of 155 gallons of oil are spilled on the floor and none of the oil is removed by the floor drains, the calculated fire will last less than three minutes. This is not sufficient time for the critical structural steel to be heated to 1000°F.

The HPCI turbines and RCIC turbine lube oil systems have a maximum oil flow of 60 gpm at 110 psi. The potential for a high pressure leak affecting the steel is low. The piping is seismically designed and automatic open head deluge water spray systems protect the HPCI and RCIC oil systems.

Oil sumps located in Fire Zone 1-1G and 2-1G have a 1120 gallon capacity. The construction of these sumps, however, would prevent the ignition and burning of the oil. The sumps are constructed of a steel liner cast into concrete below the

Reactor Building Basement. The cover of the sumps is a 1 1/2' thick concrete slab with a 2' x 2 1/2' manhole constructed of a minimum of 3/4" thick steel plate.

3.1.2 Charcoal

The HVAC units which contain charcoal are provided with fixed deluge systems and are contained within steel enclosures. Because of the physical configuration of the charcoal beds a fire will be slow and smoldering with a low heat release rate. Therefore, these units will not effect building structural steel integrity.

3.1.3 Transient Combustibles

Investigations by Sandia Laboratories (Ref. 8, Table 3) indicate that transient combustibles produce low heat release rates resulting in room temperatures below 500°F.

The presence of transient combustibles is administratively controlled throughout the facility. When present transient combustibles are located at floor level. If transient combustibles are considered along with a cable tray, it would be expected, based on the above referenced Sandia data, that the transient would be an ignition source only if the cable tray was close to the transient combustible. Such a combination of heat release caused by cable trays and transient combustibles at floor level would not effect structural steel located at the ceiling. Additionally, since the structural steel justification was based on 1000°F critical temperature, there still remains a 300°F allowance before transient combustibles would produce a local hot spot of 1300°F (1300°F is the allowable local hot spot temperature during a NFPA 251 test).

3.2 Technical Basis

This section of the report provides the technical basis used to address the effects of each unique combustible configuration on the required structural steel members.

The basic methodology developed in this section is referred to as the Energy Balance Method. The Energy Balance Method provides a means to calculate the energy released from a given combustible configuration, to calculate the energy absorption capability of a given structural mass and to determine by comparing these two calculations whether or not the critical temperature can be exceeded.

As discussed below, the Sandia Laboratories' "Fire Retardant Coating Test" (Ref. 1) provides the data necessary to predict the energy release of a cable tray fire. The Sandia Laboratories' "Fire Protection Research Program Corner Effects Tests" Report (Ref. 4) provides additional data to confirm these predictions and predict the heat release effects of the burning cables as a function of the distance of these cable trays from the corner. The heat release data with increasing distance from the corner suggests that the ability of the cables to burn and the resultant energy release is greatly diminished as the reradiation effects typical of the close corner relationship are removed. The energy release figures provided in the corner effects tests are used to baseline the values measured in the "Fire Retardant Coating Tests" and as a conservative prediction of the heat release value to be used in the methodology outlined below.

Energy Balance Method

Energy Absorption

The energy absorption capability of a given structural mass can be calculated as follows:

$Ec_T = Er \times Q$

where:

Ec_T = the critical energy needed to heat all the components in a given area to the critical temperature (BTU)

Er = Energy required to raise a unit amount of a given component from ambient to the critical temperature.

Q = The total quantity of each component in the area.

The typical components in a given area which would be present to absorb heat are structural steel, concrete, ductwork, piping, air, equipment and even the steel cable tray itself. For purposes of our evaluation only structural steel and concrete will be considered as heat absorbing components.

The heat required to raise the temperature of one pound of structural steel to 1000°F can be calculated by the following equation:

$Er_S = CP_S \times (Tc\text{-}To)$ (Eq. 1a)

where:

Er_S = Energy required to raise the temperature of pound of structural steel from ambient to the critical temperature (BTU/lb)

CP_S = Specific heat of steel (Cp = .112 BTU/lb °F for steel)

To = Pre-fire room temperature = 100°F

Tc = Critical temperature = 1000°F

Inserting the given values into equation 1a yields:

$$Er_S = \frac{.112 BTU}{lb^\circ F}(1000^\circ F - 100^\circ F) = 100.8 \text{ BTU/lb}$$

Therefore, approximately 100 BTUs per pound of steel are required to heat the steel to the critical temperature. The critical energy required to heat a given structural member to the critical temperature of 1000°F is expressed as:

$Ec_S = Er_S \times W \times L$ (Eq. 2a)

where:

Ec_S = Critical energy needed to heat a given structural steel member to the critical temperature (BTU)

W = weight of structural steel member per foot (lb/ft)

L = length of structural steel member subject to direct energy effects (ft)

The heat required to raise the temperature of one square foot of concrete 1" deep to 1000°F can be calculated by the following equation:

$Er_C = Cp_C \times (Tc\text{-}To)$ (Eq. 1b)

where:

Er_C = Energy required to raise the temperature of one square foot of concrete 1" deep from ambient to the critical temperature (BTU/lb)

Cp_C = Specific heat of concrete (Cp - .156 BTU/lb °F for concrete)

To = Pre-fire room temperature = 100°F

Tc = Critical temperature = 1000°F

Inserting the given values into equation Ib yields:

$$Er_C = \frac{.156\,BTU}{lb^\circ F}(145\#/ft3)(1ft/12inch)(1000^\circ F - 100^\circ F) = 1696.5\,BTU/ft^2$$

Therefore, approximately 1700 BTUs per square foot of concrete are required to heat the concrete to the critical temperature. The critical energy required to heat a given concrete area to the critical temperature of 1000°F is expressed as:

$$Ec_C = Er_C \times A_c \qquad \text{(Eq. 2b)}$$

where:

Ec_C = Critical energy needed to heat a given concrete area to the critical temperature (BTU)

A_C = the effected concrete area

<u>Energy Release</u>

The energy released from a cable tray can be developed as follows:

The heat released from a two-cable tray fire can be predicted from data developed during Sandia Laboratories Fire Retardant Coating Tests (Ref. 1). During small scale testing, Sandia (Ref. 1, Table A-XI) determined the maximum Heat Release Rate to be 134 KW/M^2 which is equal to 11.8 BTU/ft^2 sec.

Sandia performed a full scale free burn test of two stacked 18-inch wide cable trays filled with IEEE 383 cable (Ref. 1 Test 20). The total heat released from this test can be predicted by conservatively assuming the Sandia small scale maximum heat release rate was constant during the entire fire test burn period. This is expressed as:

$$Ht = Hr \times At \times T \qquad \text{(Eq. 3)}$$

Ht = Total heat released (BTU)
Hr = Maximum heat release rate (BTU/ft^2 sec)
At = Area of cable tray burned (ft^2)
T = Burn Time (sec)

In this test, the bottom tray was damaged for 24 linear inches and burned 9 minutes. The top tray was damaged for 54 linear inches and burned for 12 minutes. Using this data in equation 3 yields:

$$\text{Heat Release Top Tray} = \frac{11.8\,BTU}{\sec ft^2} x \frac{18\,inches\ x\ 54\,inches}{144\,sq\ inches/ft^2} x \frac{12\min}{1\ \min/60\sec} = 57{,}348\,BTU$$

$$\text{Heat Release Top Tray} = \frac{11.8\,BTU}{\sec ft^2} x \frac{18\,inches\ x\ 24\,inches}{144\,sq\ inches/ft^2} x \frac{9\min}{1\ \min/60\sec} = 19{,}116\,BTU$$

$$\text{Total Heat Release (Ht)} = 57{,}348 + 19{,}116 = 76{,}464\,BTU$$

The maximum total heat release per area can be expressed as follows:

Hmax = Ht/At (Eq. 4)

where:

Hmax = Maximum total heat release per area (BTU/ft^2)

Substituting our previously developed data into equation 4 yields:

$$H\max = \frac{76{,}464\,BTU}{\frac{18\,inches(54\,inches + 24\,inches)}{144\,inches^2/ft^2}} = 7842\,BTU/ft^2$$

This maximum total heat release per area can then be applied to other configurations by the following equation:

H' = Hmax x A' (Eq. 5)

where:

H' = Predicted heat release for a given configuration (BTU)

A' = Area of cable tray burned for that given configuration (ft^2)

Sandia Laboratories also conducted separate corner effects tests of cable trays (Ref. 4) where calorimeters recorded heat flux above the cable tray fires. This additional test series can be used to confirm the predicted maximum heat release value of 7842 BTU/ft^2 and also to determine the maximum heat release values for configurations with different corner configurations.

The corner effect test data was obtained during full scale free burn fire tests in a corner configuration. The cable tray type, arrangement, fill and contents were similar to the fire retardant rating tests arrangement. During these corner tests the actual maximum heat flux (heat release rate) was measured by determining the heat release directly above the cable tray with the cable tray located at various distances from the corner (Ref. 5 – Table I and II). The maximum heat flux multiplied by burn time would conservatively indicate the total heat at the upper calorimeter as follows:

Hmax = Hf x T (Eq. 6)

where:

Hf = maximum heat flux (BTU/ft^2 hr)

By substituting the data from the actual corner tests the following data can be generated:

Cable Tray* Distance from Corner	Max Heat Flux (Hf) (BTU/ft^2 x hr)	Burn Time (T) (min)	Max Heat Release /Area (Hmax) (BTU/ft^2)
5 in x 10.5 in	18,430	20	6140 BTU/ft^2
10.5 in x 18 in	12,300	24	4932 BTU/ft^2
60 in x 120 in	2,370	25	987 BTU/ft^2
* (See Figure 2.0)			

The 6140 BTU/ft^2 is comparable to the 7842 BTU/ft^2 derived from the fire retardant coating test data. This is expected, because at the short corner distance the predicted heat release would nearly equal the measured maximum heat release.

Using this developed data and the results of the Sandia Corner Effects Test (Ref. 4), a determination can be made as to the amount of heat transferred to the structural components in an area due to a fire in a cable tray located some distance below the steel member. It has been determined that 7842 BTU/ft^2 is the maximum heat released at the cable tray or group of cable trays.

Figure 1.0 of this report is a reproduction of Figure 7 from the Sandia corner effects test (Ref. 4). The data in this figure can be used to determine the maximum heat release values as a function of corner configuration.

Acceptance Criteria

The energy required to heat a given structural mass to 1000°F is compared with the energy released by a fire in the vicinity of that mass to determine whether or not the fire threatens structural integrity.

If the following ratio is satisfied, structural integrity will be assured:

$$\frac{Ec}{H^1} t\ 1.0 \qquad \text{(Eq. 7)}$$

where (as previously defined)

Ec_t = The critical energy needed to heat all the components in a given area to the critical temperature (BTU).

H^1 = Predicated heat release for a given configuration (BTU).

<u>Conservatisms</u>

The following demonstrates that the use of this technical basis at Susquehanna is conservative:

- The maximum heat release rates used in our analysis were based on cable tray test conducted by Sandia (Ref. 4). In these tests cross linked PE (polyethylene) cables is a loose packed configuration were tested.

  EPRI conducted a series of full scale fire tests using the following cable types and packing arrangements:

  - Tightly packed ethylene propylene rubber (EPR)/hypalon cables
  - Loosely packed ethylene propylene rubber (EPR)/hypalon cables
  - Tightly packed PE cables
  - Loosely packed PE cables

  The results of the EPRI test demonstrated the following relationships.

  - The tighter the cable packing, the lower the heat release will be.
  - The EPR/hypalon cables have a lower heat release than the PE cables.

  Since Susquehanna SES used EPR/hypalon cables in a tight packed arrangement, the quantitative test data indicates that the use of the heat release data from the Sandia test has an inherent factor of safety of approximately 8 when applied to our plant.

  - The Sandia observed maximum heat release rate data (Ref. 1, 4) was assumed over the entire burn time. During an actual fire, the heat release rate would gradually increase to the maximum and then decrease.

- All cable trays were assumed to be full.
- Heat transfer to the room air was ignored.
- Steel was assumed to fail if the 1000°F critical temperature was reached. The reduced load capabilities of the structural steel at temperatures above 1000°F were ignored.
- It was assumed that high fire temperatures existed for sufficient time to allow heating of the steel. In many cases the longer heating intervals required for the larger structural steel members will not exist for sufficient time to allow the necessary heat transfer.

3.3 Two Horizontal Cable Tray Criteria

3.3.1 Description

All required structural steel framing members were reviewed. Any member affected by a combustible configuration comprised of no more than two (2) horizontal perpendicular cable trays with no other cable trays within a four (4) foot distance and not less than one foot below the structural steel were determined to be acceptable. (See Figure 3.0.)

3.3.2 Approach

The Energy Balance Method will be used to provide a justification for the criteria by demonstrating that this combustible configuration will not cause temperatures above 1000°F for the lightest member to which the criteria was applied.

3.3.3 Justification

The following justification is provided to quantitatively demonstrate that the combustible effects from two (2) horizontal perpendicular cable trays one foot below the structural steel are insufficient to cause a structural steel member to be heated to 1000°F. (See Figure 3.0.)

Therefore, any structural steel member larger than that member justified is acceptable for the described combustible configuration, because larger quantities of heat are required to heat larger steel members.

The lightest structural steel member to which this criteria was applied is a W21 x 49.

Therefore, a W21 x 49 beam (flange width - 6.52 in, weight - 49 -lb/ft) and two 24-in wide cable trays must be justified.

<u>Energy released at the cable tray</u>:

From Figure 3.0 it can be seen that the cable tray is 33" below the ceiling. Using a value of 9500 BTU/ft$_2$-HR for a distance from the ceiling of 30" from Figure 1.0 and using 25 minutes, the longest burn time, from the table on page 10, calculate Hmax for this configuration.

Since:

$H_t = H_r \text{ x } A_t \text{ x } t$ (Eq. 3)

And

$Hmax = H_t / A_t$ (Eq. 4)

Therefore:

$$H\max = H_r\,xt = 9500\frac{BTU}{ft^2 - Hr}x\,25\min.x\frac{1hr}{60\min.}$$

$$H\max = 3{,}958\frac{BTU}{ft^2} \qquad \text{(Eq.5)}$$

$$H^1 = 3{,}958\frac{BTU}{ft^2}x\frac{24\,inches}{12\,inches/ft}x\frac{6.52\,inches}{12\,inches/ft}x\,2\,trays$$

$$H^1 = 8{,}602\,BTU$$

<u>Energy required to heat beam to 1000°F:</u>

$$Ec = 49\frac{lbs}{ft}x\frac{24\text{ inches}}{12\text{ inches/ft}}x\frac{100BTU}{lb} = 9{,}800BTU \qquad \text{(Eq. 2)}$$

<u>Ratio (energy required to energy released):</u>

$$\frac{9{,}800\text{ BTU}}{8{,}602\text{ BTU}} = 1.14 \quad 1.0 \qquad \text{(Eq. 7)}$$

Therefore, the criteria is justified.

This justification assumes that the maximum heat release rate of the burning cable tray configuration is a function of the distance of the cable tray from the ceiling rather than from the underside of the structural steel member. This is acceptable because all parts of the cable tray are at least 33" from the ceiling except for a short, 6.5", section beneath the structural steel member. It is unrealistic to assume that the corner effects will dramatically increase in this short distance.

This justification also assumes that only the portion of the cable tray directly beneath the structural steel member contributes to raising the temperature of the steel. This is justified because those portions of cable tray not directly under the steel will cause heat-up of the reinforced concrete slab above them. For each additional foot of cable tray considered 7,916 BTU's is released. Assuming a 45° distribution of this heat into the concrete slab, the additional heat absorption afforded by the concrete, using the methodology outlined in Section 3.2, is 12,750 BTU'S. Therefore, more energy absorption capability is added than additional heat released.

3.4 NPFA 13 Sprinkler Criteria

3.4.1 Description

The Unit 1 and Unit 2 Reactor Buildings both have areas with automatic sprinkler protection designed, installed and tested to the requirements of NFPA 13. All required structural steel framing members in areas protected by NFPA 13 sprinkler systems and having combustible configurations less than those justified herein were determined to be acceptable.

3.4.2 Approach

For a given quantity of cable trays, an automatic sprinkler system is capable of preventing structural steel damage by controlling a fire and cooling the steel. Six cable trays have been selected as being a combustible configuration which can be protected by a sprinkler system. Branch Technical Position CMEB 9.5-1 (Rev. 2) lends credence to this criteria in that it requires automatic suppression systems only when an area contains more than six cable trays. Additionally, extensive large scale fire testing of rack storage arrangements, a far more hazardous combustible configuration than cable tray, have demonstrate that ceiling level automatic sprinklers installed in accordance with NFPA 13 are effective in preventing heat damage to unprotected steel beams and columns. The requirements of NFPA Standard 231C, "Standard for Rack Storage of Materials". (Ref. 4) were developed based on the results of these large scale tests. A comparison between the combustible configurations and fire hazards associated with rack storage and cable trays will be used to justify our criteria.

3.4.3 Justification

Our criteria can be justified by comparing the relative fire hazard of a six-cable-tray fire with that of the rack storage fire which meets the NFPA Standard 231C requirements and does not require structural steel protection.

Rack storage of materials, especially most plastic materials, presents a difficult to control fire hazard. The materials and the cardboard packaging holding these materials are easily ignited. Once ignited, the rack storage configuration provides ideal conditions for rapid and intense combustion. In the rack storage configuration the boxes of materials are surrounded on all sides by sufficient oxygen for combustion, and the flue spaces created between adjacent boxes are ideal for reradiation effects which promote fire spread. Also, the pelletized materials (4' x 4') present large areas of blockage from sprinkler protection and allow fire growth to a level which can overpower traditional sprinkler systems. Recognition of these conditions led to extensive large scale fire tests. These tests served as the basis for the National Fire Protection Associations's "Standard for Rack Storage of Materials" (NFPA 231C) (Ref. 4).

The rack storage test program and NFPA standard clearly show that when an adequately designed ceiling sprinkler system is installed, fireproofing is not required for steel columns or ceiling steel. (Ref. 4 Sec. 3-2.1, 3-2.3, B-3-2.1, and B-3-2.3.)

In contrast, the cable trays at Susquehanna contain IEEE 383 qualified cables which require at least 70,000 BTU/hr heat input to ignite the cables. Due to the tight packing of cables in cable trays, there is only limited exposure to air. Cable tray fires are slow developing relative to cardboard packaging materials, and unlike other fuel arrays, cable trays present a fuel arrangement which allows fire propagation in only two directions. Finally, the cable tray itself is constructed of non-combustible steel.

In the Reactor Buildings the predominant fire spread is vertically from tray to tray. Horizontal fire spread from cable tray to cable tray is possible, but the majority of the cable trays in the Reactor Building are arranged with spacing which are not ideal for horizontal fire spread.

The following example shows how to determine the required ceiling sprinkler system parameters for a high hazard rack storage configuration when structural steel fireproofing is not provided on either ceiling beams or columns.

3.4.4 NFPA 231C Sprinkler Design Example

The following example uses NFPA 231C requirements to determine sprinkler system parameters for a given rack storage combustible configuration when structural steel fireproofing is not to be used.

a. Problem Definition - Determine the sprinkler density for a ceiling sprinkler system capable of maintaining the building's structural integrity for the following rack storage configuration.

1) The stored material is pelletized cardboard cartons containing foamed polystyrene. The pallets and cartons are not encapsulated with plastic.

2) The aisle spacing is 8 feet. The rack storage height is 15 feet.

3) There are no in-rack sprinklers.

4) Structural steel ceiling beams and columns are not fireproofed.

b. NFPA 231C Requirements

1) The combustible material described above would be classified as a Class IV commodity per NFPA 231C Section 2-1.1.4.

2) By referring to Table 6-11.1 in NFPA 231C and applying the following conditions:

i) The rack storage height is over 12 feet but less than 20 feet.

ii) The combustible material is classified as a Class IV commodity.

iii) The pallets and cartons are not encapsulated with plastic.

iv) An 8-foot wide aisle is used between rack configurations.

v) No in-rack sprinklers are provided.

It can be determined that Figure 6-8.2 can be used to determine the allowable reduction factor to be applied to the sprinkler design density and that Figure 6-11.1d curve E or F is to be used to determine the unfactored sprinkler design density. (Refer to NFPA 231C for figures.)

3) Using NFPA 231C Table 6-8.2, it is determined that a 60% reduction factor may be applied to the required sprinkler design density determined below.

4) NFPA 231C Table 6-11.d curve F will be used because Susquehanna SES uses 212°F rated sprinkler heads. Curve F applies to 165°F rated heads. Curve E applies to 265°F rated heads. Using the curve for the lower rated heads results in a more conservative sprinkler density. Using 2500 square feet, which was used as the design area for sprinkler coverage used in the design of the SSES Reactor Buildings, it can be determined that the required sprinkler design density for this rack storage example is:

   Required Sprinkler Design Density = .54 GPM/ft^2

5) By applying the 60% reduction factor determined in step 3 above, the final sprinkler density is determined to be:

   Sprinkler Density = .54 x .60 = 0.32 GPM/ft^2

6) The requirements of NFPA 231C sections 3-2.1 and 3-2.3 are satisfied by the storage height limitations of 15 feet and the sprinkler design which conforms to Chapters 6.7.8 and 9. Therefore, fireproofing of structural steel beam and columns is not required for this example.

c. Conclusion

A ceiling sprinkler system with a design density of .32 GPM/ft^2 over 2500 square feet is considered sufficient to protect non-fireproofed structural steel (ceiling beams and columns) from damage when subjected to a rack storage hazard with the above parameters.

3.4.5 Comparison of Our Cable Tray Criteria With the Fire Hazard of the Rack Storage Example

a. Cable Trays

Cable trays present an important fire protection challenge to control damage prior to affecting safe shutdown or station availability, but cable tray fires have low heat release rates, spread slowly, and do not pose the danger to structures that the rack storage materials do.

As discussed in Section 3.2 of this report, the Sandia Laboratories Fire Retardant Cable Test (Ref. 1) Table A-XI indicates a maximum of 11.8 BTU/ft^2 sec (134,690 W/M^2) for non-coated electrical cables. Therefore, it can be concluded that the total heat release rate for six cable trays would be 70.8 BTU/ft^2 sec.

b. Rack Storage

Rack storage stores combustible materials in configurative ideal for combustion (i.e., air space around fuel, and distances ideal for radiant heat transfer). Therefore, rack storage presents an extremely difficult fire to control. Rack storage fires have extremely high heat release rates, spread very quickly, and can threaten structural integrity within minutes unless proper sprinkler protection is provided.

Heat release rate data for the rack storage commodity was obtained from Factory Mutual Data (Ref. 10, Table 2, Page 26) which indicates that a pallet of polystyrene in cartons 14 to 15 feet high has an average heat release rate of 300 BTU/ft^2 sec.

c. As a result of the information in a and b above, the following data comparison of critical fire protection parameters can be presented.

DATA COMPARISON		
Hazard	Cable Tray Criteria	Rack Storage Example
Heat Release Rate	70.8 BTU/ft^2 sec.	300 BTU/ft^2 sec.
Sprinkler Density	.15 GPM/ft^2	.32 GPM/ft^2
*SSES was designed on the basis of a .15 GPM/ft^2 sprinkler density over a 2500 sq. ft. area.		

d. Conclusion

The dominant mechanism governing a sprinkler system's ability to extinguish fires and also to protect structural steel from damage is the ability of the sprayed water to absorb the heat released from the fire. This absorption occurs as the heat of the fire is used to change liquid water to steam.

The heat release rates of different materials as they are consumed is an indication of the relative fire hazard of the different fires. As the heat release rate increases, larger and larger quantities of water are necessary to absorb the higher heat levels generated.

Therefore, a comparison of the data presented in Item c above on heat release rates and sprinkler densities can be used in demonstrating the adequacy of the Susquehanna sprinkler design for our cable tray configurations. Since the rack storage example above proved that a .32 GPM/ft^2 density sprinkler system could control a fire with a heat release rate of 300 BTU/ft^2 min, using a strictly linear relationship we can predict a .15 GPM/ft^2 density sprinkler system would control a fire with a heat release rate of 140 BTU/ft^2 sec or 12 cable trays (140 BTU/ft^2 sec divided by 11.8 BTU/ft^2 sec per cable tray).

The assumption of linearity applied above would be viewed as being highly unconservative if the light hazard fire test data was used to predict the sprinkler system requirements to protect a configuration with high fire hazard potential. This is valid because as the level of the combustibles doublest effects such as reradiation can have an exponential effect. In contrast, however, to extrapolate results from the higher density system to the lower density system on a linear basis is clearly a conservative and supportable approach.

While this comparison predicts a wide margin of safety over the six-tray criteria, the criteria was limited to six cable trays to be conservative, to parallel the Branch Technical Position CMEB 9.5-1 (Rev. 2) requirements, and to assure that specific orientations and arrangements exceeding the criteria would be looked at on a case-by-case basis to ensure the adequacy of the sprinkler system.

Therefore, the existing ceiling level automatic sprinkler system in the Susquehanna SES Reactor Building can be expected to protect structural steel with a wide margin of safety in the event of a fire involving six cable trays.

3.5 Case-By-Case Fire Protection Analysis

3.5.1 Description

For all required structural steel framing members not satisfying either of the two criteria outlined above one of the following approaches was used to justify that structural steel fire proofing was not required:

a) For non-sprinklered areas, a case-by-case evaluation using the Energy Balance Method outlined in Section 3.1 of this report was performed. The most severe cable tray exposure was analyzed for each steel member evaluated. In cases where the most severe exposure was not obvious, several exposures were evaluated.

b) For sprinklered areas, a case-by-case evaluation to determine that the existing combustible configuration would be controlled by the sprinkler system was performed.

4.0 RESULTS

All structural steel in the Unit 1 and 2 Reactor Buildings was reviewed in conjunction with the combustible configuration exposing the structural steel to determine if the combustible configuration would cause structural steel temperatures in excess of the critical temperature.

No situations were found where the addition of fireproofing materials was determined to be necessary to keep structure steel temperatures below the critical temperature.

For areas acting as fire area barriers:

a) The structural steel supporting the roof of the Reactor Building switchgear rooms (Fire Zone 1-4C, 1-4D, 1-5F, 1-5G, 2-4C, 2-4D, 2-5F and 2-5G) were confirmed to already be provided with 3-hour fire rated fireproofing (These are not the subject of deviation request No. 6).

b) The specific combustible configurations and justifications for each of the remaining fire rated areas is contained in Deviation Request No. 6, Non-Fireproofed Structural Steel.

5.0 MODIFICATIONS

No modifications are required.

6.0 SCHEDULE

Schedule data for modifications is not applicable. No modifications were identified by this analysis.

7.0 COMPENSATORY MEASURES

Compensator measures are not applicable. No deficiencies were identified by this analysis.

8.0 CONCLUSION

The evaluation of the structural steel in the Susquehanna Steam Electric Station Unit 1 and 2 Reactor Buildings has determined, based on the conservative evaluation criteria outlined in this report, not to require structural steel fire proofing.

With these results, as summarized in Deviation Request No. 6, Non-Fireproofed Structural Steel, all structural steel is justified.

TABLE DR6-1

Fire Zone Beneath Rated Floor Slab	Top Of Slab Elevation	NFPA 13 Sprinkler Protection Provided	Drawing Reference
Unit 1 Reactor Building			
1-1F	683'-0"	No	C-206006 Sht. 1
1-1E	683'-0"	No	C-206006 Sht. 2
1-3A	719'-1"	Partial	C-206007 Shts. 1&2
1-3B-W	719'-1"	Yes	C-206021 Sht. 1
1-3B-W	719'-1"	Yes	C-206021 Sht. 2
1-4A-W	749'-1"	Yes	C-206008 Shts. 1&3
1-4A-W 1-4A-N	749'-1"	Yes	C-206008 Sht. 2
1-4A-W 1-4A-S	749'-1"	Yes	C-206008 Sht. 4
1-4A-W 1-4A-N	749'-1"	Yes	C-206008 Sht. 5
1-4G	761'-10"	No	C-206009 Shts. 1&2
1-5A-S	779'-1"	Yes	C-206010 Shts. 1&2
1-5B	779'-1"	No	C-206010 Shts. 3&4
Unit 2 Reactor Building			
2-1A, C & D	670'-0"	No	C-213472 Shts. 1&2
2-1F	683'-0"	No	C-206011 Sht. 1
2-1E	683'-0"	No	C-206011 Sht. 2
2-3B-N	719'-1"	Yes	C-206012 Shts. 1&2
2-3B-W	719'-1"	Yes	C-206022 Sht. 1
2-3B-W	719'-1"	Yes	C-206022 Sht. 2
2-4A-S 2-4A-W	749'-1"	Yes	C-206013 Sht. 1
2-4A-W	749'-1"	Yes	C-206013 Shts. 2&3
2-4A-W 2-4A-S	749'-1"	Yes	C-206013 Sht. 4
2-4A-W 2-4A-N	749'-1"	Yes	C-206013 Sht. 5
2-4G	761'-10"	No	C-206014 Shts. 1&2
2-5A-N	779'-1"	Yes	C-213469 Shts. 1&2
2-5C 2-5A-S 2-5B	779'-1	No Partial (see note 1) Yes	C-206015 Shts. 1,2,&3
2-6A	799'-1"	No	C-206016 Sht. 1

Note:

1. NFPA 13 Sprinkler protection provided in the Northwestern area of the fire zone 2-5A-S identified as the Valve Access Vestibule Area. Sprinklers are installed above and below corridor grating.

TABLE DR6-2			
Fire Zone Beneath Rated Floor Slab	**Top Of Slab Elevation**	**NFPA 13 Sprinkler Protection Provided**	**Drawing Reference**
Control Structure			
0-21A	676'-0"	No	E-205986 Sht. 1
0-22A	686'-0"	No	E-205987 Sht. 1
0-22A (Ceil. Space)	698'-0" No	No	E-205988 Sht. 1
0-24E (See Note 1)	714'-0"	No	E-205989 Sht. 1
0-24I	See Note 2	No	See Note 2
0-24K	See Note 2	No	See Note 2
0-28S	See Note 2	No	See Note 2
0-26A, E-N, P, R	754'-0"	Partial	E-205922 Sht. 1
0-28A-I	783'-0"	No	E-205994 Sht. 1
0-28A-II	783'-0"	No	E-205994 Sht. 1
0-28B-1	783'-0"	No	E-205994 Sht. 1
0-28B-II	783'-0"	No	E-205994 Sht. 1
0-28C	783'-0"	No	E-205994 Sht. 1
0-28D	783'-0"	No	E-205994 Sht. 1
0-28E	783'-0"	No	E-205994 Sht. 1
0-28F	783'-0"	No	E-205994 Sht. 1
0-28G	783'-0"	No	E-205994 Sht. 1
0-28H	783'-0"	No	E-205994 Sht. 1
0-28I	783'-0"	No	E-205994 Sht. 1
0-28J	783'-0"	No	E-205994 Sht. 1
0-28K	783'-0"	No	E-205994 Sht. 1
0-28L	783'-0"	No	E-205994 Sht. 1
0-28M	783'-0"	No	E-205994 Sht. 1
0-28N	783'-0"	No	E-205994 Sht. 1
0-28T	783'-0"	No	E-205994 Sht. 1
0-22B	806'-0"	No	E-205995 Sht. 1
0-29B	806'-0"	No	E-205995 Sht. 1

NOTES:

1. Only the steel above the Fire Zone 0-24E (below Elev. 714'-0") is not fireproofed. The remaining main floor steel below elevation 714'-0" is fireproofed.
2. Steel beams inside HVAC chases do not require fireproofing. See the following for location:

STEEL BELOW ELEVATION	DRAWING REFERENCE
714'-0"	E-205989 Sht. 1
729'-1"	E-205990 Sht. 1
741'-1"	E-205991 Sht. 1
754'-0"	E-205992 Sht. 1
771'-0"	E-205993 Sht. 1

APPENDIX A

FIGURES

APPENDIX B

REFERENCES

1. Sandia Fire Retardant Coating Test
12-7-77 to 1.31-78 Sandi78-0518

2. NFPA Code 251 - Standard Methods of Fire Tests of Building, Construction Materials 1985 Edition

3. NFPA Code 231C - Rack Storage of Materials 1980 Edition

4. Sandia Fire Protection Research Program
Corner Effects Tests - Sand79-0966

5. Categorization of Cable Flammability Intermediate Scale Fire Tests of Cable Tray Installations – EPRI NP-1881, August 1982.

6. NRC's Branch Technical Position CMEP 9.5-1 (Rev. 2).

7. Sandia Investigation of Twenty-Foot Separation Distance as a Fire Protection Method as Specified in 1OCFR5O, Appendix R SAND83-0306.

8. Manual of Steel Construction - 8th edition AISC, Inc.

9. Vendor Drawing M-343 layout drawing and hydraulic calculations.

10. Evaluating Upsprinklered Fire Hazards, Alpert and Ward, Factor Mutual Research (RC84-Bt-9).

11. Fire Protection Review Report (Rev. 2) Susquehanna Steam Electric Station.

12. Chemical Engineers' Handbook - 4th edition, J. H. Perry.

13. Building Code Requirements for Reinforced Concrete, ACI 318-83.

UNITS 1 AND 2

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SUMMARY TABLE OF CONTENTS

APPENDIX R DEVIATION REQUEST NO. 7

FIRE SPREAD LIMITATIONS

DEVIATION REQUEST:

Certain fire zones can be considered to act as a fire area boundary between Fire Areas R-1A and R-1B in the Unit 1 Reactor Building and between Fire Areas R-2A and R-2B in the Unit 2 Reactor Building. The fire zones which act as the fire area boundaries are called "buffer zones."

FIRE AREAS/ZONES AFFECTED:

In the Unit 1 Reactor Building the following fire zones are considered to be buffer zones since they provide a fire area boundary between Fire Areas R-1A and R-1B:

1-6B	1-6F	0-6G
1-6C	1-7A	0-6H
1-6D		0-8A

In the Unit 2 Reactor Building the following fire zones are considered to be buffer zones since they provide a fire area boundary between Fire Areas R-2A and R-2B:

2-6B	2-6E	2-7A
2-6D	2-6F	0-8A

REASON FOR DEVIATION REQUEST:

10CFR50 Appendix R, Section III.G requires separation of cables and equipment required for safe shutdown by a fire barrier having a 3-hour rating. Furthermore, NRC Generic Letter 86-10 states that "the term 'fire area' as used in Appendix R means an area sufficiently bounded to withstand the hazards associated with the fire area and, as necessary, to protect important equipment within the fire area from a fire outside the area." Normally, fire areas are separated by a wall or floor having a fire resistive rating of 3 hours. The walls of the buffer zones do not have a 3-hour rating but possess sufficient integrity of construction and spatial separation to provide a fire area boundary.

JUSTIFICATION:

The buffer zones are fire zones which occupy the upper elevations (i.e., 779', 799' and 818') of each reactor building. Their location is shown on drawings E-205954, E-205955 and E-205956 for Unit 1 and on drawings E-205962, E-205963 and E-205964 for Unit 2. These drawings are contained in Section 8.0. They are zones which are almost entirely devoid of any safe shutdown cables or equipment and the combustible loading in all of these zones is very low.

These zones are considered to provide an equivalent degree of safety as a fire rated wall for the following reasons:

1. In all cases, a minimum of 50 ft. horizontal separation exists between the fire zones in Fire Areas R-1A and R-1B for Unit 1 and in Fire Areas R-2A and R-2B for Unit 2.

2. All buffer zones have fire detection except for the following:

   1-6F Spent Fuel Pool (filled with water)
   2-6F Spent Fuel Pool (filled with water)
   0-6H Cask Storage Pit (filled with water)

3. All buffer zones have very low combustible loadings and there are no specific locations within these zones which have the potential to cause a fire hazard.

4. The walls which bound these zones are not fire rated yet their construction would contain a fire and the products of combustion reasonably well. The walls are of reinforced concrete construction, the doors are of heavy metal construction and the penetrations in the walls are constructed similarly as in a fire rated wall. Therefore, although not fire rated, the boundaries would inhibit the transgression of a fire from one fire area to the next.

5. All buffer zones have manual fire suppression equipment located throughout the area.

6. Typically, the buffer zones are situated such that a fire would have to pass through adjacent buffer zones to spread from one fire area to the next. This is considered extremely improbable based on the specific configuration of the buffer zones with respect to the fire areas they separate.

7. For the purpose of the safe shutdown analysis, the buffer zones were considered to be part of both fire areas which they act to separate. This approach is conservative since it requires protection of all safe shutdown cables or equipment in these zones regardless of safe shutdown path. In all buffer zones, both paths (1 and 3) of safe shutdown equipment are protected where necessary.

In conclusion, it can be stated that the spatial separation, construction techniques and low combustible configurations enable the buffer zones listed in this deviation request to act as a fire area boundary. Therefore, a fire initiated in Fire Area R-1A of the Unit 1 Reactor Building may impact the buffer zones but will not spread into any other fire zone in Fire Area R-1B. Similarly, a fire initiated in Fire Area R-1B may impact the buffer zones but will not spread into any other fire zone in Fire Area R-1A. The same assurance can be stated for Unit 2.

APPENDIX R DEVIATION REQUEST NO. 8

ONE HOUR FIRE BARRIER WRAP WITH LIMITED SUPPRESSION

DEVIATION REQUEST:

The installation of a three hour fire barrier wrap in Fire Zones 0-28B-I, 0-28B-II, 1-2D and 0-28H without automatic suppression in order to comply with 10CFR50 Appendix R, Section III.G.2.a would not significantly enhance the fire protection for those fire zones nor overall plant safety, and therefore a one hour fire barrier is acceptable.

FIRE AREAS/ZONES AFFECTED:

This deviation request applies to Fire Areas CS-17 (Fire Zone 0-28B-I), CS-24 (Fire Zone 0-28B-II), R-1B (Fire Zone 1-2D) and CS-15 (Fire Zone 0-28H).

REASON FOR DEVIATION REQUEST:

10CFR50 Appendix R, Section III.G.2.a requires that redundant safe shutdown equipment/cables be separated by a fire barrier having a 3-hour rating when automatic suppression is not provided.

The redundant safe shutdown equipment/cables are separated by a fire barrier having a 1-hour rating and no automatic suppression is provided.

EXISTING ARRANGEMENT:

Fire Zones 0-28B-I and 0-28B-II contain safety related load centers and miscellaneous battery chargers and distribution panels. Two-hour rated barrier walls separate equipment by division and all cabling in these zones is enclosed in conduit. The combustible loadings for these fire zones are low. Manual suppression equipment and ionization detectors are provided in these fire zones.

Fire Zone 1-2D consists of one room (approximately 14' X 25') housing various control cables and Unit 1's remote shutdown panel. Approximately 75% of the cabling in the fire zone is contained in conduit. The minority division raceways located on the fire zone consist of control cable for the Emergency Service Water System. The combustible loading for the fire zone is low. Manual suppression equipment and ionization smoke detectors are provided in the fire zone.

Fire Zone 0-28H consists of one room (approximately 20' x 50') housing various cables in conduit and the cold instrument repair facility. The minority division raceways are located above a non-rated false ceiling and are run in conduit. The combustible loading for the fire zone is low. Manual suppression and ionization detectors are provided for the fire zone.

JUSTIFICATION:

When the combustible loading and reasonable transient combustibles are considered, fire detection, manual fire suppression, and one-hour rated cable enclosures without automatic suppression provide adequate protection for safe shutdown cables.

NRC APPROVAL:

This deviation request was transmitted to the NRC on February 9, 1982 (PLA-1013). The NRC approved this deviation request in Supplement No. 4 to the Susquehanna SES Safety Evaluation Report.

DEVIATION REQUEST NO. 9 HAS BEEN WITHDRAWN

DEVIATION REQUEST NO. 10 HAS BEEN WITHDRAWN

APPENDIX R DEVIATION REQUEST NO. 11

HVAC PENETRATIONS REACTOR BUILDING FIRE WALLS

DEVIATION REQUEST:

Fire dampers are not required to be installed in the following ventilation duct penetrations in fire rated wall assemblies between affected Fire Zones.

Penetration	Fire Zone/Fire Zone
X-25-3-37	1-3A/1-3B-N
X-25-5-23	1-5B/1-4G
X-25-5-13	1-5B/1-5A-N
X-25-5-15	1-5B/1-5A-N
X-27-4-16	1-4A-S/1-4G
X-27-4-17	1-4A-S/1-4G
X-27-5-29	1-5B/1-5A-S
X-27-5-30	1-5B/1-5A-S
X-28-5-44	1-5A-W/1-5E
X-29-5-25	1-5A-W/1-5E
X-30-5-4	2-5B/2-5A-N
X-30-5-5	2-5B/2-5A-N
X-30-5-32	2-5B/2-4G
X-30-5-50	2-5B/2-5A-N
X-32-4-3	2-4A-S/2-4G
X-32-4-4	2-4A-S/2-4G
X-32-5-41	2-5B/2-5A-S
X-33-5-26	2-5A-W/2-5E
X-33-5-27	2-5A-W/2-5E

FIRE AREAS/ZONES AFFECTED:

This deviation request concerns Fire Areas in the Unit 1 and Unit 2 Reactor Buildings.

REASON FOR DEVIATION REQUEST:

NRC guidance to 10CFR50, Appendix R, Section III.G.2 requires that fire areas shall have three hour barriers, and such barriers shall have fire rated dampers installed at duct penetrations. Various fire walls within the Unit 1 and Unit 2 Reactor Building have ventilation system (HVAC) duct penetrations without fire dampers thus rendering the rating of the barrier less than three hours.

EXISTING ARRANGEMENT:

A description of the wall assemblies penetrated by ventilation ducts is provided in Table DR11-1.

See attached sheets of Drawing C-205789 for details. Attached Drawing A 205790, Sht. 1, provides the legend for understanding these drawings.

JUSTIFICATION:

The NFPA 90A-1985, Section 3-3.2.1.1 states: "Approved fire dampers shall be provided where ducts or air grills penetrate partitions required to have a fire resistance rating of 2 hours or more." The maximum average combustible loading for any Fire Zone in the Reactor Buildings is limited to 1-1/2 hours. This is based on a conservative estimate of in-situ combustibles and an allowance of 15 minutes for transient combustibles. The specific combustible configurations and potential for transient combustibles were evaluated for each duct penetration. It was concluded that the exposure to these fire barriers due to concentrated combustibles in proximity to the barriers in no case presently exceed one hour. Therefore, the subject duct assemblies do not require fire dampers per Section 3-3.2.1.1 of NFPA 90A.

Attached Drawing C-205789 documents the actual combustible configuration surrounding each HVAC duct assembly and wall penetration in the affected Fire Zones. Cables in cable trays are the primary source of combustible materials contributing to the postulated fire in each Fire Zone.

Transient and specific in-situ combustibles were examined in each affected Fire Zone and are presently calculated to provide average combustible loadings of less than 1-1/2 hours. Additionally, no localized concentration of combustibles was found which exceeded one hour. All of the subject duct assemblies are well above their respective flood elevations. Heat generated from transient combustibles was not found to be of a magnitude which would negatively affect duct assemblies. In-situ combustibles in these areas were found to be either of a low magnitude or located in Fire Zones that have an automatic suppression system which would mitigate the heat generated as a result of a fire.

An analysis was performed by PP&L which examined the effect of the worst case combustible configuration on an HVAC duct assembly. This case is found in Fire Zone 1-3B-N. The analysis postulated that the combustibles concentrated in the vicinity of the duct assembly were consumed and that the area was enclosed to create a localized furnace. With these postulated conditions, the maximum temperature which could be developed in this furnace area was calculated to be 216°F. The analysis continued by examining the heat transfer effect between the 216°F duct assembly and the cooler supply air being transmitted through the duct and discharging into adjacent Fire Zone 1-3A. The maximum air discharge temperature into Fire Zone 1-3A was calculated to be 146°F.

The results of the analysis lead to the following conclusions:

- Since the maximum temperature on the fire side of the fire barrier is 216°F, the non-fire side of the fire barrier will remain below the ambient temperature plus a 250°F temperature rise, which is the fire barrier acceptance test criteria.

- Since the HVAC duct temperatures remain below 160°F, a fire damper operated by a 160°F or higher fusible link would not operate. All dampers at Susquehanna have fusible links with a 160°F actuation temperature or higher.

- Since automatic sprinklers in the Reactor Buildings are rated at 212°F minimum, the increased room temperature resulting from an air inlet temperature of 145°F will not result in sprinkler system activation. (The analysis calculated the final room temperature of Fire Zone 1-3A to be 105°F.)

Since the configuration in Fire Zone 1-3B-N with respect to concentrated combustibles in the vicinity of the duct assembly represents the worst case, it can be concluded that the 216°F calculated furnace temperature represents the worst case situation covered by this deviation request. Automatic sprinkler protection where provided will reduce this maximum temperature. Equipment and cables in the adjacent affected Fire Zone will not be damaged unless, in the event of a fire in an unsprinklered Fire Zone, sufficient heated air can be transferred via the HVAC duct. Air will not be transferred if the HVAC system is not operating, nor is it possible for hot air to be released from a return air duct. Therefore, only cases where a supply duct in an unsprinklered area transferring heated air to an adjacent Fire Zone need to be considered. This limits consideration to only three Fire Zones: 1-3B-N and 2-4A-S.

As discussed previously, the analysis of a fire in Fire Zone 1-3B-N demonstrates that the adjacent zone (1-3A) is not affected. The combustible concentration in Fire Zone 2-4A-S is significantly less than in Fire Zone 1-3B-N and the corresponding adjacent zone (2-4G) is sprinklered. Therefore, based on the analysis for Fire Zone 1-3B-N, it can be concluded that there would be no equipment or cable failures in Fire Zone 2-4G due to a fire in Fire Zone 2-4A-S.

Furthermore, a fact-finding report on air duct penetrations through a one-hour fire resistive wall assembly was conducted by Underwriters Laboratories, Inc. (see Attachment No. 1). This report describes the performance of HVAC duct penetrations through a one-hour rated fire resistive wall assembly when the wall assembly was subjected to a fire test conducted in accordance with the requirements of the Standard for Fire Tests of Building Construction Materials, UL 263 (ASTM E119).

The air duct assemblies which penetrated the wall assembly consisted of two square 10 inch by 10 inch inside dimension galvanized steel ducts and one square 10 inch by 10 inch inside dimension Class I rigid fiberglass duct. All the air duct assemblies had open duct drops on both sides of the wall assembly. None of the air duct assemblies contained fire dampers. The fire resistive wall assembly consisted of 5/8 inch thick gypsum wallboard screw attached to steel studs which were spaced 24 inches on center.

The fire performance included temperatures measured and recorded at various locations within, on the top surface of, to the side of and above the air duct assemblies, the structural integrity of the air duct assemblies, the passage of flames through the air duct assemblies, and the passage of flames through the wall assembly. In the test, the galvanized steel duct assembly was 0.022 inch thick (Susquehanna SES minimum thickness is 0.048 inch), and it was exposed to flames of controlled extent and severity in accordance with the Standard Time-Temperature Curve. In the test, all of the duct assemblies were in the positive pressure area of the furnace which would have aided flame propagation through the ducts to the non-fire side of the wall.

The test results showed that the galvanized steel ducts were intact and remained in place with no degradation of the duct assembly. This test confirms the validity of NFPA 90A, Section 3-3.2.2.1.1. It should be noted that all ducting subject to this deviation request is constructed of galvanized steel. Therefore, this test also gives substance to our deviation request in that the ducts in the test experienced a maximum furnace temperature of approximately 1700°F with no degradation whereas the duct in our analyzed worst case combustible configuration has been calculated to experience a maximum furnace temperature of approximately 216°F.

The NFPA "Fire Protection Handbook" (14th edition, Pages 7-69) states: "In the gauges commonly used, some sheet ducts may protect an opening in a building construction assembly for up to one hour, if properly hung and adequately fire stopped. Therefore, ducts passing through fire barriers having a rating of up to one-hour fire resistance can be assumed to present no extra-ordinary hazard. If the wall, partition, ceiling, or floor is required to have a fire resistance rating of more than one hour, a fire damper is required . . ."

The analysis of the worst case combustible configuration covered by this deviation request shows significantly lower postulated fire temperatures than those associated with the one-hour fire referred to in the NFPA handbook. Also, the minimum 18-gauge (0.048 inch thick) sheet metal ducts used at Susquehanna (Ref: Drawing C-1126) are heavier than the commonly used gauges referred to by the NFPA statement. The ducts are seismically hung (Ref: Drawing C-1129 through C-1136) and adequately fire stopped. (Ref: Respective penetration drawing for each listed duct penetration on Drawing C-205789, all sheets.)

Therefore, it is our position that these ducts adequately mitigate the effects of a fire and do not require fire dampers. Furthermore, this Deviation Request will remain valid for these HVAC duct penetrations as long as the sprinklered areas remain sprinklered and as long as combustible configuration changes in non-sprinklered areas do not cause:

a) Calculated maximum fire barrier exposure temperatures during a fire to exceed 1700°F (the maximum Standard Time-Temperature Curve value for a one-hour fire test), and/or

b) Calculated temperatures in adjacent sprinklered fire areas to reach a level at which automatic sprinkler systems would be activated.

The following descriptions and drawings (C-205789, all sheets, and A-205790, Sht. 1) provide the basis for our position and address each horizontal ventilation duct penetration on an individual case-by-case basis. Through this case-by-case approach, each duct penetration is shown in its actual combustible configuration in the plant. Parameters such as nearby combustibles, direction of duct air flow, location of duct openings, sprinkler protection, HVAC system and general duct and Fire Zone configuration have been examined to clarify and specifically document the rationale used for this deviation request.

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PENETRATION:	X-25-3-37
ADJACENT FIRE ZONES:	1-3A/1-3B-N
DUCT SIZE AT PENETRATION:	8" X 6"
VENTILATION SYSTEM:	REACTOR BUILDING ZONE I SUPPLY

PENETRATION: X-25-3-37 FIRE ZONE/FIRE ZONE: 1-3A/1-3B-N

DUCT SIZE: 8" x 6" VENTILATION SYSTEM: Reactor Building Zone I Supply

DISCUSSION:

As shown on Shts. 1 and 1A of Drawing C-205789, the duct assembly penetrates the fire barrier wall at Elevation 704'-0". This penetration joins Fire Zone 1-3A with Fire Zone 1-3B-N. A supply air register is located on the face of the fire barrier wall in Fire Zone 1-3A. Fire Zone 1-3A has an automatic fire suppression system, south of Column No. 25.

JUSTIFICATION:

a) Fire initiated in Fire Zone 1-3A with potential to spread to Fire Zone 1-3B-N.

The combustibles in Fire Zone 1-3A consist of five cable trays located 2 feet to the east of the subject penetration. The first opening in the duct assembly in Fire Zone 1-3B-N is located approximately 30 feet from the subject penetration. Based on the UL test results, a fire initiated in Fire Zone 1-3A will not generate enough heat to adversely impact any system in Fire Zone 1-3B-N.

b) Fire initiated in Fire Zone 1-3B-N with potential to spread to Fire Zone 1-3A.

Due to the large concentration of combustibles surrounding the HVAC supply air duct assembly in Fire Zone 1-3B-N, an analysis was performed to determine the increase in room air temperature in adjacent Fire Zone 1-3A. This analysis determined a duct discharge air temperature into Fire Zone 1-3A to be 146°F, consequently heating Fire Zone 1-3A to a temperature of 105°F. This increase in room air temperature would not activate the sprinkler system in Fire Zone 1-3A. Additionally, the previously referenced UL test assures that the duct assembly itself will not degrade as the result of a fire in Fire Zone 1-3B-N. Therefore, a fire initiated in Fire Zone 1-3B-N will not generate enough heat to adversely impact any systems in Fire Zone 1-3A.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent Fire Zones and the combustible configuration within the Fire Zones, a fire damper is not required in penetration X-25-3-37.

PENETRATION: ADJACENT FIRE ZONES:	X-25-5-23 1-5B/1-4G
DUCT SIZE AT PENETRATION: VENTILATION SYSTEM:	24" X 18" REACTOR BUILDING ZONE I EQUIPMENT COMPARTMENT (FILTERED) EXHAUST

PENETRATION: X-25-5-23 FIRE ZONE/FIRE ZONE: 1-5B/1-4G

DUCT SIZE: 24" x 18" VENTILATION SYSTEM: Reactor Building Zone I Equipment Compartment (Filtered) Exhaust

DISCUSSION:

As shown on Shts. 2 and 2A of Drawing C-205789, this duct assembly penetrates the P-line wall at Elevation 770'-1". This penetration joins Fire Zone 1-4G with Fire Zone 1-5B. An exhaust air register is located flush with the wall in Fire Zone 1-4G and another exhaust air register is located in Fire Zone 1-5B, approximately 18 feet away from the subject penetration. Neither Fire Zone has sprinkler protection.

JUSTIFICATION:

a) Fire initiated in Fire Zone 1-4G with potential to spread to Fire Zone 1-5B.

Fire Zone 1-4G has minimal combustibles with no combustibles located within 10 feet of the register in that room. Therefore, a fire initiated in Fire Zone 1-4G would not generate enough heat to pass through penetration X-25-5-23 and adversely impact any system in Fire Zone 1-5B. In addition, there would not be enough heat generated in Fire Zone 1-4G to impact any room through which this duct system passes.

b) Fire initiated in Fire Zone 1-5B with potential to spread to Fire Zone 1-4G.

Fire Zone 1-5B has minimal combustibles. As noted in the referenced sketch, a 12 inch x 4 inch cable tray is situated directly under the exhaust air register in Fire Zone 1-5B. However, this cable tray would not generate enough heat to affect the duct assembly and furthermore there are no combustibles in the vicinity of the exhaust air register in Fire Zone 1-4G. Therefore, a fire initiated in Fire Zone 1-5B would not generate enough heat to adversely impact any systems in Fire Zone 1-4G.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent Fire Zones and the combustible configuration within the Fire Zones, a fire damper is not required in penetration X-25-5-23.

PENETRATION:	X-25-5-13
ADJACENT FIRE ZONES:	1-5B/1-5A-N
DUCT SIZE AT PENETRATION:	30" X 26"
VENTILATION SYSTEM:	UNIT 1 PRIMARY CONTAINMENT DRYWELL PURGE EXHAUST TO STANDBY GAS TREATMENT

PENETRATION: X-25-5-13 FIRE ZONE/FIRE ZONE: 1-5B/1-5A-N

DUCT SIZE: 30" x 26" VENTILATION SYSTEM: Unit 1 Primary Containment Drywell and Suppression Pool Purge Exhaust to Standby Gas Treatment

DISCUSSION:

As shown on Shts. 2 and 2A of Drawing C-205789, this duct system penetrates the fire barrier wall at Elevation 772'-7". This penetration joins Fire Zone 1-5A-N with Fire Zone 1-5B. There are no openings in the duct assembly in Fire Zone 1-5A-N or Fire Zone 1-5B. Neither Fire Zone has sprinkler protection.

JUSTIFICATION:

a) Fire initiated in Fire Zone 1-5A-N with potential to spread to Fire Zone 1-5B.

Since this duct system performs a primary containment purge function, there are no openings in the duct system throughout its entire length. Therefore, a fire initiated in Fire Zone 1-5A-N would not generate enough heat to breach the duct system and transfer heat into Fire Zone 1-5B or into any other Fire Zone through which this duct passes.

b) Fire initiated in Fire Zone 1-5B with potential to spread to Fire Zone 1-5A-N.

Since this duct system performs a primary containment purge function, there are no openings in the duct system throughout its entire length. Therefore, a fire initiated in Fire Zone 1-5B would not generate enough heat to breach the duct system and transfer heat into Fire Zone 1-5A-N or into any other Fire Zone through which this duct passes.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent Fire Zones and the combustible configuration within the Fire Zones, a fire damper is not required in penetration X-25-5-13.

PENETRATION:	X-25-5-15
ADJACENT FIRE ZONES:	1-5B/1-5A-N
DUCT SIZE AT PENETRATION:	22" X 18"
VENTILATION SYSTEM:	REACTOR BUILDING ZONE I EQUIPMENT COMPARTMENT (FILTERED) EXHAUST

PENETRATION: X-25-5-15 FIRE ZONE/FIRE ZONE: 1-5B/1-5A-N

DUCT SIZE: 22" x 18" VENTILATION SYSTEM: Reactor Building Zone I Equipment Compartment (Filtered) Exhaust

DISCUSSION:

As shown on Shts. 2 and 2A of Drawing C-205789, the duct assembly penetrates the fire barrier wall through penetration X-25-5-15 at Elevation 770'-1". This penetration joins Fire Zone 1-5A-N with Fire Zone 1-5B. An exhaust air register is located in the duct in Fire Zone 1 5B. Neither Fire Zone has sprinkler protection.

JUSTIFICATION:

a) Fire initiated in Fire Zone 1-5A-N with potential to spread to Fire Zone 1-5B.

There are no openings in the duct assembly in Fire Zone 1-5A-N within at least 50 feet of the subject penetration. If a fire were initiated in Fire Zone 1-5A-N, the heat generated as a result of that fire would have to travel through at least 50 feet of ductwork before reaching into Fire Zone 1-5B. As the heat would escape from the exhaust air register in Fire Zone 1-5B, it would migrate upwards away from cable tray F1PL and not have sufficient heat content to adversely affect this cable tray or any other system in Fire Zone 1-5B.

b) Fire initiated in Fire Zone 1-5B with potential to spread to Fire Zone 1-5A-N.

Fire Zone 1-5B has minimal combustibles. As noted on the referenced drawing, a 12 inch x 4 inch cable tray is situated directly under the exhaust air register in Fire Zone 1-5B. However, this cable tray would not generate sufficient heat to affect the duct assembly in Fire Zone 1-5A-N, and since there are no openings in the duct assembly in Fire Zone 1-5A-N within at least 50 feet of the subject duct penetration, sufficient heat would not be generated by a fire in Fire Zone 1-5B to adversely affect any system in Fire Zone 1-5-N.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent Fire Zones and the combustible configuration within the Fire Zones, a fire damper is not required in penetration X-25-5-15.

PENETRATION:	X-27-4-16
ADJACENT FIRE ZONES:	1-4A-S/1-4G
DUCT SIZE AT PENETRATION:	30" X 18
VENTILATION SYSTEM:	REACTOR BUILDING ZONE I SUPPLY

PENETRATION: X-27-4-16 FIRE ZONE/FIRE ZONE: 1-4A-S/1-4G

DUCT SIZE: 30" x 18" VENTILATION SYSTEM: Reactor Building Zone I Supply

DISCUSSION:

As shown on Shts. 3 and 3A of Drawing C-205789, the duct assembly penetrates the fire barrier at Elevation 743'-3". This penetration joins Fire Zone 1-4A-S with Fire Zone 1-4G. A supply air register is located in Fire Zone 1-4G near the face of the fire barrier wall. Fire Zone 1-4A-S is a fully sprinklered area.

JUSTIFICATION:

a) Fire initiated in Fire Zone 1-4G with potential to spread to Fire Zone 1-4A-S.

Fire Zone 1-4G has minimal combustibles with the only combustible near penetration X-27-4-16 being cable tray F1KY. Based on the previously referenced analysis, the consequences of a fire in Fire Zone 1-4G would not adversely impact any systems in Fire Zone 1-4A-S. Therefore, a fire generated in Fire Zones 1-4G would not generate enough heat to adversely impact any systems in Fire Zone 1-4A-S.

b) Fire initiated in Fire Zone 1-4A-S with potential to spread to Fire Zone 1-4G.

Fire Zone 1-4A-S is protected by an automatic fire suppression system which would mitigate the consequences of any heat generated in Fire Zone 1-4A-S as a result of a fire in Fire Zone 1-4A-S. Therefore, a fire initiated in Fire Zone 1-4A-S would not generate enough heat to adversely impact any systems in Fire Zone 1-4G.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent Fire Zones and the combustible configuration within the Fire Zones, a fire damper is not required in penetration X-27-4-16.

PENETRATION:	X-27-4-17
ADJACENT FIRE ZONES:	1-4A-S/1-4G
DUCT SIZE AT PENETRATION:	12" X 12"
VENTILATION SYSTEM:	TRANSFER DUCT

PENETRATION: X-27-4-17 FIRE ZONE/FIRE ZONE: 1-4A-S/1-4G

DUCT SIZE: 12" x 12" VENTILATION SYSTEM: Transfer Duct

DISCUSSION:

As shown on Shts. 4 and 4A of Drawing C-205789, this duct assembly penetrates the fire barrier at Elevation 743'-0". This penetration joins Fire Zone 1-4A-S with Fire Zone 1-4G. A supply air register is located in Fire Zone 1-4G near the face of the fire barrier wall. This duct system is a transfer duct which supplies air from Zone 1-4A-S to Fire Zone 1-4G at a rate of 500 cfm. Fire Zone 1-4A-S is a fully sprinklered area.

JUSTIFICATION:

a) Fire initiated in Fire Zone 1-4G with potential to spread to Fire Zone 1-4A-S.

Fire Zone 1-4G has minimal combustibles with the nearest combustible (cable tray F1KY) located approximately 5'-2" beneath the duct supply air register. Cable tray F1KY is fire wrapped in Fire Zone 1-4A-S. After cable tray F1KY enters Fire Zone 1-4G, it drops to a distance of approximately 7'-3" beneath the duct supply air register. Based on the low combustible loading of Fire Zone 1-4G and the distance between the supply air register and the nearest cable tray, a fire in Fire Zone 1-4G will not generate enough heat to adversely impact any system in Fire Zone 1-4A-S.

b) Fire initiated in Fire Zone 1-4A-S with potential to spread to Fire Zone 1-4G.

Fire Zone 1-4A-S is protected by an automatic fire suppression system which would mitigate the consequences of any heat generated by a fire in Fire Zone 1-4A-S. The one cable tray (F1KY) located near the duct opening is fire wrapped. Therefore, a fire initiated in Fire Zone 1-4A-S would not generate enough heat to adversely impact any system in Fire Zone 1-4G.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent Fire Zones and the combustible configuration within the Fire Zones, a fire damper is not required in penetration X-27-4-17.

PENETRATION:	X-27-5-29
ADJACENT FIRE ZONES:	1-5B/1-5A-S
DUCT SIZE AT PENETRATION:	18" X 18"
VENTILATION SYSTEM:	REACTOR BUILDING ZONE I SUPPLY

PENETRATION: X-27-5-29 FIRE ZONE/FIRE ZONE: 1-5A-S/1-5B

DUCT SIZE: 18" x 18" VENTILATION SYSTEM: Reactor Building Zone I Supply

DISCUSSION:

As shown on Sht. 5 of Drawing C-205789, the duct assembly penetrates the fire barrier wall at Elevation 771'-6". This penetration joins Fire Zone 1-5A-S with Fire Zone 1-5B. A supply air register is located against the face of the fire barrier wall in Fire Zone 1-5B. Fire Zone 1-5A-S is a fully sprinklered area.

JUSTIFICATION:

a) Fire initiated in Fire Zone 1-5A-S with potential to spread to Fire Zone 1-5B.

Fire Zone 1-5A-S is protected by an automatic fire suppression system which would mitigate the consequences of any heat generated in Fire Zone 1-5A-S as a result of a fire in Fire Zone 1-5A-S. Therefore, a fire initiated in Fire Zone 1-5A-S would not generate enough heat to adversely impact any system in Fire Zone 1-5B.

b) Fire initiated in Fire Zone 1-5B with potential to spread to Fire Zone 1-5A-S.

Fire Zone 1-5B has minimal combustibles and the only combustible near the duct opening is located above the top of the duct. Therefore, a fire initiated in Fire Zone 1-5B would not generate enough heat to adversely impact any system in Fire Zone 1-5A-S.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent Fire Zones and the combustible configuration within the Fire Zones, a fire damper is not required in penetration X-27-5-29.

PENETRATION:	X-27-5-30
ADJACENT FIRE ZONES:	1-5B/1-5A-S
DUCT SIZE AT PENETRATION:	30" X 26"
VENTILATION SYSTEM:	UNIT 1 PRIMARY CONTAINMENT DRYWELL PURGE EXHAUST TO STANDBY GAS TREATMENT

PENETRATION: X-27-5-30 FIRE ZONE/FIRE ZONE: 1-5A-S/1-5B

DUCT SIZE: 30" x 26" VENTILATION SYSTEM: Unit 1 Primary Containment Drywell Purge Exhaust to Standby Gas Treatment

DISCUSSION:

As shown on Sht. 6 Drawing C-205789, the duct assembly penetrates the fire barrier wall at Elevation 772'-7". This penetration joins Fire Zone 1-5A-S with Fire Zone 1-5B. Fire Zone 1-5A-S is a fully sprinklered area.

JUSTIFICATION:

a) Fire initiated in Fire Zone 1-5A-S with potential to spread to Fire Zone 1-5B.

Fire Zone 1-5A-S is protected by an automatic fire suppression system which would mitigate the consequences of any heat generated in Fire Zone 1-5A-S as a result of a fire in Fire Zone 1-5-S. Also, there are no openings in the duct assembly in either Fire Zone. Therefore, a fire generated in Fire Zone 1-5A-S would not generate enough heat to adversely impact any system in Fire Zone 1-5B.

b) Fire initiated in Fire Zone 1-5B with potential to spread to Fire Zone 1-5A-S.

Fire Zone 1-5B has minimal combustibles and there are no openings in the duct assembly in either Fire Zone 1-5B nor Fire Zone 1-5A-S. Therefore, a fire in Fire Zone 1-5B would not generate enough heat to adversely impact any system in Fire Zone 1-5A-S.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent Fire Zones and the combustible configuration within the Fire Zones, a fire damper is not required in penetration X-27-5-30.

PENETRATION:	X-28-5-44
ADJACENT FIRE ZONES:	1-5A-W/1-5E
DUCT SIZE AT PENETRATION:	18" X 12"
VENTILATION SYSTEM:	REACTOR BUILDING ZONE I EQUIPMENT COMPARTMENT (FILTERED) EXHAUST

PENETRATION: X-28-5-44 FIRE ZONE/FIRE ZONE: 1-5E/1-5A-W

DUCT SIZE: 18" x 12" VENTILATION SYSTEM: Reactor Building Zone I Equipment Compartment (Filtered) Exhaust

DISCUSSION:

As shown on Shts. 7 and 7A of Drawing C-205789, the duct assembly penetrates the fire barrier wall at Elevation 771'-3". This penetration joins Fire Zone 1-5E with Fire Zone 1-5A-W. An exhaust air register is located against the face of the wall in Fire Zone 1-5E.

JUSTIFICATION:

a) Fire initiated in Fire Zone 1-5E with potential to spread to Fire Zone 1-5A-W.

Fire Zone 1-5E has minimal combustibles with no combustibles located near the subject penetration. Also, there are no duct openings located within 50 feet of the penetration in Fire Zone 1-5A-W. Therefore, a fire generated in Fire Zone 1-5E would not generate enough heat to adversely impact any system in Fire Zone 1-5A-W.

b) Fire initiated in Fire Zone 1-5A-W with potential to spread to Fire Zone 1-5E. Fire Zone 1-5A-W is protected by an automatic fire suppression system which would mitigate the consequences of any heat generated in Fire Zone 1-5A-W as a result of a fire in Fire Zone 1-5A-W. Therefore, a fire initiated in Fire Zone 1-5A-W would not generate enough heat to adversely impact any system in Fire Zone 1-5E.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent Fire Zones and the combustible configuration within the Fire Zones, a fire damper is not required in penetration X-28-5-44.

PENETRATION:	X-29-5-25
ADJACENT FIRE ZONES:	1-5A-W/1-5E
DUCT SIZE AT PENETRATION:	12" X 8"
VENTILATION SYSTEM:	REACTOR BUILDING ZONE I SUPPLY

PENETRATION: X-29-5-25 FIRE ZONE/FIRE ZONE: 1-5E/1-5A-W

DUCT SIZE: 12" x 8" VENTILATION SYSTEM: Reactor Building Zone I Supply

DISCUSSION:

As shown on Shts. 8 and 7A of Drawing C-205789, the duct assembly penetrates the fire barrier wall at Elevation 766'-9". This penetration joins Fire Zone 1-5E with Fire Zone 1-5A-W. A supply air register is located on the face of the fire barrier wall in Fire Zone 1-5E.

JUSTIFICATION:

a) Fire initiated in Fire Zone 1-5E with potential to spread to Fire Zone 1-5A-W.

Fire Zone 1-5E has minimal combustibles with the nearest combustible approximately 10 feet from the supply air register. Also, there are no openings in the duct assembly in Fire Zone 1-5A-W located within 30 feet of penetration X-29-5-25. Therefore, a fire initiated in Zone 1-5E would not generate enough heat to adversely impact any system in Fire Zone 1-5A-W.

b) Fire initiated in Fire Zone 1-5A-W with potential to spread to Fire Zone 1-5E.

Fire Zone 1-5A-W is protected by an automatic fire suppression system which would mitigate the consequences of any heat generated in Fire Zone 1-5A-W as a result of a fire in Fire Zone 1-5A-W. Therefore, a fire initiated in Fire Zone 1-5A-W would not generate enough heat to adversely impact any system in Fire Zone 1-5E.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent Fire Zones and the combustible configuration within the Fire Zones, a fire damper is not required in penetration X-29-5-25.

PENETRATION:	X-30-5-4
ADJACENT FIRE ZONES:	2-5B/2-5A-N
DUCT SIZE AT PENETRATION:	18" X 18"
VENTILATION SYSTEM:	REACTOR BUILDING ZONE II SUPPLY

PENETRATION:	X-27-5-29	FIRE ZONE/FIRE ZONE:	1-5A-S/1-5B
DUCT SIZE:	18" x 18"	VENTILATION SYSTEM:	Reactor Building Zone II Supply

DISCUSSION:

As shown on Sht. 9 of Drawing C-205789, this duct assembly penetrates the fire barrier wall at Elevation 770'-9". This penetration joins Fire Zone 2-5B with Fire Zone 2-5A-N. A supply air register is located in Fire Zone 2-5B at the face of the fire barrier wall. Fire Zone 2-5A-N is a fully sprinklered area.

JUSTIFICATION:

a) Fire initiated in Fire Zone 2-5B with potential to spread to Fire Zone 2-5A-N.

Fire Zone 2-5B has minimal combustibles and the nearest combustible to the duct supply air register is cable tray E2KK which is offset horizontally from the duct by approximately 6 feet. Based on the minimal combustibles in Fire Zone 2-5B and the nearest opening in the duct assembly in Fire Zone 2-5A-N being greater than 35' from penetration X-30-5-4, a fire initiated in Fire Zone 2-5B would not generate enough heat to adversely impact any system in Fire Zone 2-5A-N.

b) Fire initiated in Fire Zone 2-5A-N with potential to spread to Fire Zone 2-5B.

Fire Zone 2-5A-N is protected by an automatic fire suppression system which would mitigate the consequences of the heat generated in Fire Zone 2-5A-N as a result of a fire in Fire Zone 2-5A-N. Therefore, a fire initiated in Fire Zone 2-5A-N would not generate enough heat to adversely impact any system in Fire Zone 2-5B.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent Fire Zones and the combustible configuration within the Fire Zones, a fire damper is not required in penetration X-30-5-4.

PENETRATION: ADJACENT FIRE ZONES: DUCT SIZE AT PENETRATION: VENTILATION SYSTEM:	X-30-5-5 2-5B/2-5A-N 22" X 22" REACTOR BUILDING ZONE II EQUIPMENT COMPARTMENT (FILTERED) EXHAUST
PENETRATION: ADJACENT FIRE ZONES: DUCT SIZE AT PENETRATION: VENTILATION SYSTEM:	X-30-5-32 2-5B/2-4G 24" X 18" REACTOR BUILDING ZONE II EQUIPMENT COMPARTMENT (FILTERED) EXHAUST

PENETRATION: X-30-5-5 FIRE ZONE/FIRE ZONE: 2-5B/2-5A-N

DUCT SIZE: 22" x 22" VENTILATION SYSTEM: Reactor Building Zone II Equipment Compartment (Filtered) Exhaust

DISCUSSION:

As shown on Sht. 10 of attached Drawing C-205789, the duct assembly penetrates the fire barrier wall at Elevation 773'-3". This penetration joins Fire Zone 2-5B with Fire Zone 2-5A-N. Fire Zone 2-5A-N is a fully sprinklered area.

JUSTIFICATION:

a) Fire initiated in Fire Zone 2-5B with potential to spread to Fire Zone 2-5A-N.

Fire Zone 2-5B has minimal combustibles and there is an exhaust air register in the duct assembly in Fire Zone 2-5B. However, the first opening in the duct assembly in Fire Zone 2-5A-N is greater than 30 feet from penetration X-30-5-5. Therefore, a fire initiated in Fire Zone 2-5B would not generate enough heat to adversely impact any system in Fire Zone 2-5A-N.

b) Fire initiated in Fire Zone 2-5A-N with potential to spread into Fire Zone 2-5B.

Fire Zone 2-5A-N is protected by an automatic fire suppression system which would mitigate the consequences of any heat generated in Fire Zone 2-5A-N as a result of a fire in Fire Zone 2-5A-N. Therefore, a fire initiated in Fire Zone 2-5A-N would not generate enough heat to adversely impact any system in Fire Zone 2-5B. This automatic suppression system would also mitigate the effects of heat being further transmitted through the duct assembly into Fire Zone 2-4G.

As this duct assembly continues, it enters Fire Zone 2-4G, which also must be separated from Fire Zone 2-5A-N. However, using the same reasoning as in the above paragraph, a fire in Fire Zone 2-5A-N would not have a path capable of spreading fire to Fire Zone 2-4G.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent Fire Zones and the combustible configuration within the Fire Zones, a fire damper is not required in penetration X-30-5-5.

PENETRATION:	X-30-5-32
ADJACENT FIRE ZONES:	2-5B/2-4G
DUCT SIZE AT PENETRATION:	24" X 18"
VENTILATION SYSTEM:	REACTOR BUILDING ZONE II EQUIPMENT COMPARTMENT (FILTERED) EXHAUST

PENETRATION:	X-30-5-32	FIRE ZONE/FIRE ZONE:	2-5B/2-4G
DUCT SIZE:	24" x 18"	VENTILATION SYSTEM:	Reactor Building Zone II Equipment Compartment (Filtered) Exhaust

DISCUSSION:

As shown on Sht. 10 of Drawing C-205789, the duct assembly penetrates the fire barrier wall at Elevation 773'-3". This penetration joins Fire Zone 2-5B with Fire Zone 2-4G. An exhaust air register is located within Fire Zone 2-4G and Fire Zone 2-5B.

JUSTIFICATION:

a) Fire initiated in Fire Zone 2-4G with potential to spread to Fire Zone 2-5B.

Fire Zone 2-4G has minimal combustibles and there are no combustibles located near the exhaust air register in Fire Zone 2-4G. There is an exhaust air register in the duct assembly in Fire Zone 2-5B. Therefore, a fire initiated in Fire Zone 2-4G would not generate enough heat to adversely impact any system in Fire Zone 2-5B. Additionally, the lack of combustibles in Fire Zone 2-4G inhibits the effect of a fire in Fire Zone 2-4G from adversely impacting any system in Fire Zone 2-5A-N.

b) Fire initiated in Fire Zone 2-5B with potential to spread into Fire Zone 2-4G.

Fire Zone 2-5B has minimal combustibles and there is an exhaust air register in the duct assembly in Fire Zone 2-5B. Additionally, there are no combustibles located near the exhaust air register in Fire Zone 1-4G. Therefore, a fire initiated in Fire Zone 2-5B would not generate enough heat to adversely impact any system in Fire Zone 2-4G.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent Fire Zones and the combustible configuration within the Fire Zones, a fire damper is not required in penetration X-30-5-32.

PENETRATION:	X-30-5-50
ADJACENT FIRE ZONES:	2-5B/2-5A-N
DUCT SIZE AT PENETRATION:	30" X 26"
VENTILATION SYSTEM:	UNIT 2 PRIMARY CONTAINMENT DRYWELL PURGE EXHAUST TO STANDBY GAS TREATMENT

<u>PENETRATION</u>: X-30-5-50 <u>FIRE ZONE/FIRE ZONE</u>: 2-5B/2-5A-N

<u>DUCT SIZE</u>: 30" x 26" <u>VENTILATION SYSTEM</u>: Unit 2 Primary Containment Drywell Purge Exhaust to Standby Gas Treatment

<u>DISCUSSION</u>:

As shown on Shts. 11 and 11A of Drawing C-205789, this duct assembly penetrates the fire barrier wall at Elevation 770'-9". This penetration joins Fire Zone 2-5B with Fire Zone 2-5A-N. There are no duct openings in either Fire Zone. Fire Zone 2-5A-N is a fully sprinklered area.

<u>JUSTIFICATION</u>:

a) Fire initiated in Fire Zone 2-5B with potential to spread to Fire Zone 2-5A-N.

Fire Zone 2-5B has minimal combustibles and the nearest combustible is approximately 5 feet from the duct assembly. Also, there are no openings in the duct assembly in this zone. Therefore a fire initiated in Fire Zone 2-5B would not generate enough heat to adversely impact any system in Fire Zone 2-5A-N.

b) Fire initiated in Fire Zone 2-5A-N with potential to spread to Fire Zone 2-5B.

Fire Zone 2-5A-N is protected by an automatic fire suppression system and there are no openings in the duct assembly in this zone. The automatic suppression system would mitigate the consequences of any heat generated in Fire Zone 2-5A-N as a result of a fire in Fire Zone 2-5A-N and, therefore, a fire initiated in Fire Zone 2-5A-N would not generate enough heat to adversely impact any system in Fire Zone 2-5B.

<u>CONCLUSION</u>:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent Fire Zones and the combustible configuration within the Fire Zones, a fire damper is not required in penetration X-30-5-50.

PENETRATION:	X-32-4-3
ADJACENT FIRE ZONES:	2-4A-S/2-4G
DUCT SIZE AT PENETRATION:	30" X 18"
VENTILATION SYSTEM:	REACTOR BUILDING ZONE II SUPPLY

PENETRATION: X-32-4-3 FIRE ZONE/FIRE ZONE: 2-4A-S/2-4G

DUCT SIZE: 30" x 18" VENTILATION SYSTEM: Reactor Building Zone II Supply

DISCUSSION:

As shown on Shts. 15 and 15A of Drawing C-205789, this duct assembly penetrates the fire barrier wall at Elevation 741'-11". This penetration joins Fire Zone 2-4A-S with Fire Zone 2-4G. A supply air register is located in Fire Zone 2-4G near the face of the fire barrier wall. Fire Zone 2-4A-S does not have sprinkler protection in the area of concern and Fire Zone 2-4G has no sprinkler protection.

JUSTIFICATION:

a) Fire initiated in Fire Zone 2-4G with potential to spread to Fire Zone 2-4A-S.

Fire Zone 2-4G has minimal combustibles with the only combustibles near penetration X-32-4-3 being two E2KJ cable trays. Based on the previously referenced analysis in this deviation request, the consequences of a fire in Fire Zone 2-4G would not adversely impact any systems in Fire Zone 2-4A-S. Therefore, a fire generated in Fire Zone 2-4G would not generate enough heat to adversely impact any systems in Fire Zone 2-4A-S.

b) Fire initiated in Fire Zone 2-4A-S with potential to spread to Fire Zone 2-4G.

As discussed within the justification for this deviation request, the combustible configuration and fire hazards of this portion of Fire Zone 2-4A-S are bounded by the analyzed condition in Fire Zone 1-3B-N. The first opening in the duct assembly in Fire Zone 2-4A-S is greater than 25 feet from the subject penetration. Therefore, the combustible configuration in this portion of Fire Zone 2-4A-S would not generate enough heat to adversely impact any system in Fire Zone 2-4G.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent Fire Zones and the combustible configuration within the Fire Zones, a fire damper is not required in penetration X-32-4-3.

PENETRATION:	X-32-4-4
ADJACENT FIRE ZONES:	2-4A-S/2-4G
DUCT SIZE AT PENETRATION:	12" X 12"
VENTILATION SYSTEM:	TRANSFER DUCT

PENETRATION: X-32-4-4 FIRE ZONE/FIRE ZONE: 2-4A-S/2-4G

DUCT SIZE: 12" x 12" VENTILATION SYSTEM: Transfer Duct

DISCUSSION:

As shown on Shts. 15 and 15A of Drawing C-205789, the duct assembly penetrates the fire barrier wall at Elevation 735'-0". This penetration joins Fire Zone 2-4A-S with Fire Zone 2-4G. An air register is located in Fire Zone 2-4G near the face of the fire barrier wall. This duct system is a transfer duct which supplies air from Fire Zone 2-4A-S to Fire Zone 2-4G at a rate of 500 cfm. Fire Zone 2-4A-S does not have sprinkler protection in the area of concern and Fire Zone 2-4G has no sprinkler protection.

JUSTIFICATION:

a) Fire initiated in Fire Zone 2-4G with potential to spread to Fire Zone 2-4A-S.

Fire Zone 2-4G has minimal combustibles with the nearest combustibles being two E2KJ cable trays. These trays are located at approximately the same elevation as the air register of the duct system. Any heat generated by these two cable trays would have a minimal effect on this transfer duct. Therefore, a fire initiated in Fire Zone 2-4G would not adversely impact any systems in Fire Zone 2-4-A-S.

b) Fire initiated in Fire Zone 2-4A-S with potential to spread to Fire Zone 2-4G.

There are no significant combustibles in area beneath the transfer duct grill in Fire Zone 2-4A-S. Any heat generated by the combustibles in Fire Zone 2-4A-S would migrate upwards and not be significant enough to impact the transfer duct. Therefore, a fire generated in Fire Zone 2-4A-S would not generate enough heat to adversely impact any systems in Fire Zone 2-4G.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent Fire Zones and the combustible configuration within the Fire Zones, a fire damper is not required in penetration X-32-4.4.

PENETRATION:	X-32-5-41
ADJACENT FIRE ZONES:	2-5A-S/2-5B
DUCT SIZE AT PENETRATION:	30" X 26"
VENTILATION SYSTEM:	UNIT 2 PRIMARY CONTAINMENT DRYWELL PURGE EXHAUST TO STANDBY GAS TREATMENT

PENETRATION:	X-32-5-41	FIRE ZONE/FIRE ZONE:	2-5A-S/2-5B
DUCT SIZE:	30" x 26"	VENTILATION SYSTEM:	Unit 2 Primary Containment Drywell Purge Exhaust to Standby Gas Treatment

DISCUSSION:

As shown on Shts. 12 and 12A of Drawing C-205789, the duct assembly penetrates the fire barrier at Elevation 769'-9". This penetration joins Fire Zone 2-5A-S with Fire Zone 2-5B. There are no duct openings in either Fire Zone.

JUSTIFICATION:

a) Fire initiated in Fire Zone 2-5A-S with potential to spread to Fire Zone 2-5B.

There are no openings in the duct assembly in Fire Zone 2-5A-S or Fire Zone 2-5B and the only combustibles near the duct assembly in Fire Zone 2-5A-S are on the side of and above the duct. Therefore, a fire initiated in Fire Zone 2-5A-S would not generate enough heat to adversely impact any system in Fire Zone 2-5B.

b) Fire initiated in Fire Zone 2-5B with potential to spread to Fire Zone 2-5A-S.

The duct assembly in Fire Zone 2-5B has no openings and the combustible loading in this zone is minimal with no combustibles within 5' of the duct. Therefore, a fire initiated in Fire Zone 2-5B would not generate enough heat to adversely impact any system in Fire Zone 2-5A-S.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent Fire Zones and the combustible configuration within the Fire Zones, a fire damper is not required in penetration X-32-5-41.

PENETRATION:	X-33-5-26
ADJACENT FIRE ZONES:	2-5A-W/2-5E
DUCT SIZE AT PENETRATION:	12" X 8"
VENTILATION SYSTEM:	REACTOR BUILDING ZONE II SUPPLY

PENETRATION: X-33-5-26 FIRE ZONE/FIRE ZONE: 2-5A-W/2-5E

DUCT SIZE: 12" x 8" VENTILATION SYSTEM: Reactor Building Zone II Supply

DISCUSSION:

As shown on Shts. 13 and 14A of Drawing C-205789, this duct assembly penetrates the fire barrier wall at Elevation 767'-1". This penetration joins Fire Zone 2-5A-W with Fire Zone 2-5E. A supply air register is located in Fire Zone 2-5E near the face of the fire barrier wall. Fire Zone 2-5A-W is a fully sprinklered area.

JUSTIFICATION:

a) Fire initiated in Fire Zone 2-5E with potential to spread to Fire Zone 2-5A-W.

Fire Zone 2-5E has minimal combustibles. The first opening in adjacent Fire Zone 2-5A-W is approximately 18 feet from the supply air register in Fire Zone 2-5E. Therefore, a fire initiated in Fire Zone 2-5E would not generate enough heat to adversely impact any system in Fire Zone 2-5A-W.

b) Fire Zone 2-5A-W is protected by an automatic fire suppression system which would mitigate the consequences of any heat generated in Fire Zone 2-5A-W as a result of a fire in Fire Zone 2-5A-W. Therefore, a fire initiated in Fire Zone 2-5A-W would not generate enough heat to adversely impact any system in Fire Zone 2-5E.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent Fire Zones and the combustible configuration within the Fire Zones, a fire damper is not required in penetration X-33-5-26.

PENETRATION:	X-33-5-27
ADJACENT FIRE ZONES:	2-5A-W/2-5E
DUCT SIZE AT PENETRATION:	18" X 12"
VENTILATION SYSTEM:	REACTOR BUILDING ZONE II EQUIPMENT COMPARTMENT (FILTERED) EXHAUST

PENETRATION: X-33-5-27 FIRE ZONE/FIRE ZONE: 2-5A-W/2-5E

DUCT SIZE: 18" x 12" VENTILATION SYSTEM: Reactor Building Zone II Equipment Compartment (Filtered) Exhaust

DISCUSSION:

As shown on Shts. 14 and 14A of Drawing C-205789, the duct assembly penetrates the fire barrier wall at Elevation 769'-0". This penetration joins Fire Zone 2-5A-W with Fire Zone 2-5E. An exhaust air register is located at the face of the wall in Fire Zone 2-5E. Fire Zone 2-5A-W is a fully sprinklered area.

JUSTIFICATION:

a) Fire initiated in Fire Zone 2-5E with potential to spread to Fire Zone 2-5A-W.

Fire Zone 2-5E has minimal combustibles and there are no openings in the duct assembly in adjacent Fire Zone 2-5A-W. Therefore, a fire initiated in Fire Zone 2-5E would not generate enough heat to adversely impact any system in Fire Zone 2-5A-W.

b) Fire initiated in Fire Zone 2-5A-W with potential to spread to Fire Zone 2-5E.

Fire Zone 2-5A-W is protected by an automatic fire suppression system which would mitigate the consequences of any heat generated as a result of a fire in Fire Zone 2-5A-W. Therefore, a fire initiated in Fire Zone 2-5A-W would not generate enough heat to adversely impact any system in Fire Zone 2-5E.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent Fire Zones and the combustible configuration within the Fire Zones, a fire damper is not required in penetration X-33-5-27.

TABLE DR11-1

Fire Zone/ Fire Area	Penetration	Duct Size	Zone Sprinklered	Zone Without Duct Opening	Drawing C-205789 Reference
UNIT 1					
1-3A/1-3B-N	X-25-3-27	8" X 6"	1-3A (Part)	Neither	Shts. 1&1A
1-5B/1-4G	X-25-5-23	24" X 18"	Neither	Neither	Shts. 2&2A
1-5B/1-5A-N	X-25-5-13	30" X 26"	Neither	Both	Shts. 2&2A
1-5B/1-5A-N	X-25-5-15	22" X 18"	Neither	Neither	Shts. 2&2A
1-4A-S/1-4G	X-27-4-16	30" X 18"	1-4A-S	Neither	Shts. 3&3A
1-4A-S/1-4G	X-27-4-17	12" X 12"	1-4A-S	Neither	Shts. 4&4A
1-5B/1-5A-S	X-27-5-29	18" X 18"	1-5A-S	Neither	Sht. 5
1-5B/1-5A-S	X-27-5-30	30" X 26"	1-5A-S	Both	Sht. 6
1-5A-W/1-5E	X-28-5-44	18" X 12"	1-5A-W	Neither	Shts. 7&7A
1-5A-W/1-5E	X-29-5-25	12" X 8"	1-5A-W	Neither	Shts. 8&7A
UNIT 2					
2-5B/2-5A-N	X-30-5-4	18" X 18"	Both	Neither	Sht. 9
2-5B/2-5A-N	X-30-5-5	22" X 22"	Both	2-5A-N	Sht. 10
2-5B/2-4G	X-30-5-32	24" X 18"	2-5B	Neither	Sht. 10
2-5B/2-5A-N	X-30-5-50	30" X 26"	Both	Both	Shts. 11&11A
2-4A-S/2-4G	X-32-4-3	30" X 18"	Neither	Neither	Shts. 15&15A
2-4A-S/2-4G	X-32-4-4	12" X 12"	Neither	Neither	Shts. 15&15A
2-5B/2-5A-S	X-32-5-41	30" X 26"	2-5B 2-5A-S (Part)	Both	Shts. 12&12A
2-5A-W/2-5E	X-33-5-26	12" X 8"	2-5A-W	Neither	Shts. 13&14A
2-5A-W/2-5E	X-33-5-27	18" X 12"	2-5A-W	2-5A-W	Shts. 14&14A

ATTACHMENT 1

Underwriter's Laboratories Inc.

Fact-Finding Report

on

Air Duct Penetrations Through One Hour

Fire Resistive Wall Assembly

APPENDIX R DEVIATION REQUEST NO. 12

FIRE BARRIERS WITHOUT FIRE DAMPERS IN

VERTICAL VENTILATION DUCT PENETRATIONS

DEVIATION REQUEST:

Fire dampers are not required to be installed in the following ventilation duct penetrations in fire rated floor/ceiling assemblies between affected fire zones.

Penetration	Fire Zone/Fire Zone
X-27-6-17	1-5A-S/1-6A
X-27-6-18	1-5A-S/1-6A
X-27-6-50	1-5A-S/1-6A
X-27-6-51	1-5A-S/1-6A
X-27-6-83	1-5A-S/1-6A
X-28-5-66	1-4A-W/1-5A-W
X-39-5-34	1-4A-W/1-5A-S
X-29-5-54	1-4A-W/1-5A-S
X-34-5-4	1-4A-S/2-5A-W

FIRE AREAS/ZONES AFFECTED:

This deviation request concerns Fire Areas R-1A, R-1B, R-2A and R-2B.

REASON FOR DEVIATION REQUEST:

NRC guidance to 10CFR50, Appendix R, Section III.G requires fire rated barriers between Fire Areas. The guidance documents provided by the NRC indicate these barriers shall be rated for 3-hours fire resistance and ventilation ducts that penetrate such barriers shall have fire dampers installed. The floor/ceiling assemblies identified to be upgraded in PP&L's September 4, 1985 response (PLA-2529) contain ventilation duct penetrations which do not contain fire dampers.

EXISTING ARRANGEMENT:

A description of the floor/ceiling assemblies penetrated by ventilation ducts is provided in Table DR12-1.

See attached sheets of Drawing C-205791 for details. Attached Drawing A-205790, Sht. 1 provides the legend for understanding these drawings.

JUSTIFICATION:

NFPA 90A-1985, Section 3-3.2.1.1 states that "Approved fire dampers shall be provided where ducts or air grills penetrate partitions required to have a fire resistance rating of 2 hours or more." The maximum average combustible loading for any fire zone in the Reactor Building is limited to 1-1/2 hours. This is based on a conservative estimate of in-situ combustibles and an allowance of 15 minutes for transient combustibles. The specific combustible configurations and potential for transient combustibles were evaluated for each duct penetration. It was concluded that the local combustible loading exposure to these fire barriers is less than 1 hour. Therefore, the subject duct assemblies do not require fire dampers per Section 3-3.2.1.1 of NFPA 90A.

Furthermore, all of the fire zones located beneath the penetrations in question are protected by an automatic fire suppression system. In the event of a fire in one of the fire zones beneath these penetrations, the automatic suppression system would mitigate the heat generated in those zones and prevent the fire from impacting the fire zone located above the rated floor. Conversely, the fire zones located above the penetrations in question do not contain sufficient combustibles to generate enough heat to adversely impact the fire zones located beneath the penetrations. This statement is substantiated by the analysis prepared for Deviation Request No. 11. This analysis conservatively concluded that with the worst case combustible configuration in Deviation Request No. 11, the maximum air temperature in the duct assembly would be 146°F. Although this analysis was conducted for a horizontal duct assembly, the combustible configuration would not raise the air temperature in the vertical duct above unacceptable limits. The results of the analysis demonstrates the following:

- Since the maximum temperature on the fire side of the fire barrier is 216°F, the non-fire side of the fire barrier will remain below the ambient temperature plus a 250°F temperature rise, which is the fire damper acceptance test criteria.

- Since the HVAC duct temperature remain below 165°F, a fire damper operated by a 165°F or higher fusible link would not operate.

- Since automatic sprinklers in the Reactor Buildings are rated at 212°F minimum, the increased room temperature resulting from an air inlet temperature of 145°F will not result in sprinkler system activation. (The analysis calculated the final room temperature of Fire Zone 1-3A to 105°F.)

A fire in Fire Zone 1-3B-N with a resultant 216°F room temperature represents the worst case covered by this deviation request, because Fire Zone 1-3B-N contains a more severe combustible loading than any case covered by this deviation request. Automatic sprinkler protection where provided will reduce this maximum temperature. Equipment and cables in the adjacent affected fire zones will not be damaged, in the event of a fire in an unsprinklered fire zone, sufficient heat air can be transferred via the HVAC duct. Air will not be transferred if the HVAC system is not operating, nor is it possible for hot air to be released from a return air duct. Therefore, only cases where a supply duct in an unsprinklered area could transfer air to the adjacent fire zone needs to be considered.

Air flow temperatures which could actuate sprinklers in adjacent fire zones are not a problem in the ducts with vertical penetrations because either:

- The duct has no openings in either fire zone or on either side of the fire barrier.

  - OR -

- The supply duct to a sprinklered fire zone has no openings in that fire zone.

  - OR -

- The fire zone is sprinklered and in the event of a fire in that fire zone, the fire would be controlled before it could heat the HVAC duct supplying air to the adjacent fire zone on the opposite side of the fire barrier.

The NFPA "Fire Protection Handbook" (14^{th} edition, Pages 7-69) states: "In the gauges commonly used, some sheet metal ducts may protect an opening in a building construction assembly for up to 1-hour, if properly hung and adequately fire stopped. Therefore, ducts passing through fire barriers having a rating of up to 1-hour fire resistance can be assumed to present no extraordinary hazard. If the wall, partition, ceiling or floor is required to have a fire resistance rating of more than 1-hour, a fire damper is required . . . "

The minimum 18 gauges (0.048 inch thick) sheet metal ducts used at Susquehanna (Ref: Drawing C-1126) are heavier than the commonly used gauges referred to by the NFPA statement. The ducts are seismically hung (Ref: Drawings C-1129 through C-1136) and adequately fire stopped (Ref: Respective penetration drawing for each listed duct penetration on Drawing C-205791, all sheets).

A 3-hour fire resistance rating can be achieved by a fire damper constructed of 24 gauge steel. It is therefore reasonable to conclude that HVAC ducts without openings in the fire zone and constructed of a minimum of 18 gauge steel will not be breached by a fire.

Therefore, it is our position that these ducts adequately mitigate the effects of a fire and do not require fire dampers.

Furthermore, this Deviation Request will remain valid for these HVAC duct penetrations as long as the sprinklered areas remain sprinklered and as long as combustible configuration changes in sprinkler areas do not cause:

a) Calculated maximum fire barrier exposure temperatures during a fire to exceed 1700°F (the maximum standard) time-temperature curve value for a 1-hour fire test) and/or

b) Calculated temperatures in adjacent sprinklered fire areas to reach a level at which automatic sprinkler systems would be activated.

The following descriptions and drawings (C-205791, all sheets) provide the basis for our position and address each ventilation duct penetration on an individual case-by-case basis. Through this case-by-case approach, each duct penetration is shown in its actual combustible configuration in the plant. Parameters such as nearby combustibles, direction of duct air flow, location zone configuration have been examined to clarify and document the justification for this deviation request.

PENETRATION:	X-27-6-17
ADJACENT FIRE ZONES:	1-5A-S/1-6A
DUCT SIZE AT PENETRATION:	26" DIAMETER
VENTILATION SYSTEM:	REACTOR BUILDING STANDBY GAS TREATMENT SYSTEM SUCTION FROM RECIRCULATION SYSTEM

PENETRATION:	X-27-6-17	FIRE ZONE/FIRE ZONE:	1-5A-S/1-6A
DUCT SIZE:	26"	VENTILATION SYSTEM:	Reactor Building Standby Gas Treatment System From Recirculation System

DISCUSSION:

As shown on Shts. 1, 1A and 1B of Drawing C-205791, the duct assembly penetrates the fire barrier floor at Elevation 779'-1". This penetration joins Fire Zone 1-5A-S with Fire Zone 1-6A. Fire Zone 1-5A-S is a fully sprinklered area.

JUSTIFICATION:

a) Fire initiated in Fire Zone 1-5A-S with potential to spread to Fire Zone 1-6A.

Fire Zone 1-5A-S is protected by an automatic suppression system which would mitigate the consequences of any heat generated in Fire Zone 1-5A-S as the result of a fire in Fire Zone 1-5A-S. Therefore, a fire initiated in Fire Zone 1-5A-S would not generate enough heat to adversely impact any systems in Fire Zone 1-6A.

b) Fire initiated in Fire Zone 1-6A with potential to spread to Fire Zone 1-5A-S.

Fire Zone 1-6A has minimal combustibles, and there are no openings in the duct assembly in this fire zone. Therefore, a fire generated in Fire Zone 1-6A would not generate enough heat to adversely impact any system in Fire Zone 1-5A-S.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent fire zones and the combustible configuration within the fire zones, a fire damper is not required in penetration X-27-6-17.

PENETRATION:	X-27-6-18
ADJACENT FIRE ZONES:	1-5A-S/1-6A
DUCT SIZE AT PENETRATION:	32" DIAMETER
VENTILATION SYSTEM:	UNIT 1 PRIMARY CONTAINMENT DRYWELL AND SUPPRESSION POOL PURGE EXHAUST TO STANDBY GAS TREATMENT

PENETRATION: X-27-6-18 FIRE ZONE/FIRE ZONE: 1-5A-S/1-6A

DUCT SIZE: 32" VENTILATION SYSTEM: Unit 1 Primary Containment Drywell and Suppression Pool Purge Exhaust to Standby Gas Treatment

DISCUSSION:

As shown on Shts. 2, 2A and 2B of Drawing C-205791, the duct assembly penetrates the fire barrier floor/ceiling at Elevation 779'-1". This penetration joins Fire Zone 1-5A-S with Fire Zone 1-6A. There are no openings in the duct assembly in Fire Zone 1-5A-S or Fire Zone 1-6A. Fire Zone 1-5A-S is fully protected by an automatic suppression system.

JUSTIFICATION:

a) Fire initiated in Fire Zone 1-5A-S with potential to spread to Fire Zone 1-6A.

Fire Zone 1-5A-S is protected by an automatic suppression system which would mitigate the consequences of any heat generated in Fire Zone 1-5A-S as a result of a fire in Fire Zone 1-5A-S. Therefore, a fire initiated in Fire Zone 1-5A-S would not generate enough heat to adversely impact any system in Fire Zone 1-6A.

b) Fire initiated in Fire Zone 1-6A with potential to spread to Fire Zone 1-5A-S.

Fire Zone 1-6A has minimal combustibles and there are no openings in the duct assembly in this fire zone. Therefore, a fire generated in Fire Zone 1-6A would not generate enough heat to adversely impact any system in Fire Zone 1-5A-S.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent fire zones and the combustible configuration within the fire zones, a fire damper is not required in penetration X-27-6-18.

PENETRATION:	X-27-6-50
ADJACENT FIRE ZONES:	1-5A-S/1-6A
DUCT SIZE AT PENETRATION:	32" X 20"
VENTILATION SYSTEM:	REACTOR BUILDING ZONE III UNFILTERED EXHAUST

PENETRATION: X-27-6-50 FIRE ZONE/FIRE ZONE: 1-5A-S/1-6A

DUCT SIZE: 30" x 20" VENTILATION SYSTEM: Reactor Building Zone III Unfiltered Exhaust

DISCUSSION:

As shown on Shts. 3, 3A and 3B of Drawing C-205791, the duct assembly penetrates the fire barrier floor/ceiling at Elevation 779'-1". This penetration joins Fire Zone 1-5A-S with Fire Zone 1-6A. Fire Zone 1-5A-S has full sprinkler protection.

JUSTIFICATION:

a) Fire initiated in Fire Zone 1-5A-S with potential to spread to Fire Zone 1-6A.

Fire Zone 1-5A-S is protected by an automatic suppression system which would mitigate the consequences of any heat generated in Fire Zone 1-5A-S as a result of a fire in Fire Zone 1-5A-S. Therefore, a fire initiated in Fire Zone 1-5A-S would not generate enough heat to adversely impact any systems in Fire Zone 1-6A.

b) Fire initiated in Fire Zone 1-6A with potential to spread to Fire Zone 1-5A-S.

Fire Zone 1-6A has minimal combustibles and there are no combustibles in the immediate area of the duct assembly. There are no openings in the duct in Fire Zone 1-6A; however, there is an exhaust air register in adjacent Fire Zone 1-6I. There are no combustibles located near this exhaust air register. Sufficient combustibles do not exist in Fire Zones 1-6A and 1-6I to generate enough heat to adversely impact any systems in Fire Zone 1-5A-S.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent fire zones and the combustible configuration within these zones, a fire damper is not required in penetration X-27-6-50.

PENETRATION:	X-27-6-51
ADJACENT FIRE ZONES:	1-5A-S/1-6A
DUCT SIZE AT PENETRATION:	30" X 20"
VENTILATION SYSTEM:	REACTOR BUILDING ZONE III SUPPLY

PENETRATION: X-27-6-51 FIRE ZONE/FIRE ZONE: 1-5A-S/1-6A

DUCT SIZE: 30" x 20" VENTILATION SYSTEM: Reactor Building Zone III Supply

DISCUSSION:

As shown on Shts. 4, 4A and 4B of Drawing C-205791, the duct assembly penetrates the fire barrier floor/ceiling at Elevation 779'-1". This penetration joins Fire Zone 1-5A-S with Fire Zone 1-6A. Fire Zone 1-5A-S has full sprinkler protection.

JUSTIFICATION:

a) Fire initiated in Fire Zone 1-5A-S with potential to spread to Fire Zone 1-6A.

Fire Zone 1-5A-S is protected by an automatic suppression system which would mitigate the consequences of any heat generated in Fire Zone 1-5A-S as a result of a fire in Fire Zone 1-5A-S. Therefore, a fire initiated in Fire Zone 1-5A-S would not generate enough heat to adversely impact any system in Fire Zone 1-6A.

b) Fire initiated in Fire Zone 1-6A with potential to spread to Fire Zone 1-5A-S.

Fire Zone 1-6A has minimal combustibles and there are no combustibles in the vicinity of the duct assembly. This duct assembly also goes through Fire Zone 1-6I; however, that zone also has minimal combustibles with no combustibles in the vicinity of the duct assembly. There are no openings in the duct assembly in Fire Zone 1-5A-S. Therefore, sufficient combustibles do not exist in Fire Zones 1-6A or 1-6I to generate enough heat to adversely impact any systems in Fire Zone 1-5A-S.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent fire zones and the combustible configuration within the fire zones, a fire damper is not required in penetration X-27-6-51.

PENETRATION:	X-27-6-83
ADJACENT FIRE ZONES:	1-5A-S/1-6A
DUCT SIZE AT PENETRATION:	20" X 8"
VENTILATION SYSTEM:	REACTOR BUILDING HVAC ZONE I EQUIPMENT COMPARTMENT (FILTERED) EXHAUST SYSTEM Note: This duct section has been blanked off and abandoned in place.

PENETRATION: X-27-6-83 FIRE ZONE/FIRE ZONE: 1-5A-S/1-6A

DUCT SIZE: 20" x 8" VENTILATION SYSTEM: Reactor Building HVAC Zone I Equipment Compartment (Filtered) Exhaust System

DISCUSSION:

As shown on Shts. 5, 5A and 5B of Drawing C-205791, the duct assembly penetrates the fire barrier floor/ceiling at Elevation 779'-1". This penetration joins Fire Zone 1-5A-S with Fire Zone 1-6A. Fire Zone 1-5A-S has full sprinkler protection. It should be noted that this duct section has been blanked off at Elevation 780'-1" and has been abandoned in place.

JUSTIFICATION:

a) Fire initiated in Fire Zone 1-5A-S with potential to spread to Fire Zone 1-6A.

   There are no openings in the duct assembly in Fire Zone 1-5A-S and heat generated by a fire in Fire Zone 1-5A-S would be mitigated by the automatic suppression system in Fire Zone 1-5A-S. Therefore, a fire initiated in Fire Zone 1-5A-S would not generate enough heat to adversely impact any system in Fire Zone 1-6A.

b) Fire initiated in Fire Zone 1-6A with potential to spread to Fire Zone 1-5A-S.

   The duct assembly is capped one foot above its floor penetration in Fire Zone 1-6A and there are no combustibles in the vicinity of this one foot length of duct. Therefore, a fire initiated in Fire Zone 1-6A would not generate enough heat to adversely impact any system in Fire Zone 1-5A-S.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent fire zones and the combustible configuration within the fire zones, a fire damper is not required in penetration X-27-6-83.

PENETRATION:	X-28-5-66
ADJACENT FIRE ZONES:	1-4A-W/1-5A-W
DUCT SIZE AT PENETRATION:	22" X 22"
VENTILATION SYSTEM:	REACTOR BUILDING EMERGENCY SWITCHGEAR ROOMS COOLING UNITS SUPPLY

PENETRATION: X-28-5-66 FIRE ZONE/FIRE ZONE: 1-4A-W/1-5A-W

DUCT SIZE: 22" x 22" VENTILATION SYSTEM: Reactor Building Emergency Switchgear Rooms Cooling Units Supply

DISCUSSION:

As shown on Shts. 6, 6A and 6B of Drawing C-205791, this duct assembly penetrates the fire barrier floor at Elevation 749'-1". This penetration joins Fire Zone 1-4A-W with Fire Zone 1-5A-W. Fire Zone 1-4A-W has full sprinkler protection.

JUSTIFICATION:

a) Fire initiated in Fire Zone 1-4A-W with potential to spread to Fire Zone 1-5A-W.

Fire Zone 1-4A-W is protected by an automatic fire suppression system which would mitigate the consequences of any heat generated in Fire Zone 1-4A-W as a result of a fire in Fire Zone 1-4A-W. Therefore, a fire initiated in Fire Zone 1-4A-W would not generate enough heat to adversely impact any system in Fire Zone 1-5A-W.

b) Fire initiated in Fire Zone 1-5A-W with potential to spread to Fire Zone 1-4A-W.

Fire Zone 1-5A-W is protected by an automatic fire suppression system which would mitigate the consequences of any heat generated in Fire Zone 1-5A-W as a result of a fire in Fire Zone 1-5A-W. Therefore, a fire initiated in Fire Zone 1-5A-W would not generate enough heat to adversely impact any system in Fire Zone 1-4A-W.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent fire zones and the combustible configuration within the fire zones, a fire damper is not required in penetration X-28-5-66.

PENETRATION:	X-29-5-34
ADJACENT FIRE ZONES:	1-4A-W/1-5A-S
DUCT SIZE AT PENETRATION:	36"
VENTILATION SYSTEM:	REACTOR BUILDING ZONE I SUPPLY TO UNIT 1 PRIMARY CONTAINMENT DRYWELL AND SUPPRESSION POOL PURGE SUPPLY

PENETRATION: X-29-5-34 FIRE ZONE/FIRE ZONE: 1-4A-W/1-5A-S

DUCT SIZE: 36" VENTILATION SYSTEM: Reactor Building Zone I Supply to Unit 1 Primary Containment Drywell and Suppression Pool Purge Supply

DISCUSSION:

As shown on Shts. 7, 7A, 7B and 7C of Drawing C-205791, the duct assembly penetrates the fire barrier floor at Elevation 749'-1". This penetration joins Fire Zone 1-4A-W with Fire Zone 1-5A-S. Both Fire Zone 1-4A-W and Fire Zone 1-5A-S have full sprinkler protection. Additionally, there are no openings in this duct run with both ends having normally closed dampers.

JUSTIFICATION:

a) Fire initiated in Fire Zone 1-4A-W with potential to spread to Fire Zone 1-4A-S.

   There are no openings in the duct assembly in either fire zone and heat generated by a fire in Fire Zone 1-4A-W would be mitigated by the automatic suppression system in Fire Zone 1-4A-W. Therefore, a fire initiated in Fire Zone 1-4A-W would not generate enough heat to adversely impact any system in Fire Zone 1-5A-S.

b) Fire initiated in Fire Zone 1-5A-S with potential to spread to Fire Zone 1-4A-W.

   There are no openings in the duct assembly in either fire zone and heat generated by a fire in Fire Zone 1-5A-S would be mitigated by the automatic suppression system in Fire Zone 1-5A-S. Therefore, a fire initiated by Fire Zone 1-5A-S would not generate enough heat to adversely impact any system in Fire Zone 1-4A-W.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent fire zones and the combustible configuration within the fire zones, a fire damper is not required in penetration X-2-5-34.

PENETRATION:	X-29-5-54
ADJACENT FIRE ZONES:	1-4A-W/1-5A-S
DUCT SIZE AT PENETRATION:	22" X 22"
VENTILATION SYSTEM:	REACTOR BUILDING EMERGENCY SWITCHGEAR ROOMS COOLING UNIT SUPPLY

PENETRATION: X-29-5-54 FIRE ZONE/FIRE ZONE: 1-4A-W/1-5A-S

DUCT SIZE: 22" x 22" VENTILATION SYSTEM: Reactor Building Emergency Switchgear Rooms Cooling Unit Supply

DISCUSSION:

As shown on Shts. 8, 8A and 8B of Drawing C-205791, the duct assembly penetrates the fire barrier floor at Elevation 749'-1". This penetration joins Fire Zone 1-4A-W with Fire Zone 1-5A-S. Both Fire Zone 1-4A-W and Fire Zone 1-5A-S have full sprinkler protection.

JUSTIFICATION:

a) Fire initiated in Fire Zone 1-4A-W with potential to spread to Fire Zone 1-5A-S.

There are no openings in the duct assembly in either Fire Zone 1-4A-W or Fire Zone 1-5A-S. A fire in Fire Zone 1-4A-W would be mitigated by the automatic suppression system in Fire Zone 1-4A-W and therefore, a fire initiated in Fire Zone 1-4A-W would not generate enough heat to adversely impact any system in Fire Zone 1-5A-S.

b) Fire initiated in Fire Zone 1-5A-S with potential to spread to Fire Zone 1-4A-W.

There are no openings in the duct assembly in either Fire Zone 1-5A-S or Fire Zone 1-4A-W. A fire in Fire Zone 1-5A-S would be mitigated by the automatic suppression system in Fire Zone 1-5A-S and therefore, a fire initiated in Fire Zone 1-5A-S would not generate enough heat to adversely impact any system in Fire Zone 1-4A-W.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent fire zones and the combustible configuration within the fire zones, a fire damper is not required in penetration X-29-5-54.

PENETRATION:	X-34-5-4
ADJACENT FIRE ZONES:	2-4A-S/2-5A-W
DUCT SIZE AT PENETRATION:	40" X 28"
VENTILATION SYSTEM:	REACTOR BUILDING HVAC ZONE II SUPPLY TO UNIT 2 PRIMARY CONTAINMENT DRYWELL AND SUPPRESSION POOL PURGE SUPPLY

PENETRATION: X-34-5-4 FIRE ZONE/FIRE ZONE: 2-4A-S/2-5A-W

DUCT SIZE: 40" x 28" VENTILATION SYSTEM: Reactor Building HVAC Zone II Supply to Unit 2 Primary Containment Drywell and Suppression Pool Purge Supply

DISCUSSION:

As shown on Shts. 9, 9A and 9B of Drawing C-205791, the duct assembly penetrates the fire barrier floor/ceiling at Elevation 749'-1". This penetration joins Fire Zone 2-4A-S with Fire Zone 2-5A-W. Both Fire Zone 2-4A-S and Fire Zone 2-5A-W have automatic suppression system protection in the vicinity of the subject penetration. Additionally, there are no openings in this duct run with both ends having normally closed dampers.

JUSTIFICATION:

a) Fire initiated in Fire Zone 2-4A-S with potential to spread to Fire Zone 2-5A-W.

The combustibles located near the duct assembly in Fire Zone 2-4A-S are two cable trays. A fire in Fire Zone 2-4A-S would be mitigated by the automatic suppression system in Fire Zone 2-4A-S. Therefore, a fire initiated in Fire Zone 2-4A-S would not generate enough heat to adversely impact any system in Fire Zone 2-5A-W.

b) Fire initiated in Fire Zone 2-5A-W with potential to spread to Fire Zone 2-4A-S.

Fire Zone 2-5A-W is protected by an automatic fire suppression system which would mitigate the consequences of any heat generated in Fire Zone 2-5A-W as a result of a fire in Fire Zone 2-5A-W. Therefore, a fire initiated in Fire Zone 2-5A-W would not generate enough heat to adversely impact any system in Fire Zone 2-4A-S.

CONCLUSION:

Based on the above discussion, NFPA 90A, Section 3-3.2.1.1, the physical layout of the adjacent fire zones and the combustible configuration within the fire zones, a fire damper is not required in penetration X-34-5-4.

TABLE DR12-1

Fire Zone/ Fire Area	Penetration	Duct Size	Zone Sprinklered	Zone Without Duct Opening	Drawing C-205791 Reference
R-1A to R-1B:					
1-5A-S/1-6A	X-27-6-17	27" Dia.	1-5A-S	Both	Shts. 1, 1A & 1B
1-5A-S/1-6A	X-27-6-18	32" Dia.	1-5A-S	Both	Shts. 2, 2A & 2B
1-5A-S/1-6A	X-27-6-50	30" X 20"	1-5A-S	1-5A-S	Shts. 3, 3A & 3B
1-5A-S/1-6A	X-27-6-51	30" X 20"	1-5A-S	1-5A-S	Shts. 4, 4A & 4B
1-5A-S/1-6A	X-26-6-83	20" X 8"	1-5A-S	Both	Shts. 5, 5A & 5B
1-4A-W/1-5A-W	X-28-5-66	22" X 22"	Both	Both	Shts. 6, 6A & 6B
1-4A-W/1-5A-S	X-29-5-34	36" Dia.	Both	Both	Shts. 7, 7A & 7B & 7C
1-4A-W/A-5A-S	X-29-5-34	22" X 22"	Both	Both	Shts. 8, 8A & 8B
R-2A to R-2B:					
2-4A-S/2-5A-W	X-34-5-4	40" X 28"	Both	Both	Shts. 9, 9A & 9B